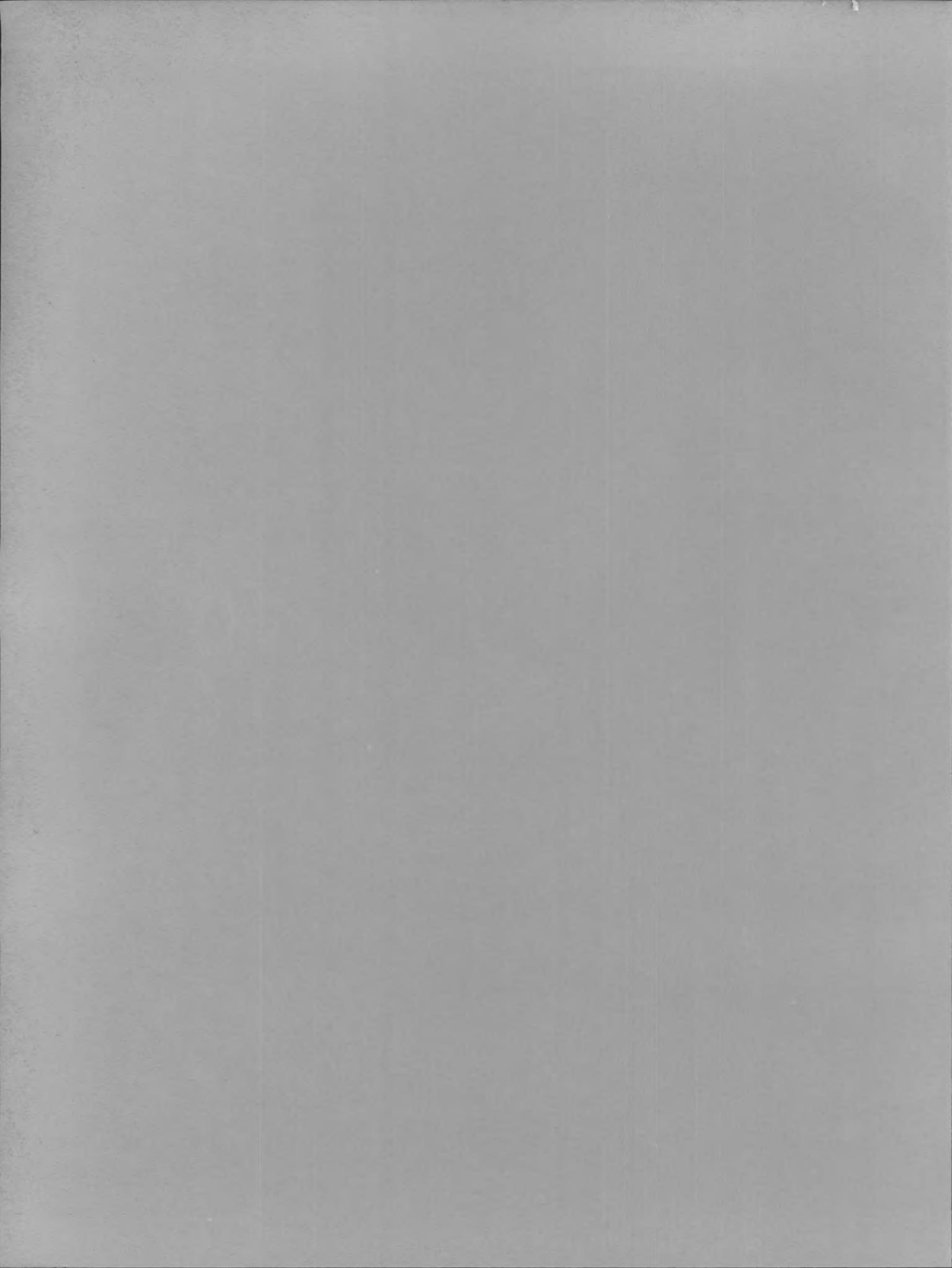
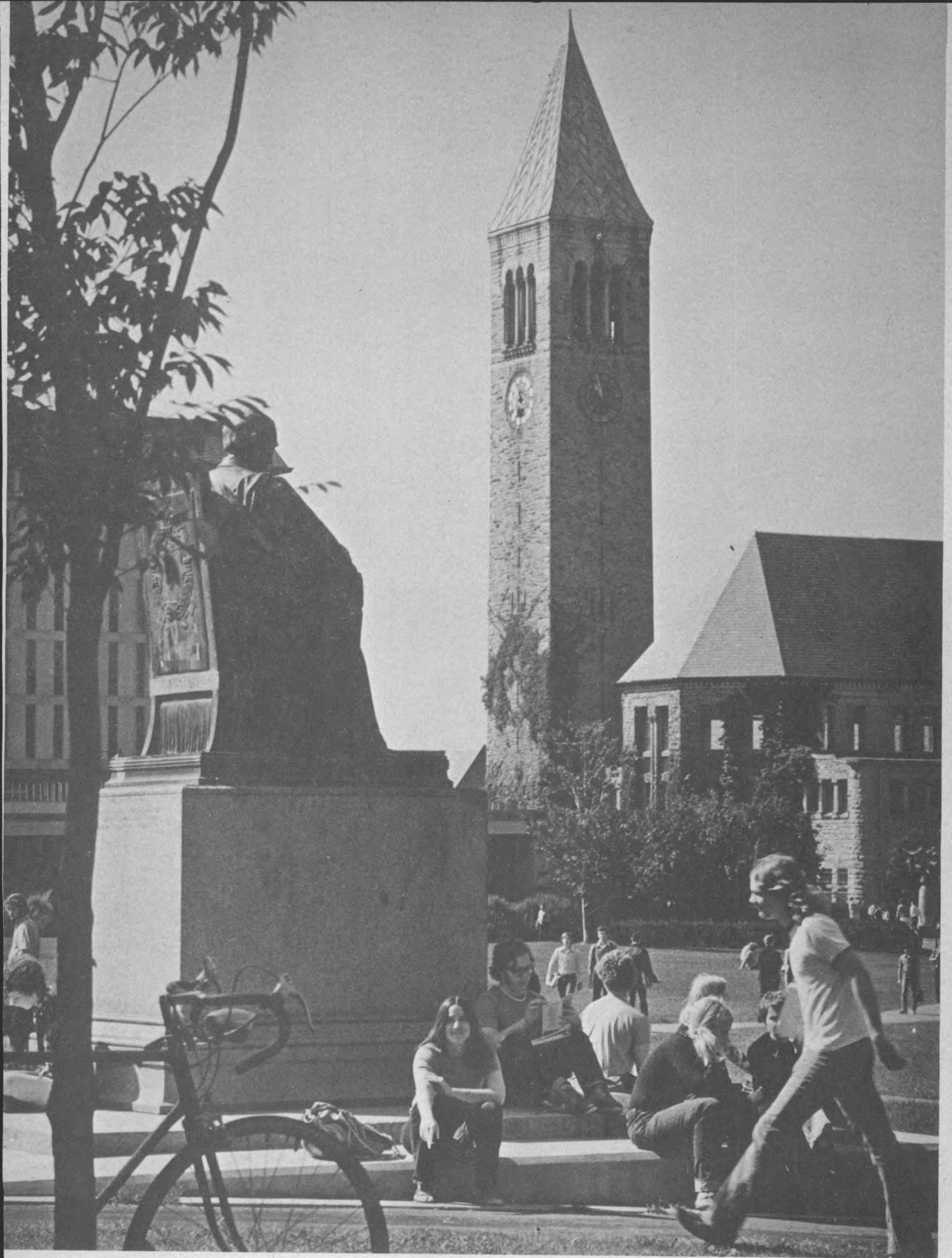
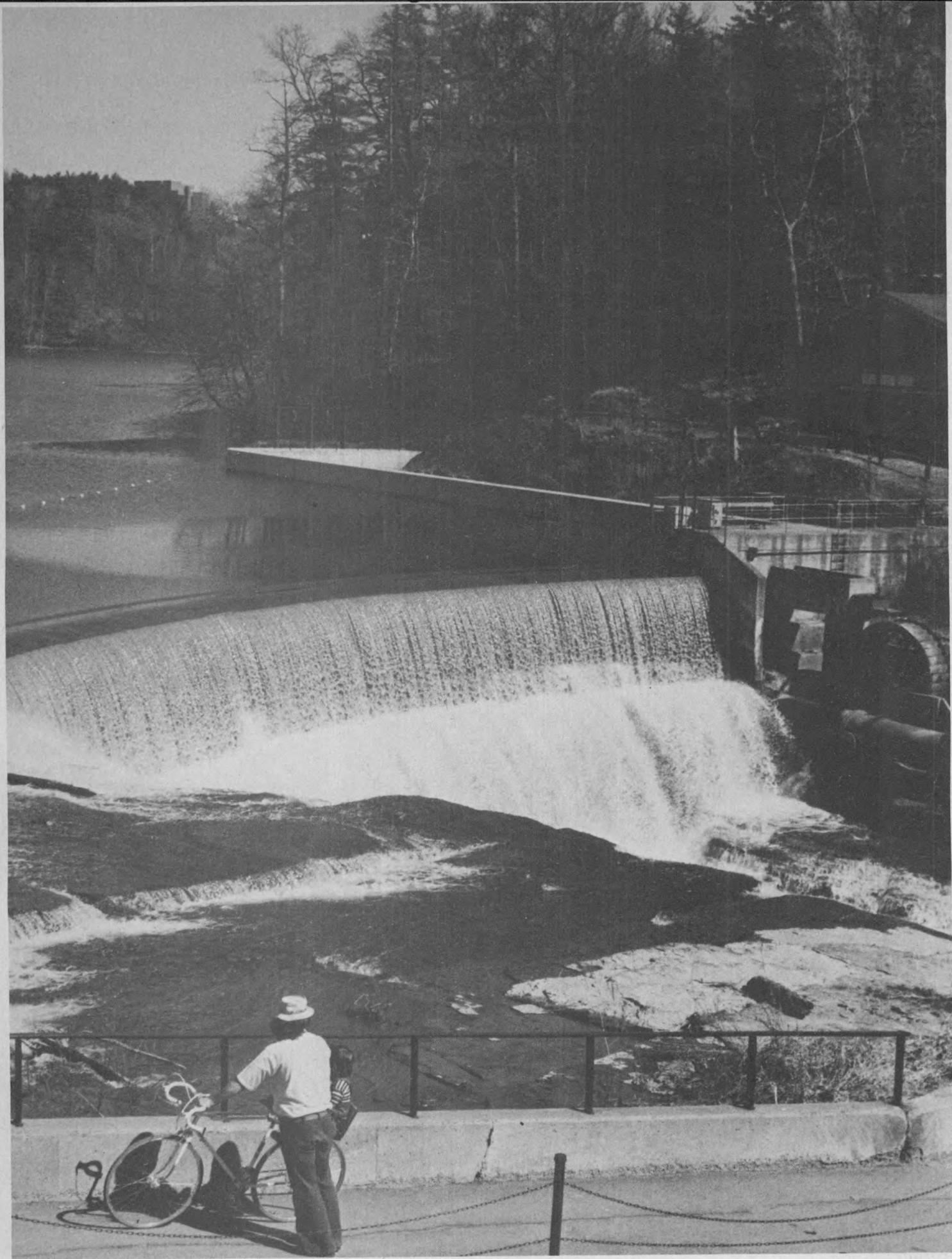


**Cornell University  
Announcements  
Description of  
Courses**







# **Cornell University**

## **Description of Courses**

**1976-77**

### **Cornell University Announcements**

Volume 68 of the Cornell University Announcements consists of fourteen catalogs, of which this is number 4 dated April 28, 1976. Publication dates: fourteen times a year (four times in August; twice in March, April, and September; once in May, July, October, and November). Publisher: Cornell University, Sheldon Court, 420 College Avenue, Ithaca, New York 14853. Second-class postage paid at Ithaca, New York.

## Cornell Academic Calendar

### 1976-77

Registration, new students	Thursday, September 2
Registration, continuing and rejoining students	Friday, September 3
Fall term instruction begins	Monday, September 6
Thanksgiving recess:	
Instruction suspended, 1:10 p.m.	Wednesday, November 24
Instruction resumed	Monday, November 29
Fall term instruction ends, 1:10 p.m.	Saturday, December 11
Final examinations begin	Wednesday, December 15
Final examinations end	Thursday, December 23
Registration, new and rejoining students	Thursday, January 20
Registration, continuing students	Friday, January 21
Spring term instruction begins	Monday, January 24
Spring recess:	
Instruction suspended, 1:10 p.m.	Saturday, April 2
Instruction resumed	Monday, April 11
Spring term instruction ends, 1:10 p.m.	Saturday, May 7
Final examinations begin	Monday, May 16
Final examinations end	Tuesday, May 24
Commencement Day	Monday, May 30

The dates shown in the Academic Calendar are subject to change at any time by official action of Cornell University.

In enacting this calendar, the University Senate has scheduled classes on religious holidays. It is the intent of Senate legislation that students missing classes due to the observance of religious holidays be given ample opportunity to make up work.

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# Cornell University

Founded in 1865, Cornell University is an independent Ivy League institution and the land-grant university of the state of New York. There are fourteen colleges and schools, of which four are state supported and ten privately endowed. Eleven of these divisions are located on the Ithaca campus and three—the Medical College, the Graduate School of Medical Sciences, and the School of Nursing—are located in New York City.

This volume describes courses and programs of those divisions on the Ithaca campus only. Those interested in the divisions located in New York City should write to the appropriate division requesting its *Announcement*.

## Guide to Course Listings

The list of courses that follows is arranged into two broad groups.

### Group 1

Those divisions that offer both undergraduate- and graduate-level courses:

- Agriculture and Life Sciences
- Architecture, Art, and Planning
- Arts and Sciences
- Biological Sciences
- Engineering
- Hotel Administration
- Human Ecology
- Industrial and Labor Relations
- Nutritional Sciences
- Officer Education

### Group 2

The graduate professional divisions:

- Business and Public Administration
- Law
- Veterinary Medicine

There are no courses offered by the Graduate School as a unit; graduate-level courses are contained in the various departments that offer the instruction.

Within each division courses are generally arranged in alphabetical order by department and in numerical order within the departments. All courses, 0–999, are briefly described for those divisions (Group 1) offering instruction to both undergraduate and graduate students. Courses in the graduate professional divisions (Group 2) are designated by number and title only. Those of the New York City divisions are not included as this volume encompasses only instruction offered at the Ithaca campus.

All academic courses of the University are open to students of all races, religions, ethnic origins, ages, sexes, and political persuasions. No requirement, prerequisite, device, rule, or other means shall be used by any employee of the University to encourage, establish, or maintain segregation on the basis of race, religion, ethnic origin, age, sex, or political persuasion in any academic course of the University.

# Course Numbering System

The course levels have been assigned as follows:

- 100-Level Course—introductory course, no prerequisites required, open to all qualified students.
- 200-Level Course—lower-division course, open to freshmen and sophomores, may require prerequisites.
- 300-Level Course—upper-division course, open to juniors and seniors, prerequisites required.
- 400-Level Course—upper-division course, open to seniors and graduates, requires 200- and 300-level course prerequisites or equivalent.
- 500-Level Course—professional level (e.g. B&PA, Law, Vet.).
- 600-Level Course—graduate-level course, open to upper-division students.
- 700-Level Course—graduate-level course.
- 800-Level Course—master's level, thesis, research.
- 900-Level Course—doctoral level, thesis, research.

## Other Information

Information concerning admissions, requirements for graduation, grades and academic standing, and special arrangements such as advanced placement generally will be found either directly preceding the course listings for the school of college to which these details apply, or directly before the course listings of a particular department when the material is relevant only to this smaller unit. Whenever such materials about various requirements are not contained in this volume, students are advised to consult the individual *Announcement* of that division (as, for example, the *Announcement of the School of Hotel Administration*) for this information or to consult their advisers.

It is not possible to keep this single volume list of courses completely up-to-date. The most current information regarding courses, credit hours, sections, days, times, buildings, rooms, and registration procedures may be found in the *Course and Time Roster* and the *Course and Room Roster*, issued four times a year by the Office of the Registrar. Students are also advised to consult the individual college offices for up-to-date course information.

The courses and curricula described in this *Announcement*, and the teaching personnel listed herein, are subject to change at any time by official action of Cornell University.

It is the policy of Cornell University actively to support equality of educational opportunity. No student shall be denied admission to the University or be discriminated against otherwise because of race, color, creed, religion, national or ethnic origin, or sex.

## Special Opportunity Programs

Cornell University administers a variety of special opportunity programs designed to provide financial assistance and other forms of assistance to (1) minority students and (2) low-income students meeting program guidelines. The emphasis of these special programs is to aid in increasing representation of students from minority groups present in New York State who historically have been underrepresented in higher education. However, participation is also available to those residing outside New York State. For details, prospective students should consult the *Guide for Candidates* which accompanies each undergraduate application or will be sent upon request by the Office of Admissions, 410 Thurston Avenue, Ithaca, New York 14853.

# New York State College of Agriculture and Life Sciences

## Orientation

**5 Orientation** Fall or spring. 3 credits. (The credit is not counted toward the 120 hours required for the degree.)

Fall term: for entering students only; M W F 8 (two sections) or 12:20 (two sections). Spring term: may be elected by first-year students only; M W F 12:20. Instructor to be appointed.

Emphasis is on the analysis and reasoning involved in the solution of verbal problems which have been drawn mainly from College of Agriculture and Life Sciences courses requiring the use of mathematics.

## 7 College Reading and Study Skills

**Program** Twice each term. Noncredit.

Program 1, starts one week after the beginning of fall term; Program 2, dates will be announced; Program 3, starts one week after the beginning of spring term; and Program 4, dates will be announced. Programs are open to all registered students. No formal registration necessary. Simply present yourself at one of the announced times. For information, telephone 256-3413. W. Pauk.

Principles and techniques for more effective reading and studying are explained, demonstrated, and practiced in class. The reading laboratory provides an opportunity for increasing one's rate of reading.

## 27 Introduction to Farm Techniques

Spring. Noncredit. Grade does not appear on transcript. M T W Th F 2-5. Classes meet at various college farm facilities. Students attend one session per week. W. F. Miller.

Provides supervised instruction in the basic manual skills of farming. Skills covered include hand and machine milking, livestock handling, operation of tractors and field equipment, and general orientation to the practices and procedures of day-to-day farm operation. For registration and course information, see Office of Student and Alumni Services, 16 Roberts Hall.

## 115 Introductory College Mathematics

Fall or spring. 4 credits. M W F 8, 12:20; lab, T or Th 12:20.

H. A. Geiselman. Designed to give students with sound high school mathematics backgrounds a unified treatment of the basic concepts of college algebra, analytic geometry, and the elements of calculus. Considerable emphasis will be placed upon the concept of function, graphing, problem solving, and methods of proof. The Cornell University Computing Language (PL-C) will be taught and used to strengthen and integrate the mathematical topics covered in the course.

## 300 Preveterinary Orientation Seminar

Fall. Noncredit. S-U grades only. Hours to be arranged. Sponsored by the Beta Epsilon Phi Preveterinary Honor Society.

R. B. Furry, Adviser. Provides an opportunity to acquaint preveterinary students with various aspects of the veterinary profession and related specialization alternatives. Topics by guest lecturers range from admissions through teaching, research, and extension activities, to employment opportunities.

## 401-402 America and World Community (also Government 401-402)

401, fall; 402, spring. 3 credits per term. Time to be announced. One World Room, Anabel Taylor, N. E. Awa, J. C. Mbata, and other

professors to be announced. The theme of "World Community" will be examined in terms of the directions which the concept suggests, with special reference to the role of the United States in translating the concept to reality. The course seeks to examine the American experience against the background of world community from the point of view of the humanities, the social sciences, the natural sciences, and religious studies.

## Agricultural Economics

O. D. Forker, chairman; D. J. Allee, R. D. Aplin, R. Barker, S. L. Barraclough, D. G. Barton, N. L. Bills, D. Blandford, R. N. Boisvert, C. A. Bratton, E. H. Brown, M. E. Brunk, J. B. Bugliari, D. L. Call, G. L. Casler, L. D. Chapman, H. E. Conklin, G. J. Conneman, L. M. Day, W. G. Earle, D. A. Eiler, D. U. Fisher, D. K. Freebairn, G. A. German, D. L. Good, D. C. Goodrich, Jr., R. B. How, R. J. Kalter, W. A. Knoblauch, E. L. LaDue, D. R. Lifferth, B. Mason, J. W. Mellor, J. F. Metz, Jr., R. A. Milligan, T. D. Mount, T. T. Poleman, K. L. Robinson, D. G. Sister, R. S. Smith, B. F. Stanton, R. P. Story, W. G. Tomek, H. A. Wadsworth, Jr., T. T. Williams.

## Farm Business Management and Finance

**302 Farm Business Management** Spring. 4 credits. Not open to freshmen. 302 is a prerequisite for 402.

Lec, M W 10:10; one discussion period, F 8, 9:05, 10:10, 11:15, or 12:20; lab, T W or Th 1:25-4:25. On days farms are visited, the laboratory period is 1:25-5:30. One all-day trip and four half-day trips are taken to visit farm businesses. G. J. Conneman. Focus is on the intensive study of problems associated with planning, organizing, operating, and managing a farm business. Emphasis is placed on the tools of managerial analysis and decision making. Topics include management information systems, business analysis, economic principles, and budgeting; acquisition, organization, and management of capital, labor, land, and machinery.

## 402 Advanced Farm Business Management

Spring. 3 credits. Prerequisite: 302 or equivalent.

Lec, M W 9:05; lab, W 1:25-3:20. On days farms are visited, the laboratory period is 1:25-5:30. G. L. Casler. Emphasis is placed on evaluating the profitability of alternative investments and enterprises. Principal topics include the effects of income taxes on investment decisions, capital investment analysis, linear programming, financial risk and uncertainty. Experience in computer applications to farm business management will be provided.

## 405 Farm Finance

Spring. 3 credits. Prerequisite: 302. Lec, T Th 10:10; disc, T 1:25-3:20. R. S. Smith. A study of financial arrangements for farmers and the credit institutions that serve them. Emphasis is on problems of capital management associated with organizing and operating a commercial farm. Alternative sources of capital are analyzed and consideration given to safe and profitable debt levels and selection of alternative investment opportunities.

## 406 Farm Appraisal

Fall. 3 credits. Prerequisite: 302. Lec, T 10:10; lab, T 1:25-4:25. On days farms are visited, the laboratory period is 1:25-5:30. D. L. Good. A study of factors governing the price of farms, methods of farm valuation, and practice in the appraisal of farms and other properties.

## 608 Production Economics

Spring. 3 credits. Prerequisite: Econ 102 or equivalent; Math 108 or Math 111 or equivalent suggested although not required.

Lec, T Th 11:15; disc, M 1:25-3:20. E. L. LaDue. A comprehensive survey of production economic

theory with emphasis on applications to agriculture and agribusiness. Topics covered include the derivation and use of production, cost, and supply functions. Some time is spent on the application of production theory to special problem areas.

## Business Management

Attention is directed to courses in economics and mathematics in the College of Arts and Sciences and in administration in the Schools of Hotel Administration, Business and Public Administration, and Industrial and Labor Relations.

## 220 Introduction to Business Management

Fall. 3 credits. Lec, M W F 10:10; disc, W 1:25-3:20, Th 8-9:55, 11:15-1:10, 1:25-3:20, F 9:05-11, 10:10-12:05. In weeks discussions are held, there will be no Friday lecture. D. R. Lifferth.

Examines various analytical tools and principles of business management relating to planning, directing, organizational design, and information and control systems, taking into account the social, legal, and economic environment in which business decisions are made. Teams operate and manage a business enterprise using a computerized management decision game.

## 221 Accounting

Spring. 3 credits. Not open to freshmen. Lec, M F 10:10; lab, T W or Th 9:05-11, 12:20-2:15, or 2:30-4:25. D. A. Eiler. A comprehensive study of basic financial accounting principles. An introduction to cost accounting and the analysis and interpretation of financial statements. Emphasis on accounting concepts rather than procedures.

## 320 Business Law

Fall. 3 credits. Limited to upperclass students. Lec, M W F 9:05. One preliminary exam will be given in the evening. J. B. Bugliari. Consideration is given chiefly to legal problems of particular interest to persons who expect to engage in business, with emphasis on the fields of personal property, contracts, agency, real property, partnerships and corporations.

## 321 Business Law

Fall. 4 credits. Limited to upperclass students with permission of the instructor. Lec, M W F 9:05; disc, M 3:35. One preliminary exam will be given in the evening. J. B. Bugliari. The lecture portion same as 320. Discussion portion will deal with practical applications of the legal principles covered in the course and attempt also to give some deeper insight into the role and function of the lawyer and the judiciary in our society.

## 322 Taxation in Business and Personal Decision Making

Spring. 3 credits. Suggested prerequisites: at least one course in accounting and a course in business law. Lec, M W 2:30-4. J. B. Bugliari, R. S. Smith. Impact of taxation, both state and federal, on business and personal decision making. State and local real property, income and sales taxes, federal income, and estate and gift taxes affecting individuals and corporations. Tax management of unincorporated businesses and smaller corporate firms. Tax policy and mechanics of taxation.

## 323 Managerial Accounting and Economics

Fall. 3 credits. Prerequisites: 221 and Econ 102 or equivalents. Lec, T Th 10:10; disc, Th F 12:20-2:15; 1:25-3:20; 2:30-4:25. Two preliminary examinations will be given in the evening. R. D. Aplin. Designed to relate accounting and economic principles to management decision making and control. Major topics: cost behavior; volume-profit relationships; standards and flexible budgets; responsibility accounting and contribution approach to cost allocation; measuring divisional performance;

## 6 Agricultural Economics

relevant cost analysis for decision making; linear programming; and inventory planning and control systems.

**324 Financial Management** Spring. 3 credits. Prerequisites: 221 and Econ 102 or equivalents. Students who have not taken 323 will be expected to attend a special section each of the first two weeks of the term.

Lec. M W F 9:05; disc. W 2:30-4:25; Th 8-9:55; 12:20-2:15; F 9:05-11; 12:20-2:15. In weeks when discussions are held, there will be no Friday lecture. Discussions will be held instead of a Friday lecture in all but two weeks of the term. Two preliminary examinations will be given in the evening. R. D. Alpin.

Designed to give knowledge and understanding of business finance. Focus is on the management of long-term funds and assets. Some attention given to current asset management. Major topics include investment decisions; sources and costs of long-term capital; handling uncertainty; managing the cash position and credit-granting decisions.

**420 Advanced Business Law** Spring. 3 credits. Limited to upperclass students.

Lec. T Th 8:30-9:55. One preliminary exam will be given in the evening. J. B. Bugliari. Designed to provide a fairly detailed and comprehensive legal background. Selected areas covered in 320 will be further developed, and particular consideration will be given to the law pertaining to bailments, sales, secured transactions, bankruptcy, negotiable instruments, insurance, and trusts and estates.

**421 Advanced Business Law** Spring. 4 credits. Limited to upperclass students with permission of instructor.

Lec. T Th 8:30-9:55; disc. T 3:35. One preliminary exam will be given in the evening. J. B. Bugliari. The lecture portion of this course will cover the same material as 420. The discussion portion will deal with practical application of certain of the legal principles covered in the course, such as sales contracts, consumer protection, mortgage transactions, bankruptcy proceedings, negotiable paper, insurance, and drawing a will.

**424 Managerial Decision Making** Spring. 3 credits. Limited to seniors with advisers in agricultural economics.

T Th 10:10-11:40. W. G. Earle. An integrating course which examines business policy formulation and execution from the standpoint of the corporate manager. Designed as an advanced course for potential business managers and owners. Includes the concepts and function of strategy, the nature of a company's environment, and the role of leadership in achieving business goals.

**425 Personal Financial Management** Spring. 2 credits. Preliminary for seniors.

Lec. F 12:20. One hour discussion each week, time to be arranged. Instructor to be appointed. Managing personal income to maximize financial goals and objectives. Discussion sessions will be devoted to problems and case studies in financial planning for students and young families. Discussion leaders will include representatives of financial institutions including banks and insurance companies.

**426 Cooperative Management** Fall. 3 credits. M W F 12:20. D. R. Lifferth.

Considers the economic theory and function of cooperatives. The legal status of cooperatives and special problems of cooperative planning, organization, and control will be discussed.

### Marketing and Food Industry Management

**240 Marketing** Spring. 3 credits.

Lec. M W F 11:15; disc. M 2:30-4:25;

T 12:20-2:15, 2:30-4:25, W 2:30-4:25, Th 12:20-2:15, 2:30-4:25, F 10:10-12:05. In weeks discussions are held, there will be no Friday lecture. D. C. Goodrich.

An introductory study of the food marketing system and the society it serves, including the goals and operating practices of marketers (in such areas as buying, grading, transportation, packaging, and advertising), the behavior and purchasing practices of consumers, and the social issues arising from conflicts between these groups.

**346 Pricing Milk and Dairy Products** Fall. 3 credits.

Lec. M W F 11:15; disc. F 12:20. R. P. Story. A review of the structural characteristics of the dairy industry and an analysis of the pricing systems for market milk. Particular attention will be given to government programs, including marketing orders, price supports, and import policies.

**347 Marketing Horticultural Products** Fall. 3 credits. Prerequisite: 240 or equivalent.

T Th 9:05. R. B. How. Economic characteristics of markets, marketing channels, and marketing services for fruit, vegetables, and floricultural commodities. The role of public and private agencies in market information and regulation. Analysis of alternative pricing and distribution systems. The potential for market research and development programs.

**441 Food Distribution** Fall. 4 credits. Limited to juniors and seniors.

M W F 10:10 and W 2-4. W. G. Earle. A study of the structure and the competitive nature of the food industry. Attention is given to an analysis of the gross margin, expenses, and earnings of food retailers. Government regulations with regard to mergers and buying and selling activities are examined. Food industry specialists frequently join the discussion session.

**443 Food Industry Management** Spring. 4 credits. Limited to juniors and seniors.

M W F 10:10 and W 2-4. W. G. Earle. A case-study approach is used to examine the application of management principles and concepts to operating problems of food retailers. Areas included are site selection, buying, merchandising, personnel administration, private label products, and financing expansion programs. Leading food industry specialists frequently join the discussion session on Wednesday afternoons.

**449 Field Study of Marketing Institutions** Spring. 2 credits. Registration by permission.

M 12:20. G. A. German. Economic functions performed by various types of specialized marketing agencies, with emphasis on their physical operating patterns. Observations are made of the organization and operation of businesses in the food industry. Five days of spring vacation are spent in Boston visiting food distribution firms and marketing institutions.

**[641 Food Merchandising** Fall. 2 credits. Prerequisite: permission of instructor. Not offered fall 1976.

Lec. Th 2:30-4:25. M. E. Brunk. A seminar exploring alternative merchandising and promotional devices for food industry retailers and manufacturers. Special attention is given to identification and measurement of basic forces having an impact on consumer buying behavior.]

**740 Marketing Research** Spring. 2 credits. Prerequisite: permission of instructor.

Lec. Th 12:20-2:15. M. E. Brunk. Objectives of marketing research, organization and management of research, organization and management of research agencies, problem identification, selecting and planning projects, designing and use of research by management.

**741 Economic Efficiency in Food Marketing and Prices** Fall. 3 credits.

Disc. M W 12:20-2:15. O. D. Forker. A seminar on the application of economic theory and quantitative methods to research in agricultural marketing and pricing systems; cost and price relationships in space, form, and time are discussed along with public policy issues in market efficiency and price determination.

**742 Social Responsibility in Marketing** Spring. 3 credits. Open only to graduate students.

T Th 12:20-2:15. Staff. A seminar course concerned with public policy in marketing. Concepts from industrial organization, consumer economics, and antitrust are integrated in appraising public decisions in the marketing area. Examples are drawn primarily from analyses of the food marketing system.

**743 Export Marketing** Fall. 2 credits. Graduate students only.

Lec. Th 2:30-4:25. M. E. Brunk. History and development of commercial United States exports of agricultural commodities and the mechanics and procedures of exporting. Alternatives in sales contracts, shipping, insurance, financing, business structure, researching markets, and promotion. Trading experiences of specific commodity specialists.

### Economics of Agricultural Development

**464 Economics of Agricultural Development** Spring. 4 credits. S-U grades optional. Prerequisites: 150 or Econ 101-102, or permission of instructor.

T Th 9:05 and W 7:30-9:25 p.m. J. W. Mellor. Examination of the processes of economic development in the developing nations, and their interactions with United States policy. Rural development policy will receive primary attention with emphasis on developing nations with a dominant agriculture sector, and on the key role of agriculture in the overall economic transformation of these economies.

**660 Food, Population, and Employment** Fall. 5 credits.

M W 2:30-4, plus an individual weekly meeting with the instructor. T. T. Poleman. Examines the linkages between employment, food, and population growth in less-developed countries. Food economics and the world food situation are treated as cornerstones and examined in historical perspective. A major term paper is stressed. To ensure students an opportunity to work individually with instructor, enrollment is limited to 15.

**665 Seminar on Latin American Agricultural Policy** Fall. 3 credits. Prerequisite: 464 or permission of instructor.

T 2:30-4:25. D. K. Freebairn. An examination of policies for the development of the agricultural sector in Latin America, including an identification of policy objectives and a review of the instruments of public policy implementation. Particular attention is paid to the interactions of agrarian structure, agricultural productivity, and rural welfare.

**666 Seminar in Agricultural Development** Fall or spring. 3 credits.

Hours to be arranged. An analysis of current problems for development of the agricultural sector of low-income countries with emphasis on the implications of such problems to the definition of research. The seminar will normally be taught by a visiting professor who has had recent direct experience in low-income countries.

**769 Seminar on Agriculture and Economic Planning Models** Spring. 3 credits. Prerequisites:

basic macroeconomics and quantitative methods. T 12:20-2:15. J. W. Mellor. M. S. Mudahar.

Will deal with planning models as applied to less developed economies and will emphasize the interaction between the agricultural and the nonagricultural sectors. Will cover one sector models of the Harrod-Domar type, labor surplus models such as the Lewis, Fei-Ranis, and Jorgensen models, and various multisectoral models.

## Public Policy

Attention is directed to course offerings in the Departments of City and Regional Planning, Consumer Economics and Public Policy, Economics, Government, and Natural Resources, and the Schools of Civil and Environmental Engineering and Business and Public Administration.

### 150 The Economics of Agricultural Geography

Fall. 4 credits.  
Lec, M W F 11:15; disc, T W Th or F 2:30-4:25.  
D. G. Sisler.

The economics and geography of the world's agriculture. Elementary economic principles, historical development, physical geography, and population growth are studied in their relation to the economic problems of farmers. Particular emphasis is given to the study of agriculture of various farming regions of the United States and their economic problems and competitive situation.

### 230 Local Government

Fall. 3 credits. S-U grades optional.  
Lec, T Th 9:05; disc, T 2:30-4:25.  
Government in the United States with emphasis upon examination, analysis, and resolution of public issues confronting leadership in localities of New York. Government organization, administration, functions, and finance are discussed in this context.

### 332 Economics of the Public Sector

Fall. 3 credits. Prerequisite: Econ 102 or equivalent.  
Lec, M W F 11:15. B. Mason.  
Application of economic concepts to evaluation of the structure and performance of the private and public sectors of the economy. Emphasis on microeconomic analysis of public finance and resource allocation. Principal topics: market failure, income distribution, taxation, evaluation of public expenditures, articulation of public interest, and current public policy issues.

### 333 Economics of the Public Sector

Fall. 1 credit. Prerequisite: Econ 311 and one semester college calculus. Corequisite: 332.  
Disc, Th 2:30-4:25. B. Mason.  
Will treat topics introduced in lecture at a more advanced level. Discussions will deal with theoretical as well as practical aspects of public finance. Students will participate in a tax simulation game.

### 350 Resource Economics

Fall. 3 credits.  
Suggested prerequisite: Conservation 201 and an introductory economics course or permission of instructor.

Lec, T Th 10:10; disc, T 1:25-3:20 and as arranged. D. J. Allee, H. E. Conklin.  
The application of economic and political science concepts to the use of natural resources with varying attention to water, land, forests, and fisheries. Attention will be given to regional growth, the impact of urban growth, and public decision making in the resources and environmental management area.

### 351 Farm and Food Policies

Fall. 3 credits.  
S-U grades optional.  
Lec, T Th 9:05; disc, Th 11:15 or 1:25, F 10:10.  
K. L. Robinson.  
The course deals broadly with farm and food policies including price-support and storage programs, the potential role of food aid, agricultural trade policies, domestic food subsidies, and rural poverty.

### 352 Agricultural Prices

Spring. 3 credits.  
Suggested prerequisite: Econ 101-102.  
M W F 11:15. K. L. Robinson.

An analysis of agricultural demand, supply, and price determination under alternative market structures, institutional aspects of pricing farm and food products, temporal and spatial price relationships, price forecasting, and the economic consequences of pricing decisions.

### 450 Evaluating Resource Investment and Environmental Quality

Spring. 3 credits.  
Prerequisite: an introductory course in economics and/or a 300-level course, or permission of instructor. Primarily for juniors and seniors.

T Th 10:10-11:30; other discussion as arranged.  
D. J. Allee.  
Means of reaching decisions on environmental questions. Concepts of social value and benefit-cost analysis, determination of degrees of importance of environmental problems, environmental impact statements, definitions of environmental quality, and questions of political economy.

### 452 Agricultural Resource Inventories

Spring. 3 credits.  
Lec, F 8-9:55; disc, F 1:25-4:25; field trips  
F 1:25-5:30. H. E. Conklin.

An examination of methods for inventorying and classifying agricultural resources, especially land, from the standpoint of their usefulness in economic analysis.

### 650 Economic Analysis of Public Investment

Spring. 4 credits. Primarily for graduate students, but open to seniors. Prerequisites: Econ 311 or 511, or permission of instructor.  
T Th 9:05-11. R. J. Kalter.

The application of economic theory and analysis to governmental decision making, budgeting, and expenditures processes with emphasis on the welfare criteria of economic efficiency and income distribution. Techniques of benefit-cost, equity, and systems analysis stressed. Discount rates, benefit estimation, externalities, multipliers, uncertainty, and social welfare functions will be covered.

### 651 Economics of Exhaustible Resources

Fall. 3 credits.  
Lecture/seminar. Hours to be arranged.  
L. D. Chapman  
Economic theory relevant to problems of finite resources, including macroeconomic policy, dynamic analysis, and optimal control theory. Recent developments in empirical analysis, including input-output analysis, econometric models, and supply-demand simulation. Illustrative application to particular resources such as energy and forestry. The question of limits to growth.

### 652 Special Problems in Land Economics

Fall or spring. 1 or more credits. Graduate students only. Prerequisite: permission of instructor.  
Hours to be arranged. D. J. Allee, H. E. Conklin.  
Special work on any subject in the field of land economics.

### 750 Workshop on Resource Economics

Fall. 2 to 6 credits. Open only to graduate students. Prerequisite: 650 or permission of instructor.  
T 2:30-4:25. R. J. Kalter and other staff.  
The application of economic theory and analysis to governmental decision making with emphasis upon graduate students' research.

### 751 Seminar on Agricultural Policy

Spring. 3 credits. Open only to graduate students.  
M 1:25-3:20. K. L. Robinson.  
A discussion of agricultural trade, price and income-support policies and techniques appropriate to the analysis of policy issues.

### 752 Readings in Philosophy

Spring. 3 credits.  
Open only to Ph.D. candidates.  
S 9:05-12. H. E. Conklin.  
Readings are selected for their relevance to research in agricultural economics and are chosen from among books such as *Structure of Scientific*

*Revolutions, The Theory of Experimental Inference, The Nerves of Government, Economics as a Science, and A Theory of Economic History.*

## Quantitative Methods

Attention is directed to related courses in economics, economic and social statistics (ILR), industrial engineering and operations research, mathematics, and statistics and biometry; selected courses particularly relevant to agricultural economics are dual listed.

### 310 Introductory Statistics

Fall. 3 credits.  
Prerequisite: Orientation 115 or equivalent level of algebra.  
Lec, T Th 11:15; disc, M T or W 1:25; computing period in the afternoon or morning following the discussion, M T W 2:30, T W Th 10:10. T. D. Mount.  
An introduction to statistical inference including probability concepts, estimation, hypothesis testing, simple linear regression, and correlation.

### Statistics II (Industrial and Labor Relations)

311) Fall. 4 credits. Prerequisite: one term of applied statistics or permission of instructor.

### Introduction to Computer Uses in Data Analysis

(Rural Sociology 314) Spring. 3 credits. S-U grades optional. Prerequisite: one term of statistics or permission of instructor.  
T Th 11:15. Lab to be arranged. D. E. Moore.

### 412 Introduction to Quantitative Methods

Spring. 3 credits. Primarily for juniors, seniors, and M. S. candidates. Prerequisite: 323 recommended but not required.  
Lec, T Th 10:10; disc, Th or F 1:25-3:20.  
D. G. Barton.  
Introduction to linear programming and related mathematical programming. Problems considered include linear, multiple goal, parametric, separable, and integer programming. Emphasis is on applications that include model building, obtaining computerized solutions, and output interpretation. The economic content of linear programming is also examined. Applications are made to agricultural and business problems.

### Matrix Algebra (Statistics and Biometry 417)

Fall. 4 credits. Prerequisite: the equivalent of one year of college algebra.  
Lec, M W F 8; discussion section to be arranged.  
S. R. Searle.

### 710 Econometrics I

Spring. 4 credits.  
Prerequisites: ILR 311, or Statistics and Biometry 604, or equivalent; Statistics and Biometry 417 suggested.  
Lec, T Th 2:30-4:25. W. G. Tomek.  
A comprehensive treatment of the classical linear regression model at the level of *Econometric Methods* by Johnston. Generalized least squares, analysis of covariance, and elementary distributed lag models are introduced. Simultaneous equations estimators constitute about 30 percent of the course. Principles of econometrics are emphasized as a basis for empirical research.

### 711 Econometrics II

Fall. 4 credits. Prerequisite: 710 or equivalent; Statistics and Biometry 417 recommended.  
Lec, M W 3:35-5. T. D. Mount.  
Additional coverage (beyond that of 710) of generalized least squares, distributed lag, and analysis of covariance models; extensions include specification error analysis, seemingly unrelated regressions, and variance components models. Other topics covered are principal components, factor analysis, and probit and logit analysis. Applications emphasize microeconomic problems.

### 712 Quantitative Methods I

Fall. 4 credits.  
Prerequisite: 417 or equivalent suggested but not required.  
Lec, M W F 11:15; discussion arranged.

R. N. Boisvert

Comprehensive treatment of linear programming and its extensions, including postoptimality analysis and the transportation model. Special topics in integer and nonlinear programming, including spatial equilibrium and risk programming models, input-output models are treated in detail. Applications are made to problems in agricultural, resource, and regional economic problems.

**713 Quantitative Methods II** Spring, 3 credits.

Prerequisite: 712 or permission of instructor.

Lec, M W F 10:10-11. R. A. Milligan.

Probabilistic models and methods including simulation (major emphasis), queuing theory, inventory theory, Bayesian decision making, Markov chains, and dynamic programming. Applications to a variety of problems (primarily dynamic) in agricultural economics and business management.

**714 Econometric Models** Spring, 3 credits.

Offered in alternate years; will be offered in 1977.

Lec, hours to be arranged. T. D. Mount, W. G. Tomek.

The theory and art of specifying and evaluating econometric models. Topics include economic theory as a guide to model building, evaluating parameters estimates, sequential estimators, and evaluating the forecasting ability of a model. Empirical studies in agricultural economics provide a basis for discussion.

**717 Introduction to Research in Agricultural Economics** Fall, 2 credits. Open to graduate students only.

W 1:25-3:20. Staff.  
A discussion of the research process and scientific method and their applications in agricultural economics. Topics include inductive and deductive methods, development of hypotheses, methods of testing alternatives, sources and methods of obtaining data, sampling and analytical procedures.

**Other**

**380 Independent Honors Research in Social Science** Fall and spring, 1 to 6 credits. Open only to candidates who have met the requirements for the honors program. A maximum of six credits may be earned in the honors program.

**499 Undergraduate Research** Fall and spring, 1 to 4 credits. S-U grades optional. Student must attach to preregistration material the written permission of the staff member who will supervise the work and assign the grade. Open to seniors with quality point averages of 2.7 or higher. Permits outstanding undergraduates to carry out independent studies of suitable problems under appropriate supervision.

**699 Graduate Research** Up to six credits. Prerequisite: graduate standing and permission of major adviser.

**Agricultural Engineering**

E. S. Shepardson, chairman; L. D. Albright, R. D. Black, J. K. Campbell, J. R. Cooke, H. R. Davis, E. O. Eaton, E. W. Foss, R. B. Furry, W. W. Gunkel, R. W. Guest, D. A. Haith, A. G. Hashimoto, W. W. Irish, L. H. Irwin, L. G. James, W. J. Jewell, F. G. Lechner, G. Levine, R. C. Loehr, H. A. Longhouse, R. T. Lorenzen, D. C. Ludington, E. D. Markwardt, W. F. Millier, R. A. Parsons, D. R. Price, G. E. Rehkugler, N. R. Scott, J. W. Spencer, M. F. Walter.

**101 Mechanical Drawing** Fall 3 credits.

Lec, T Th 8; lab, W 1:25-4:25. H. Longhouse. Introduction to mechanical drawing including lettering, sketching, multiview drawings, sections, auxiliaries, revolutions, pictorial drawings, elementary descriptive geometry, and the application of these

principles to problems. Both machine and architectural drawing conventions are discussed.

**103 Use of Pocket and Programmable Desk Calculators** Spring, 1 credit.

Disc-lab, M or F 2:30-4:25. L. D. Albright. Structured practice in using machines that eliminate the tedium of doing arithmetic computations. Emphasis on learning to use effectively programmable calculators with RPN and algebraic entry modes. Problem solving as well as simulation programming. Digital computer languages not covered.

**110 Farm Metal Work** Fall or spring, 2 credits.

Lec, Th 9:05; fall labs, M T 1:25-4:25; spring labs, M T or Th 1:25-4:25. F. G. Lechner. Monday lab, limited to 24 students, includes instruction in the fundamentals of metal lathe work and arc and oxyacetylene welding. Tuesday and Thursday labs, limited to 20 students, include instruction in sheet metal work, pipe fitting, hot and cold metal work, and arc and acetylene welding.

**131 Elements of House Design** Spring, 3 credits. S-U grades optional.

Lec, T Th 10:10; lab, T W or Th 1:25-4:25. Staff. An introduction to the design process. The basic principles of planning and design of buildings and systems for human habitation with emphasis on the rural dwelling. Topics include site selection, structural design, water and waste water systems, electrical systems, lighting, heating, ventilation, and air conditioning.

**132 Farm Carpentry** Fall, 2 credits.

Lec, T 9:05; labs, limited to 15 students, T W or Th 1:25-4:25. F. G. Lechner. Instruction in the fundamentals of farm carpentry, including concrete work, and equipment and buildings constructed of wood. Each student is required to plan and construct an approved carpentry project. Indoor furniture projects are not acceptable.

**151 Introduction to Agricultural Engineering and Computing** Fall, 2 or 3 credits. Prerequisite: one term of calculus or concurrent registration.

Lec, T F 1:25-2:15; rec-lab, T F 2:30-4:25. G. E. Rehkugler. An introduction to digital computing with the PL/C language through the use of computing problems specifically in agricultural engineering subjects and generally in related areas such as environmental technology and agriculture. Basics of PL/C will be completed in 10 weeks for 2 credits. The remaining study will introduce interactive computing through APL.

**152 Engineering Drawing** Spring, 3 credits.

Lec, M W 8; lab, M or T 1:25-4:25. H. Longhouse. Designed to promote an understanding of the engineer's universal graphic language. The lectures and laboratories will develop working knowledge of drawing conventions, drafting techniques, and their application to machine, architectural, and pictorial drawing problems. Introduction to descriptive geometry and problem-solving techniques also will be included.

**201 Energy and Man** Spring, 1-3 credits.

Lec, M W F 8. W. W. Gunkel, L. D. Albright. Subject will be presented in modular form. Module 1: 2 credits. Lec, M W 8. Basic concepts of energy. Energy use in agriculture and the food system. Traditional and alternate sources of energy. Individual attitudes and energy conservation will be explored. Module 2: 1 credit. Lec, F 8. The energy transfer process will be investigated. Topics will include heating, cooling, drying, solar radiation, electricity, and refrigeration.

**221 Plane Surveying** Fall, 3 credits. S-U grades optional. Limited to 90 students, 30 per laboratory.

Lec, T Th 11:15; lab, M T or W 1:25-4:25.

R. D. Black.

An introduction to plane surveying. The use and care of equipment is stressed while doing field problems related to construction and mapping.

**222 Engineering Surveys** Spring, 3 credits. S-U grades optional. Prerequisite: 221 or equivalent. Limited to 30 students.

Lec, T Th 8; lab, M 1:25-4:25. R. D. Black. An introduction to photogrammetric measurements, hydrologic surveys, route surveys, mapping, and control surveys of limited extent. The use of measurements in the solution of engineering problems will be emphasized.

**271 Applied Hydraulics** Spring, 3 credits. S-U grades optional.

Lec, T Th 9:05; lab, M 1:25-4:25. Lab limited to 30 students. L. G. James. Elements of fluid mechanics and hydrology as applied to common problems in nature associated with the flow of water. Emphasis will be on the practical problems related to flow in pipes, open channels, flow measurements, runoff estimates, data collection, data analysis, pumps, and hydro-machinery.

**301 Safety and Accident Prevention** Spring, 2 credits. S-U grades optional.

Lec, T Th 9:05. E. W. Foss. Educational programs, engineering design, and legal efforts including the Federal Occupational Safety and Health Act will be studied. Safety related organizations ranging from local police and fire departments to international organizations such as National Fire Protection Association and the United Nations will be reviewed. Emphasis will be placed on agricultural and rural applications.

**310 Advanced Farm Metal Work** Fall or spring. Fall, 1 credit; spring, 1 or 2 credits. Prerequisite: 110 or permission of instructor.

Lab, fall and spring, F 1:25-4; for 2 credits a second lab must be arranged. F. G. Lechner. Fall, advanced machine shop. Spring, advanced welding and metal construction project.

**311 Farm Machinery** Spring, 3 credits. S-U grades optional. Not open to freshmen.

Lec, T Th 11:15. One rec-lab each week, T W or Th 1:25-4:25. Limited to 15 students each lab section. W. F. Millier. A study of the operating principles, use, selection, and methods of estimating costs of owning and operating farm machines. The laboratory work will include practice in the calibration of planting, fertilizing, and pesticide application machinery, plus study of the functional characteristics of agricultural machines and machine components.

**312 Power for Agricultural Operations** Fall, 3 credits. Prerequisite: Phys 102 or equivalent. Audio-visual-tutorial lec.

Lec, at student convenience; lab, W Th 1:25-4:25. W. F. Millier. A study of power in agriculture with emphasis on the principles and adjustment of internal combustion engines and tractors. Topics include agricultural power in the United States and the world, carburetors, transmissions, tractor tests, tractor traction, ignition systems, and human factors.

**315 Electricity on the Farm** Spring, 3 credits. Offered in alternate years. Prerequisite: 131 or Phys 102 or equivalent.

Lec, T Th 10:10; lab, T or Th 1:25-4:25. Instructor to be assigned. The application of electricity for light, heat, and power on farms, with emphasis on the principles of operation, selection, and installation of electrical equipment for the farmstead.

**321 Soil and Water Conservation** Fall, 2 credits. S-U grades optional. Must be taken with Agron 321.

Lec, 8; disc-lab, M or T 1:25-4:25. Additional labs

offered if enrollment requires. M. F. Walter.  
A study of the principles and practices used in the solution of soil and water conservation problems. Both farm and nonfarm problems are explored. Engineering aspects of erosion control, water management and storage, and drainage are examined.

### 325 Introduction to Environmental

**Pollution** Spring. 3 credits. S-U grades optional. M W F 11:15. D. C. Ludington.

A general course dealing with impairment of the environment by the wastes of man. The causes and effects of air, water, and soil pollution will be discussed. Fundamental factors underlying waste production, abatement, treatment, and control will be included. A selected number of wastes from urban, rural, and industrial areas will be used to illustrate the factors.

### 326 Agricultural Practices and Environmental

**Pollution** Fall. 3 credits. Prerequisite: 325 or permission of instructor.

Lec-rec, T Th 8-9:30. D. C. Ludington.  
Agricultural practices will be studied with regard to maintaining and improving environmental quality. Subjects will include alternatives for managing wastes associated with animal production, use of inorganic fertilizers and pesticides, conservation of soil and water, and rural domestic waste disposal. Pollution of water and air—esthetic aspects and legal restraints will be emphasized. Guest lecturers will be used.

### 331 Farmstead Production Systems

Fall. 3 credits. S-U grades optional. M W F 8. R. T. Lorenzen.

A study of the facilities and equipment associated with agricultural production on the farmstead, with emphasis on operational planning and biotransformation design, including the production environment.

### 332 Farm Buildings Design

Fall. 2 credits. Prerequisite: 101 or 151, or permission of instructor. Lec-lab combination, Th 1:25-4:40. R. T. Lorenzen.

Structural and thermal design of buildings used for farmstead production systems including strength and thermal characteristics of basic structural and insulation materials.

### 400 Special Problems in Agricultural

**Engineering** Fall or spring. 1 credit or more.

Normally reserved for seniors in upper two-fifths of class; undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade. Prerequisite: adequate ability and training for the work proposed.

Staff.  
Special work in any area of agricultural engineering on problems under investigation by the department or of special interest to the student, provided, in the latter case, that adequate facilities can be obtained.

### 401 Career Development in Agricultural

**Engineering** Fall. 1 credit. S-U grades optional. Open only to seniors.

Lec, T 12:20. W. W. Gunkel.  
Presentation and discussion of the opportunities, qualifications, and responsibilities for positions of service in the various fields of agricultural engineering.

### 415 Physical Analysis of Plant and Animal

**Materials** Spring. 2 credits. Prerequisite: one semester of calculus.

Lec, T Th 8. G. E. Rehkugler.  
Analysis of the physical properties of plant and animal materials. Physical properties are defined and the relationship of the physical properties to material deformation, flow, failure, and damage is examined. Both thermal and physical-mechanical properties are analyzed relative to natural and processed products handling, processing, and storage.

### 416 Laboratory Practice in Physical

**Analysis** Spring. 1 credit. Prerequisite: one semester of calculus.

Rec, F 1:25-2:15, or lab, F 1:25-4:30, given on alternate weeks. G. E. Rehkugler.  
Laboratory component of course 415. Laboratory practice in measurement of the physical behavior of natural and processed plant and animal materials.

### 450 Introduction to Analog Computation

Fall. 2 credits. Prerequisite: basic knowledge of differential equations.

Lec, T 11:15; lab, T or Th 2:30-4:25. R. B. Furry.  
Fundamentals of analog computing with elementary examples of applications from biological and physical systems. Includes basic computing elements, analog programming, scaling, and computer operation.

### 461 Agricultural Machinery Design

Spring. 3 credits. Offered in alternate years. Prerequisite: mechanical design or equivalent.

Lec, T Th 10:10; lab, Th 1:25-4:25. W. W. Gunkel.  
The principles of design and development of agricultural machines to meet functional requirements. Emphasis is given to computer-aided analysis and design, stress analysis, selection of construction materials, and testing procedures. Engineering creativity and agricultural machine systems are also stressed.

### [462 Agricultural Power

Fall. 3 credits. Offered in alternate years. Prerequisite: engineering mechanics (dynamics) or equivalent. Not offered fall, 1976.

Lec, T Th 10:10; lab, Th 1:25-4:25. W. W. Gunkel.  
Utilization of energy in agriculture. Emphasis is given to basic theory and analysis and testing of internal combustion engines and suitable components for use in farm tractors and other power applications. Soil mechanics related to traction and vehicle mobility; economics and human factors in design will be considered.]

### 465 Processing and Handling Systems for

**Agricultural Materials** Spring. 3 credits. Offered in alternate years. Prerequisite: 450.

Lec, T Th 11:15; lab, T or W 2:30-4:25. R. B. Furry.  
Separation, drying, psychrometrics, fluid flow measurement, heat transfer applications, and an introduction to dimensional analysis and controls for agricultural applications. Problem solutions employ both analog and digital computers.

### 471 Soil and Water Engineering

Fall. 3 credits. Prerequisite: fluid mechanics or hydraulics and soils, or concurrent registrations; farm management recommended.

Lec, T Th 9:05; lab, Th 1:25-4:25. L. G. James.  
The application of engineering principles to problems of soil and water management. Hydrology, design and construction of erosion control systems, channel stabilization, small reservoirs, earth embankments, drainage, and irrigation.

### 475 Introduction to Environmental Systems

**Analysis** Fall. 3 credits. Prerequisite: 1 year college math.

Hours: to be announced. D. A. Haith.  
Introduction to systems analysis and its application to environmental quality management. Simulation, linear programming, and dynamic programming applied to problems in water and air pollution control, solid waste disposal, agricultural wastes, etc.

### 481 Agricultural Structures Design

Spring. 2 credits. Offered during alternate years. Prerequisite: Structural Engineering I.

1 lec and 1 disc-lab, hours to be arranged. N. R. Scott.  
Application of basic structural concepts to design of agricultural structures. Emphasis on wood structures, including design of trusses, rigid frames, prefabricated panels, and columns.

### 482 Environmental Control for Animals and

**Plants** Spring. 2 credits. Offered during alternate

years. Prerequisite: thermodynamics.

1 lec, 1 disc-lab, hours to be arranged. N. R. Scott.  
Thermal interchanges between animals (including man) and plants with the environment. Physiological principles affecting thermal comfort and health. Ventilation, air conditioning, psychrometrics, solar energy, and weather phenomena.

### 491 Highway Engineering

Fall. 3 credits. Prerequisite: Civil Engineering D301 or permission of instructor.

Lec, W F 12:20; lab, M 12:20-3:20. L. H. Irwin.  
Study of highway systems, planning, economy analysis, road location and geometric design, traffic engineering, drainage design, soil engineering, highway materials, pavement design, and highway maintenance. Emphasis is on secondary roads.

### 492 Bituminous Materials and Pavement

**Design** Spring. 3 credits. Prerequisite: 491 or permission of instructor.

Lec, W F 12:20; lab, M 12:20-3:20. L. H. Irwin.  
Properties of asphalts, aggregates, and bituminous mixtures; bituminous mixture design. Seal coat and surface treatment design. Soil stabilization methods. Flexible pavement design methods; rigid pavement design methods; pavement design for frost conditions.

### 495 Transportation Policies for Developing

**Nations** Fall. 3 credits. Prerequisite: upperclass or graduate standing and permission of instructor.

Limited to 20 students. Offered on sufficient demand. T Th 1:25-3. L. H. Irwin.

A multidisciplinary study of transportation in developing nations. Areas of investigation will include policymaking and implementation, economic policy analysis, sociological considerations, and technology of road building. A term project report on an appropriate aspect of transportation for developing nations will be required.

**501-502 MPS Project** Fall and spring. Total credit up to six hours.

Hours to be arranged. Staff.  
Comprehensive project utilizing applied problems pertinent to agricultural engineering. Required of each MPS candidate in the field.

### 551-552 Agricultural Engineering Design

**Project** Fall and spring. 6 credits. Prerequisite: admission of the M. Eng. (Agr.) degree program or equivalent preparation.

Hours to be arranged. G. E. Rehkugler and staff.  
Comprehensive design projects dealing with existing engineering problems in the field. Emphasis is on the formulation of alternate design proposals which include consideration of economics, nontechnical factors, engineering analysis, and complete design for the best alternative design solution.

### 651 Similitude Methodology

Spring. 3 credits. 2 lec, 1 lab, hours to be arranged. R. B. Furry.  
Similitude methodology, including the use of dimensional analysis to develop general equations to define physical phenomena; model theory, distorted models, and analogies, with an introduction to a variety of applications in engineering.

### 652 Instrumentation

Spring. 3 credits. Prerequisite: electrical systems or permission of instructor.

2 lec, 1 lab, hours to be arranged. N. R. Scott.  
Application of instrumentation concepts and systems to physical and biological measurements. Characteristics of instruments, signal conditioning and interfacing, shielding and grounding, transducers, data acquisition systems, and radiotelemetry are considered.

### 672 Drainage Engineering

Spring. 3 credits. Prerequisite: 471 or permission of instructor.

Lec, T Th 9:05; lab Th 1:25-4:25. R. D. Black, M. F. Walter.  
Analysis and design of surface, subsurface, and

combined drainage systems with emphasis upon agricultural applications. The elements of surface, channel, and porous media flow will be analyzed as well as entire systems of collectors, storages, pumps, and methods of overflow protection for large areas. Organization of drainage districts, drainage programs, and legal aspects of drainage will be reviewed.

**677 Treatment and Disposal of Agricultural Wastes** Fall. 3 credits. Prerequisite: permission of instructor.

Lec, M W F 8. W. J. Jewell.  
Emphasis is on the causes of agricultural waste problems and application of fundamentals of treatment and control methods to minimize related pollution. Fundamentals of biological, physical, and chemical pollution control methods are applied to animal wastes, crop production, and food and fiber processing wastes in examples and design of management systems.

**678 Water Quality Modelling (also Civil Engineering H626)** Spring. 3 credits. Prerequisite: calculus through 294 or 215.

Hours to be announced. D. A. Haith, C. A. Shoemaker.  
Quantitative descriptions of the effects of point and nonpoint sources of pollution on the chemical and biological aspects of receiving waters. Mathematical models of dissolved oxygen, agricultural and urban runoff, and aquatic ecosystems.

**679 Use of Land for Waste Treatment and Disposal** Spring. 3 credits. Prerequisite: permission of instructor.

Lec, M W F 9:05. W. J. Jewell.  
Three areas are covered: the socio-legal-technical factors; the properties of land and crop systems which make land application of wastes a viable alternative; and the use of fundamentals to development regulations and the design of full-scale units.

**685 Biological Engineering Analysis** Fall. 4 credits. Prerequisite: permission of instructor, or Engineering T & AM 311.

T Th 10:10-11:40. J. R. Cooke.  
Engineering problem-solving strategies and techniques will be explored. The student will solve several representative engineering problems which inherently involve biological properties. The mathematical modeling will emphasize problem formulation and interpretation of results. The student's knowledge of fundamental principles will be utilized extensively. Principles of feedback control theory will be applied to biological systems.

**750 Orientation for Research** Fall. 1 credit.

Lec, M 4, except first 5 weeks, 3:20. R. B. Furry.  
Introduction of newly joining graduate students to departmental research policy, programs, methodology, resources, and candidate responsibilities and opportunities.

**761 Power and Machinery Seminar** Spring.

1 credit. S-U grades only. Prerequisite: graduate status and permission of instructor.  
Hours to be arranged. Staff.  
Study and discussions of research and new developments in agricultural power and machinery.

**771 Soil and Water Engineering Seminar** Spring. 1 to 3 credits. S-U grades optional. Prerequisite: graduate status and/or permission of instructor.

Hours to be arranged. Staff  
Study and discussion of research or design procedures related to selected topics in irrigation, drainage, erosion control, and agricultural hydrology.

**775 Agricultural Waste Management Seminar** Fall and spring. 1 credit. S-U grades only. Prerequisite: permission of instructors.  
F 3:35-4:30. Staff.

Management of agricultural wastes with emphasis on physical, chemical, biological, and economic factors effecting waste production, treatment and handling, utilization, and disposal.

**781 Agricultural Structures and Related Seminar** Spring. 1 credit. S-U grades only.

Prerequisite: graduate status or permission of instructor.  
1 disc, hours to be arranged. N. R. Scott.  
Consideration of farmstead production systems with emphasis on biological, economic, environmental, and structural requirements.

**785 Biological Engineering Seminar** Spring. 1 credit. S-U grades only. Prerequisite: graduate status or permission of instructor.

1 disc, hours to be arranged. N. R. Scott, J. R. Cooke.  
The interaction of engineering and biology will be examined, especially the environmental aspects of plant, animal, and human physiology in order to improve communications between engineers and biologists.

## Agronomy

R. F. Lucey, chairman; M. Alexander, W. H. Allaway, R. W. Arnold, D. R. Bouldin, W. B. Duke, J. M. Duxbury, G. W. Fick, D. L. Grunes, W. K. Kennedy, W. R. Knapp, J. Kubota, D. J. Lathwell, E. R. Lemon, D. L. Linscott, M. B. McBride, R. D. Miller, R. B. Musgrave, R. L. Obendorf, G. W. Olson, J. H. Pevery, W. S. Reid, T. W. Scott, R. R. Seane, T. R. Sinclair, E. L. Stone, F. N. Swader, A. Van Wambeke, R. M. Weaver, R. M. Welch, M. J. Wright, P. J. Zwermer.

## Soil Science

**200 Nature and Properties of Soils** Fall or spring. 4 credits. S-U grades optional. Prerequisites: Chem 103, 207, 215, or Bio Sci 131.

Lec, M W F 9:05; lab, M T W Th or F 1:25-4:25.  
Fall, D. J. Lathwell; spring, T. W. Scott.

A comprehensive introduction to the field of soil science with emphasis on scientific principles and their application in solutions of practical soil management problems.

**301 Identification, Appraisal, and Geography of Soils** Fall. 4 credits. S-U grades optional. Prerequisite: 200 or permission of instructor.

Lec, M W F 10:10; lab, W 2-4:25. R. W. Arnold.  
The soil as a natural body. Principles of identification and classification of geographic units of soil and interpretation of such units for applied objectives. Geography of major kinds of soil of North America in relation to environment and cultural patterns. Field practice characterizing, mapping, and interpreting geographical soil units.

**321 Soil and Water Conservation** Fall. 2 credits. S-U grades optional. Prerequisite: 200.  
M W 8. Staff.

Must be taken with Agricultural Engineering 321. A study of the principles and practices used in soil and water conservation, agronomic aspects of erosion control, water management, storage, drainage, and irrigation.

**324 Soil Fertility Management** Fall. 3 credits. Prerequisite: Agron 200 or permission of instructor.  
M W F 9:05. D. R. Bouldin.

An integrated discussion of soil-crop yield relationships with emphasis on the soil as a source of mineral nutrients for crops and the role of fertilizers and manure in crop production.

**331 Aquatic Plant Management** Fall. 3 credits. Prerequisites: Bio Sci 101-102 and Chem 103-104 or equivalents.

T Th 11:15 and T 1:25-4:25. J. H. Pevery.  
The chemistry and physiology of higher aquatic

plants will be studied from the inorganic solid, solution, and gaseous phases of the environment to cellular and subcellular levels of the plants. Application of the basic physical and chemical concepts presented to predict effects on aquatic plant growth will be illustrated in laboratory and field situations.

**401 Geography and Appraisal of Soils of the Tropics** Spring. 3 credits. S-U grades optional.

Prerequisite: 200 or equivalent or permission of instructor.  
Lec, M W 12:20; disc, F 2:30-4:25.  
A. Van Wambeke.  
Character of principal kinds of soils in the major climatic regions of the tropics: wet, wet-dry, and dry. Emphasis is on soil properties as bases for interpretation of crop management requirements and production potential. Lectures introduce principles whose applications are examined through discussions, problem solving, and independent literature study.

**403 Organic Soils** Fall. 2 credits. Offered in alternate years. Prerequisite: Agron 200.

W or Th 1:25-4:25. J. M. Duxbury.  
A combination of field study and discussion of the genesis, ecology, physical and chemical properties, agricultural uses, and management of organic soils. Some field trips will not return before 5:30 p.m.

**404 Forest Soils** Fall. 2 credits. Prerequisite: 200.

Lab (Sept-Oct), lec, M or T 1:25-4:25.  
E. L. Stone.  
Field trips will last until 5-5:30. Each section limited to 20 students.

**406 Soil Microbiology (lectures)** Spring. 3 credits. Offered in alternate years. Prerequisite: 200 or Microbio 290. Not offered spring 1977.

M W F 10:10. M. Alexander.  
A study of the major groups of soil microorganisms, their ecological interrelationships, and the biochemical functions of soil organisms.]

**407 Soil Microbiology (laboratory)** Spring. 1 credit. Offered in alternate years. Prerequisite: concurrent registration in 406. Not offered in spring 1977.

T 1:25-4:25. M. Alexander.  
Laboratory exercises concerned with the ecology and biochemical activities of soil microorganisms.]

**410 Microbial Ecology (also Microbiology 492)** Spring. 3 credits. Offered in alternate years.

Prerequisite: an elementary course in some facet of microbiology.  
M W F 10:10. M. Alexander.  
An introduction to the basic principles of microbial ecology. Attention is given to the behavior, activity, and interrelationships of bacteria, fungi, algae, and protozoa in natural ecosystems.

**450 Special Topics in Soil Science** Fall or spring. 1 to 6 credits. S-U grades optional.

Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade.  
Hours to be arranged. Staff.  
The topics to be treated will be arranged at the beginning of each term for individual self-study or for group discussions.

**470 Undergraduate Research in Soil Science** Fall or spring. Credit to be arranged.

Written permission from the staff member who will supervise the work and assign the grade must be attached to preregistration material.  
Hours to be arranged. Staff.  
Independent research on current problems selected from any phase of soil science.

**480 Management Systems for Tropical Soils** Fall. 3 credits. S-U grades optional.

Prerequisite: 200 or equivalent or permission of instructor. Not offered fall 1976.

Lec, W F 8; disc, W 2:30-4:25. Staff on tropical soils.

Physical, chemical, and biological bases for adapting soil management systems for crop production to needs of important kinds of tropical soils. Emphasis is on combinations of practices for managing soil fertility, water, and till for food-crop production. Soils of contrasting properties and environments will be studied.]

#### 506 Use of Soil Information and Maps as Resource Inventories

Fall. 2 credits. Open to everyone interested in using soils. S-U grades optional. Offered in alternate years. Not offered fall, 1976.

T Th 11:15. G. W. Olson.

Principles, practices, and research techniques in interpreting soil information and maps for planning, developing, and using areas of land.]

#### 602 Chemical Methods of Soil Analysis

Spring. 3 credits. Prerequisite: 200 and Chem 207-208 or their equivalent.

T Th 1:25-3:30. M. B. McBride.

Lab exercises demonstrating analytical methods used to quantify soil chemical properties, with emphasis on spectroscopic techniques. Fundamental concepts of soil chemistry will be discussed.

#### 603 Morphology, Genesis, and Classification of Soils

Spring. 3 credits. Offered in alternate years. Prerequisite: 301 or permission of instructor.

T Th 10:10-12. R. W. Arnold.

Principles of soil classification, reactions, and processes of soil genesis, soil taxonomy, and development and significance of major groups of soils of the world.

#### 606 Advanced Soil Microbiology

Fall. 1 credit. S-U grades only for graduate students. Prerequisite: 406 or permission to register.

T 12:20. M. Alexander.

Discussions of current topics in special areas of soil microbiology. Particular attention is given to biochemical problems in microbial ecology.

#### 607 Soil Physics

Fall. 3 credits. Offered in alternate years. Prerequisite: 200 and one year of college physics or permission of instructor.

M W F 11:15. R. D. Miller.

A study of physical properties and processes in soils with emphasis on basic principles.

#### 608 Water Status in Plants and Soils

Fall. 2 credits. Offered in alternate years. Prerequisite: permission of instructor.

Lec, 1 hour to be arranged; lab, Th 1:25-4:25 or as arranged. E. R. Lemon, R. D. Miller.

Techniques for field appraisal of status of water in plants and soil, including methods used in evapotranspiration studies.

#### 609 Soil Organic Matter

Fall. 2 credits. Offered in alternate years. Prerequisites: Agron 200 and Chem 357-358 or equivalent. Not offered fall, 1976.

T Th 9:05. J. M. Duxbury.

A discussion of current concepts of the nature, mode of formation, dynamics, and role of organic matter in soils. Some consideration is given to the behavior of man-made organic chemicals in the soil environment.]

#### 701 Soil Chemistry

Fall. 3 credits. Prerequisite: 200 and a one-year course in introductory physical chemistry, or permission of instructor.

T Th S 10:10. M. B. McBride.

Chemical properties of soils, with emphasis on structure and surface chemistry of soil minerals, ion exchange, mineral-solution equilibria, and adsorption reactions of the inorganic soil components.

#### 724 Soil Fertility Advanced Course

Spring. 3 credits. Offered in alternate years. Prerequisite:

graduate status with a major or minor in agronomy.

T Th S 9:05. D. R. Bouldin.

A study of selected topics in soil-crop relationships with emphasis on concepts of soil fertility, interpretation of experimental data, and soil fertilizer chemistry.

#### 760 Graduate Research in Soil Science

Fall or spring. Credit and hours by arrangement. Not open to undergraduates. Open to all members of the graduate field.

#### 790 Agronomy Seminar

Fall or spring. Without credit. Required of graduate students majoring or minoring in the department.

T 4.

#### Special Studies of Problems of Agriculture in the Tropics (International Agricultural Development 602)

#### Crop Science

##### 111 Introduction to Crop Science

Fall or spring. 4 credits. No prerequisite; open to all classes.

Lec, M W F 10:10; fall lab, M T W Th or F

1:25-4:25; spring lab, M T W or Th 1:25-4:25. Fall,

R. L. Obendorf; spring, R. R. Hahn.

Principles of field crop growth, development and maturation, species recognition, soil and climatic adaptations, liming and mineral nutrition, weed control, cropping sequences, management systems, and crop improvement are considered. Feed crops for livestock and food and fiber crops including forage, grain, protein, and oil crops are emphasized. Field trips (one or two) to study experimental methods and/or farm operations are held during laboratory periods until 5.

##### 312 Feed Crops

Spring. 4 credits. Prerequisites: 111 or equivalent; Anim Sci 112 is recommended.

Lec, M W F 8; disc, T 9:05. G. W. Fick.

The production and management of crops used for livestock feed are considered in terms of establishment, growth, maintenance, harvesting, and preservation. Forage grasses, forage legumes, and corn are emphasized and consideration is given to their value as livestock feed in terms of energy, protein, and other nutritional components.

##### 315 Weed Science

Spring. 3 credits. Prerequisites: 111, 200, and Bio Sci 103 and 104 or Bio Sci 145.

Lec, T Th 8; lab, M 2-4:25. W. B. Duke.

Principles of weed science are examined. Emphasis is given to (a) weed ecology; (b) chemistry of herbicides in relation to effects on plant growth; and (c) control of weeds in all crops. Laboratory covers factors which affect herbicide activity and includes some weed identification.

##### 371 Undergraduate Research in Crop Science

Fall or spring. Credit to be arranged.

Written permission from the staff member who will supervise the work and assign the grade must be attached to preregistration material.

Hours to be arranged. Staff.

Independent research on current problems selected from any phase of crop science.

##### 422 Tropical & Crop Production

Spring. 3 credits. Prerequisites: a course in elementary botany and crop science and permission of instructor.

Lec, M W F 10:10. M. J. Wright.

Designed to provide some knowledge and understanding of the tropical environment and its agriculture and the crops of the tropics and subtropics.

##### 611 Analysis and Computer Simulation of Crop Production

Fall. 3 credits. Offered in alternate years. Prerequisite: permission of instructor; plant physiology and computer programming suggested.

M W F 11:15. G. W. Fick.

Study of existing crop models is followed by

development and refinement of programs representing the students' own work. The computer language CSMP is used. Emphasis is placed on quantitative formulation and testing of complex hypotheses related to crop growth. Carbon exchange, transpiration, microclimate, soil water supply, root functions, and dry matter distribution in growing crops are covered.

##### 613 Crop Ecology

Fall. 2 credits. Offered in alternate years. Prerequisite: 111, 200, and Bio Sci 240. Class meetings to be twice weekly for last ten weeks of semester for two hours per meeting.

Hours to be arranged. R. B. Musgrave.

A study of special techniques used to obtain and analyze physiological data on crop plant responses to environmental conditions occurring in the field.

##### 651 Special Topics in Crop Science

Fall or spring. 1 to 6 credits. S-U grades optional. Undergraduates must attach to their preregistration material, written permission from the staff member who will supervise the work and assign the grade.

Hours to be arranged. Staff.

The topic to be treated will be arranged at the beginning of each term for individual self-study or for group discussions.

##### 761 Graduate Research in Crop Science

Fall, spring, or summer. Credit and hours by arrangement. Not open to undergraduates. Open to all members of the graduate field.

##### 790 Agronomy Seminar

Without credit. See Agronomy—Soil Science.

#### Forages of the Tropics for Livestock Production (Animal Science 403)

#### Special Studies of Problems of Agriculture in the Tropics (International Agricultural Development 602)

## Animal Sciences

Department of Animal Science: J. T. Reid, chairman; H. R. Ainslie, B. J. Appgar, W. F. Brannon, R. W. Bratton, W. R. Butler, L. E. Chase, C. E. Coppock, J. M. Elliot, R. W. Everett, R. H. Foote, R. C. Gorewit, W. Hansel, D. A. Hartman, H. F. Hintz, D. E. Hogue, J. E. Lowe, R. E. McDowell, W. G. Merrill, J. I. Miller, R. P. Natzke, P. A. Oldenacu, W. G. Pond, R. L. Quaas, S. W. Sabin, H. F. Schryver, S. T. Slack, S. E. Smith, R. W. Spalding, J. R. Stouffer, M. L. Thonney, H. F. Travis, D. R. VanCampen, N. L. VanDemark, P. J. VanSoest, L. D. VanVleck, R. G. Warner, G. H. Wellington.

Department of Poultry Science: R. J. Young, chairman; R. E. Austic, R. C. Baker, A. Bensadoun, S. E. Bloom, H. F. Brotman, G. F. Combs, Jr., C. E. Ostrander, J. M. Regenstien, E. A. Schano, M. L. Scott, G. H. Thacker, A. vanTienhoven.

##### 100 Introductory Animal Science

Fall. 3 credits. S-U grades optional.

Lec, W F 10:10; lab, T Th F 2-4:25. J. M. Elliot. For the beginning student, an introduction to the subject matter dealing with domestic animals and with current practices and problems of the livestock and meat industries. The place of the physical and biological sciences in animal agriculture is discussed. Emphasis is on the nutrition, physiology, breeding, and management of dairy cattle, beef cattle, sheep, swine, and horses.

##### 105 Contemporary Perspectives of Animal Science

Spring. 1 credit. S-U grades optional.

T 1:25, W 10:10, 12:20. Animal science faculty.  
A forum for students and faculty to discuss the contemporary and future role of animals in relation to the needs of man.

### 230 Poultry

Spring. 3 credits.  
Lec, T Th 11:15; lab, W 2-4:25. On the several days when there are field trips, a longer Wednesday session may be necessary.  
G. F. Combs.

Designed to acquaint the student with the scope of the poultry industry, with emphasis on the principles of avian biology and their application in the various facets of poultry production.

### 241 Applied Livestock Selection and Meat Evaluation: Beef Cattle, Sheep, and Swine

Fall. 2 credits. Prerequisite: 100 or permission of instructor.

Lec and lab, W 2-4:25. J. I. Miller, G. H. Wellington.

Practical application of the various methods used in determining the utility value of market and breeding classes of meat animals and carcasses. Grading standards, meat quality and yield factors, breeding records, performance, and progeny tests are considered. A one-day field trip is taken to study market and consumer acceptability of meat products.

### 260 Beef cattle

Spring. 3 credits. Prerequisite: 100 or permission of instructor.

Lec, T Th 10:10; lab, M 2-4:25. J. I. Miller.  
The management, feeding, breeding, selection, and marketing problems involved in the beef cattle enterprise are emphasized. A one-day field trip is taken to study successful beef production methods.

### 265 Horses

Spring. 2 credits. Prerequisite: 100 or permission of instructor.

Lec, Th 9:05; lab, Th 1:25-4:25. H. F. Hintz, J. E. Lowe.

Selection, management, feeding, breeding, training, and marketing of light horses.

### 365 Seminar on Horse Production

Fall. 2 credits. Prerequisites: 112, 220, 221, and 265, or equivalent. Enrollment limited to 18 students.

F 1:25-4. H. F. Hintz, J. E. Lowe.

Students present seminars on the management of various types of horse enterprises such as the breeding farm, training stable, and riding stable. One all-day field trip will be taken.

### 370 Swine

Fall. 3 credits. Prerequisite: 100; 112, 220, and 221 also recommended.

Lec, T Th 11:15; lab and disc periods, alternate M 1:25-4:25. The laboratory and discussion period is offered on alternate Mondays, arranged so students can take 380 concurrently. W. G. Pond.

The characteristics of swine and their breeding, feeding, management, and selection. Laboratory and discussion periods are designed to give the student a practical knowledge of the pig as an animal and of commercial swine production practices.

### 380 Sheep

Fall. 3 credits. Prerequisite: 100; 112, 220, and 221 also recommended.

Lec, T Th 10:10. Lab and disc periods, alternate M 1:25-4:25. The laboratory is given on alternate Mondays, arranged so students can take 370 concurrently. D. E. Hogue.

The breeding, feeding, management, and selection of sheep. Lectures and laboratory are designed to give the student a practical knowledge of sheep production as well as the scientific background for improved practices.

### 400 Livestock Production in Warm Climates

Spring. 3 credits. Prerequisites: 112, 220, and 221, or permission of instructor.

Lec, T Th 10:10; disc, W 1:25-3:20.

R. E. McDowell.

Deals with factors inhibiting efficiency of performance of livestock and roles animals can fulfill as sources of human food, power for agriculture, and fiber in warm

climate regions of the world.

### 403 Forages of the Tropics for Livestock Production.

Spring. 3 credits. Offered in alternate years. Prerequisite: crop production, livestock nutrition, or permission of instructors.

Lec, T Th 12:20; disc T 1:25. R. E. McDowell, P. J. Van Soest, L. V. Crowder.

Review of tropical grasslands, sown pastures, and fodders and their utilization as feed resources; grass and legume characteristics; establishment and management of pastures and feed source alternatives; forage quality and utilization.

### Poultry Hygiene and Disease (Veterinary

255)

Fall. 2 credits. Offered in alternate years. Limited to 15 students. Prerequisite: Microbio 290 and 291 and permission of instructor.

Th 2-4:25. Veterinary College. M. C. Peckham.  
The nature of the infectious and parasitic diseases of poultry and the principles of hygiene applicable to poultry farming for the prevention and control of disease.

### Health and Diseases of Animals (Veterinary

475)

Spring. 3 credits. Not open to first-year students or to those who have had no course in animal husbandry.

Lec, M W F 11:15. Veterinary College. C. E. Hall.  
Diseases of domestic animals, chiefly those related to food and fiber production, are discussed generally and with specific examples or models. Causes, prevention and control, and importance to human health are emphasized.

### Special Studies on Problems of Livestock Production in the Tropics (International Agriculture 602)

### Meats

#### 290 Meat and Meat Products

Fall or spring. 3 credits.

Lec, T Th 9:05; lab, fall M T or Th 1:25-4:25; spring M T or W 1:25-4:25. J. R. Stouffer.

An introduction to meat science through a study of the characteristics of meat from slaughter to consumption. Structure, composition, inspection, grading, preservation, cutting, and processing will be included. A trip to commercial meat plants will be taken.

#### 392 Wholesale and Retail Meat

Fall. 3 credits.

Lec, F 11:15; lab, W 11:15-1:45. G. H. Wellington.  
Selection, packaging, wholesale distribution, retail merchandising, and consumer use of meat in home and institutional kitchens. Lecture-demonstration followed by student practice. A one-day field trip is included and it necessitates one night's lodging near New York prior to industry visits.

#### 490 Science and Technology of Meat and Eggs

Spring. 3 credits. Prerequisite: 290 or permission of instructor.

Lec, T Th 11:15; lab, Th 1:25-4:25.  
G. H. Wellington, J. M. Regenstein.

The character of muscle and associated tissues as food. The relationship of structure and composition to food quality and palatability. The applications of science to meat preservation, processing, and distribution through laboratory demonstration and practice in the pilot meat plant in Morrison Hall.

### Dairy Husbandry

#### 250 Dairy Cattle

Fall. 3 credits. S-U grades optional.

Lec, T Th 10:10; lab, M T Th 1:30-4. R. P. Natzke.  
Introduces students to the major components of the dairy industry. Topics discussed include breeding, feeding, reproduction, milking, milk secretion, replacement rearing, disease prevention, and record keeping. Laboratories are designed to provide limited practice in husbandry techniques.

#### 251 Dairy Cattle Selection and Type Evaluation

Spring. 3 credits.  
Lab, W 1:25-5:30; 1-hr discussion arranged at students convenience; 1 all-day Sat. field trip.  
S. T. Slack

Emphasis on conformation characteristics for practice type to achieve wearability for high lifetime production. Practical sessions include planned trips to outstanding herds in the state.

#### 350 Dairy Cattle Production and Management

Spring. 3 credits. Prerequisites: 112, 220, 221, or permission of instructor.

Lec, T Th 10:10; lab, T W 1:25-4:25. R. P. Natzke, C. E. Coppock, L. D. VanVleck.

Analysis of breeding, feeding, housing, and management systems for economical production; evaluation of milking systems including principles of milk secretion and milking procedures. Includes farm visits to observe application of modern technology in operation.

#### 352 Advanced Dairy Cattle Selection

Fall. 3 credits. Prerequisite: 251. Registration by permission.

Practice hours to be arranged. S. T. Slack.  
Emphasis on additional training in comparative judging for students selected from 251 to represent the institution in intercollegiate judging competition.

### Animal Breeding and Genetics

#### 221 Introductory Animal Genetics

Spring. 3 credits. S-U grades optional. Prerequisite: one year of college biology.

Lec, T Th 12:20; disc, W Th or F 2-4:25.  
R. L. Quaas.

An examination of basic genetic principles and their application to the improvement of domestic animals, with emphasis on the effects of selection and mating systems on animal populations.

#### 225 Animal and Plant Genetics (also Plant Breeding 225)

Spring. 5 credits. Prerequisite: introductory biological sciences.

Lec, M W F 12:20; lab, T or Th 1:25; disc to be arranged. H. F. Brotman, L. V. Crowder.

Basic genetic principles of animals and plants, structure and expression of hereditary material, Mendelian inheritance, cytogenetics, sex determination and differentiation, genetic interactions, population genetics, disease resistance, and somatic cell genetics. Tests of theories and applications by lab experiments.

#### 321 Seminar on Genetics of the Horse

Spring. 1 credit. Prerequisite: 265 or permission of instructor; 221, 225, or Bio Sci 281 recommended.

Hours to be arranged. L. D. VanVleck.  
Discussion of genetics of the horse with special reference to simply inherited traits and selection for quantitative traits.

#### 419 Animal Cytogenetics

Fall. 4 credits. Limited to 20 students. Prerequisites: 221, 225, or Bio Sci 281, or permission of instructor.

Lec, T Th 10:10; lab, T or W 1:25-5, and 2 other hours to be arranged. S. E. Bloom.

A study of normal and abnormal chromosomes in higher animals. Lecture topics include chromosome organization, chromosome movement, cytogenetics of abortuses, parthenogenesis, chromosomes and cancer, mitotic and meiotic errors, and human clinical cytogenetics. In laboratory, students obtain chromosome preparations from various animals and use cytochemical and photographic methods for karyotype analysis.

#### 420 Quantitative Animal Genetics

Fall. 3 credits.  
Lec, T Th 11:15; lab, W Th or F 2-4:25.  
L. D. VanVleck.

A consideration of problems involved in improvement of animals, especially farm animals, through application of the theory of quantitative genetics with emphasis on selection index.

**421 Seminar in Animal Genetics** Fall, 1 credit.

Prerequisite: 221 or may take concurrently with 420.

Hours to be arranged. L. D. VanVleck,  
R. W. Everett.

Discussion of applications of principles of quantitative genetics and animal breeding to specific types of animals such as dairy, meat, and horses.

**422 Research Techniques in Quantitative Animal Genetics** Fall, 1 credit. Prerequisite: 420 (may take concurrently).

Hours to be arranged. L. D. VanVleck.

Introduction to methods of research in quantitative genetics and animal breeding, including estimation of heritability, repeatability, and genetic and phenotypic correlations.

**430 Livestock Improvement through Artificial Breeding** Spring, 4 credits. Open to upperclass and graduate students. Prerequisites: 220, 221, or equivalent, or permission of instructor.

Lec, T 10:10; disc, to be arranged; lab, T F or M Th 2-4:25. R. W. Bratton.

Study of the artificial breeding industry and the physiological and genetic principles used to maximize the improvement of the genetic traits of economic importance in farm livestock production. An opportunity is afforded students to gain individual experience in both the physiological and genetic techniques relevant to both the male and female aspects of artificial breeding.

**520 Experimental Methods in Quantitative Genetics and Animal Breeding** Spring, 3 credits.

Prerequisites: Stat Bio 417 and either Stat Bio 517 or a course in mathematical statistics.

Hours to be arranged.  
Estimation of genetic and environmental parameters required to design efficient selection programs. Particular emphasis is given to interpretation of experimental and survey data with unequal subclass numbers and to prediction of genetic progress resulting from alternative selection methods.**620 Seminar in Animal Breeding** Fall or spring, 1 credit. Open to graduate students with major or minor in animal breeding.

Hours to be arranged.

**Animal Physiology****220 Animal Reproduction and Development** Fall, 4 credits. Prerequisite: a year of college biology or equivalent. Limited to 36 students per lab section.

Lec, T Th 9:05; dem and lab, M T W Th or F 2-4:25 or T 10:10-12:35 or F 11:15-1:25. R. H. Foote.

An introduction to the comparative anatomy and physiology of reproduction of farm animals. The life cycle from fertilization through development and growth to sexual maturity will be studied, with emphasis on physiological mechanisms involved, relevant genetic control, and the application to fertility regulation of animal and human populations. An audio-tutorial laboratory is available for independent study to prepare for laboratory experiments.

**427 Fundamentals of Endocrinology** Fall, 4 credits. Prerequisite: a course in human or veterinary physiology, or permission of instructor.

Lec, T Th S 10:10; lab, T or Th 1:25-4:25.

W. Hansel, W. R. Butler.  
The physiology of the endocrine glands and the roles played by each hormone in the regulation of normal body processes. The laboratory work consists of a series of experiments designed to illustrate the basic principles of endocrinology.**[428 Comparative Physiology of Reproduction of Vertebrates** Spring, 2 credits. Prerequisite: 427 or consent of instructor. Not offered spring, 1977.Lec, W F 1:25. A. van Tienhoven.  
Sex and its manifestations. Neuroendocrinology, endocrinology of reproduction, sexual behavior, gametogenesis, fertilization, embryonic development,

oviparity, viviparity, environment and reproduction, nutrition and reproduction.]

**[429 Reproductive Physiology of Vertebrates Laboratory** Spring, 2 credits. Prerequisite: 428 or coregistration in 428, or permission of instructor. Not offered spring, 1977.Hours to be arranged; organization meeting F 2:30. A. van Tienhoven.  
The laboratory provides students with an opportunity to design and execute independently experiments with limited objectives.]**451 Physiology and Biochemistry of Lactation** Spring, 3 credits. Offered in alternate years. Prerequisite: 220 and Bio Sci 231, or permission of instructor.

Lec, T Th 9:05; lab, Th 2-4:25. R. C. Gorewit.

Emphasis is placed on mammary gland development, anatomy, physiological control of milk secretion, and biochemical synthesis of milk constituents in laboratory and farm animals.

**610 Seminar in Animal Reproduction and Endocrinology** Spring, Noncredit. Open to graduate students with major or minor in animal physiology.

T 4:30.

**Elementary Animal Physiology (Veterinary 345)** Spring, 3 credits. Prerequisites: one year of biology or zoology and college courses in chemistry.

M W F 10:10. L. L. Nangeroni.

Lectures and demonstrations arranged especially for students of agriculture, but open to others. Intended for students who do not plan to continue in physiology or allied fields.

**Introductory Animal Physiology (Veterinary 346)** Spring, 4 credits. 3 lectures and 1 recitation. Prerequisites: one year of biology, college chemistry, and mathematics.M W F 11:15. D. N. Tapper.  
A general course in vertebrate physiology emphasizing the basic characteristics of the circulatory, nervous, pulmonary, renal, and gastrointestinal systems and of energy metabolism, endocrinology, and reproductive physiology. Neural and hormonal control of function is emphasized. (See Physical Biology 348 for associated laboratory.)**Introductory Physical Biology (Veterinary 347)** Fall, 3 credits. Prerequisites: basic biology, chemistry, and calculus, or permission of instructor.M W F 10:10. R. H. Wasserman, F. W. Lengemann, H. Moraff.  
The specific application of quantitative and physical concepts to biological problems. This course provides background or is complementary to other courses at this or advanced levels that deal with physiology, nutrition, radioisotopes in biological research, cellular membranes, quantitative ecology, and biophysics. Topics include the interrelations of biological and physical sciences; mathematical approach to physiological problems; principles of tracers, kinetics, and compartmental analysis; systems analysis and control theory; membranes and transport processes; physicochemical aspects; thermodynamics and biological systems; ion binding to macromolecules ion selectivity theory.**Introductory Animal Physiology Laboratory (Veterinary 348)** Spring, 1 credit. Prerequisite or corequisite: Physical Biology 346. Designed to supplement Physical Biology 346. Limited to 100 students with priority of registration given to students concentrating in animal physiology.1:25-4:25, day to be announced; lab sessions/alternate weeks. D. N. Tapper.  
Laboratory sessions will consist of demonstrations, instructor-assisted experiments, and student-run experiments covering the nervous, pulmonary, renal, circulatory, and gastrointestinal systems.**Introductory Animal Physiology Laboratory (Veterinary 348)** Spring, 1 credit. Prerequisite or corequisite: Physical Biology 346. Designed to supplement Physical Biology 346. Limited to 100 students with priority of registration given to students concentrating in animal physiology.1:25-4:25, day to be announced; lab sessions/alternate weeks. D. N. Tapper.  
Laboratory sessions will consist of demonstrations, instructor-assisted experiments, and student-run experiments covering the nervous, pulmonary, renal, circulatory, and gastrointestinal systems.**Mammalian Physiology (Biological Sciences 414)****Animal Nutrition****112 Livestock Nutrition** Spring, 4 credits.

Prerequisite: Chemistry 103 or 207; recommended: Animal Science 100.

Lec, M W F 10:10; lab M T W Th or F 2-4:25. S. E. Smith.

Introduction to animal nutrition, covering fundamentals of nutrition, the composition of feeds, feeding standards, and their application to various forms of production in dairy and beef cattle, sheep, swine, and horses.

**113 Nutrition of Companion Animals** Fall, 1 credit. Prerequisite: 112 or equivalent.W 7-9 p.m. First seven weeks. H. F. Hintz.  
Nutrition of companion animals with emphasis on the dog and cat. Digestive physiology, nutrient requirements, feeding practices, and interactions of nutrition and disease will be discussed.**311 The Principles and Practice of Animal Feeding** Spring, 3 credits. Offered primarily for students in the College of Veterinary Medicine. Non-animal science, preveterinary students may complete this course as the basic nutrition prerequisite to the veterinary college. Animal science majors should complete courses 112 and 410.Lec, W F 8; lab, W 2-4:20. D. E. Hogue.  
Consideration is given to the basic principles of animal nutrition; nutritive requirements for various body functions; the identification, composition, and nutritive value of feeds; and the formulation of animal rations. The species covered include dairy cattle, beef cattle, sheep, swine, and horses, and there will be some consideration of dogs, cats, and other small animals.**410 Principles of Animal Nutrition, Lectures** Fall, 3 credits. Prerequisite: organic chemistry; biochemistry is recommended prior to or concurrently.M 8 or 4:30, W F 8; 2 disc per term to be arranged. R. G. Warner.  
The principles of nutrition are developed from a discussion of the biochemical and physiological interaction of the nutrients as they apply to the cell and the whole animal. Examples are selected from a broad range of animal species including man.**411 Principles of Animal Nutrition, Laboratory** Fall, 1 credit. Enrollment limited to 20 students. Must be concurrently registered in 410.Hours to be arranged. R. G. Warner, H. F. Hintz, R. E. Austic, H. F. Travis, D. E. Hogue.  
Laboratory problems with animals will be conducted which are designed to introduce the student to techniques of experimental nutrition.**415 Poultry Nutrition** Fall, 1 credit. Prerequisite: 410 or permission of instructor.M 11:15. G. F. Combs, Jr.  
A practical consideration of principles of nutrition applied to feeding poultry, including use of linear programming techniques in diet formulation.**511 Laboratory Work in Animal Nutrition** Fall, 4 credits. S-U grades optional. Prerequisite: quantitative analysis and 410, or its equivalent, or permission of instructor.Lab, M W F 2-4:25. W. G. Pond.  
Each student engages in a series of group and individual short research projects with laboratory and farm animals. Both classical and modern techniques of animal experimentation are considered. The applications of biochemical methods to the solution of animal nutrition problems are stressed.**619 Field of Nutrition Seminar** Fall or spring, Noncredit.M 4:30.  
Current research in nutrition presented by visitors and faculty.

## Advanced Nutrition

A series of nutrition courses are offered jointly by the Department of Animal Science, College of Agriculture and Life Sciences; Department of Poultry Science, College of Agriculture and Life Sciences; and the Division of Nutritional Sciences.

Prerequisites include courses in nutrition, physiology, and biochemistry to include intermediary metabolism, or permission of instructor.

Among the topics presented are the biochemical and physiological bases of digestion, absorption, transport and metabolism of nutrients, and species differences where applicable. Historical as well as current concepts of nutrition are discussed.

**603 Nutritional Energetics** Spring, 2 credits.  
M W 10:10. J. T. Reid.

**604 Vitamins and Minerals** Fall, 2 credits.  
T Th 10:10. M. L. Scott.

**605 Forages and the Rumen** Fall, 4 credits.  
Prerequisite: a course in general nutrition and biochemistry 431, or permission of instructor.  
M W F 12:20. P. J. Van Soest.

Ruminant nutrition, lower-tract fermentation in monogastrics, nutritional biochemistry of forage plants, fiber and cellulosic materials.

**607 Protein Nutrition** Fall, 2 credits.  
Lec. W F 8. R. E. Austic.

A course dealing with proteins and amino acids in nutrition, with emphasis on the dynamic aspects of protein digestion, amino acid absorption, metabolism, and nitrogen excretion. Bioavailabilities of amino acids, utilization of nonprotein nitrogen, amino acid requirements, and assessment of nutritional status will be discussed.

**613 Forage Analysis** Spring, 2 credits.  
Prerequisite: permission of instructor.

Lab only, to be arranged. P. J. Van Soest. Chemical composition and nutritive evaluation of forage plants and related materials. Course will include a term paper summarizing results of independent laboratory study of either materials or methods.

**Protein and Amino Acids (Division of Nutritional Sciences 601)** Fall, 2 credits.  
M W 10:10. M. A. Morrison.

**Lipids (Division of Nutritional Sciences 602)** Fall, 2 credits.  
T Th 11:15. A. Bensadoun.

## Departmental Research and Seminars

**390 Poultry Problems** Fall or spring, 1, 2, or 3 credits. S-U grades optional. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade. Not open to students who have earned 6 or more undergraduate research credits elsewhere in the College.

R. J. Young.  
Investigation of some problem in the field of poultry science by the student under the direction of a member of the staff.

**395 Undergraduate Research** Fall or spring, 6 credits maximum during undergraduate career; not open to students who have earned 6 or more undergraduate research credits elsewhere in the College. Open only to juniors and seniors with grade averages of 2.7 or above. Designed to afford opportunities for students to carry out independent studies of research problems under appropriate supervision. Each student will be expected to review pertinent literature, prepare a project outline, conduct the research, and prepare a report.

**396 Undergraduate Teaching** Fall or spring, 1 or 2 credits; no more than 4 credits may be earned

during entire undergraduate career. Open only to students with grade averages of 2.7 or above. Designed to consolidate the student's knowledge by assisting in the teaching of a course allied with the student's education and experience. A participating student is expected to meet regularly with a discussion or laboratory section, to gain teaching experience, and regularly to discuss teaching objectives, techniques, and subject matter with the professor in charge.

**402 Undergraduate Seminar.** Spring, 1 credit. S-U grades optional. Restricted to advanced undergraduates.

Hours to be arranged. R. P. Natzke, R. W. Everett. A study of literature pertinent to special topics in animal science. Students will be required to review literature and to present oral and written reports.

**500 Research** Fall or spring. Credit and hours to be arranged. All members of animal science program area.

**601 Seminar** Fall or spring, 1 credit. S-U grades only. Required of all graduate students with either a major or minor in animal science.  
M 11:15. Animal science faculty.

**609 Seminar in Poultry Biology** Fall or spring. S-U grades only. For graduate students.  
Hours to be arranged. Members of the department staff.  
A survey of recent literature and research in poultry biology.

## Atmospheric Sciences\*

B. E. Dethier, W. W. Knapp, A. B. Pack, D. A. Paine.

**101 Basic Principles of Meteorology** Fall, 3 credits.  
Lec. T Th 11:15; lab, M T W Th or F 1:25-4:25.  
B. E. Dethier.

Simplified treatment of structure of the atmosphere; heat balance of the earth; general and secondary circulations; air masses, fronts, and cyclones; hurricanes, thunderstorms, tornadoes, and atmospheric condensation. In the laboratory, emphasis is on techniques of analysis of weather systems.

**103 Basic Principles of Meteorology (Lab)** Fall, 1 credit. Prerequisite: introductory course in meteorology without a laboratory.  
M T W Th or F 1:25-4:25. B. E. Dethier.  
Techniques of analysis of weather systems and the application of dynamical and empirical methods of prediction of the daily atmospheric circulation.

**202 Dynamic Climatology** Spring, 3 credits. Prerequisite: 101.  
M W F 11:15. A. B. Pack.

The first part of the course is devoted to the description of world climates in terms of global distribution of radiation, temperature, pressure, and wind; precipitation and air masses. The second part of the course relates climates and climatic anomalies to planetary, regional, and local circulations.

**325-326-327-328 Meteorological Communications** 325 and 327, fall; 326 and 328, spring, 1 credit. S-U grades optional. Primarily for undergraduate meteorology majors.  
Hours to be arranged. Staff.

The student will become acquainted with facsimile, teletype, and satellite receiving equipment and the data products used in weather forecasting.

**411-412 Theoretical Meteorology I and II** Fall and spring, 3 credits. Prerequisites: 1 year each of

calculus and physics. Course 411 is prerequisite to 412, unless special permission is obtained from instructor.

M W F 10:10. W. W. Knapp.  
Topics include thermodynamics of dry air, water vapor and moist air, hydrostatics and stability; meteorological coordinate systems; variation of wind and pressure fields in the vertical; winds in the planetary boundary layer; surfaces of discontinuity; mechanisms of pressure change; vorticity and circulation.

**413 Argicultural Meteorology** Spring, 3 credits.  
T Th S 10:10. A. B. Pack.

An examination of atmospheric conditions and relationships near the ground, including the interplay between the atmosphere and land surfaces, plant covers, and topography. Moisture relationships in the soil-atmosphere-plant continuum, crop protection from weather hazards, and applications of knowledge of climate to studies of crop growth and production are also discussed.

**[417 Physical Meteorology** Fall, 3 credits. Offered in alternate years. Prerequisite: 1 year each of calculus and physics. Not offered in fall, 1976.  
M W F 12:20. W. W. Knapp.

Primarily a survey of natural phenomena of the atmosphere with emphasis on their underlying physical principles. Topics include composition and structure of the atmosphere; atmospheric optics, acoustics and electricity; solar and terrestrial radiation; and principles of radar probing of the atmosphere.]

**430 Synoptic Meteorology** Spring, 4 credits. Prerequisites: 411 and 412, or permission of instructor.

Lec. M 9:05-11; lab, W 9:05-11. D. A. Paine. The application of quasi-geostrophic theory as a diagnostic and forecast methodology, including the use of facsimile products derived from the barotropic, baroclinic, and primitive equation numerical models. Lab work includes surface and upper air analyses, thickness and vorticity computations utilizing synoptic and radiosonde data documenting macroscale cyclogenesis.

**432 Isentropic Theory and Analysis** Spring, 4 credits. Prerequisite: 430 or permission of instructor.

Lec. T 9:05-11; lab, Th 9:05-11. D. A. Paine. The equations of motion, continuity and energy relationships in constant entropy coordinates. Derivation and construction of adiabatic versus diabatic trajectories. Ertel's potential vorticity theorem evaluated by the quasi-Lagrangian trajectory technique. The lab employs the 430 storm data to contrast constant pressure and isentropic methods of analysis.

**449 Physics of Clouds, Rain, and Rainmaking** Fall, 3 credits. Offered in alternate years. Prerequisites: 1 year each of calculus and physics.  
M W F 12:20. W. W. Knapp.

Primarily centered on the microphysical processes occurring in natural clouds which lead to the development of precipitation. Subject matter includes a brief survey of the macrophysical properties of clouds, homogeneous and heterogeneous condensation processes, growth of cloud particles, and natural and artificially stimulated precipitation processes.

**461-462 Undergraduate Research in Meteorology** Fall and spring, 1 to 3 credits.  
Staff.

Required of honor students in the physical sciences majoring in meteorology.

**470 Numerical Weather Prediction** Spring, 3 credits. Offered in alternate years. Prerequisites: 430 and basic computer language course.

M W F 1:25. D. A. Paine.  
The theory of barotropic and baroclinic modeling. An

\*Part of the Department of Agronomy

equivalent barotropic model and a version of Charney's "thermotropic" model will be constructed and run on the computer utilizing actual weather data.

#### 474 Multiscale Studies of the Atmosphere

Spring. 3 credits. Offered in alternate years. Prerequisites: 411 and 412 and permission of instructor. Not offered spring 1977.

M W F 1:25. D. A. Paine.

A study of the energy-momentum cascade from macroscale to microscale weather phenomena, utilizing a conservation theorem for three components of relative vorticity, the divergence and equivalent potential vorticity theorems. Data from severe weather outbreaks serve as a practicum in mesoscale analysis.]

#### 650 Special Topics in Meteorology and Climatology

Fall or spring. 1 or more credits.

Staff.  
Study of meteorological topics more advanced than or different from those in other courses. Subject matter depends on the background and desires of those enrolling.

#### 691 Seminar in Meteorology

Fall or spring.

Prerequisite: permission of instructor.

Hours to be announced. B. E. Dethier.  
Subjects for future times may be such things as weather modification, paleoclimatology and atmospheric pollution.

#### 962 Research in Meteorology

Fall or spring. 1 or more credits. Thesis research.

Staff.

## Biological Sciences See p. 128.

## Communication Arts

C. H. Freeman, chairman; N. E. Awa, J. A. Barwind, R. D. Colle, C. E. Cook, R. H. Crawford, B. O. Earle, J. E. Hardy, J. E. Lawrence, R. D. Martin, C. C. Russell, V. R. Stephen, W. B. Ward, S. A. White.

#### 150 Introduction to Communication

Fall. 3 credits. Limited to communication arts freshmen and first-year transfer students.

T Th 9:05; F 12:20. N. E. Awa and staff.  
Designed to introduce majors to the field of communication, giving them a basic foundation in the various areas and dimensions of the field as well as an understanding of their interrelations. Course includes major spectrums of human communicative effort: oral, written, visual, nonverbal, theory, international communication, and communication law.

#### 200 Theory of Human Communication

Fall or spring. 3 credits. S-U grades optional.  
 Lec. T Th 10:10; disc. T or Th 12:20. N. E. Awa.  
Introduction to behavioral theories of communication from a multidisciplinary perspective. Contributions from the mass media, anthropology, sociology, psychology, social psychology, rhetoric, and cybernetics are considered.

#### 205 Parliamentary Procedure

Fall or spring. 3 credits. Not open to freshmen.  
 Th 1:25-4:25. R. D. Martin.  
Study of the principles and practice of parliamentary procedure as related to conducting an effective meeting. Emphasis on practical experience and appreciation for the importance of a well-run meeting as an integral component of effective communication. Includes recording of minutes, committee assignments, development of bylaws, and meeting evaluations.

#### 210 Communicating Public Service Information

Fall. 3 credits. For non-communication arts majors.  
 M W F 8. J. E. Lawrence.  
Examines concepts, methods, techniques, and processes for communicating information to the

general public. Explores use of public service time and space through broadcasting, films, publications, and other outlets. Emphasis on basic understanding of media requirements and procedures for disseminating public service information. Students will design information programs.

#### 215 Introduction to Mass Media

Fall or spring. 3 credits. S-U grades optional. Limited to 190 students above the freshman level.

M W F 11:15. C. C. Russell.  
History, policies, philosophies, and practices of communication media. Freedom of the press, ethics, libel, and slander are considered in the day-to-day function of the media.

#### 230 Visual Communication

Fall. 3 credits. Not open to freshmen.  
 M W F 10:10. V. R. Stephen.  
A general survey of the use and importance of visual communication methods and materials in today's society. Posters, charts, displays, photography, slides, overhead projection, motion pictures, and television are among the topics discussed. Practical projects are assigned.

#### 231 Art of Publication

Spring. 3 credits. Not open to freshmen.

W 1:25-4:25. V. R. Stephen.  
Designed to explore visual concepts to increase communication effectiveness through the printed word. Importance of selecting and coordinating format, layout, typography, and illustrations is stressed. Lectures, a field trip, and assignments examine merits and problems in using publications as a communication medium.

#### 301 Oral Communication

Fall or spring. 3 credits. Limited to juniors and seniors.  
 Lec. M or T 12:20; disc. M W 8, 9:05, 10:10, 11:15, or T Th 8, 9:05, 10:10, 11:15, or W F 11:15 and 12:20. Each discussion section limited to 24 students. N. E. Awa, B. O. Earle, C. H. Freeman, R. D. Martin, and staff.

Training and experience in the theory, preparation, presentation, and evaluation of oral topics. Designed to encourage interest in public affairs and to develop self-confidence. Videotape is used as a tool to counsel students in principles of effective oral communication.

#### 302 Persuasion

Spring. 3 credits. Prerequisite: 301.  
 M W F 11:15. Conferences by appointment, daily 8-5. B. O. Earle.  
The course will concentrate on persuasion in various interpersonal settings. Oral presentations will stress the theory of persuasion.

#### 303 Small Group Communication

Spring. 3 credits. Open to juniors and seniors only. Prerequisite: 200 or permission of instructor.  
 M W 12:20-1:45. N. E. Awa.  
Theory and practice in leadership and participation in small group communication. The course examines the values and limitations of group discussion, collaborative behavior, and conflicts in a democracy.

#### 311 Radio and Television Communication

Fall. 3 credits. Limited to 40 students. Prerequisite: 200.  
 T Th 9:05; lab. W 1:25-3:25. R. D. Colle.  
Study of the problems of access to and designing content for radio and television. Includes analysis of program formats.

#### 312 Advertising and Promotion

Spring. 3 credits. S-U grades optional. Limited to 190 students of the junior, senior, and graduate level.  
 M 1:25-4:25. C. C. Russell.  
Examines advertising principles and techniques in both an historical and an economic perspective. Advertising and promotion campaigns and their overall effectiveness as a multiplier in the economy are analyzed. Current advertising trends and the strategy of media planning are examined.

#### 313 Writing for Magazines

Fall or spring. 3 credits. Open to juniors, seniors, and graduate students.  
 M 1:25-4:25. W. B. Ward.  
Intensive fact-writing to help students communicate more effectively through the medium of the printed word in magazines. Art and techniques of good writing studied; continuous analysis of magazines in many fields of interest. All articles analyzed and returned to each student for rewriting and submission to a magazine.

#### 314 Technical and Scientific Writing and Editing

Fall or spring. 3 credits. Limited to 50 students above freshman level.  
 T Th 10:10; W 12:20. J. E. Hardy.  
Designed to develop skills in writing and editing scientific and technical information with emphasis on achieving clarity, accuracy, and appropriate format. Interpreting scientific and technical information for various publics is practiced through study of reports, instructions, brochures, and articles. One writing or editing assignment each week.

#### 315 News Writing and Analysis

Fall. 3 credits. Limited to 30 students.  
 T 1:25-4:25. W. B. Ward; C. R. Holcomb, editor and publisher, J. W. Walter, managing editor, and other *Ithaca Journal* staff.  
The writing and analysis of news stories. A study of the elements that make news, sources of news, interviewing, writing style and structure, new publishing techniques, press problems, and press-society relations. Reasonable typing ability is essential.

#### 318 Radio Writing and Production

Spring. 3 credits. S-U grades optional. Prerequisite: 311.  
 T 1:25-4:25. R. D. Colle.  
Writing for various radio formats, with emphasis on public affairs programs, including documentaries and interviews. Students will tape record their programs for possible use on radio stations in the state.

#### 319 Television Writing and Production

Fall. 3 credits. S-U grades optional. Limited to 25 students. Prerequisite: 311.  
 Th 1:25-4:25. R. D. Colle.  
Creation of television information programs, from development of idea through research, scripting, and production.

#### 380 Independent Honors Research in Social Science

Fall or spring. 1-6 credits. Open only to candidates who have met the requirements for the honors program. A maximum of 6 credits may be earned in the honors program.

#### 401 Communication Law

Spring. 3 credits. Enrollment limited to majors at the junior, senior, and graduate levels, and others by permission.  
 M W F 11:15. Staff.

#### 403 Topics in Communication Theory

Fall. 3 credits. Offered in alternate years. Prerequisite: 200 or permission of instructor. Not offered fall, 1976.  
 W 1:25-4:25. J. A. Barwind.  
Specific topics in communication theory will be discussed as determined by the interest of faculty and students.]

#### 404 Psychology of Communication

Spring. 3 credits. Prerequisite: 200 or permission of instructor.  
 M W F 9:05. J. A. Barwind.  
An advanced study of communication theory from a multidisciplinary orientation. Topics to be covered include interpersonal interaction, channels of communication, and effectiveness of message. Study will include intensive analysis of primary sources of major communication theorists.

#### 420 Print Media Laboratory

Fall. 2 credits. Prerequisite: 313, 314, 315, or 231. Open to majors at junior and senior levels.  
 Th 1:25-4:25. J. E. Hardy, V. R. Stephen.  
Writing, editing, and layout principles practiced in

publishing the *Cornell Countryman*. Some additional outside work sessions may be required.

**421 Broadcast Media Laboratory** Fall, 2 credits. Prerequisite: 318 or 319. Open to majors at junior and senior levels.

T 1:25-4:25. R. D. Colle.  
Emphasis placed on production of television and radio programs for various audiences.

**422 Print Media Laboratory** Spring, 2 credits. Prerequisite: 313, 314, 315, or 231. Open to majors at junior and senior levels.

Th 1:25-4:25. J. E. Hardy, V. R. Stephen.  
Continuation of 420.

**423 Broadcast Media Laboratory** Spring, 2 credits. Continuation of 421.

**440 Photo Communication** Fall or spring, 3 credits. Limited to 25 juniors and seniors. Priority given to communication arts majors; others by permission of instructor.

Fall, Th 1:25-4:25; spring, T 1:25-4:25. C. H. Freeman.  
Basic photography: camera handling, film processing, projection printing, and photographic lighting. Photo-journalism emphasized during the latter part of the course. Designed for those with limited experience in photography. Students will be expected to furnish their own supplies and cameras.

**495-496 Independent Research** Fall or spring, 1-3 credits. Open to seniors and graduate students in communication arts. Seniors must attach to their preregistration material written permission from the staff member who will supervise the work and assign and grade.

Staff.  
Designed to permit outstanding students to carry out independent studies in communication research under appropriate supervision.

**501 Intercultural Communication** Spring, 3 credits.

T 1:25-4:25. N. E. Awa.  
A systematic analysis of sociocultural and psycholinguistic obstacles to effective communication between cultures, subcultures, and ethnic and identity groups. Also examined are the subtleties and complexities of nonverbal behavior in cross-cultural transactions. Examples are drawn from ethnolinguistic and cross-cultural studies, Peace Corps experience, and programs of change crossing cultural boundaries.

**512 Seminar: Interpersonal Communication** Spring, 3 credits.

W 1:25-4:25. J. A. Barwind.  
A study of recent advances and research in leadership, small-group interaction, and communication networks. New developments will be examined as they relate to business, administration, and education.

**524 Communication in the Developing Nations** Fall, 3 credits. Open to seniors and graduate students.

W 1:25-4:25. R. H. Crawford.  
An examination of existing communication patterns and systems and their contributions to the development process. Special attention is given to the interaction between communication development and national development in primarily agrarian societies.

**526 Comparative Mass Media** Spring, 3 credits. Th 1:25-4:25. R. H. Crawford.

An examination of differing national models for media system organization and how each developed in relation to its cultural context. Includes the study of relations with government, mode of support, purposes, scope, and objectives of the media system.

**531 Studies in Communication** Fall, 3 credits. Open to graduate students in communication arts; others by permission.

M 1:25-4:25. R. H. Crawford.  
A review of classical and contemporary research in communication, including key concepts and areas of investigation. Exploration of the scope of the field and the interrelationships of its various branches.

**532 Methods of Communication Research** Fall, 3 credits. Limited to graduate students.

T 1:25-4:25. J. A. Barwind.  
An analysis of the methods employed in communication research. Particular emphasis is placed on understanding the rationale for experimental, descriptive (empirical and nonempirical), and historical-critical research methods.

**540 Special Problems in Communication** Spring, 3 credits.

M 1:25-4:25. R. H. Crawford.  
Designed to allow students to study and work on special problems in communication. Each student will select a problem of his own choice and the course will be structured around the analysis and solution of these problems.

**543 Frontiers in Communication** Spring, 3 credits.

Th 1:25-4:25. R. D. Colle.  
A study of recent developments in communication. Emphasis is on the strategic application of the newest methods, materials, and technology in visual, print, film, oral, and telecommunication media to contemporary and future problems involving communication.

**550 Advanced Communication Seminar** Spring, 3 credits. Primarily for graduate students but open to seniors.

T 9:05-12:05. W. B. Ward.  
An analysis of special communication problems faced by different types of organizations, institutions, and companies; case histories used to show how communication programs are organized and executed to help solve problems.

**560 Advanced Communication Projects** Fall or spring, 3 credits. Open only to communication arts graduate students. May not be repeated.

Staff.  
Independent studies and projects carried out in conjunction with selected undergraduate courses.

**590-591 Communication Teaching Laboratory** Fall and spring, 1-3 credits. Limited to juniors, seniors, and graduate students. Prerequisite: permission of the staff member who will supervise the work and assign the grade.

Hours to be arranged.  
Designed primarily for students who wish to gain experience in teaching communication courses. Students will work with an instructor in the development of course objectives, philosophy, and planning as well as aiding with actual instruction.

**595 Directed Graduate Study** Fall or spring, 3-6 credits.

Staff.

**110 Introduction to Psychology** Fall or spring, 3 credits.

Lec. M W F 10:10; disc. Th or F 8, 9:05, 10:10, 11:15, 12:20, 1:25, 2:30, or 3:35. G. W. McConkie.  
Introduction to the field of psychology. Prerequisite for many courses in the behavioral and social sciences. Also intended as general course for students taking no further psychology.

**240 The Art of Teaching** Spring, 3 credits. T Th 1:25-2:40. G. J. Posner.

An experiential exploration of teaching as an activity that occurs throughout life and in an infinite variety of situations. Through exercises, discussion, and fieldwork, students learn to observe and analyze teaching situations, gaining a better understanding of what teaching involves and what career opportunities exist.

**270 Educational Studies** Fall, 3 credits. M W 9:05, 1 additional hour arranged. K. A. Strike.  
An introductory study of central and representative issues of policy and practice that mold education in the United States.

**311 (411)\* Educational Psychology** Fall or spring, 3 credits. Prerequisite: introductory course in psychology.

Fall: Section 1, M W F 11:15. R. E. Ripple. Section 2: special section for agricultural education majors. Hours to be arranged. M. D. Glock. Spring. M W F 9:05. M. D. Glock.

An introductory survey course covering topics in educational psychology. Emphasis is on human learning and the educational process from a psychological point of view. The course is set in a broadly based teaching-learning context appropriate for prospective teachers, youth group leaders, community leaders, and those in the service professions.

**312 (440) Introduction to School Learning** Spring, 3 credits. Prerequisite: 311 or permission of instructor.

M W 1:30-3. J. D. Novak.  
As a basis for understanding and evaluating instructional programs, Ausubel's learning theory and some of the works of Piaget, Bruner and Rogers are introduced. Participants will analyze a segment of instruction as a term project according to criteria presented.

**317 (417) Psychology of Adolescence** Spring, 3 credits. S-U grades optional. Prerequisite: introductory course in psychology.

T Th 1:25-3:20. R. E. Ripple.  
A survey of the nature of adolescent development with emphases on causal factors pertaining to adolescent behavior. Focus is on an examination of the interrelationships among the major aspects of adolescent development, an examination of some of the dominant themes of adolescence, acquaintance with research on adolescent development, and implications for the educational process.

**331 Introduction to Teaching Agriculture** Spring, 1 credit.

Lec. M 1:25-3; lab, to be arranged. W. E. Drake.  
An introduction to the origin, development, objectives, curricula, and methods of teaching agriculture in secondary schools. Required of persons who plan to enter the student teaching program.

**335 Youth Organizations** Spring, 3 credits. Prerequisite: basic course in psychology.

Lec. T Th 10:10; lab, to be arranged. J. P. Bail.  
Role of selected youth organizations in providing educational experiences for adolescents. Factors affecting membership in such organizations, including psychological, sociological, and economic aspects will be surveyed. Emphasis will be placed on

## Education

H. L. Wardeberg, chairman; H. G. Andrus, J. P. Bail, J. G. Bennett, A. L. Berkey, G. J. Broadwell, R. L. Bruce, H. R. Cushman, W. E. Drake, A. R. Edsall, J. R. Egner, R. B. Fischer, H. A. Geiselmann, M. D. Glock, D. B. Gowin, E. J. Haller, D. E. Hedlund, S. J. Klees, J. P. Leagans, G. W. McConkie, J. Millman, K. M. Moore, J. D. Novak, W. J. Pauk, G. J. Posner, R. E. Ripple, V. N. Rockcastle, K. A. Strike, F. H. Stutz, G. M. Winter.

\*The number in parentheses indicates the number assigned to the course last year.

the various roles the adult volunteer leader may play. Field experience with a recognized youth organization will be required.

**352 (452) Reading Statistics** Fall or spring. 1 credit. Prerequisite: registration in spring term limited to those concurrently enrolled in Educ 353. Fall, T 12:20; spring, T Th 8:30-9. J. Millman. Introduction to statistical vocabulary and symbolism frequently used in reporting empirical research in education and other social sciences. Students will be taught how to comprehend statistical terminology and results.

**353 (453) Introduction to Educational Statistics** Spring. 3 credits. Prerequisite: 352 (may be elected concurrently) or permission of instructor. T Th 9:05-11. J. Millman. A study of common statistical procedures encountered in educational inquiry. Includes the mathematical bases, computation, and interpretation of univariate and multivariate descriptive and inferential statistics.

**370 (470) Issues in Educational Policy** Spring. 3 credits. M W F 9. F. H. Stutz. An examination of the social, economic, and political issues that affect teaching and learning in schools and other educational settings. Emphasis is given to enduring policy issues. Examples of issues to be considered include equality of opportunity, governance, teacher and school accountability, and school-community relations. This course is especially designed for those entering a career in education.

**380 Independent Honors Research in Social Science** Fall or spring. 1-6 credits. S-U grades optional. Open only to candidates who have met requirements for the honors program. A maximum of 6 credits may be earned in the honors program. Staff.

**400 (300) Field Experience** Fall or spring. 1-4 credits. S-U grades optional. Undergraduates must attach to their preregistration material written permission from the faculty member who will supervise the work and assign the grade. Staff. A student may engage in planned semiprofessional or professional practice in an educational enterprise. Each student prepares a plan of action including rationale, purposes, and procedures, and arranges with a faculty member to supervise and evaluate the field experience.

**[401 Our Physical Environment** Fall or spring. 3 credits. Not offered fall, 1976 or spring, 1977. T 1:25-4:25. V. N. Rockcastle. A practical study of the basic physical principles of the environment, with special reference to the kind of analysis that might aid in teaching others about these principles. Includes commonplace phenomena in physics and earth science and relates these to the biota. Also includes a two-week unit on photography and darkroom procedures. Especially useful for teachers and environmental educators.]

**403 Environmental and Natural History Writing** Spring. 3 credits. Prerequisite: previous course in composition plus working knowledge of biology and geology. Permission of instructor required.

W 7-9 p.m. R. B. Fischer. The course aims to improve writing skills of environmentalists who wish to influence others through articles in magazines, newspapers, and environmental education center publications.

**404-405 Field Natural History** Fall and spring. 3 credits. Prerequisites: basic biology and ecology and permission of instructor. Lec, M 10:10; lab, M Th 1:25, followed by field trip until 4:30. R. B. Fischer. This materials and methods course deals with

northeastern plants, animals, and ecological communities and their environmental effects. Man's impact is stressed. Lectures and supporting fieldwork demonstrate the use of such materials in environmental education programs of interpretive centers, schools, and field biology courses.

**411 (551) Educational Measurement** Spring. 3 credits. Prerequisite: permission of instructor before first meeting. T 1:25-4:25. M. D. Glock. Construction of achievement tests and use of other measuring instruments in the classification and guidance of pupils for improvement of instruction.

**413 (583) Developmental Counseling** Fall. 3 credits. Prerequisites: 110 and 317 or equivalent. T 10:10; Th 10:10-12:20. D. E. Hedlund. Examination of selected theoretical approaches to facilitating human development. Exploration of the methods and interpersonal skills defined by several systems of counseling, human relations, and psychotherapy. Focus on facilitating specific adult developmental issues such as career planning and career change, aging, and coping with death.

**432 Teaching Agriculture: Methods, Materials, and Directed Practice** Fall. 9 credits. Prerequisite: 331 or permission of instructor. Lec, lab, disc, to be arranged. A. L. Berkey and staff. Directed participation in teaching agriculture at the secondary school level. Includes evaluation of area resources; instructional materials and facilities; development of curricula; directing work experience; planning instruction; and advising youth organizations.

**433 Special Problems in Agricultural Education** Spring. 1 or 2 credits. S-U grades optional. Th 1:25-2:15. H. R. Cushman. Opportunity to study individually selected problems in agricultural education.

**434 Adult Education Programs in Agriculture** Fall. 3 credits. Lec, to be arranged. H. R. Cushman. Determining instructional needs, planning programs of instruction, teaching in groups, giving on-job instruction, and evaluating adult education programs in agriculture. To be taken concurrently with Educ 432.

**435 (522) Educating for Community Action** Spring. 3 credits. W 11:15-1:10; F 11:15. R. L. Bruce. Design and execution of educational aspects of community action programs. Deals with the identification and statement of educational goals, selection of teaching strategies, and evaluation of outcome.

**445 (446) Curriculum Design** Fall. 3 credits. T Th 10:10-11:30. G. J. Posner. A general "how-to-do-it" approach to course planning. Readings, group discussions, workshops, and individual conferences centering on each student's own project. This project consists of designing a course in a subject area, for an age level and an institutional setting of the student's own choosing.

**[446 (447) Implementing Instruction** Spring. 3 credits. Not offered spring, 1977. Lec, lab, W 1:25-4:25. V. N. Rockcastle. A study of the elements of effective instruction in lecture, laboratory, seminar, field trip, and other modes of instruction. Actual practice in developing and presenting various modes of instruction, with critiques by the class.]

**448 (445) Reading, Learning, and Study Skills** Spring. 3 credits. T 1:25-3:30. W. J. Palk. For students who desire to learn how to teach people

(children, upper-grade students, adults, illiterates, semilliterates) to read and to learn. Included in the regular lectures on academic skills will be such special topics as teaching adults to read and write; diagnosing reading problems; using readability formulas; helping reluctant readers; and using remedial and developmental materials.

**471 (463) Sociology of Education** Spring. 3 credits. S-U grades optional. T Th 10:10-11:30. E. J. Haller. Introduction to the major themes in the contemporary literature on the sociology of education. Topics include social factors affecting learning, social stratification and education, socialization, teacher-student roles, professional career patterns, and the political context of educational organizations.

**472 Philosophy of Education** Fall. 3 credits. T 2:30-4:25. K. A. Strike. A study of central issues in the philosophy of education. Questions of ethics, political philosophy, and the theory of knowledge will be examined and the implications for education assessed.

**473 Contemporary Philosophy of Education** Spring. 3 credits. Prerequisite: none—an interest in philosophical matters recommended. M W 11-12:15. D. B. Gowin. An intensive treatment of one or two selected topics in contemporary philosophy of education.

**475 Political and Social Philosophy of Education** Spring. 3 credits. Offered in alternate years. T 2:30-4:30. K. A. Strike. An examination of philosophical viewpoints on political and social ideals, such as liberty and equality, and an application of the results to educational institutions.

**[477 (467) Law and Educational Policy** Spring. 3 credits. Offered in alternate years. Not offered spring, 1977. T 2:30-4:30. K. A. Strike. A study of recent federal court decisions concerning education. Emphasis on examining legal issues against a background of related educational theory and in terms of the consequences of legal decisions for the development and operation of educational institutions.]

**479 (580) The American College Student** Spring. 3 credits. S-U grades optional. T Th 10:10-12. K. M. Moore. Students gain insight into historical experience of their predecessors, the contemporary structure and function of higher education, and an assessment of their own and other students' developmental needs and problems.

**500 (400) Informal Study** Fall or spring. 1-3 credits. S-U grades optional. Undergraduates must attach to their preregistration material written permission from the faculty member who will supervise the work and assign the grade. Staff. A student may, with approval of a faculty adviser, study a problem or topic not covered in a regular course, or may undertake tutorial study of an independent nature in an area of educational interest.

**511 Educational Psychology** Fall. 3 credits. S-U grades optional. Prerequisite: introductory course in psychology. M W F 1:25. R. E. Ripple. A basic survey course for graduate students covering topics in educational psychology. Emphasis on psychological factors involved in human learning and the educational process. Set in a broad-based conceptual model of any behavioral setting for learning. Appropriate for graduate students seeking an introductory survey course in educational psychology and for those who want a refresher

contemporary educational psychology course.

**512 (555) Standardized Tests: Use and Interpretation** Fall. 3 credits.

Th 3:35-5:15, 1 additional hour to be arranged.  
H. G. Andrus.

Designed for teachers, counselors, or personnel majors who plan to work with standardized tests.

**513 (507) A Learning Theory Approach to Education** Fall. 3 credits. Prerequisite: 311 or 511, or permission of instructor.

M W 1:25-3; J. D. Novak.

Presents Ausubel's learning theory and shows how this theory can be used for improved design of curriculum and instruction and design of better research in education.

**514 (584) Group Processes in Education** Spring. 3 credits. S-U grades optional. Prerequisite: permission of instructor.

T Th 10:10-12:20. D. E. Hedlund.

Consideration of effective group membership and leadership, with emphasis on the theory and practice of facilitating small group processes. Included are the design and evaluation of structured group exercises for the classroom, the use of groups in counseling, and an examination of the consulting role as an educational strategy.

**[515 (589) Affective Education** Spring. 3 credits. Offered in alternate years. Prerequisite: permission of instructor. Not offered spring, 1977.

T 2:30-4:25. D. E. Hedlund.

This course examines the conceptual base and the methodology of teaching for objectives in the affective realm. The first part of the semester will be devoted to the intrapersonal dynamics of individual development and the relationship of affective and cognitive learning. The second part of the course will focus on the interactive nature of the teaching-learning transaction and the effective use of small group dynamics in teaching. The capability to design teaching-learning experiences that incorporate affective objectives is a major goal of the course. The course is largely experiential, providing participation in a variety of approaches to affective education.]

**519 (599) Methods of Educational Inquiry** Fall. 3 credits. Prerequisite: one course in statistics or 352 (may be elected concurrently).

T Th 2:30-4; J. Millman.

Techniques of empirical research in education, including design of experiments and methods of data collection. Provides an opportunity for students to write a research proposal and for small groups to conduct a ministudy. Students will be taught how to plan and conduct an empirical research study and how to critique the work of others.

**532 Teaching Argicultural and Occupational Education** Spring. 3 credits. Prerequisite: permission of instructor.

M 2:30-5; A. L. Berkey.

Intended for persons who have had an introductory course in teaching methods. Selected teaching methods are analyzed in terms of application to teaching situations. Self-evaluation skills are developed through videotaping. Selection, preparation, and use of instructional materials are stressed through individual projects.

**533 Curriculum in Agricultural and Occupational Education** Fall. 3 credits.

M 1:25-3:30. W. E. Drake.

Principles, objectives, and sources of information will be developed for planning occupational curricula. Consideration will be given to the planning, development, and management of experience programs in occupational education.

**534 Adult Education Programs: Organization and Direction** Fall. 3 credits.

F 1:25-4:20. H. R. Cushman.

Alternative procedural models for organizing and conducting adult occupational education courses will be presented. Guidelines and procedures for implementing the models in secondary and postsecondary school settings will be emphasized.

**535 (523) Continuing Education Programs** Spring. 3 credits. Prerequisite: some practical work experience.

W 1:20-4; G. J. Broadwell.

An overview of selected administrative theories, principles, and strategies as they are or can be applied by administrators and supervisors in professional organizations. Primary focus will be on educational organizations, with emphasis on extension type programs.

**543 (573) Structure of Knowledge and Curriculum** Spring. 3 credits. Prerequisite: permission of instructor.

M W 12:20-2:10. D. B. Gowin.

A method for the critical analysis of knowledge and value claims embedded in primary sources is presented. Students use this method of analysis on materials chosen according to their own background or interest. Students develop their materials to the point where they could be used for instructional purposes. A special theory of curriculum developed by the instructor will be presented.

**544 (444) Teaching Mathematics** Spring. 3 credits.

T Th 3:35-4:50. H. A. Geiselmann.

Intended to provide competence in presenting mathematics using various approaches—discovery, audiovisual aids, laboratory techniques, individualized instruction, use of games, puzzles; acquaintance with teaching resources; geometrical constructions; discussion of the slow learner. Each student must select a project and present it to the class.

**545 Curriculum Theory and Analysis** Fall. 3 credits. Prerequisite: 311 or 511 (may be taken concurrently) or permission of instructor.

M W 10:10-11:30. G. J. Posner.

An examination of the basic elements involved in making curriculum decisions and an analysis of current approaches to curriculum. Students learn to analyze a curriculum in the context of a conceptual framework.

**546 (527) Evaluation for Program Management** Fall. 3 credits. S-U grades optional.

W 2:30-5; R. L. Bruce.

Primary attention is given to educational and other community change programs but inferences to other program management tasks are made.

**[561 Administration of Educational Organizations, I** Fall. 3 credits. Offered in alternate years. Not offered fall, 1976.

M 9-11; E. J. Haller.

Sociological perspectives on educational organizations. Consideration of classic and contemporary organization theories and their application to both public and higher education.]

**562 Administration of Educational Organizations, II** Fall. 3 credits. Offered in alternate years.

W 3:35-6; J. R. Egner.

Social psychological perspectives on educational organizations. Application and extension of open system theory to human organizations.

**563 Governance of Public Education** Fall. 3 credits. Offered in alternate years.

W 3:35-6; E. J. Haller.

Consideration of the structure of control in public education. Relationships among federal, state, and local agencies, and the administrative roles in school districts. Considerable attention will be directed to social and political analyses of the community.

**564 Educational Finance** Spring. 3 credits. S-U grades optional.

T 3:35; G. M. Winter.

Attention will be focused on tasks and procedures involved in budgeting, support systems, allocation, control, accountability, and the measurement and reporting of benefits and productivity. Opportunity for individuals to focus upon their own areas of interest, such as occupational education, the two-year college, the secondary school, or higher education.

**569 Personnel Development: Issues in Higher Education** Fall. 3 credits.

Th 3:35-6; J. R. Egner.

An examination of selected issues that affect the administration and development of academic and nonacademic personnel in higher education institutions.

**574 History of American Education** Fall. 3 credits.

M 3:30-5:15; F. H. Stutz.

An examination of the role of education in the development of the American society. Emphasis is given to enduring policy issues and to the effects of social theory on educational practice.

**575 Educational Policy Development and Decision Making** Fall. 3 credits. S-U grades optional. Offered in alternate years.

T 3:30-5:30; E. J. Haller, S. J. Klees.

Intended to familiarize students with the educational policy development process at the local, state, and national levels. Policy development is viewed from several perspectives—economic, political, and legal. Alternative models—both quantitative models and political models—applicable to policy decision making are discussed and analyzed. The role of citizens, interest groups, elected officials, administrators, policy analysts, and the courts in the formulation and execution of educational policy is examined.

**578 Comparative Education** Fall. 3 credits.

T 1:25-3:25; F. H. Stutz.

A comparative examination of educational development in the context of historical, social, and economic trends. Selected countries, institutions, and issues are used for case study. Emphasis is given to governance and policy issues.

**579 (581) Higher Education: Problems and Issues.** Fall. 3 credits. Offered in alternate years.

T Th 10:10-12:05; K. M. Moore.

Students will gain insight into contemporary higher education and issues relevant to administrators and other professionals in the field. Treats ethics, student rights, governance, and research in higher education.

**[586 Higher Education in America** Fall. 3 credits. S-U grades optional. Offered in alternate years. Not offered fall, 1976.

T Th 10:10-12; K. M. Moore.

An historical view of the development of higher education, designed for those desiring a general overview.]

**600 Internship in Education** Fall or spring. 2-6 credits. S-U grades optional. Each registration must be arranged with and approved by a faculty member who will assume responsibility for supervising work.

Staff.  
Opportunity for practical experience in educational professions development.

**602 Proseminar in Higher Education** Fall or spring. 1 credit. S-U grades optional.

W 12-1; K. M. Moore and staff.  
Designed for those with specialization in continuing or higher education administration. Exposure to practicing professionals in the field and to contemporary issues and practices. High student participation expected.

**606 Seminar in Science and Environmental**

**Education** Fall or spring. 1 credit. S-U grades optional.

T 7:30 p.m.–9:30 p.m. R. B. Fischer.

Coordinates various interest groups in science and environmental education. Currently the seminar has a focus on the development of a curriculum in environmental education.

**611 (699) Conceptual Problems in Educational Inquiry** Fall. 3 credits. S-U grades optional.

Prerequisite: experience or course work in research.

Th 12:20–2:20. D. B. Gowin.

Techniques and procedures for the critical appraisal of research documents. Practice in such appraisal is required, with primary emphasis upon conceptual structures rather than research techniques. Students may use their own research proposals or research products as material for analysis.

**615 (681) Seminar in Career and Developmental Counseling** Fall. Variable credit. S-U grades optional. Prerequisite: permission of instructor.

T 2:30–4:25. D. E. Hedlund.

Selected topics in career and developmental counseling and humanistic approaches to education.

**617 Seminar: Experimental Research in Reading** Spring. 3 credits. S-U grades optional.

Offered in alternate years. Prerequisite: background in cognitive psychology or psycholinguistics.

Hours to be arranged. G. W. McConkie.

An opportunity to explore selected areas of reading research in depth and to gain research skills in those areas.

**618 Seminar: Adult Learning and Development** Spring. 3 credits. S-U grades optional. Prerequisite: permission of instructor.

Hours to be arranged. R. E. Ripple.

Deals with adult development and learning behavior from points of view of educational psychology, social psychology, and sociology. Inferences are drawn from theory and research to the practice of adult continuing education. Appropriate for graduate students in educational psychology, extension and continuing education, community service education, and others interested in adult learning and development.

**[619 Seminar in Educational Psychology and Curriculum** Spring. 3 credits. S-U grades optional. Offered in alternate years. Prerequisite: permission of instructor. Not offered spring, 1977.

Hours to be arranged. R. E. Ripple.

Selected aspects of the relationship between curriculum and the psychology of education. Although specific content focus may vary, emphasis will be on the psychology of human learning with implications for structuring learning experiences and curriculum development. Appropriate for graduate students in educational psychology, curriculum and instruction, and others with interests in the relationship between psychology and curriculum.]

**624 (524) Designing Extension and Continuing Education Programs** Fall. 3 credits. Prerequisite: permission of instructor.

T 1:25–4. J. P. Leagans.

Designed to help students develop understandings of current theories, concepts, principles, and procedures central to the process of developing programs and curricula for the continuing education of adults. Emphasis is placed on such key problems as conceptualization of the nature and role of programming, situation analysis and needs identification, choosing among alternative courses of action, stating program objectives, macro and micro planning, and program organization.

**625 (525) Educational Communication** Spring. 3 credits. S-U grades optional.

T 1:25–4. J. P. Leagans.

Focuses on the problems of linking knowledge sources and knowledge needs of adult audiences. Emphasizes the process of persuasive

communication of useful technology. Models of the communication process are reviewed as a framework for conceptualizing major elements of educational communication including communicator, audience, message, channels, techniques, expression, encoding, decoding, feedback, fidelity, and organizing communication programs.

**[627 Behavioral Change in International Rural Modernization** Spring. 2 credits. Not offered spring, 1977.

Th 1:25–3:20. J. P. Leagans.

Analysis of concepts and strategies for repatterning human behavior at both the macro and micro levels. Changes in human behavior are viewed as a dependent variable in the rural development process.]

**635 (535) Teacher Preparation in Agriculture** Fall. 3 credits. Prerequisite: teaching experience in agriculture.

W 1:25–3:20. W. E. Drake.

Open to persons with teaching experience interested in the preparation of occupational teachers. Involvement in the Cornell program of teacher preparation in agriculture is expected.

**636 (536) Occupational Education Programs: Administration and Supervision** Spring. 3 credits.

Prerequisite: experience in teaching, industry, or related work.

W 2:30–4:25. J. P. Bail.

The practices followed and problems faced in the administration and supervision of occupational programs at the secondary and postsecondary level will be stressed. Attention will be given to the role of the occupational director and supervisor in program planning and implementation.

**639 (539) Evaluating Programs of Occupational Education** Spring. 3 credits. Offered in alternate years. Prerequisite: teaching experience.

T 1:25–3:20. W. E. Drake.

Analysis of objectives, evaluative criteria, and procedures used for the evaluation of occupational education in secondary and postsecondary schools.

**645 Seminar in Curriculum Theory and Research** Spring. 3 credits. Prerequisites: 545 or 446, or permission of instructor.

Hours to be arranged. G. J. Posner.

Theoretical issues in curriculum and appropriate areas for curriculum research are discussed.

**668 Seminar in Educational Administration** Spring. 3 credits. Prerequisite: permission of instructor.

M 9–11:10. J. R. Egner.

Intensive study of a selected topic (to be announced).

**669 Studies in Educational Administration** Spring. 3 credits.

W 4–6. J. R. Egner, E. J. Haller.

Analysis and critique of current research in educational administration. Discussion of research priorities and strategies in the conceptual area of educational governance.

**670 (681) Seminar on the American University** Spring. 3 credits. S-U grades optional.

W 10–12. K. M. Moore.

Topic for 1977: Academic Women. Designed for students who intend to become academic professionals, teachers, counselors, or do research on women in higher education. Students will assist with assertive training workshop and oral history project on professors emerita.

**671 (663) Seminar in the Sociology of Education** Fall. 3 credits. S-U grades optional.

W 9–11. E. J. Haller.

Intensive study of a selected topic in the sociology of education, with consideration of its organizational and policy implications.

**673 Seminar in Dewey's Philosophy of**

**Education** Fall. 3 credits. S-U grades optional. Prerequisite: prior work in philosophy and permission of instructor.

Hours to be arranged. D. B. Gowin.

A detailed analysis of some selected major Dewey work (*Democracy and Education*, *Experience and Education*, *Art As Experience*). One objective of the seminar will be to help students learn how to read Dewey and to compare and apply his ideas about education to problems and issues that are pressing today.

**675 (575) Seminar in Educational Policy** Fall or spring. 3 credits.

W 2:30–4:30. Staff.

Topic for each semester to be announced.

**700 (500) Master's Level Thesis Research** Fall or spring. Credit arranged. S-U grades optional. Each registration must be approved by a faculty member who will assume responsibility for guiding the work.

Staff.

Limited to students working on theses or other research and development projects.

**711 Seminar in Educational Psychology** Fall. 3 credits. S-U grades optional. Prerequisite: permission of instructor before first meeting.

Th 4:30–6:30. M. D. Glock.

The seminar has varied emphasis from year to year focusing on theoretical issues in the teaching, measurement, and evaluation of reading.

**716 Seminar in Educational Research** Fall. 3 credits. S-U grades optional. Prerequisite: permission of instructor.

Hours to be arranged. J. Millman.

An intensive study of the literature in a particular area of research methodology. Topics in recent years have included procedures and issues in educational evaluation, the interface of instruction and measurement, and the design of educational experiments. The topic for the current term to be announced.

**726 (626) Seminar: Extension and Continuing Education** Fall or spring. Credit arranged.

Hours to be arranged. J. P. Leagans.

Opportunity for majors and minors in extension and continuing education and community service education and staff jointly to analyze and reflect on current professional problems and issues.

**730 (630) Seminar in Agricultural and Occupational Education** Spring. 2 credits. S-U grades optional.

Th 2:30–4:25. A. L. Berkey.

For master's degree candidates who have had teaching experience and doctoral candidates with majors or minors in agricultural and occupational education. Emphasis is on current problems and research and includes discussion of student research proposals.

**744 (594) Seminar on College Teaching** Fall. 3 credits. S-U grades optional. Prerequisite: permission of instructor.

M W 3:30–5. J. D. Novak, D. B. Gowin.

Participants will (1) review Ausubel's learning theory as it applies to college teaching, (2) practice "unpacking" knowledge of their discipline for purposes of instructional design, and (3) prepare an instructional unit or module illustrating principles presented. Tutorial assistance will be provided; some experience with videotape.

**771 (671) Seminar in Philosophy of Education.** Spring. 3 credits. S-U grades optional. Prerequisite: permission of instructor.

W 10:10–12. K. A. Strike.

Topics to be announced.

**774 Seminar in Educational History** Spring. 3 credits. Prerequisite: 574 or equivalent.

M 3:35-5:15. F. H. Stutz  
Topic for 1977 to be announced.

**800 Doctoral Level Thesis Research** Fall or spring. Credit arranged. S-U grades optional. Each registration must be approved by a faculty member who will assume responsibility for guiding the work. Staff.  
Limited to students working on theses or other research and development projects.

## Entomology

E. H. Smith, chairman; C. O. Berg, J. L. Brann, W. L. Brown, Jr., E. W. Cupp, J. E. Dewey, G. C. Eickwort, P. P. Feeny, J. G. Franclemont, G. G. Gyrisco, R. G. Helgesen, W. T. Johnson, J. P. Kramer, R. A. Morse, A. A. Muka, C. E. Palm, R. L. Patton, L. L. Pechuman, D. Pimentel, E. M. Raffensperger, R. B. Root, E. T. Schmidtman, M. Semel, M. J. Tauber, W. M. Tingey, C. F. Wilkinson, R. G. Young.

### General Entomology

**212 Insect Biology** Fall. 3 credits. Prerequisite: Bio Sci 101-102 or concurrent registration, or their equivalent.  
Lec, W F 11:15; lab, M T W Th or F 2-4:25.  
G. C. Eickwort.

Introduces the science of entomology by focusing on basic principles of systematics, morphology, physiology, behavior, and ecology of insects. The laboratory in early fall includes field trips to collect and study insects in their natural environment. A small collection stressing ecological categories is required.

**518 Techniques of Biological Literature** Fall. 2 credits. Offered in alternate years.

Lec, T Th 9:05. J. G. Franclemont.  
History of the development of entomological literature and critical study of the biologists' works of reference. Practice in the use of indices and use and preparation of bibliographies.

### Insect Taxonomy, Morphology, and Acarology

**322 Insect Morphology** Fall. 4 credits. Offered in alternate years. Prerequisites: 212 or 241, and permission of instructor.  
Lec, M F 10:10; Lab, M F 1:25-4:25.  
G. C. Eickwort.

An introduction to the external and internal anatomy of insects, with emphasis on the comparative and functional aspects. The laboratory is devoted largely to dissection.

**331 Introductory Insect Taxonomy** Spring. 3 credits. Prerequisite: 212.  
Lec, Th 10:10; lab, T Th 2-4:25. J. G. Franclemont.  
An introduction to the systematics and distribution of insects. Laboratory practice in the identification of orders, families, and representative genera of insects; methods of collection and preparation of insect specimens. Field trips are taken in the late spring.

**[521 Acarology** Fall. 4 credits. Offered in alternate years. Prerequisite: 212 and permission of instructor. Not offered fall, 1976.

Lec, M F 10:10; lab, M F 1:25-4:25. G. C. Eickwort.  
An introduction to the taxonomy, morphology, and bionomics of mites and ticks, with emphasis on taxa of economic importance. A collection will be required.]

**[531 Taxonomy of the Smaller Orders of Insects** Fall. 3 credits. Offered in alternate years. Prerequisite: 331. Not offered fall, 1976.

Disc, F 10:10; lab, F 2-4:25 and 1 other by arrangement. W. L. Brown.  
Discussions of the classification, evolution, and bionomics of the orders and families of insects,

exclusive of the larger orders of Holometabola. Laboratory studies on the literature and on the characters and classification of representative genera and species. Continuation of taxonomy of Holometabola is in courses 532, 533, and 534.]

**532 Taxonomy of the Immature Stages of Holometabola** Fall. 3 credits. Offered in alternate years. Prerequisite: 531 or permission of instructor.  
Lec, W 10:10; lab, W F 2-4:25. J. G. Franclemont.  
Lectures on structure and habits of insect larvae. Laboratory studies of the literature, comparative morphology, and identification of the immature stages of the Holometabola.

**533 Taxonomy of the Coleoptera and Lepidoptera** Spring. 3 credits. Offered in alternate years. Prerequisite: 331.  
Lec, W 10:10; lab, W F 2-4:25. J. G. Franclemont.  
Laboratory studies on the literature and on the characters and classification of representative genera and species of these orders.

**[534 Taxonomy of the Diptera and Hymenoptera** Spring. 3 credits. Offered in alternate years. Prerequisite: 331. Not offered spring, 1977.

Lec, W 10:10; lab, W F 2-4:25, and 1 other by arrangement. W. L. Brown.  
Laboratory studies on the literature and on the characters and classification of representative genera and species of these orders.]

### Pest Management

**241 Applied Entomology** Spring. 3 credits. Prerequisite: Bio Sci 101-102 or equivalent.  
Lec, T Th 10:10; lab, T or W 2-4:25.  
E. M. Raffensperger.  
A compendium of the insects associated with crops and farm animals. Discussions of insect pest management requirements on farm and garden along with descriptions of control methods, materials, and equipment.

**340 Insect Pest Management** Spring. 4 credits. Prerequisites: 212 or 241, and 400 or Bio Sci 361, and permission of instructor. Limited to 20 students.  
Lec, M W F 9:05; lab, M 1:25-4. R. G. Helgesen.  
A lecture and laboratory introduction to principles and techniques of insect pest management as these relate to the diverse problems in contemporary economic entomology.

**341 Arthropod Pests of World Importance** Fall. 2 credits. Prerequisite: 340.

Lec, T Th 9:05. E. H. Smith.  
Major arthropod pests of the world are surveyed in the context of the nature and extent of injury and pest management options. The roles of agencies involved in pest management are considered together with the social and economic factors relating to the implementation of control programs.

**342 Special Topics in Economic Entomology** Term to be arranged. 1 or 2 credits. Offered in alternate years. Prerequisite: 212 or 241.

Hours to be arranged. Entomology faculty and invited lecturers.  
Deals with specialty topics such as plant resistance to arthropods (see Plant Breeding 516C); pesticide application technology; insect monitoring, scouting, and survey technology; potential of insect growth regulators and pheromones; nature and implications of insecticide resistance.

**577 Biological Control** Fall. 3 credits. Prerequisite: 212, Bio Sci 361, and permission of instructor.

Lec, T Th 9:05; lab, T 2-4:25. M. J. Tauber.  
Theory and method of biological control of arthropod pests and weeds. Laboratory includes studies with living parasites and predators.

### Medical Entomology and Insect Pathology

**452 Medical Entomology** Fall. 3 credits. Prerequisite: 212 and Vet 330, or permission of instructor.  
Lec, M W 9:05; lab, F 9:05-12:05. E. W. Cupp.  
A survey of arthropods of public health and veterinary importance with emphasis on transmission dynamics of pathogens, the bionomics of vector populations, and current control concepts. Morphology and taxonomy of selected groups are examined in the laboratory with additional exercises in vector-pathogen relationships and epidemiological techniques.

**453 Insect Pathology** Spring. 4 credits. Prerequisite: 212 or equivalent, a course in microbiology, and permission of instructor.  
Lec, M W 10:10; lab, Th 1:05-4:05. J. P. Kramer.  
A survey of the diseases of insects caused by viruses, bacteria, fungi, and protozoans plus a consideration of the role of microbial diseases in natural and applied insect control. Laboratory investigations center around living insect-pathogen associations and the consequences of these associations for both insect and microbe.

### Apiculture

**260 Introductory Beekeeping** Spring. 2 credits. T Th 11:15. R. A. Morse.  
Introduces the fundamentals of beekeeping including the life history, instincts, and general behavior of honey bees. Special attention is given to the biology of the honey bee. Some lectures are devoted to pollination of agricultural crops and the production of honey and beeswax.

**262 Biology of the Honey Bee** Fall. 1 credit. Limited to 10 students. Prerequisite: permission of instructor.  
15 laboratories by arrangement in September and October only. R. A. Morse.  
A laboratory and field course in which the classical experiments by von Frisch on vision, chemical senses, and language of the honey bee are repeated. Laboratories include demonstration of sex attractant, swarm orientation, the natural nest, and a study of wasp, bumble bee, and other social insect nests.

### Environmental Entomology

**400 Insect Ecology** Fall. 3 credits. Prerequisites: 212 and Bio Sci 361, or their equivalents.  
Lec, W F 10:10; lab, W F 1:25-4:25. R. B. Root.  
Familiarity with ecological principles is assumed; emphasis is placed on integrating these concepts through detailed analysis of entire life systems. Includes adaptive syndromes and functional role of insects in terrestrial ecosystems, field methods, natural history of arthropod guilds, contrast between natural and managed systems, and population dynamics.

**471 Bionomics of Fresh-Water Invertebrates** Spring. 4 credits. Prerequisite: 212; Bio Sci 361 recommended.  
Lec, W F 10:10; lab, M F or T Th 1:30-4:25.  
C. O. Berg.  
A field and laboratory study of aquatic insects and other macroscopic fresh-water invertebrates, including conditions for life in streams, ponds and other fresh-water habitats, identification of macroscopic invertebrates (especially aquatic insects) found there, life histories, methods of collection, trophic interactions, and other ecological relationships.

**595 Environmental Biology** Fall or spring. 1-3 credits. Prerequisite: permission of instructor.  
Hours to be arranged. D. Pimentel.  
Focuses on complex energy-environmental problems. Utilizing a multidisciplinary approach, task-force

groups of nine students, each representing several disciplines, investigate significant energy-environmental problems. Each task-force group will spend two semesters preparing a report for publication, modeled after National Academy of Sciences reports.

**660 Insect Ecology Field Course** Spring. 2 credits. Restricted to graduate students. Prerequisites: courses in ecology, entomology, and taxonomy, and permission of instructor.

W 7:30 p.m. The class will be away from campus during spring recess and the following week. R. B. Root.

A field course stressing methods for study of insect populations and communities. The class will engage in a coordinated set of projects at the Archbold Field Station and Everglades National Park in Florida.

**672 Seminar in Aquatic Ecology** Fall. 1 credit. Offered in alternate years. Prerequisites: 471 or Bio Sci 462, and permission of instructor.

Hours to be arranged. C. O. Berg. Discussion and analysis of current concepts and problems in limnology and aquatic entomology, including the critical study of selected reference works and research papers.

## Insect Physiology, Biochemistry, and Behavior

**583 Insect Physiology Lectures** Fall. 3 credits. Prerequisite: 212.

Lec, M W 11:15; lab, W 2-4:25. Entomology faculty and invited lecturers.

An introduction to insect physiology. Lectures and laboratories deal with basic principles and recent findings.

**587 Insect Biochemistry** Fall. 2 credits. Offered in alternate years. Prerequisite: permission of instructor.

Hours to be arranged. R. G. Young. Primarily a laboratory course, emphasizing some comparative aspects of biochemistry. Lectures provide rationale for the laboratory.

**662 Insect Behavior Seminar** Spring. 1 credit. Prerequisites: 212 and Bio Sci 321 or equivalent, and permission of instructors.

Hours to be arranged. G. C. Eickwort, M. J. Tauber.

## Toxicology

**590 Insect Toxicology and Insecticidal Chemistry** Spring. 4 credits. Offered in alternate years. Prerequisites: general chemistry and organic chemistry. Undergraduate students by permission of instructor.

Lec, M W F 9:05; lab, day to be arranged, 1:25-4:25. C. F. Wilkinson.

The chemistry of insecticides and their metabolism and mode of action in insects and mammals.

## Research of Special Topics

Fall or spring. Credit to be arranged. Prerequisite: permission of instructor. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work.

**408 Undergraduate Research** Entomology faculty.

**418 Special Topics for Undergraduates.** Entomology faculty.

**507 Special Topics for Graduate Students** Entomology faculty.

**508 Graduate Research** Entomology faculty.

**509 Teaching Entomology** Entomology faculty.

Credit is given for teaching entomology or for extension training.

## Department Seminar

**Jugatae** Fall and spring. M 4-5. A seminar conducted by Jugatae, the entomology club of Cornell University, to discuss topics of interest to its members and guests.

## Floriculture and Ornamental Horticulture

C. F. Gortzig, chairman; A. Bing, J. W. Boodley, A. M. Elliot, C. C. Fischer, R. T. Fox, G. L. Good, R. J. Lambert, R. W. Langhans, A. S. Lieberman, R. G. Mower, E. F. Schaufler, J. G. Seeley, P. L. Steponkus, H. B. Tukey, Jr.

## General Courses

### General Horticulture (Vegetable Crops 103)

### Introduction to Landscape Design (Landscape Architecture 102)

**100 Introductory Floriculture and Ornamental Horticulture** Fall. 3 credits. S-U grades optional for students not specializing in floriculture.

Lec, M W 8; lab, T W 2-4:25. J. W. Boodley. Principally for freshmen. Emphasis is placed on an introduction to and comprehension of basic plant physiology and plant processes, control of the plant environment, and the industry and opportunities. A required weekend field trip to visit commercial enterprises is made and costs approximately \$15 plus room and meals.

**105 Principles of Flower Arrangement** Fall or spring. 2 credits. Enrollment limited to 22 students for each laboratory section. Preference given to department majors.

Fall: lec, Th 9:05; lab, T W or Th 2-4:25. R. T. Fox. Spring: lec-lab, T W 1:25-4:25, Th 12:20-3:35. C. C. Fischer.

A study of the care and handling of flowers, the factors affecting keeping quality, and the design principles involved in the use of flowers and related decorative materials. There is a lab materials charge of \$20.

### 401-411 Physiology of Horticultural Plants.

Fall. 401 (lec), 2 credits; 411 (lab), 1 credit. Prerequisite: Bio Sci 242 or 342, or permission of instructor. 411 limited to 40 students.

401 T Th 8; 411, Th 1:25-4:25. H. B. Tukey, Jr. Application of physiology to germination of seeds, rooting of cuttings, manipulation of bulbs, and propagation of plants by budding and grafting. Stress on basic mechanisms concerning initiation and development of roots and shoots.

**402 Physiology of Horticultural Plants** Spring. 4 credits Prerequisite: Bio Sci 242 or 342, or permission of instructor.

Lec, M W F 8; lab, time to be arranged. P. L. Steponkus.

A study of the physiology of growth and development of horticultural plants in response to their environment.

## Plant Materials

**210 Taxonomy of Cultivated Plants** Fall. 4 credits. Intended primarily for department majors. Prerequisite: Bio Sci 105-106 or 245 or an equivalent course, or permission of instructor.

Lec, M W 10:10; lab, M W 2-4:25. J. W. Ingram, Jr. A study of the kinds of cultivated ferns and seed plants and their classification into families and genera. Emphasis is placed on methods of identification, preparation, and use of analytical keys,

distinguishing characteristics of families, their importance in horticulture, and the basics of nomenclature.

**213 Woody Plant Materials** Spring. 4 credits. Limited to 60 students (primarily department majors). Prerequisite: 210 or permission of instructor.

Lec, T Th 9:05; lab, T 2-4:25 and W or F 2-4:25. R. G. Mower.

A study of the trees, shrubs, and vines used in landscape planting. Emphasis is placed on winter identification and their values for use as landscape material.

**312 Herbaceous Plant Materials** Fall. 3 credits. Limited to 60 students (primarily department majors). Prerequisite: 210 or permission of instructor.

Lec, T Th 10:10; lab, T 2-4:25. R. G. Mower. A study of the ornamental herbaceous plants used in landscape and garden plantings. Emphasis is placed on the identification, use, and culture of bulbs, annuals, and perennials.

**313 Woody Plant Materials for Landscape Use** Fall. 3 credits. Limited to 30 students (primarily landscape architecture majors).

Lec, to be arranged; lab, F 1:25-4:25. R. G. Mower.

A study of the trees, shrubs, vines, and ground covers commonly used in landscape plantings in the northeastern United States. Emphasis will be placed on leaf identification and on characteristics that determine their usefulness as landscape subjects. Opportunity for independent study will be provided.

## Nursery and Turfgrass Crop Management

**314 Turfgrass Management** Spring. 3 credits. Prerequisite: Agron 200 or permission of instructor.

Lec, T Th 10:10; lab, Th 2-4:25. Staff. The scientific principles, practices, and materials for the construction and maintenance of lawn, sports, and utility turfgrass areas. Environmental effects on growth also studied.

**317 Nursery Crop Production and Maintenance** Fall. 4 credits. Prerequisite: 401.

Lec, M W F 9; lab, M 1-3, 3-5. G. L. Good. Problems of commercial propagation and growth of nursery plants to marketable stage. Digging, storage, and packaging of nursery stock included. Consideration is given to the planting and culture of landscape plants. Some aspects of garden center management are stressed. Field trips are included in lab work. Field trips cost \$15 plus room and meals.

**318 Advanced Turfgrass Management** Fall. 2 credits. Prerequisite: 314 or equivalent, and permission of instructor.

Staff. A continuation of course 314 with emphasis of applying scientific principles to management of golf courses, athletic fields, parks, industrial grounds, and sod production. A weekend inspection trip is taken to experimental test plots and special turfgrass areas; cost \$10 plus room and meals.

## Commercial Floriculture

**325 Flower-Store Management** Fall. 3 credits. Prerequisite: 105 and permission of instructor.

Lec, 2 hours to be arranged; lab, F 2-4:25. R. T. Fox.

Lectures devoted to flower-shop management, business methods, merchandising, and marketing of floricultural commodities. Laboratories to include the application of subject matter and the principles of commercial floral arrangement and design. Lab materials charge, \$20. Required field trips made to flower shows and to wholesale and retail florist establishments; cost, \$15 plus room and meals.

**424 Principles of Florist Crop Production** Fall. 4 credits. Prerequisite: 401 and Bio Sci 242 or 342 (may be taken concurrently) or equivalent, or permission of instructor.

Lec, M W F 9:05; lab, M 2-4:25. J. G. Seeley. Commercial production of florist crops. Emphasis on principles of culture of ornamental plants as influenced by greenhouse environment. Field trips are made to commercial greenhouses; cost, \$20 plus room and meals.

#### 425 Greenhouse Production Management

Spring. 3 credits. Prerequisite: an elementary course in horticulture or equivalent.

Lec, T Th 10:10-12:20. R. W. Langhans. Intended to provide the latest information relative to efficient operation and administration of a commercial greenhouse range outside the sphere of actual production methods for specific crops. Consideration is given to the industry, centers of production, competition, location, types of structures, heating, ventilation, cooling, fertilizing and watering systems, and business analysis and management. Field trips will be taken.

### Department Seminars

**450 Special Topics on Ornamental Plants** Fall or spring. Credit to be arranged. Limited to 15 students (primarily for upperclass department majors). Prerequisite: 213, 312 or 313 or the equivalent, and permission of instructor.

Hours to be arranged. R. G. Mower. Topical subjects in plant materials. Independent and group study of important groups of woody and herbaceous plant materials not considered in other courses. The topic to be covered will be given each semester in the supplementary announcement.

#### 550 Special Problems in Floriculture and Ornamental Horticulture

1 or more credits. S-U grades optional. Prerequisite: adequate training for the work. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade.

C. F. Gortzig and staff. Special work on problems under investigation by the department or of special interest to the student, provided adequate facilities are available. Students must satisfy the staff member under whom the work is to be taken, that their preparation warrants their choice of problems.

**600 Seminar** Fall or spring. S-U grades only. For department staff and graduate students. Th 4:30.

### Freehand Drawing and Illustration

**109 Drawing for Landscape Architects** Fall. 3 credits. Primarily for department majors; others admitted with permission of instructor. M W 1:25-4:25. A. Elliot.

Emphasizes the development of a graphic language and an approach to freehand perspective. Outside sketchbook assignments.

**110 Perspective for Landscape Architects** Spring. 3 credits. Primarily for department majors. T Th 1:25-4:25. R. J. Lambert.

Practice in perspective construction from plans and elevations, rendering techniques, and basic design principles. Outside sketchbook assignments.

**111 Freehand Drawing** Fall or spring. 3 credits. S-U grades optional for graduate students only. Prerequisite: permission of instructor. Credit may not be received for both 109 and 111.

Fall: M W F 10:10-12:05. R. J. Lambert. Spring: 6 studio hours scheduled in either two- or three-hour units between 9:05 and 12:05. M T W Th F or T 2-4:25. These hours must include lec, T or W 10:10. A. Elliot.

Objective is to develop accuracy of observation and skill in delineation. Practice is given in outdoor sketching and still-life and figure drawing. Principles of freehand perspective are taught and applied. Outside sketchbook assignments.

**211 Freehand Drawing and Illustration** Fall. 2 credits. Prerequisite: 111 or equivalent. S-U grades optional for graduate students only.

6 studio hours scheduled in either two- or three-hour units between 9:05 and 12:05. M T W Th F. R. J. Lambert.

Progression to the organization of complete illustrations. Subject matter largely from sketchbooks, still-life, and imagination. Composition, perspective, and ways of rendering in different media are considered.

**214 Watercolor** Spring. 2 credits. Prerequisite: 111 or equivalent. S-U grades optional for graduate students only.

6 studio hours scheduled in either two- or three-hour units between 9:05 and 12:05. M T W Th F. R. J. Lambert.

A survey of watercolor techniques. Subject matter largely still-life, sketchbook, and on-the-spot outdoor painting.

**316 Advanced Drawing** Fall or spring. 2 credits. S-U grades optional. Prerequisite: 211 or permission of instructor.

6 hours to be arranged. A. Elliot, R. J. Lambert. For students who wish to attain proficiency in some particular type of illustration or technique.

**417 Scientific Illustration** Fall. 2 credits.

Prerequisite: 211, 316, or equivalent. S-U grades optional for graduate students only. 6 studio hours scheduled between 9:05 and 12:05. M T W Th. A. Elliot.

A survey of methods of illustration. Training in techniques of accurate representation in media suitable for reproduction processes, including pen and ink, scratchboard, wash, and mixed media.

See also: Landscape Architecture courses, p. 25.

### 102 Introduction to Landscape Architecture

#### 201 Fundamentals of Landscape Design

#### 202 Planting Design and Implementation

#### 231 Landscape Architectural Design I—Principles of Landscape Architecture

#### 232 Landscape Architectural Design II—Site Planning

#### 331 Landscape Architectural Design III—Recreation Design

#### 332 Landscape Architectural Design IV—Community Design Workshop

#### 431 Landscape Architectural Design V—Regional Landscape Design Studio

#### 432 Landscape Architectural Design VI—Design Workshop and Terminal Project

#### 242 Site Construction I—Materials and Construction Details

#### 341 Site Construction II—Grading, Circulation, and Utilities

#### 362 Landscape Graphics

#### 371 Site Analysis Techniques

#### 452 Professional Practice

#### 491 Plants and Design

## Food Science

R. A. Ledford, chairman; R. C. Baker, D. K. Bandler, F. W. Bodyfelt, P. E. Brecht, H. F. DeGraff, T. W. Downes, D. C. Graham, L. F. Hood, W. K. Jordan, J. E. Kinsella, F. V. Kosikowski, F. W. Liu, R. P. March, N. N. Potter, J. M. Regenstein, G. E. Rehkgler, J. W. Sherbon, W. F. Shipe, Jr., J. R. Stouffer, G. H. Wellington, R. R. Zall.

#### 100 Introductory Food Science

Fall. 3 credits. M W F 10:10. N. N. Potter. A comprehensive introduction to food science and technology—its scope, principles, and practices. Topics are constituent properties, methods of preservation, the major food groups including their handling and processing, and current problems such as chemical additives and world feeding needs. Interrelationships between chemical and physical properties, processing, nutrition, and food quality are stressed.

**150 Food Facts and Fads** Spring. 2 credits. S-U grades optional.

Lec, M 7:30 p.m.; disc, 1 hour to be arranged. W. F. Shipe, staff, and invited speakers. A series of public lectures dealing with current topics relating to foods. Attempts will be made to dispel misconceptions about foods and the factors affecting them. Lectures are open to students and public. Students enrolled participate in weekly discussions dealing with lecture material and assigned readings.

**200 Man and His Food** Spring. 2 credits.

Lec and disc, Th 2:30-4:25. Herrell DeGraff. The dynamics of food and population balances in both the developed and less-developed world regions, and the world's growing dependence on science to provide adequate food.

**210 Food Analysis** Spring. 3 credits. Prerequisite: Chem 104 or 208.

Lec, W, F 12:20; lab, F 1:25-4:25. J. W. Sherbon. Designed to acquaint the student with chemical tests used by food analysts. Emphasis is on understanding and use of good analytical techniques including gravimetric, volumetric, and spectrophotometric methods. Procedures for screening, routine quality control, and official tests for fats, proteins, carbohydrates, and selected minor nutrients introduced.

**[211 Milk and Frozen Desserts** Fall. 2 credits.

Given in alternate years. Not offered fall, 1976. Lec, W 12:20; lab, W 1:25. W. K. Jordan, R. R. Zall. Deals with the principles and practices of processing fluid milk products and frozen desserts. The chemical, microbiological, and technological aspects of processing these dairy products will be considered. Field trips to processing plants will supplement the lectures and laboratory work.]

**300 Physical Chemistry of Foods I** Fall.

3 credits. Prerequisite: Orien 115 or equivalent. Not open to graduate students. Lec, M W 11:15; disc, F 12:30-2:15 or 2:30-4:15. J. M. Regenstein (odd years), J. W. Sherbon (even years).

An introduction to the principles of molecular structure, energetics, and kinetics is offered with applications of these principles to food systems and similar biological materials. Topics include thermodynamics, properties of solutions, phase equilibria, reaction mechanisms, and transport phenomena.

**301 Nutritional Aspects of Raw and Processed Foods** Spring. 3 credits. Prerequisite: Nutr Sci 115 or permission of instructor.

M W F 9:05. D. C. Graham. Deals with those principles that relate processing procedures to the nutritional value of foods.

**302 Introduction to Food Engineering** Fall. 4 credits. Prerequisites: 100 and a course in physics. Lec M W F 10:10; lab, M 1:25-4:25. W. K. Jordan. Engineering aspects of dairy and food plant operations.

**303 Introduction to the Economics of Food Packaging** Spring. 1 credit. T 10:10. T. W. Downes.

An introduction to the materials, functions, and costs associated with food packaging.

**304 Sanitary Principles, Toxicology, and Public Health** Spring. 3 credits. Prerequisite: 100.

Lec, T Th 10:10; lab, Th 1:25. R. R. Zall. Biological and chemical control of food processing and food contamination. United States Public Health Service, United States Department of Agriculture, the Federal Drug Administration, and other agencies that are involved in the regulation of the production, protection, and processing of foods. Quality assurance in foods.

**400 Undergraduate Research in Food Science** Fall or spring. 2 credits. Students must

attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade. Except for students enrolled in the honors program, credit will be limited to 4 credits.

Hours to be arranged. Staff. Independent study.

**[401 Concepts of Product Development]** Spring. 2 credits. S-U grades optional. Offered in alternate years. Prerequisite: 100 or equivalent. Not offered spring, 1977.

M W 10:10. L. F. Hood. A discussion of the sequence of events involved in the development and marketing of new food products. Topics will include packaging and labeling, food additive and ingredient regulations, taste panels, market testing, market research, and patents.]

**[402 Product Development Laboratory]** Spring. 2 credits. S-U grades optional. Offered in alternate years. Prerequisite: concurrent registration in 401 and permission of instructor. Not offered spring, 1977.

Lec, M W 10:10; lab, W F 1:25-4:25. L. F. Hood. A laboratory to be taken concurrently with 401. Emphasis will be on gaining practical experience in the development of new foods.]

**[403 International Food Science and Development]** Fall. 3 credits. Offered in alternate years. Not offered fall, 1976.

M W 1:25-4:25. F. V. Kosikowski. Characteristics of the development, processing, and marketing of staple and exotic foods throughout the world. Expanding protein resources for man in critical areas, pollution control, and diseases related to food are considered. Organization, operations, and contributions of United Nations technical agencies, governments, and nongovernmental organizations are discussed.]

**[404 Food Processing I—Drying, Freezing, Heat Preservation]** Spring. 3 credits. Offered in alternate years. Not offered spring, 1977.

Lec, T Th 11:15; lab, T 1:25-4:25. N. N. Potter. Deals with the principles and practices of drying, freezing, canning, and other heat treatments applied to foods. Current processing methods will be considered as related to the chemistry, microbiology, and technology of the ingredients and final products.]

**405 Food Processing II—Concentrating, Separating, Mixing** Spring. 3 credits. Offered in alternate years.

Lec, T Th 11:15; lab, T 1:25-4:25. W. K. Jordan, R. R. Zall. Deals with the principles and practices of evaporation, reverse osmosis, homogenization, size reduction, waste management, and other unit

operations important to the food industry.

**[406 Food Processing III Lecture—Fermentations]**

Fall. 3 credits. Offered in alternate years. Prerequisite: background in microbiology and biochemistry. Not offered in fall, 1976.

Lec, T Th 11:15; disc, Th 12:20-4:25. F. V. Kosikowski.

A presentation of the principles and practices of fermentations leading to important foods from plant, animal, and single-cell protein sources. Included are wine, cheese, petroproteins, and food grade enzyme preparations.]

**407 Food Processing IV—Fats and Oils** Fall.

3 credits. Offered in alternate years. Open to upperclass and graduate students.

Lec, W F 9:05; lab, F 1:25-4:25. J. E. Kinsella. Sources, composition, and properties of edible fats and oils are discussed. Effects of lipids on food quality and storage stability and factors affecting chemical and physical stability of food fats are described. Chemical technology of emulsions, shortenings, edible oils, margarine, and butter also considered.

**[408 Food Processing III Demonstration—**

**Fermentations]** Fall. 1 credit. Offered in alternate years. Prerequisite: concurrent registration in 406. Enrollment limited. Not offered fall, 1976.

Lab, T 1:25-4:25. F. V. Kosikowski. Laboratory demonstrations in food-processing fermentations.]

**409 Food Chemistry** Spring. 3 credits.

Prerequisites: organic chemistry or biochemistry; concurrent registration in 410 recommended

Lec, T Th 8:30-9:55; disc, S 9:05. W. F. Shipe, P. Brecht, L. F. Hood, J. E. Kinsella, J. M. Regenstein.

Deals with the relationship between the chemical composition and properties of foods. Special attention will be given to the interactions among the components of food.

**410 Sensory and Objective Evaluations of**

**Foods** Spring. 3 credits. Prerequisites: statistics; concurrent registration in 409 recommended.

Lec, M W F 11:15; lab, W or Th 2-4:25. W. F. Shipe.

Deals with the sensory techniques used in evaluating the flavor, color, and texture of foods and effects of these properties on consumer acceptance. Objective methods for measuring these qualities and appropriate statistical methods for analyzing the subjective and objective results and establishing a quality control program.

**[411 Food Mycology]** Fall. 3 credits. Offered in alternate years. Prerequisite: Microbio 290, 291, or equivalent; Microbio 394 recommended. Not offered fall, 1976.

Lec, W F 10:10; lab, F 1:25-4:25. D. C. Graham. To acquaint students with important fungi, both from the standpoint of their beneficial as well as their harmful effects in food production, preservation, and spoilage. Labs deal with morphology, culture and isolation, identification of fungi, and isolation and quantification of fungal toxins.]

**415 Principles of Food Packaging** Fall. 3 credits.

Lec, M W F 9:05. T. W. Downes. Intended primarily for students in food science and related fields. The basic properties of some packaging materials and systems will be discussed and these principles will be utilized to describe packaging systems for specific applications to meats, dairy products, fruits and vegetables, fats and oils, etc.

**450 Special Topics in Food Science** Fall or spring. Maximum 3 credits each term. Registration by permission of the instructor.

Institute staff. Designed for the food science student wishing to

become informed on any specific topic selected that is related to food science. The course may include individual tutorial study, a special lecture topic selected by a professor or a group of students, and/or selected lectures of a course already offered. Topics may be changed so that the course may be repeated for credit.

**601 Food Protein Chemistry** Fall. 3 credits.

Offered in alternate years. Open to graduate students and to qualified seniors with permission of the instructor. Prerequisite: 300 or its equivalent. Students who have already had Bio Sci 531 may not take this course for credit.

Lec, M W F 8. J. M. Regenstein. The chemistry and physical chemistry of proteins will be discussed. Important proteins of food systems will be examined in terms of methodology currently used in protein chemistry for characterization and purification. Interactions of proteins with other food components also will be covered.

**602 Food Lipids** Fall. 2 credits. Offered in

alternate years. Open to graduate students. T Th 8. J. E. Kinsella. Disposition of lipid materials in foods and the manner lipids influence the chemical and physical attributes of various foods. Effects of production techniques, storage, heating, refrigeration, and enzymes on food lipids and the chemical mechanisms of oxidation. Importance of lipids to food flavors is discussed.

**[603 Food Carbohydrates]** Spring. 2 credits.

Offered in alternate years. Open to qualified seniors and graduate students. Prerequisites: Bio Sci 431 or equivalent. Not offered spring, 1977.

Lec, T Th 10:10. L. F. Hood, R. S. Shallenberger. A consideration of the chemistry of carbohydrates in foods including sugars, starches, pectins, gums, and cellulose. Emphasis will be placed on their origins in raw materials and the subsequent changes occurring during processing and storage.]

**604 Chemistry of Dairy Products** Fall. 2 credits.

Offered in alternate years. Prerequisites: qualitative and quantitative analysis and organic chemistry.

Lec, T Th 12:20. R. A. Ledford and staff. A study of milk constituents and physical properties. Deals with milk enzymes, lactose, milk fat, milk proteins, and minor constituents, and includes biological variations and processing effects.

**605 Applications of Physical Chemistry to**

**Foods** Fall. 1 credit. Prerequisite: physical chemistry or coregistration in 300. Not open to students who have completed or are registered in 710.

Lec, F 11:15; disc, M 8 or 12:20. J. M. Regenstein (odd years), J. W. Sherbon (even years). The application of physical chemical principles to important food systems with special emphasis on emulsions. Intended for students who have already had physical chemistry or are coregistered in 300.

**606 Instrumental Methods** Spring. 5 credits.

Prerequisite: permission of instructor. Lec, M W F 8; lab, M or T 1:25-4:25.

J. W. Sherbon. Deals with instrumental methods widely used in research and industry. The major emphasis is on chromatography, spectroscopy, electrophoresis, thermal analysis, and the use of computers. The stress will be on the theoretical and practical aspects of the material presented.

**[607 High-Protein Food Technology]** Fall.

2 credits. Offered in alternate years. Prerequisites: majors in international food science and other qualified students; recommended: 403 or equivalent. Not offered fall, 1976.

M 1:25-4:25. Other hours by arrangement. F. V. Kosikowski.

The characteristics and processing techniques of high-protein foods and their place in an expanding world population are examined. Protein foods from

cereals, pulses, oilseeds, milk, and marine life will be considered along with single-cell protein foods from petroleum, cellulose, and whey.]

**[608 Food Color and Food Pigments** Fall. 1 credit. Offered in alternate years. Prerequisites: organic chemistry. Not offered fall, 1976.

Lec, F 12:20. J. P. VanBuren.

An introduction to theories of color perception and color spaces will be followed by a survey of chemical and physical properties of the major food pigments and their stability during processing and storage. Color and pigments of selected commodities will be examined in detail.]

**609 Rheology** Spring. 1 credit. Offered in alternate years.

Lec, F 12:20. M. C. Bourne.

Fundamental concepts of rheology applied to foods with emphasis on objective methods for measuring textural properties. Principles and practice involved in measuring texture, viscosity, and consistency; instrumentation, and correlations between objective and sensory methods of texture measurements. Examples of rheological problems in each major food group are discussed.

**610 Introductory Chemical Toxicology** Fall. 1 credit. Offered in alternate years. Prerequisite: biochemistry and animal physiology.

Lec, F 11:15. G. S. Stoewsand.

An introduction to the concepts and essentials of toxicology, especially as related to foods; physiologically active compounds in natural and processed foods; antinutritive substances; intentional food additives; potential contaminants; safety evaluation and regulation of foods. Assigned writing or brief student lecture will widen knowledge of current research.

**[612 Cereal Science and Technology** Fall. 3 credits. Offered in alternate years. Not offered fall, 1976.

Lec, T Th 10:10-12:05.

The science and technology of cereal products will be studied as one of the most developed applications of the basic sciences. Students will evaluate methods and operations with which trained food technologists should be familiar.]

**614 Mathematical Evaluation of Processed Packaged Foods** Spring. 3 credits. Offered in alternate years.

Lec and disc, Th 2-4:25. T. W. Downes.

Mathematical methods utilized to evaluate the thermal processing of packaged foods will be presented in depth. These techniques will also be utilized in predicting shelf-life and nutrient loss.

**615 Secondary Plant Metabolites** Fall. 1 credit. Offered in alternate years. Prerequisite: biochemistry (Bio Sci 431 or 432).

Lec, F 12:20. G. Hrazdina.

Deals with the biochemistry of secondary plant metabolites (i.e. sulphur-containing compounds, alkaloids, flavonoids, terpenes, etc.) and their importance to food products. Major emphasis will be on the chemical properties of these compounds, their reactions, their occurrence in edible plants, and their influence on food products.

**700 Seminar** Fall or spring. 1 credit, S-U grades only. For graduate students only; required of all food science graduate students.

**701 Preparation for Food Science Teaching** Fall or spring. Credit to be arranged. Open to qualified food science graduate students not already serving as teaching assistants.

Department head and staff.

Designed to give graduate students some experience in teaching and in the preparation of courses. Participants will assist professor in regular food science courses, including some actual teaching, and will be required to attend a number of orientation

lectures on teaching techniques.

**710 Physical Chemistry of Foods II** Fall. 3 credits. Prerequisites: Orien 115 or equivalent. Not open to students who have had physical chemistry or 300. Open only to graduate students.

Lec, M W F 11:15; disc, M 8 or 12:20.

J. M. Regenstien (odd years), J. W. Sherbon (even years).

The application of physical chemical principles to important systems with special emphasis on emulsions. In addition, an introduction to the principles of molecular structure, energetics and kinetics is offered with applications of these principles to understanding foods and other biological materials.

See also:

**Advanced Microbiology** Micro 390

**Food Microbiology** Micro 394 and 395

**Meat and Meat Products** An Sci 290

**Science and Technology of Meat, Fish, and Eggs** An Sci 490

**Postharvest Handling and Marketing of Vegetables** Veg Crops 312

**Marketing** Ag Econ 240

**Food Distribution** Ag Econ 441

**Food Industry Management** Ag Econ 443

**Economics of Food Marketing** Ag Econ 446

## International Agriculture

**600 Seminar: International Agriculture** Fall or spring. Noncredit.

Third and fourth Wednesdays of each month, 4-5. Staff.

The seminar will focus on developing an understanding of the nature and interrelatedness to agricultural development of the social sciences, plant and animal sciences, foods and nutrition, and natural resources.

**[601 Philippine Agricultural Development: Policy and Administration** Spring. 2 credits. Not offered spring 1977.

Th 3:30. F. H. Golay, G. Levine.

Major aspects of Philippine agricultural development will be considered from economic, social, and technological points of view.]

**602 Special Studies of Problems of Agriculture in the Tropics** Spring. 3 credits. Prerequisite: one or more courses from international agriculture listing and permission of instructors.

Th 2:30-4:25. Staff.

Oriented to provide students an opportunity to observe agricultural development in a tropical environment and promote interdisciplinary exchange among staff and students. The two-week field-study trip during January to Latin American countries is followed by discussions and assignments during the spring semester dealing with problems in agriculture and livestock production in the context of social and economic conditions.

**603 Administration of Agricultural and Rural Development (also Govt 692 and B&P NCE 514)** Spring. 3 credits. S-U grades optional.

T 2:30-5:30. M. L. Barnett, F. T. Bent, E. B. Oyer, N. T. Uphoff, L. W. Zuidema.

An intercollege course designed to provide graduate students a multidisciplinary perspective on the administration of agricultural and rural development activities in developing countries. The course is

oriented to students trained in agricultural and social sciences who are likely to occupy administrative roles during their professional careers.

**703 Seminar for Special Projects in Agricultural and Rural Development** Spring. Variable credit. Required for graduate students enrolled in the M.P.S. (Agriculture), majoring in international agricultural and rural development; others with permission of the program director.

Alternate Mondays, 7:30-9:30 p.m. Staff. The seminar will provide M.P.S. students the opportunity to present their special projects. It will also serve as a forum for discussion of current issues in low-income agricultural and rural development, with particular attention to interdisciplinary complexities.

See also:

**Economics of Agricultural Geography (Agricultural Economics 150)**

**Economics of Agricultural Development (Agricultural Economics 464)**

**Food, Population, and Employment (Agricultural Economics 660)**

**Seminar on Latin American Agricultural Policy (Agricultural Economics 665)**

**Seminar in Agricultural Development (Agricultural Economics 666)**

**Export Marketing (Agricultural Economics 743)**

**Seminar on Agricultural Policy (Agricultural Economics 751)**

**Seminar in Agriculture and Economic Planning Models (Agricultural Economics 769)**

**Transportation Policies for Developing Nations (Agricultural Engineering 495)**

**Identification, Appraisal, and Geography of Soils (Agronomy 301)**

**Geography and Appraisal of Soils of the Tropics (Agronomy 401)**

**Tropical Crop Production (Agronomy 422)**

**[Management Systems for Tropical Soils (Agronomy 480)]**

**Livestock Production in Warm Climates (Animal Science 400)**

**Forages of the Tropics for Livestock Production (Animal Science 403)**

**Intercultural Communication (Communication Arts 501)**

**Communication in the Developing Nations (Communication Arts 524)**

**Comparative Mass Media (Communication Arts 526)**

**Designing Extension and Continuing Education Programs (Education 624)**

**Educational Communication (Education 625)**

**[Behavioral Change in International Rural Modernization (Education 627)]**

**Arthropod Pests of World Importance (Entomology 341)**

**[International Food Science and Development (Food Science 403)]**

[High-Protein Food Technology (Food Science 607)]

[International Natural Resources (Natural Resources 511)]

International Nutrition Problems, Policy, and Programs (Nutritional Sciences 680)

Seminar in International Nutrition and Development Policy (Nutritional Sciences 695)

Special Topics in International Nutrition (Nutritional Sciences 699)

Plant Diseases in Tropical Agricultural Development (Plant Pathology 655)

[Economic Fruits of the World (Pomology 301)]

Rural Social Problems in World Perspective (Rural Sociology 105)

Subsistence Agriculture in Transition (Rural Sociology 157)

Rural Development and Cultural Change (Rural Sociology 355)

Social Change in Community and Regions (Rural Sociology 606)

Macrosociological Accounting (Rural Sociology 715)

Applications of Sociology to Development Programs (Rural Sociology 751)

Peasants, Water, and Development (Rural Sociology 754)

Special Topics in Plant Science Extension (Vegetable Crops 629)

Research Methods in Applied Plant Science (Vegetable Crops 630)

## Landscape Architecture\*

M. I. Adleman, R. L. Dwelle, T. H. Johnson, P. S. Tresch.

### General Courses

**102 Introduction to Landscape Architecture** Fall or spring, 3 credits.  
M W F 9:05. R. L. Dwelle.

The scope and principles of site planning are explored through the use of lectures, movies, and slides intended to expand awareness of the design potential of the outdoor environment. Landscape architects and representatives of related fields are regularly scheduled as guest lecturers.

**201 Fundamentals of Landscape Design** Fall, 3 credits. Limited to 15 students. Prerequisites: Flor 213 and permission of instructor.

Lec, W 1-2; studio, W F 2-4:25. R. L. Dwelle.  
An introduction to landscape design with application to residential scale site planning. Studio problems will deal with basic design vocabulary and graphics relating to the siting of single family residences, indoor-outdoor relationships, design of outdoor living areas, walks, drives, entrance and service areas, pools, decks, fencing, walls, lighting, and planting for residential properties. Local field trips will be scheduled.

**202 Planting Design and Implementation** Spring, 3 credits. Limited to 15 students.

Prerequisites: Flor 213 and permission of instructor.

Lec, W 1-2; studio, W F 2-4:25. R. L. Dwelle.  
Functional and aesthetic uses of plant materials in landscape design applied to the variety of project types most frequently encountered by the landscape contractor. Studio projects will relate to actual sites and will include the preparation of planting plans, details, and cost estimates, and will deal with procedures relating to construction implementation. Field trips to nearby projects will be scheduled.

### Design and Construction Courses

**231 Landscape Architectural Design I—Principles of Landscape Architecture** Fall, 5 credits. Intended primarily for landscape architecture majors. Limited to 22 students. Prerequisite: permission of instructor.

Lec, W F 8; studio, M W F 10:10-12:35.  
P. S. Tresch.  
Lectures and studio exercises dealing with basic principles and elements involved in the design of outdoor space as well as with the logical process of solving site design problems. Studio exercises include studies in spatial organization and composition, site evaluation factors, circulation, landform design, planting design, and graphic presentation. One of the two lecture periods each week will deal with the scope of professional practice. This is the first course in a sequence of six design studio courses required for specialization in landscape architecture.

**232 Landscape Architectural Design II—Site Planning** Spring, 5 credits. Prerequisites: 231 and permission of instructor.

Lec, W F 8; studio, M W F 10:10-12:35.  
T. H. Johnson.  
Continuing development of basic design and graphic skills through involvement with site planning projects of increasingly larger scale and complexity.

**331 Landscape Architectural Design III—Recreation Design** Fall, 5 credits. Prerequisite: 232.

Lec, F 9:05; studio, M W F 10:10-12:35.  
M. I. Adleman.  
The design of recreational areas ranging in scale from regional parks to small urban parks and playgrounds. A five-day field trip is required and expenses are estimated at approximately \$100.

**332 Landscape Architectural Design IV—Community Design Workshop** Spring, 5 credits. Prerequisite: 331.

Lec, M 9:05; studio, M W F 10:10-12:35.  
P. S. Tresch.  
Field-service projects dealing with a variety of community design needs ranging in scale from urban to rural and involving multidisciplinary design approaches.

**431 Landscape Architectural Design V—Regional Landscape Design Studio** Fall, 5 credits. Prerequisite: 332.

Lec, M 9:05; studio, M W F 10:10-12:35.  
T. H. Johnson.  
An exploration of the landscape architect's role in the evaluation of land development and open space potential and the establishment of design criteria responsive to community development needs, the natural landscape, and agricultural land. Project design studies focus on the balance between community interests, the developer's interests, and natural and agricultural landscape factors. A five-day field trip is required and expenses are estimated at approximately \$100.

**432 Landscape Architectural Design VI—Design Workshop** Spring, 5 credits. Prerequisite: 431.

Lec, M 9:05; studio, M W F 10:10-12:35.  
M. I. Adleman.  
A series of short problems related to those normally included in professional licensing examinations will accompany the design of a major terminal project reflecting individual interests in landscape

architecture. Projects will serve to reinforce each student's proficiency in dealing with the total design process and will be carried from proposal stage through inventory, analysis, schematic design, design development, cost estimating, working drawings, and specifications.

**242 Site Construction I—Materials and Construction Details** Spring, 4 credits. Prerequisite: permission of instructor.

Lec, T Th 10:10; studio, T Th 1:25-4:25.  
P. S. Tresch.  
Lectures, exercises, and projects dealing with the nature and use of materials for outdoor construction, together with construction techniques, detailing, and the preparation of working drawings.

**341 Site Construction II—Grading, Circulation, and Utilities** Fall, 4 credits. Prerequisite: Ag Engr 221 and permission of instructor.

Lec, M W 9; studio, M W 1:25-4:25. T. H. Johnson.  
Lectures, exercises, and projects dealing with landform design and the preparation of grading plans, calculations of earthwork, and layout of circulation, parking, and landscape utilities systems.

**362 Landscape Graphics** Spring, 2 credits. Prerequisite: Drawing 110 and permission of instructor.

Studio, M W 1:25-4:25. T. H. Johnson.  
Office presentation techniques for landscape plans, perspectives, sections, and models. Alternative media and methods for public presentation and/or publication of landscape design and planning proposals.

**371 Site Analysis Techniques** Fall, 2 credits. Prerequisite: 232 or permission of instructor.

Lec, T 10:10-12:05; studio, Th 10:10-12:05.  
P. S. Tresch.  
Lectures and exercises dealing with analysis procedures for the use of natural determinant information in land planning and design. Evaluation of land development potential based on the comprehensive study of site characteristics, including soils, vegetation, topography, hydrology, geology, and other natural and man-made factors.

**452 Professional Practice** Spring, 2 credits. Prerequisites: 341 and permission of instructor.

Lec, W 9; lab, W 1:25-4:25. M. I. Adleman.  
A study of the professional practice of landscape architecture including the landscape architect's role in public agencies, operation of a private office, business and legal responsibilities, proposals and fees, preparation of contract documents, and relationships to the client, the contractor, and professional consultants. Weekly field trips will be conducted to public and private offices in the region.

**491 Plants and Design** Fall, 3 credits. Prerequisites: Flor 313 or 213, and permission of instructor. Limited to 15 students.

Lec, W 9; studio, M W 1:25-4:25. M. I. Adleman.  
Advanced studies in planting design involving design principles and ecological considerations relating to the uses of plant materials, interrelationships of plants in landscape composition, horticultural requirements and procedures related to plant selection, transplanting, and maintenance and preparation of contract documents for planting including plans, details, specifications, and cost estimates.

See also:

**CRP 481 Contemporary Issues in Landscape Architecture**

**CRP 583 Urban Landscape Planning and Design**

**CRP 585 History of Landscape Architecture**

\*Part of the Department of Floriculture and Ornamental Horticulture

**Flor 213 Woody Plant Materials****Flor 313 Woody Plants for Landscape Use****Drwg 109 Drawing for Landscape Architects****Drwg 110 Perspective for Landscape Architects****Microbiology\***

E. A. Delwiche, N. C. Dondero, H. B. Naylor, C. M. Rehkugler, H. W. Seeley, P. J. VanDemark, T. L. Weaver.

**290 General Microbiology Lectures** Fall or spring. 3 credits. Prerequisites: Bio Sci 101-102 and Chem 104 or 208. It is recommended that 291 be taken concurrently.

M W F 11:15. Fall, H. W. Seeley; spring, P. J. VanDemark.

A study of the basic principles and relationships in the field of microbiology, with fundamentals necessary to further work in the subject.

**291 General Microbiology Laboratory** Fall or spring. 2 credits. Prerequisite: concurrent or previous enrollment in 290.

M W 2-4:25; T Th 8-10:30, 11-1:30, 2-4:25. Fall, H. W. Seeley; spring, P. J. VanDemark.

A study of the basic principles and techniques of laboratory practice in microbiology and fundamentals necessary to further work in the subject.

**292 General Microbiology Discussion** Spring. 1 credit. S-U grades only. Prerequisite: previous or concurrent registration in 290.

Hours to be arranged. P. J. VanDemark.  
A series of discussion groups in specialized areas of microbiology to complement 290.

**304 Tissue Culture Techniques and Applications** Fall. 2 credits. Prerequisites: 290 and 291 or permission of instructor.

F 1-3:30. C. M. Rehkugler.  
A series of lectures and demonstrations dealing with cell culture methods, especially those required to culture cells of plants and animals from different tissue origins. The application of cell culture to the study of bacterial diseases, virus replication, and the production of biologicals will be considered.

**[390 Advanced General Microbiology Lectures** Fall. 2 credits. Offered in alternate years.

Prerequisites: 290, 291, and organic chemistry. May be taken independently of 391 and in sequence or independently of 392. Not offered fall, 1976.

M W 11:15. E. A. Delwiche, N. C. Dondero.  
A consideration of the morphological, taxonomic, cultural, and physiological characteristics of important groups of heterotrophic microorganisms. Included will be (1) sporeforming bacteria, propionic acid bacteria, gram negative cocci; and (2) pseudomonads, enterics and related forms.]

**[391 Advanced General Microbiology Laboratory** Fall. 2 credits. Offered in alternate years. Prerequisite: concurrent or previous enrollment in 390. Enrollment limited. Not offered fall, 1976.

M W 2-4:30. E. A. Delwiche, N. C. Dondero.  
Intended as a laboratory complement to 390. The isolation, characterization, and study of the groups of heterotrophic microorganisms included in 390.]

**392 Advanced General Microbiology Lectures** Fall. 2 credits. Offered in alternate years. Prerequisites: 290, 291, and organic chemistry. May be taken independently of 393 and in sequence or independently of 390.

M W 11:15. H. B. Naylor, P. J. VanDemark.  
A consideration of the morphological, taxonomic, cultural, and physiological characteristics of important groups of heterotrophic microorganisms.

Included will be (1) the lactic acid bacteria; and (2) the staphylococcus-micrococcus group and related gram positive cocci.

**393 Advanced General Microbiology Laboratory** Fall. 2 credits. Offered in alternate years. Prerequisite: concurrent or previous enrollment in 392. Enrollment limited.

M W 2-4:30. H. B. Naylor, P. J. VanDemark.  
Intended as a laboratory complement to 392. The isolation, characterization, and study of the groups of heterotrophic microorganisms included in 392.

**394 Food Microbiology Lectures** Spring. 2 credits. Prerequisites: 290, 291.

M W 12:20. H. B. Naylor.  
The major families of microorganisms of importance in foods are studied systematically with emphasis on the roles played by these organisms in food preservation, food fermentations, and public health.

**395 Food Microbiology Laboratory** Spring. 2 credits. Graduate students must have permission of the instructor.

M W 2-4:25. H. B. Naylor.  
Work includes studies of the physiological characteristics of representative food microorganisms, practice in the use of general and special methods for microbiological testing and control of food products, and practice in the isolation and characterization of organisms of importance in foods.

**396 Applied and Industrial Microbiology** Fall. 3 credits. Prerequisite: 290.

T Th 10:10-11:25. E. A. Delwiche, N. C. Dondero, and staff.  
A survey of the microbiology of industrial fermentations, water, and waste decomposition.

**412 Aquatic Microbiology** Spring. 3 credits. Prerequisite: 290 or Agron 406.

T Th 10:10-11:25. N. C. Dondero.  
A consideration of the relation of microorganisms, especially the bacteria, to aquatic environments: both natural and artificial. The microbiology of waste waters will be included. Attention will be given to fundamental biological concepts and to applied aspects of the occurrence and activities of microorganisms in water.

**490 Microbial Physiology Lectures** Spring. 3 credits. S-U grades optional. Prerequisites: 290, 291, and biochemistry.

M W F 11:15. T. L. Weaver.  
The concern is with the physiological functions of microorganisms. Particular consideration is given to the dynamics of growth, the nutrition and energy metabolism of developing cultures, and the interactions of the physical and chemical environments with the growth process. Composition and structure of microorganisms, metabolism, and various microbial processes such as transport, regulation, and sporulation will be discussed.

**491 Microbial Physiology Laboratory** Spring. 3 credits. S-U grades optional. Prerequisite: concurrent or previous enrollment in 490 and permission of instructor. Enrollment limited.

T Th 12:20-12:50; other hours to be arranged.  
T. L. Weaver.  
The laboratory component of 490. Experiments designed by the instructor and students to explore fundamental concepts, techniques, and instrumentation in microbial physiology.

**492 Microbial Ecology (also Agronomy 410)** Spring. 3 credits. Offered in alternate years. Prerequisite: elementary course in some facet of microbiology.

M W F 10:10. M. Alexander.  
An introduction to the basic principles of microbial ecology. Attention is given to behavior, activity, and interrelationships of bacteria, fungi, algae, and protozoa in natural ecosystems.

**496 Selected Topics in Microbial Metabolism** Spring. 2 credits. S-U grades optional. Prerequisites: beginning courses in general microbiology, biochemistry, and organic chemistry. Primarily for upperclass and graduate students.

T Th 11:15. E. A. Delwiche.  
Selected topics pertaining to the energy metabolism, oxidative and fermentative abilities, and biosynthetic capacities of microorganisms. Where possible and appropriate the subject matter deals with the various microbial forms in a comparative sense.

**499 Research in Microbiology** Fall or spring. Credit variable. Undergraduates must attach to their preregistration material written permission of the staff member who will supervise the work and assign the grade. This course cannot be used to fulfill the specialization requirement.

Hours to be arranged. Staff.

**691 Graduate Seminar in Microbiology** Fall and spring. 1 credit. Required of all graduate students majoring in the graduate Field of Microbiology.

Hours to be arranged. Staff.

**699 Microbiology Seminar** Fall and spring. Required of all graduate students majoring in the graduate Field of Microbiology and open to all who are interested.

Hours to be arranged. Staff.

See also:

**Food Mycology (Food Science 411)**

**[Soil Microbiology (Agronomy 406)]**

**[Soil Microbiology (Agronomy 407)]**

**Advanced Soil Microbiology (Agronomy 606)**

**Microbial Genetics, Lectures (Biological Science 485)**

**Microbial Genetics, Laboratory (Biological Science 486)**

**Basic Immunology Lectures (Veterinary Medicine 315)**

**Pathogenic Microbiology (Veterinary Medicine 316)**

**[Advanced Immunology Lectures (Veterinary Medicine 705)]**

**[Advanced Immunology Laboratory (Veterinary Medicine 706)]**

**Advanced Work in Bacteriology, Virology, or Immunology (Veterinary Medicine 707)**

**Advanced Animal Virology Lectures (Veterinary Medicine 708)**

**Advanced Animal Virology Laboratory (Veterinary Medicine 709)**

**Natural Resources**

W. H. Everhart, chairman; R. A. Baer, H. B. Brumsted, J. W. Caslick, L. S. Hamilton, E. E. Hardy, J. W. Kelley, R. J. McNeil, A. N. Moen, R. R. Morrow, Jr., J. G. Nickum, R. T. Oglesby, M. E. Richmond, C. L. Schofield, D. A. Webster, B. T. Wilkins, W. D. Youngs.

\*Part of the Department of Food Science

**110 Ecological Basis for Conservation** Spring. 2 credits.

Lec, T Th 10:10 or 12:20. R. J. McNeil.  
Ecological principles as applied to human use of environment, especially its living components. Survival strategies of animals and the application of these concepts to human beings. Ecological succession, carrying capacity, limiting factors, population dynamics, animal behavior, disease, and effects of contaminants on living organisms and systems are all examples of environmental issues considered.

**111 Ecological Basis Discussions** Spring. 1 credit. Corequisite: 110.

Hours to be arranged. T. L. Cobb and staff.  
Treatment of lecture material from 110 in greater depth and with varying emphasis depending on the background and interests of the instructors and students.

**201 Environmental Conservation** Fall. 2 credits. T Th 10:10 or 12:20. R. J. McNeil.

People, natural resources, and environment. Our use and misuse of the natural components of our environment. Current resource-use problems including air and water pollution, radiation, garbage and waste, and the population explosion. An attempt is made to introduce the concept of a conservation ethic.

**202 Environmental Conservation Discussions** Fall. 1 credit. Corequisite: 201.

Hours to be arranged. T. L. Cobb and staff.  
Treatment of lecture material from 201 in greater depth and with varying emphasis, depending on the background and interests of the instructors and students.

**407 Religion, Ethics, and the Environment**

Spring. 3 credits. S-U grades optional. Juniors, seniors, graduate students; others only by permission.

T Th 9:05; 1-hour disc to be arranged.  
Study of Western religion and values as these have affected our understanding and treatment of nature. Initial historical overview followed by consideration of selected themes, including progress, play and work, objectivity and subjectivity, human finitude and death, and knowledge as control. Also responsibility to future generations; limiting growth and questions of distributive justice; implications of environmental programs for minorities, the poor, and other nations; reverence for being.

**430 Dynamics of Animal Populations** Spring. 2 credits. Prerequisite: senior or graduate standing in the Department of Natural Resources, or permission of instructor.

T Th 10:10. W. D. Youngs.  
A quantitative examination of the dynamics of animal populations. This course uses interactive computing to assist in analysis and understanding of mortality, growth, population estimation, and population interaction.

**500 Thesis Research and Professional Projects**

Fall or spring. Credit arranged. S-U grades only. Limited to graduate students working on thesis research or professional master's projects.  
Staff.

**610 Conservation Seminar** Fall or spring.

Noncredit. All graduate students in the Field of Natural Resources are expected to participate.  
Th 4-5:30. Staff.

**611 Seminar in Environmental Values** Fall.

3 credits. S-U grades optional. Graduate students and also juniors and seniors by permission.  
W 1:25-3:50. R. A. Baer.  
How the humanities, particularly religion, philosophy, and ethics, contribute to our understanding of the environment. In successive years topics will include

(1) the role of nonutilitarian values in our relationship to our natural environment, (2) land ethics, (3) new models for higher education in the age of ecology, and (4) concepts of growth and progress in Western culture and their impact on our treatment of the environment.

**Resource Analysis and Planning****300 Natural Resources Inventories** Spring. 3 credits.

Lec, M W 12:20; lab M T W 2. E. E. Hardy.  
Procedures for inventorying resources, the methods used, and theories of inventory development in relation to present needs. Examination of the processes used in generating currently used inventories, application of methods to improve existing inventories, and experience in developing inventories will be undertaken.

**510 Perspectives on Conservation** Fall.

3 credits. Graduate standing or written permission of instructor.

Th 1:25-3:30. B. T. Wilkins.  
A seminar based upon extensive readings of articles highlighting varying philosophical approaches to the conservation of natural resources. Views espoused by developmentalists, preservationists, naturalists, economists, and welfare economists will be considered.

**[511 International Natural Resources** Fall.

2 credits. Offered in alternate years. Upperclass and graduate students. Foreign students especially invited. Not offered fall, 1976.

W 3-5. L. S. Hamilton.  
A seminar devoted to exploring natural resource conservation, preservation, and development in foreign countries and the relevance of the United States experience to these problems and activities.]

**602 Seminar in Natural Resource Analysis for Ecologically Based Planning** Spring. 2 credits.

W 2:30-5. L. S. Hamilton.  
Multidisciplinary graduate seminar. Theme changes each year but usually involves a case study of a specific area of land and water. Fieldwork usually required. Engineers, economists, sociologists, soil scientists, foresters, planners, and wildlife and fishery biologists are especially invited to bring expertise to the planning table.

**604 Seminar on Selected Topics in Natural Resources Conservation** Spring. 1 credit.

Hours to be arranged. Staff.  
Primarily for graduate students majoring or minoring in natural resources conservation.

**498 Research in Resource Analysis and Planning** Fall or spring. S-U grades optional.

Prerequisite: permission of instructor.  
H. B. Brumsted, L. S. Hamilton, J. W. Kelley, R. J. McNeil, B. T. Wilkins.

See also:

**Resources Economics (Agricultural Economics 350)****Evaluating Resource Investment and Environmental Quality (Agricultural Economics 450)****Analysis and Interpretation of Aerial Photographs (Engineering CE A687)****Physical Environment Evaluation (Engineering CE A685)****Outdoor Recreation**

**419 Outdoor Recreation** Fall. 3 credits. Primarily for seniors and graduate students; open to juniors with permission.

Lec, T Th 11:15; lab, W 2-4:25.

Factors involved in allocating natural resources for outdoor recreation are considered. Characteristics of public and private administration of recreation areas are studied and trends in outdoor recreation explored. The laboratory session provides experience with applied aspects of outdoor recreation data collection and analysis for research and planning purposes.

**493 Research in Outdoor Recreation** Fall or spring. S-U grades optional. Prerequisite: permission of instructor  
B. T. Wilkins.

See also:

**Recreation Leadership (Rural Sociology 230)****Forestry**

**205 Maple Syrup Production** Spring. 1 credit. S-U grades only. Limited to 20 students. Prerequisite: permission of instructor. 3 preliminary seminars, followed by several half days of fieldwork during the maple season.

T 12:20-4:25. R. R. Morrow, A. Fontana.  
Students will work in most phases of the Arnot Forest maple operation and learn modern sap collecting techniques and quality control in making syrup. A 250-tap area is reserved for student installation of a tubing sap collection network.

**302 Forest Ecology** Fall. 3 credits. Limited to seniors and graduate students.

Lec, M W 11:15; lab M 1:25-4:25. 1 weekend trip Sat. thru Mon. L. S. Hamilton.  
Understanding the wildland environment. Development of ability to identify and analyze what is present, what was present, what is likely to happen in various forest ecosystems. All laboratory sessions in the field. One required weekend trip to the Adirondacks or other major forest.

**303 Woodland Management** Fall. 3 credits. S-U grades optional.

Lec, M W 11:15; lab, W 1:25-4:25 (one field trip ends at 5:30). R. R. Morrow.  
Designed to give the student the basic information necessary to permit sound woodland management decisions. Field trips to woodlots emphasize variations in value and potential as well as biological growth. Introduction to tree identification, log scaling, timber estimating, tree marking, and stand improvement work. Planting, management, harvesting, marketing, Christmas trees, and multiple use are discussed, as well as relationships of forestry to people and to the environment.

**496 Research in Forestry** S-U grades optional. Credit and time to be arranged.  
L. S. Hamilton, R. R. Morrow.

**Fishery Biology**

**438 Fishery Resource Management** Spring. 3 credits. Prerequisite: 440, or permission of instructor.

Lec, T Th 8; disc, to be arranged. W. H. Everhart.  
Principles and problems in the management of freshwater and marine fishery resources considered in relation to problems of human population and management of other natural resources.

**440 Fishery Science** Fall. 3 credits. Prerequisite: one year of statistics and calculus. Open to seniors majoring in fishery science and other students by permission of instructor.

M W F 9:05. W. D. Youngs.  
Principles and theories involved in dynamics of fish populations. Methods of obtaining and evaluating statistics of growth, population size, mortality, yield, and production are considered.

**442 Techniques in Fishery Science** Fall. 2

credits. Upperclass fishery majors and graduate students only. Limited to 15 students.

T Th 1:25-4:25. 1 or more weekend field trips will be scheduled. D. A. Webster.

Emphasis placed on methods of collecting fish and related data when information on population dynamics are of paramount importance. Laboratories include field experience in use of various gear and instruments. Opportunities for additional experience in ongoing college fishery research program will be provided.

**443 Managing the Aquatic Environment** Fall. 2 credits. Limited to 30 students; juniors or seniors only. Lec-disc, Th 1:30-4:30. R. T. Oglesby.

Nature of aquatic environments and effects of man on them are initial foci. Wise use of aquatic resources is surveyed in terms of human impacts on them, including the introduction of toxicants and nutrients, removal or addition of particular biotic components, and modifications of the physical environment. Emphasis will be on lakes, rivers, and estuaries.

**444 Aquaculture** Spring. 3 credits. Prerequisites: Bio Sci 477 or permission of instructor.

Lec, T Th 12:20; lab, Th 1:25-4:25. J. G. Nickum. Introduction to the development, techniques, and uses of aquaculture. The biological bases, historical development, and current status of cultural practices for fishes and invertebrates throughout the world will be considered. Laboratory will consist of discussions, demonstrations, and field trips. Individual projects providing additional experience may be arranged. One or more two-day field trips will be scheduled.

**605 Ecology and Management of Disturbed Aquatic Systems** Spring. 3 credits. Prerequisite: limnology or oceanography. Limited to 30 students; seniors or graduates only.

Lec, T Th 9:05; disc, W or F 1:25-3:25. R. T. Oglesby. Lectures and readings are focused on responses of aquatic ecosystems to stress and on significance of such reactions. Methods and strategies of management to minimize undesirable aspects of human activities will be considered. Detailed case histories will be studied and discussed. There will be at least one Saturday field exercise. Recommended for students specializing in the aquatic sciences.

**601 Seminar or Selected Topics in Fishery Biology** Fall or spring. 1 credit. Hours to be arranged. Staff.

**494 Fishery Biology** S-U grades optional. J. L. Forney, J. G. Nickum, R. T. Oglesby, C. L. Schofield, D. A. Webster, W. D. Youngs.

See also:

**Bionomics of Fresh-Water Invertebrates (Entomology 471)**

**Biology of Fishes (Biological Science 476)**

**Oceanography (Biological Sciences 461)**

**Ichthyology (Biological Sciences 479)**

**Marine Ecology (Biological Sciences 666)**

**Limnology (Biological Sciences 462)**

**Phycology (Biological Sciences 348)**

## Wildlife Science

**304 Wildlife Ecology** Spring. 4 credits. Lec, M W 8; lab, W 1:25-4:30.

Consideration of the basic physical, physiological, interspecific, and intraspecific relationships of the organism and its environment.

**410 Principles of Wildlife Management** Fall.

3 credits. Prerequisite: junior standing, Nat Res 304, Bio Sci 361, or permission of instructor.

M W F 9. Instructor to be appointed. Fundamental characteristics and mechanisms of wildlife populations and habitats. Includes ecological, social, and economic aspects of wildlife management.

**411 Techniques in Wildlife Science** Spring. 2 credits. Prerequisite: 410 or permission of instructor.

Lec, F 11:15; lab, 1:25-4:25. J. W. Caslick. Introduction to techniques used in wildlife research and management, with emphasis on field methods and Northeastern game species.

**412 Wildlife Management Laboratory** Fall. 1 credit. Prerequisite: 410 or permission of instructor.

F 1:25-4:25; several all-day field trips. Staff. Laboratory problems in wildlife management; involves data collecting and analysis. Intended for wildlife science majors.

**414 Selected Topics in Wildlife Resource Policies** Spring. 2 credits. Prerequisite: at least junior standing, 410 or equivalent, or permission of instructor. Offered in alternate years.

T 2:30-4:25; several Saturday field trips. H. B. Brumsted. Review of trends in wildlife management as reflected by state and federal legislation, policies, and programs. Emphasis given integration of wildlife goals in land-use planning and other contemporary topics.

**495 Research in Wildlife Science** Fall or spring. S-U grades optional. Credit and time to be arranged. Prerequisite: permission of instructor. Staff.

See also:

**Ornithology (Biological Sciences 473)**

**Nature and Properties of Soils (Agronomy 200)**

**Wildlife Pathology (Vet. M. 636)**

Nutritional Sciences See p. 204.

## Plant Breeding and Biometry\*

R. L. Plaisted, chairman; R. E. Anderson, R. S. Chaleff, L. V. Crowder, H. L. Everett, V. E. Gracen, Jr., P. Gregory, C. O. Grogan, R. M. Heerman, N. F. Jensen, C. C. Lowe, H. M. Munger, R. P. Murphy, W. D. Pardee, O. H. Pearson, H. M. Schaaf, R. R. Seaney, D. H. Wallace.

**225 Animal and Plant Genetics (also Animal Science 225)** Spring. 5 credits. Prerequisite: introductory biological sciences.

Lec, M W F 12:20; lab, T Th or F 1:25; disc, arranged. L. V. Crowder, H. F. Brotman. Basic genetic principles of plants and animals, structure and expression of hereditary material, Mendelian inheritance, cytogenetics, sex determination and differentiation, genetic interactions, mutations, quantitative inheritance, population genetics, disease resistance, somatic cell genetics. Tests of theories and applications by lab experiments.

**503 Methods of Plant Breeding** Fall. 4 credits. Primarily for graduate students, but open to qualified seniors who expect to engage in plant breeding. Prerequisites: Bio Sci 101-102 and 281, and a course in at least one of the following—field crops, vegetable crops, floriculture, or pomology.

Lec, T Th 8; lab, T Th 1:25-4:15. H. M. Munger, R. P. Murphy. Breeding systems for producing the possible crop variety forms are considered in detail. Laboratories include controlling pollination, producing heritable

variation, and selection techniques with emphasis on disease resistance. There will be two Saturday field trips.

**505 Physiological Genetics of Crop Plants** Spring. 3 credits. Prerequisites: courses in genetics, biochemistry, and plant physiology, or permission of instructor.

T Th 8-10. D. H. Wallace. Both genetic and environmental influence on biochemical and molecular control of plant variation in physiological phenomena like photosynthesis, respiration, translocation, self-incompatibility, male sterility, yield, and heterosis will be discussed. Emphasis will be upon variation that can be exploited in plant breeding, particularly in breeding for higher yield and adaptability.

**507 Research Orientation** Spring. 2 credits. Prerequisite: 503 or the equivalent.

M W F 9:05 for the first 10 weeks of the semester. C. O. Grogan and staff. Designed to acquaint the student with the various facets of research in plant science. Particular attention will be given to concepts, planning, and philosophies, and oral and written communication procedures used in research.

**508 Biochemical Screening Methods in Plant Breeding** Spring. 3 credits. S-U grades only.

Course open to plant breeding graduate students (minor students should obtain permission of instructor).

M 1:30-4. P. Gregory. A course primarily designed to acquaint the student with the rapid biochemical screening tests used in plant breeding programs. The advantages and limitations of these tests will be stressed. The nature, agricultural importance, and inheritance of the nutrient and tonic substances measured in the laboratory will be covered in informal lectures.

**512 Experimental Methods** Spring. 2 credits. Offered in alternate years. Prerequisite: 501 or permission of instructor.

M W F 12:20. C. C. Lowe. Use of statistical methods and application of experimental designs and plot techniques to problems in plant breeding and related agricultural research.

**516 Advanced Topics in Plant Genetics and Breeding** Fall. 1 credit each module. Students may register for 1 to 4 modules. Graduate students only. Prerequisite: 503 or Statistics 501, or permission of instructor.

Module A: T Th 9:05 first half of semester. N. F. Jensen.  
Module B: T Th 9:05 second half of semester. R. L. Plaisted.  
Module C: T Th 10:10 first half of semester. V. E. Gracen.  
Module D: See Entomology 342.  
Module A: breeding systems for autogamous crops. Module B: random mating, inbreeding, and components of genetic variance. Module C: genetics and breeding for disease and insect resistance.

**550 Special Problems in Research and Teaching** Fall, spring, or summer. 1 or more credits by arrangement with instructor. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade.

Members of the departmental staff.

**622 Seminar** Fall or spring. 1 credit. S-U grades only. T 12:20. Members of departmental staff and graduate students.

\*Biometry courses are listed under Statistics and Biometry

## Plant Pathology

D. F. Bateman, chairman; J. R. Aist, P. A. Arneson, S. V. Beer, C. W. Boothroyd, B. B. Brodie, R. S. Dickey, W. E. Fry, M. B. Harrison, R. K. Horst, H. W. Israel, R. P. Korf, E. D. Jones, J. W. Lorbeer, W. F. Mai, R. L. Millar, P. E. Nelson, W. F. Rochow, O. E. Schultz, A. F. Sherf, W. A. Sinclair, R. W. Smiley, R. C. Staples, H. D. Thurston, H. D. VanEtten, R. E. Wilkinson, O. C. Yoder, M. Zaitlin.

**300 Introductory Plant Pathology (Lectures)** Fall or spring. 2 credits. Prerequisites: Bio Sci 101-102, 103-104, or 105-106.

Lec, T Th 11:15. C. W. Boothroyd.

An introduction to the theory and practice of plant pathology, with emphasis upon recognition of plant diseases, life cycles of causal agents, and control. Detailed attention is given to the interrelationship of pathogen, host plant, and environment and to specific aspects of the science, e.g., bacteria, fungi, mycoplasmas, nematodes, and viruses as pathogens; biological control, breeding for resistance, and disease forecasting.

**301 Introductory Plant Pathology**

**(Laboratory)** Fall or spring. 2 credits. Prerequisites: Bio Sci 101-102, 103-104, or 105-106, and Plant Pathology 300 prior to or concurrently. Limited to 105 students, 21 per section; preference given to juniors, seniors, and graduate students.

Lab, M T W Th or F, 2-4:30; conferences arranged. C. W. Boothroyd.

An opportunity for study of fresh specimens of diseased field and forage crops, flowers, fruits, trees and shrubs, and vegetables, and for participation in experiments involving diagnosis of disease, e.g., isolation of plant pathogens, screening for nematodes, and inoculating with viruses. Auto-tutorial instruction with modules on several aspects of plant pathology is available.

**302 Plant Disease Control** Spring. 3 credits.

Prerequisite: 300-301 or equivalent.

Lec, T Th 11:15; lab and rec, W Th 1:25-4:25. W. E. Fry.

For undergraduates who expect to engage in general or specialty farming, in pest control, or in agricultural extension or teaching. The course is designed to provide students with working experience with diseases. Recognition, identification, effect of environment, and epidemiology will be considered in relation to disease control. Rationale of procedures will be stressed in an integrated approach to disease control.

**309 Introductory Mycology** Fall. 4 credits.

Prerequisites: a year sequence of botany or its equivalent, and permission of instructor.

Lec, T Th 1:25-2:15; lab, T Th 2:30-4:25 and 1 additional two-hour period to be arranged. J. W. Lorbeer.

An introduction to fungi emphasizing biology and comparative morphology rather than taxonomy. *Required* field trips.

**403 Pathology of Trees and Shrubs** Spring.

3 credits. Prerequisite: 301 or equivalent.

Lec, W F 10:10; lab, T or F 1:25-4:25. W. A. Sinclair.

For students desiring specialized knowledge of diseases of trees and shrubs in preparation for nursery or landscape work, for careers as park superintendents, arborists, or city foresters, or for other horticultural professions. Deals with the nature, recognition, diagnosis, and treatment of diseases of woody plants.

**431 Undergraduate Research in Mycology or Plant Pathology** Fall and/or spring. 3-5 credits.

S-U grades optional.

Labs, not less than 3 labs, 3 hours each, per week. Staff members.

Designed to afford opportunity for undergraduates to test their ability to do research work. The student is expected to pursue with interest and enthusiasm, under informal direction of the professor, some problem or problems mutually agreed upon.

**501 Advanced Plant Pathology** Fall. 5 credits.

S-U grades optional for students with a minor in plant pathology. Prerequisite: a course in introductory plant pathology and permission of instructor.

Lec, T Th 11:15, and 1 additional period to be arranged; lab, T Th or W F 2-4:25. R. L. Millar.

Designed to acquaint the student with the basic principles and techniques of the science of phytopathology and to provide an adequate foundation for successful prosecution of research in this field.

**502 Plant Disease Control and**

**Epidemiology** Spring. 2 credits. Offered in alternate years. Graduate students only. Prerequisite: 501 or equivalent.

Lec, M W 11:15. W. E. Fry.

Designed to acquaint students with current and classical information and concepts concerning plant disease control. Epidemiology will be stressed and will serve as a framework for control principles. Current control procedures will be analyzed and possible future innovations will be evaluated.

**505 Plant Virology** Fall. 3 credits. Offered in

alternate years. For graduate students with majors or minors in plant pathology; also open to graduate students interested in general virology. Prerequisite: 501 or permission of instructor.

Lec, T Th 10:10; lab, F 1:25-4:25. M. Zaitlin.

Designed to provide basic information on plant viruses and on the diseases they cause. Emphasis is placed on viral replication mechanisms.

**[506 Plant Nematology** Spring. 3 credits. Offered

in alternate years. For graduate students with majors or minors in plant pathology and, in special cases, other students interested in nematology. Prerequisite: 501 or permission of instructor. Not offered spring, 1977.

2 lec and one 3-hr lab period each week, hours to be arranged. W. F. Mai.

Anatomy, morphology, and taxonomy of plant parasitic forms and nonparasitic soil-inhabiting forms of nematodes are studied. Plant pathogenic forms also are considered from the standpoint of host-pathogen relationships, host ranges, life cycles, and the symptoms they cause. Principles and methods of control are discussed.]

**507 Bacterial Plant Pathogens** Spring. 3 credits.

Offered in alternate years. For graduate students with majors or minors in plant pathology; others by permission only. Prerequisite: 501 or permission of instructor.

Lec, T Th 10:10; lab, W F 2-4:25. R. S. Dickey.

Designed to provide students with basic information on bacterial plant diseases and phytopathogenic bacteria. The laboratory will include some of the more important techniques used in the study of bacterial plant pathogens.

**[508 Disease Physiology** Fall. 3 credits. Offered

in alternate years. For graduate students with majors or minors in plant pathology; others by permission only. Prerequisites: 501, Bio Sci 340 and 341, and permission of instructor. Not offered fall, 1976.

Lec, W F 10:10; lab, M 9:05-4:25. H. D. VanEtten and staff.

Designed to provide students with insight into the mechanisms of pathogenesis and altered metabolism of diseased plants.]

**531 Special Problems in Mycology or Plant Pathology** Fall and/or spring. 3-5 credits. For

graduate students only. Registration by permission.

Labs, 3 to 5 weekly lab periods of 3 hours each. Staff members.

For work in mycology, modern techniques and

experimental approach are stressed. For work in plant pathology for minor thesis or problems, or for students wishing to develop familiarity with modern techniques in some phase of the science. For work in plant nematology, research projects in five areas are stressed.

**[541 Philosophy of Plant Pathology** Fall.

2 credits. S-U grades only. Offered in alternate years. For Ph.D. students majoring in plant pathology.

Prerequisite: 501, 579, and at least two other courses from 502, 505, 506, 507, and 508, or permission of instructor. Not offered fall, 1976.

Conferences, M W 8-10. D. F. Bateman.

A conference with advanced graduate students examining the concepts of plant pathology as they relate to basic and applied research problems, teaching, and extension.]

**556 Advanced Plant Nematology** Fall or spring.

3 credits. For graduate students only. Prerequisite: Plant Pathology 506.

Hours to be arranged. W. F. Mai.

Graduate students with special interest in plant nematology will conduct four research projects in areas such as taxonomy, morphology, permanent mounting, soil and plant sampling procedures, procedures for extracting nematodes from soil and plant tissues, culturing host-parasite relationships between nematodes and microorganisms, and evaluation of control practices. This research is intended to broaden training in plant nematology and thus the projects selected will not duplicate thesis research.

**579 Advanced Mycology** Spring. 4 credits.

Offered in alternate years. Prerequisite: 309 or its equivalent, a course in genetics, and permission of instructor.

Lec, M 10:10; lab, M W 1:25-4:25 and 1 additional 3-hour period to be arranged. R. P. Korf.

A detailed study of the biology and taxonomy of the major groups of plant pathogenic fungi (rusts, smuts, Fungi Imperfecti, Peronosporales) with emphasis on mechanisms of variation in fungi. *Optional* field trips.

**[599 Taxonomy of Fungi** Fall. 4 credits. Offered

in alternate years. Prerequisites: 309 or its equivalent, a course in genetics, a course in plant or animal taxonomy, and permission of instructor. Not offered fall, 1976, or fall, 1977.

Lec, M W 10:10; lab, M W 1:25-4:25. R. P. Korf.

Emphasis is placed on the principles of taxonomy and nomenclature, critical evaluation of keys and monographs, and practice in identification. The Discomycetes are treated in detail. *Required* field trips.]

**645-656 Current Topics** Fall and spring. Credit

to be arranged. For graduate students with special interests in the particular area. Prerequisite: permission of instructor.

Day and time to be arranged.

Weekly discussions of current topics in special areas of plant pathology and mycology. Students will be required to do extensive reading of current literature and to present oral and written reports.

**645 Plant Virology** S-U grades only.

W. F. Rochow, M. Zaitlin.

**646 Plant Nematology** S-U grades only.

W. F. Mai.

**647 Bacterial Plant Pathogens** S-U grades only.

R. S. Dickey.

**648 Physiology of Plant Diseases** S-U grades

only.

H. D. VanEtten, R. L. Millar, O. C. Yoder, D. F. Bateman.

**649 Mycology** S-U grades only. 2 credits.

R. P. Korf.

Fall: Agaricales, Gasteromycetes. Spring:

Hemiascomycetes, Plectomycetes, Unitunicate Pyrenomycetes.

**650 Diseases of Vegetable Crops** S-U grades only.

J. W. Lorbeer, R. E. Wilkinson.

**651 Diseases of Fruit Crops** Fall. 1 credit. S-U grades only.

Disc. T 12:20. S. V. Beer, P. A. Arneson  
Discussions of various aspects of diseases of deciduous fruit crops will be led by course participants or guests. Epidemiology, physiology, and control aspects will be considered. Intended for graduate students and advanced undergraduates in plant pathology, plant protection and pomology, and viticulture.

**653 Pathology of Trees and Shrubs** S-U grades only.

W. A. Sinclair.

**654 Diseases of Florist Crops** S-U grades only.

R. K. Horst.

**655 Plant Diseases in Tropical Agricultural Development** S-U grades only.

H. D. Thurston.

**656 Cytology of Plant Diseases** 1 credit. S-U grades only.

J. R. Aist, H. W. Israel.

**657 Plant Disease Epidemiology** S-U grades only.

W. E. Fry.

**661 Seminar** Fall and spring. 1 credit. S-U grades only. Required of all majors in the department.

T 4:30-5:30. Staff.

**671 Plant Pathology Colloquium** Fall and spring. 1 credit. S-U grades only.

First and third Th of each month, 8-10 p.m. Staff and graduate students.

See also:

**Special Studies in Tropical Plant Pathology (International Agricultural Development 602)**

## Pomology

W. J. Kender, chairman; L. J. Edgerton, G. D. Blanpied, L. L. Creasy, D. C. Elfving, F. W. Liu, G. H. Oberly, L. E. Powell, J. P. Tomkins.

### General Horticulture (Vegetable Crops

**103** Intended for students who want a general course in horticulture covering flowers, fruits, and vegetables.

**101 Tree Fruits** Fall. 3 credits. Should be preceded or accompanied by an introductory course in biological sciences.

Lec, T Th 8; lab, T or W 2-4:25. L. J. Edgerton.  
A study of the general principles and practices of tree-fruit culture and their relation to the underlying sciences. Topics to be covered include propagation, varieties, orchard management, and growth and fruiting habits. Practical work is presented in grafting, pruning, site and soil selection, and planting.

### 102 Small Fruits and Grapes

Fall. 3 credits.

Lec, M W 8; lab, M or F 2-4:30. J. P. Tomkins.  
A study of the general principles and practices in the culture of grapes, strawberries, brambles, and the bush fruits.

**202 Advanced Laboratory Course** Spring. 2 credits.

Lec and lab, Th 1:25-4:25. L. J. Edgerton, G. H. Oberly.

Designed to give more extended practice in the various orchard operations than can be given in 101. Special attention is given to problems of pruning, grafting, orchard soil selection and management, pollination, and spray practice. One or two field trips are taken.

**[301 Economic Fruits of the World** Spring. 3 credits. Offered in alternate years. Prerequisite: an introductory course in biological science, or permission of instructor. Not offered spring, 1977.

Lec, M W 8; lab, F 2-4:25. F. W. Liu.  
The more important subtropical and tropical fruits such as citrus, banana, pineapple, mango, coffee, and cacao are considered. Morphology, physiology, and adaptation to climate are stressed rather than details of culture. A broad view of world pomology is given.]

**310 Postharvest Physiology and Storage of Fruits and Vegetables** Fall. 3 credits. Prerequisite: one course in pomology or vegetable crops, or permission of instructor.

Lec, M W 9:05; lab, Th 2-4:25. F. W. Liu.  
The chemistry and physiology of fruits and vegetables as they affect quality and marketability are studied. Maturity indices, handling methods, and storage practices are considered. Practical work includes observations of the effect of handling and storage methods on quality and condition of fruits and vegetables. One Saturday field trip is required.

**401 Advanced Pomology** Spring. 3 credits. Offered in alternate years. Prerequisites: 101 or 102 and introductory plant physiology, or permission of instructor.

M W F 8. L. L. Creasy.  
A comprehensive study of the principles of pomology in relation to other sciences and of the application of these sciences and current pomological research to the solution of present and future problems in commercial fruit growing.

**501 Special Topics in Experimental Pomology** Spring. 3 credits. S-U grades optional. Open to undergraduate students by permission. Offered in alternate years.

Hours to be arranged. G. D. Blanpied, L. L. Creasy, D. C. Elfving, G. H. Oberly, L. E. Powell.  
Selected topics are considered with respect to the current literature and/or experimental techniques. Topics reflect the research interests of the several professors who participate.

**502 Research** Fall or spring. 2 or more credits. S-U grades optional. Prerequisite: 401.

Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade. Members of the departmental staff.

**[504 Growth and Development of Woody Plants** Spring. 2 credits. Offered in alternate years. Prerequisite: introductory plant physiology. Not offered in spring, 1977.

T Th 9:05. L. E. Powell.  
An advanced course dealing with physiological, morphological, and biochemical changes during development, beginning with the seed and advancing through the mature reproductive plant. Hormonal control mechanisms are emphasized.]

**600 Pomology Seminar** Fall or spring. 1 credit. S-U grades only.

Hours to be arranged. Staff.  
Departmental seminars will be presented by faculty and graduate students throughout the year. In the fall term a separate section is provided for presentation of graduate research and selected topics. In the spring term a section is provided for undergraduates to present or organize topics related to their interests.

## Rural Sociology

H. R. Capener, chairman; M. L. Barnett, W. W. Bauder, M. M. Brown, P. Clavel, J. M. Cohen, J. W. Converse, E. W. Coward, Jr., G. J. Cummings, P. R. Eberts, E. C. Erickson, J. D. Francis, A. Milnor, D. E. Moore, J. C. Preston, B. M. Scott, L. K. Williams, R. M. Williams, Jr., W. F. Whyte, F. W. Young, R. C. Young.

**100 Introduction to Sociology** Fall or spring. 3 credits.

Lec, T Th 10:10; disc, M or F 9:05-2:15. Fall, P. R. Eberts; spring, D. E. Moore.  
A general introduction to theory and methods of sociology. Major topics will include small groups and interpersonal relations, social stratification and inequality, organizations and bureaucracy, and social and cultural change. Discussions will focus on selected issues and recent research, mainly in the context of the United States.

**105 Rural Social Problems in World Perspective** Spring. 3 credits.

M W F 10:10. J. M. Cohen, A. Milnor.  
A general introduction to specific theories of comparative social analysis and the process of development. Major topics for discussion include the village in industrial society; green revolution and peasant societies; famine, drought, and energy; future shock and overdevelopment; migration; protest and violence; and multinational corporations. Discussion will center on comparisons of the United States to Europe and developing nations.

**134 Recreation Leadership** Spring. 3 credits. Enrollment limited to 25. Permission of instructor required.

Lec, W 1:25; lab, W 7:30-9:10 p.m. B. M. Scott.  
Background and theoretical framework for recreation leadership which provides the setting for recreation programming and leadership. Lectures, weekly laboratory in recreation leadership, and field assignments.

**[153 National Development Policies and Locality Programs** Spring. 3 credits. Not offered spring, 1977.

Staff.  
A comparison of national policies and programs as implemented at local levels. The major focus is on policies and programs affecting the development potential of rural or nonmetropolitan areas. Specific development projects will be reviewed and evaluated. The examples will be drawn from several nations representing different cultures.]

**157 Subsistence Agriculture in Transition** Fall. 3 credits.

T Th 11:15-12:30. M. L. Barnett.  
An analysis of selected types of peasant communities, drawn from differing ecological conditions. Social structure, systems of farming and land tenure arrangements, motivational characteristics of subsistence farmers in the context of socio-economic change. Theoretical and policy aspects of modernization and traditional agriculture and programming for agricultural development.

**[162 Rural Minorities in Comparative Perspective** Spring. 3 credits. Not open to freshmen. Not offered spring, 1977.

Staff.  
This course focuses on the problems faced by rural ethnic minority groups in the United States and in other countries. Factors affecting the amount of social mobility and the degree of incorporation of marginal groups into the larger society will be examined. Action strategies for mobilizing groups toward higher levels of participation will be considered.]

**163 Strategies of Social Reform** Fall. 3 credits.

M W F 12:20. A. Milnor.  
A study of policymaking institutions and their

relationships to societal subgroups. Within these relationships relevant techniques of social action, especially organization and mobilization, will be examined focusing on selected problem areas. Special attention will be given to the assessment of success and failure relative to various strategies.

**213 Introductory Research Methods** Fall. 3 credits.

M W F 11:15. J. D. Francis.  
The first part deals with strategies of concept formation. The second is devoted to empirical research utilizing survey techniques, hypothesis formation, statistical inference, and techniques of analysis. The third part will be concerned with model building and with legitimacy of evidence. Students will gain experience in analyzing data sets or their own sources of information using computer programs.

**300 Proseminar: Issues and Policies in Rural Society** Fall or spring. 1 credit.

Th 12:30-1:45. Staff.  
Organization of rural communities, access to land and water, rural employment and occupations, changes in the structure of agriculture and its effects on food production and quality, rural outmigration, environmental conditions, and related issues will be explored in a seminar format using films and speakers (legislators, farm and rural organization spokespersons, local government officials, and other rural Americans).

**314 Introduction to Computer Uses in Data Analysis** Spring. 3 credits. S-U grades optional. Prerequisite: one course in college mathematics or statistics or permission of instructor.

T Th 11:15; lab, to be arranged. D. E. Moore.  
An introductory course in computing open to all students with interests in analyzing data. Topics will include preparation and description of data; preparation and running of computer programs; computer attributes and applications; library programs and associated facilities.

**322 Rural Organizations in Action** Spring. 3 credits.

Lec, T Th 9:05; disc, Th 3:35. J. C. Preston.  
An examination of contemporary action programs of selected farm and agribusiness related organizations and agencies relative to rural development. Emphasis will be on the examination and analysis of specific organization and/or agency programs as they affect the resolution of key public problems confronting leadership in rural communities of New York.

**[323 Social Movements and the Sociology of Confrontation** Spring. 3 credits. S-U grades optional. Enrollment limited to 25. Not offered spring 1977.

T Th 12:20-1:35. W. W. Bauder.  
To maximize participation each student is encouraged to select a social movement for comprehensive study. The theories of Blumer, Heberle, the Langs, Olson, Smelser, Toch, Turner, Young, and others will be considered and applied to the analysis of the movements selected by students.]

**324 Social Organization and the Environment** Spring. 3 credits.

M W F 9:05. H. R. Capener.  
A discussion of principles involved in the interaction of man and his physical environment as viewed from an ecosystem perspective. Special emphasis will be given to the function of social organization in man-environment exchanges. The course will provide a conceptual framework for understanding reoccurring environmental problems and alternatives for their resolution.

**344 Social Stratification and Change** Fall. 3 credits. Prerequisite: 100 or equivalent; not open to freshmen or sophomores.

M W F 1:25. D. E. Moore.  
The focus will be on processes of social stratification

as keys to understanding social change. Various theories of stratification will be reviewed before turning to an examination of stratification research in a comparative perspective. Examples will be drawn from developed and developing countries.

**345 Advanced Principles of Sociology** Fall. 3 credits.

M W F 11:15. J. M. Cohen, D. E. Moore.  
An advanced survey course concerned with the theoretical aspects of social analysis. Emphasis will be placed on (1) the central concepts in the discipline, especially as they relate to an analysis of nonurban society; (2) major classical and contemporary theoretical frameworks; and (3) philosophical issues and debates underlying sociological thought.

**355 Rural Development and Cultural Change** Spring. 3 credits.

T Th 10:10-11:25. M. L. Barnett.  
Analysis of planned social change programs in predominantly agricultural societies. Focusing on problems of administration, socioeconomic development, and the introduction of new practices and techniques. Data on resettlement, community development, irrigation, and the social problems of new high-yielding grain varieties will be considered. Designed for students concerned with professional or technical work in transitional social systems.

**356 Rural Society in America** Fall. 3 credits. S-U grades optional.

M W F 9:05. H. R. Capener.  
The focus will be on the rural sector of American society. From sociological and historical perspectives the nature of changes in rural society will be examined, including the impact of technology on agriculture, other extractive industries, natural resources, the environment, regional variation, the rural-urban dominance theme, comparative life styles, cultural orientations, value patterns, and a look to the future.

**[358 Sociology of Agriculture** Fall. 3 credits. Not offered fall 1976.

M W F 9:05. H. R. Capener.  
The course examines the basic position of agriculture in rural societies with special emphasis on North America. One major focus will be on the impact of organizational structure on how agriculture operates. Another will be on the causes and consequences of technological change on agriculture in terms of size, economic efficiency, quantity and quality. Unintended consequences also will be explored.]

**380 Independent Honors Research in Social Science** Fall or spring. 1-6 credits. Open only to candidates who have met the requirements for the honors program.

Staff.  
A maximum of six credits may be earned in the honors program.

**[421 Creative Problem Solving** Fall. 3 credits. S-U grades optional. Not offered fall, 1976.

Staff.  
The application of sociology and social psychology to problem diagnosis and to the planning of powerful programs to solve problems. Includes the problems faced both by persons and by decision-making bodies. Special emphasis is given to decisions and actions that involve change.]

**432 Community Structure and Planned Change I** Fall. 3 credits.

Lec, T Th 9:05; disc, Th 1:25. J. C. Preston.  
This course will examine major concepts, trends, and issues in community structure and social change with emphasis on domestic rural community development. Areas to be examined include the nature of change and development, organizational analysis, strategies of change, local government structure and options, and community power structure and decision-making processes.

**433 Community Structure and Planned**

**Change II** Spring. 3 credits. Prerequisite: 432 or permission of instructor.

T 12:20-4:25. J. C. Preston.  
This course is a follow-up to 432 and is devoted to applied field experience involving work with and/or special study of an agency, organization, or project in which a program has been worked out and approved. A final written project report completes the supervised field experience.

**436 Small Towns** Spring. 2 credits.

W 2:30-4:25. G. J. Cummings.  
A study of options open to small communities for enhancing quality of life. The institutions of local government and education will be examined in terms of their past performance and potential contributions in dealing with problems associated with living in places having relatively small populations.

**441 Political Economy of Regional and Rural Development** Spring. 3 credits. S-U grades optional. Offered in alternate years. Upperclass or graduate student status, or permission of instructor.

M F 11:15; disc, to be arranged. P. R. Eberts.  
An interdisciplinary course focused upon social, political, and economic aspects of regional development. Theories from demography, ecology, social organization, and planning will be used to examine the emergence of a new society and its implications for contemporary America.

**[443 Politics, Pluralism, and Development** Fall. 3 credits. S-U grades optional. Offered in alternate years. Open to upperclass and graduate students. Prerequisite: 100 or equivalent and one course in methodology or statistics. Not offered fall, 1976.

P. R. Eberts.  
Comparative analyses of social control issues in the political economies of Western democracies. Pluralism and control will be viewed relative to productive, allocative, and staffing processes of society, as they affect occupational categories, communities of different size, and institutions responsible for maintaining social order and/or development.]

**462 Organization of Rural Health Care** Fall. 3 credits.

M W F 2:30. G. J. Cummings.  
A review and analysis of alternative organizational models designed for making advances in medical knowledge accessible to people living in rural areas. Policies and organizational approaches from selected countries, including the United States, will be compared in terms of evidential effects on health status.

**464 Rural Social Problems** Spring. 3 credits.

M W F 1:25. E. C. Erickson.  
An analysis of ten rural social problems relevant to community development and planned social change. The problems will be selected using two criteria: (1) interest of class members and instructor; (2) availability of relevant research data, preferably from two or more societies and two or more cultures. The analysis will consider both the research findings and the relevant theories.

**471-491 Informal Study** Fall or spring. 1-3 credits. S-U grades optional. May be repeated. Undergraduates must attach to their preregistration material written permission from the faculty member who will supervise the work and assign the grade.  
Staff.

**471 Readings**

**481 Research Experience**

**491 Public Service Experience**

**492 Undergraduate Teaching Experience** Fall or spring. 1-3 credits. S-U grades optional. Assistants only. May be repeated. Undergraduates must attach

to their preregistration material written permission from the faculty member who will supervise the work and assign the grade.

Staff.

Participation in the ongoing teacher program of the department.

#### 606 Social Change in Communities and Regions

Fall. 3 credits. S-U grades optional.

M W F 11:15. F. W. Young.

A review of theory, empirical studies, and policy prescriptions as applied to communities and regions, especially those in less developed countries. Diffusionism, human ecology, the Weberian tradition, central place, dependency, and symbolic structural theory are compared. Subtopics: technology, innovation, growth, decline, social movements, and conflict.

#### 618 Research Design I

Fall. 4 credits.

M W F 10:10; lab, to be arranged. J. D. Francis.

First of a two-semester sequence (may be taken individually). This course discusses problems of measurement, the design of measuring instruments, and problems of reliability and validity. Some common forms of measuring instruments will be discussed including multidimensional techniques. Students are expected to use actual data for labs.

#### 619 Research Design II

Spring. 4 credits.

Prerequisite: an introductory methods course or a statistics course.

M W F 10:10; lab, to be arranged. J. D. Francis.

This course deals with sampling frames and techniques of statistical analysis procedures appropriate under each. The following topics will be treated at an intermediate level: nonexperimental designs, regression analysis, analysis of variance, analysis of covariance, and causal models. Students will use data to familiarize themselves with data handling and processing.

#### [631 Community Structure and Aging

Fall. 3 credits. S-U grades optional. Open to seniors and graduate students. Not offered fall, 1976.

Staff.

Community response to problems and needs of older persons in the population is the focus of inquiry in this course. Special attention will be given to community policies, programs, facilities, and services for the aging and to the impact of community environment on the behavior and attitudes of the aging.]

#### 635 Social Power and Community Change

Fall. 4 credits.

M W 1:25-3:15. A. Milnor.

A sociopolitical approach to power as an aspect of community life. Methodological and theoretical approaches of recent community power studies are analyzed. Representativeness, responsiveness, and output of decision-making structures and effectiveness of change strategies are considered.

#### [642 Macro Systems Theory and Policy

Analysis. Spring. 3 credits. S-U grades optional. Given in alternate years. Not offered spring, 1977.

F 12:20-2:15; disc, to be arranged. P. R. Eberts.

Analysis of major theoretical and research problems related to the application of systems theory to society's changing organizational process. Major theories will be examined, paying particular attention to their compatibility with modern analytic techniques such as simulations and projections in analyzing current issues in macro political economy.]

#### 645 Social Theory

Fall. 3 credits.

T Th 2:30-3:45. J. M. Cohen.

A comparative study of basic concepts and theories of twentieth-century sociology. The conceptual frameworks focused on are systems theory, structural functionalism, conflict theory, interaction theory, exchange theory, and ethnomethodology. The course will center on explanation and prediction in the analysis of rural societies and on the relationship between theory and methodology.

#### 661 Life Styles Related to Stages in the Life Cycle

Spring. 3 credits. S-U grades optional. Open to senior and graduate students.

Staff.

This course investigates the relationship between life styles and quality of life at different stages in the life cycle, comparing different societies and different cultures. Attention will be given to stages that present special problems including a consideration of life styles of older people.

#### [712 Factor Analysis and Multidimensional Scaling

Fall. 4 credits. Not offered fall, 1976.

M W F 10:10; lab to be arranged. J. D. Francis.

Topics discussed include philosophy of factor analysis, factor analysis models, factoring design, factoring techniques, survey of multidimensional scaling, and comparison with factor analysis models. Students must have previous coursework in scaling and statistics. As matrix algebra is an integral part of these procedures, class time will be devoted to this topic.]

#### 715 Macrosocial Accounting

Spring. 4 credits.

T Th 2:30-4:10. F. W. Young.

A survey of methods and results for describing a whole country by comparing its subnational units. Topics: varieties of available data and their uses, macrosurveys, basic structural dimensions, selected techniques, the "rural development inventory." Students compile a "country file." The course offers a range of sophisticated research methods.

#### [717 Regression and Path Analysis

Spring. 4 credits. Prerequisite: two courses in statistics and one in methods. Not offered spring, 1977.

M W F 10:10; lab, to be arranged. J. D. Francis.

The first part of the course will consist of a review of multiple and nonlinear regression. Two-stage least squares models will be discussed for sociological data along with a discussion of nonmetric regression. The latter half of the course will deal with recursive and nonrecursive path models.]

#### 751 Applications of Sociology to Development Programs

Fall. 4 credits. Open to graduate students only.

T Th 1:25-2:40. E. C. Erickson.

Consideration of problems of implementing change strategies at national, regional, and institutional levels, especially as they relate to rural development. Attention will focus also on institutional constraints on the sociologist as a researcher, as a strategist, and as a participant and on the different contexts within which developmental change occurs.

#### 754 Peasants, Water, and Development

Spring. 2-3 credits. S-U grades optional.

Hours to be arranged. M. L. Barnett.

E. W. Coward, Jr.

Examines irrigated agriculture and its relation to agricultural development. Emphasis on social processes within irrigation systems and interactions with the social setting. The seminar will provide an opportunity to examine systematically the institutional and organizational policy issues associated with the design and operation of systems of irrigated agriculture.

**771-774 Special Seminars** Fall or spring. Credit to be arranged. Prerequisite: graduate standing or permission of instructor.

#### 771 Rural Sociology

#### 772 Development Sociology

#### 773 Organization Behavior and Social Action

#### 774 Methods of Sociological Research

#### 791 Teaching Experience

Fall or spring. 1-3 credits. Prerequisite: graduate standing.

Staff.

Participation in the ongoing teaching program of the

department.

#### 792 Public Service Experience

Fall or spring. Credit to be arranged. Prerequisite: graduate standing.

Staff.

Participation in the ongoing public service activities of the department.

**871-874 Informal Study** Fall or spring. Credit to be arranged. Prerequisite: candidate for master's degree and permission of the graduate field member concerned.

#### 871 Rural Sociology

#### 872 Development Sociology

#### 873 Organization Behavior and Social Action

#### 874 Methods of Sociological Research

**881-883 Research** Fall or spring. Credit to be arranged. Prerequisite: candidate for master's degree and permission of the graduate field member concerned.

#### 881 Rural Sociology

#### 882 Development Sociology

#### 883 Organization Behavior and Social Action

**971-974 Informal Study** Fall or spring. Credit to be arranged. Prerequisite: candidate for Ph.D. degree and permission of the graduate field member concerned.

#### 971 Rural Sociology

#### 972 Development Sociology

#### 973 Organization Behavior and Social Action

#### 974 Methods of Sociological Research

**981-983 Research** Fall or spring. Credit to be arranged. Prerequisite: candidate for Ph.D. degree and permission of the graduate field member concerned.

#### 981 Rural Sociology

#### 982 Development Sociology

#### 983 Organization Behavior and Social Action

## Program on Science, Technology, and Society

See section Independent Interdisciplinary Centers and Programs.

## Statistics and Biometry\*

F. B. Cady, W. T. Federer, D. S. Robson, S. R. Searle, D. S. Solomon, C. L. Wood.

**200 Statistics and the World We Live In** Fall or spring. 3 credits.

T Th 11:15 and 1 disc. M 10:10, 1:25; T 9:05; Th

1:25; F 9:05, 11:15. Fall, D. L. Solomon; spring,

F. B. Cady.

Focus is on a better consumer understanding of statistical information through development of a formal mechanism for making generalizations. Principles of statistical inference are illustrated mainly

\*Part of the Department of Plant Breeding and Biometry

in the context of confidence interval estimation. Emphasis is on concepts of populations, sampling, probability models, frequency distributions, designs for data collection, and data evaluation.

**408 Theory of Probability** Fall. 3 credits.

Prerequisites: Math 106, 108, or 112, or permission of instructor.

M W F 10:10. D. S. Robson.

An introduction to probability theory: combinatorics, random variables and their probability distributions, generating functions and limit theory. Biological and statistical applications will be the focus of the presentation. The course can serve as either a terminal course in probability or as a foundation for a course in the theory of statistics.

**409 Theory of Statistics** Spring. 3 credits.

Prerequisite: 408 or equivalent.

M W F 10:10. D. L. Solomon.

The concepts developed in 408 are applied to provide an introduction to the classical theory of parametric statistical inference. Topics covered include data reduction and the concept of sufficiency, parameter estimation, hypothesis testing, and linear regression. Students seeking training in statistical methodology should consider courses 601-607.

**411 Stochastic Models in Biology** Spring.

3 credits. S-U grades optional. Prerequisite: 408 or equivalent.

M W F 1:25. D. L. Solomon.

An introduction to mathematical model construction in biology. Although the approach is probabilistic, deterministic counterparts of some of the models are also discussed. Special attention is given single and multiple population processes. The emphasis is on describing biological phenomena mathematically. Elementary simulation methods are described.

**417 Matrix Algebra** Fall. 3 credits. Prerequisite: a year of college algebra.

M W F 8; disc, M 1:25-2:15. S. R. Searle.

Basic matrix algebra including arithmetic, determinants, rank, linear independence, linear equations and generalized inverses, latent roots, and vectors. Emphasis is placed on developing skills for use in the applications of matrix algebra.

**600 Biometry Seminar** Fall or spring. 1 credit.

S-U grades only.

Th 3:35. Biometrics unit staff.

**601 Statistical Methods** Fall. 4 credits.

Prerequisite: graduate status or permission of instructor.

M W F 9:05 or 11:15; lab to be arranged.

F. B. Cady.

Statistical methods, both parametric and nonparametric, are developed and used to analyze data arising from a wide variety of biological situations. Topics include point and interval estimation, hypotheses testing, inference for a single population, comparisons between two populations, regression and correlation analysis, and one-way analysis of variance. Emphasis is placed on basic principles and criteria for selection of statistical techniques.

**602 Design and Analysis I** Spring. 1 credit.

Prerequisite: 601 or equivalent.

M W F 9, Jan. 24-Feb. 23; lab, to be arranged.

C. L. Wood.

Basic statistical designs will be analyzed and compared with respect to efficiency and applicability in biological experimentation. Emphasis is placed on the design and analysis of the completely randomized, randomized block, and nested designs. Two-factor factorial experiments will be considered with emphasis on the interpretation of interaction.

**603 Design and Analysis II** Spring. 1 credit.

Prerequisite: 602 or equivalent.

M W F 9, Feb. 25-April 4; lab, to be arranged.

D. S. Robson.

Emphasis will be placed on the analysis and use of factorial experiments within each of the basic designs considered in Design and Analysis I. In addition, latin square designs, partially replicated latin square designs, and F-squares will be considered. Fractional factorials and split plot experiments are also included.

**604 Regression Analysis I** Spring. 1 credit.

Prerequisite: 601 or equivalent.

T Th 12:20-1:35, Feb. 24-April 5; lab, to be arranged. C. L. Wood.

Basic topics in multiple linear regression will be covered, including least squares estimation of regression coefficients, tests for lack of fit of the regression model, regression approach to analysis of variance, and analysis of covariance. Emphasis will be placed on hypothesis testing and confidence interval estimation based on the linear model.

**605 Regression Analysis II** Spring. 1 credit.

Prerequisite: 604 or equivalent.

T Th 12:20-1:35, April 7-May 6; lab, to be arranged. F. B. Cady.

Data analysis using standard multiple regression programs will be emphasized with special attention given to interpretation of partial regression coefficients and  $R^2$ . Variable selection procedures include stepwise and PRESS with RIDGE regression an alternative to unbiased estimation. Dummy variables introduced for comparing regression lines and for covariance analysis.

**606 Sampling Biological Populations** Spring.

1 credit. Prerequisite: 601 or equivalent.

T Th 1:25-2:40, Jan. 25-Feb. 22; lab, to be arranged. D. S. Robson.

Standard methods of socioeconomic sample survey design and estimation will be presented, including stratified-random sampling, cluster sampling, double sampling, and variable probability sampling. Special emphasis given to methods of particular utility or specifically designed for biological sampling. Examples will be taken from forestry, fisheries, and other biological areas.

**607 Nonparametric and Distribution-Free**

**Statistical Methods** Spring. 1 credit. Prerequisite: 601 or equivalent.

M W F 9, April 6-May 6; lab, to be arranged.

C. L. Wood.

Nonparametric and distribution-free alternatives to normal-theory testing procedures will be presented. Analysis of variance of ranked data and nonparametric regression analysis will be emphasized. Other topics include analysis of categorical data, nonparametric multiple comparisons, goodness-of-fit testing, and randomization tests.

**699 Special Problems in Statistics and**

**Biometry** Fall, spring, or summer. 1 credit or more by arrangement with instructor. Prerequisite: permission of instructor.

Biometrics unit staff.

**[713 Design of Experiments I** Fall. 4 credits.

Offered in alternate years. Prerequisites: 417 and 603, 604, 607 or the equivalent. Not offered fall, 1976.

T Th 8-9:50; disc, to be arranged. W. T. Federer.

Principles and techniques of experimentation, theoretical concepts, extensions and variations of the completely randomized, randomized complete block, and latin square designs, the factorial experiment and confounding, interval estimation for ranked means, transformations, unequal variances, additivity, residual analyses, sample size, variance component analyses, unequal number analyses, the place of orthogonality, balance and confounding in design, and advanced statistical methodology.]

**[714 Design of Experiments II** Spring. 4 credits.

Offered in alternate years. Prerequisite: 713. Not offered spring, 1977.

T Th 8-9:50; disc, to be arranged. W. T. Federer.

Continuation of work in 713 with emphasis on the role of confounding in experiment and treatment designs, split plot and split block confounding schemes and algorithms for distinguishing between whole plots and split plots, generalized forms of analyses and construction of designs, selected topics from long-term experiments, combination of results, sequential experimentation, variance component analyses, estimation procedures, linear hypotheses, heritability studies, multivariate analyses, and unequal numbers analyses and their one-to-one correspondence with fractional replication.]

**717 Linear Models** Spring. 3 credits. Offered in

alternate years. S-U grades only. Prerequisites: 605, 417, and 409 or Math 472.

T Th 10:10-11:25; disc, T 11:25-12:05.

S. R. Searle.

Introduction to multinomial variables and distribution of quadratic forms; linear statistical models, estimable functions, and testable hypotheses; regression models, experimental design models, variance components models, and combinations thereof.

**[718 Selected Topics in Biometry** Spring.

3 credits. Prerequisites: 409, 603, 605, 606, 607 or the equivalent. Not offered in spring, 1977.

Hours to be arranged. D. S. Robson.

Topics will be selected from a list including the principles and methodology of bioassay, biosampling, nonparametric methods, mark-recapture methods, and statistical genetics.]

**[719 Multivariate Analysis** Spring. 3 credits.

Offered in alternate years. S-U grades only. Prerequisites: 417, 605, and 409, or Math 472. Not offered in spring, 1977.

T Th 10:10-11:25. S. R. Searle.

Basic topics in multivariate analysis are covered: multinomial variables, estimation, Wishart distribution, generalized  $T^2$  and generalized variance, principal components, canonical correlations, and factor analysis, with considerable emphasis placed on establishing an understanding of the detailed development of multivariate procedures.]

## Vegetable Crops

R. D. Sweet, chairman; P. E. Brecht, S. L. Dallyn, E. E. Ewing, J. R. Hicks, W. C. Kelly, P. A. Minges, P. L. Minotti, H. M. Munger, E. B. Oyer, J. L. Ozburn, R. F. Sandsted, R. Sheldrake, Jr., L. D. Topoleski, D. H. Wallace.

**103 General Horticulture** Spring. 4 credits.

Limited to 25 students per lab section.

Lec, M W F 8; lab, M T W Th or F 2-4:25.

R. Sheldrake.

Includes flower, fruit, and vegetable growing. Primarily for students who want a general knowledge of the subject or who wish to specialize in horticulture but have a limited background in practical experience or in training in plant science.

**123 Organic Gardening** Spring. 2 credits. Limited

to 20 students per section. Prerequisite: permission of instructor.

M T W or Th 1:25-4:25. W. C. Kelly.

For students not enrolled in the College of Agriculture and Life Sciences. Students must be prepared to lead a discussion and write a paper on some aspect of home gardening or amateur horticulture. Organic methods of gardening will be discussed and demonstrated, but other methods are not excluded from the discussions.

**210 Vegetable Types and Identification** Fall.

2 credits.

T 9:05-11 or 2-4. L. D. Topoleski.

Designed to acquaint the student with the vegetable species grown in the Northeast and the pests and disorders encountered in their production. Subjects

covered include identification of economically destructive weeds, diseases and insects of vegetables, identification of vegetable and weed seeds, seedlings, nutrient deficiencies, and vegetable judging, grading, and grade defects.

**211 Commercial Vegetable Crops** Fall, 4 credits. Prerequisite: 103 and Agron 200.

Lec, M W F 11:15; lab, W or F 2-4:25. E. E. Ewing. Intended for those interested in the commercial vegetable industry from the viewpoint of production, processing, marketing, or the related service industries. Topics included are techniques, problems and trends in the culture, harvesting, and storage of the major vegetable crops, including potatoes. Field trips are taken on Wednesdays in September, each starting at 11:15 a.m. and returning at approximately 6 p.m.

**312 Postharvest Handling and Marketing Vegetables** Fall, 3 credits.

Lec, T Th 9:05; lab, Th 2-4:25. J. R. Hicks. Procedures used in marketing and shipping vegetables including grade standards, methods of grading, packaging, harvesting methods, cooling principles, storage techniques, and market preparation. Field trips will be taken in early fall.

**331 Undergraduate Research** Fall or spring, 1 or more credits, by arrangement. Written permission from staff member directing the work must be obtained before registration.

Hours to be arranged. Staff. Special problems may be elected in any line of vegetable work.

**401 Vegetable Crop Physiology** Fall, 5 credits. Prerequisites: 211 and Bio Sci 242 or their equivalent.

Lec, M W F 11:15; lab, M 2-4:25; disc, Th or F 1, 2, or 3. W. C. Kelly. Subjects discussed include mineral nutrition as influenced by fertilization programs and crop sequence; nutrient interactions and induced deficiencies; growth and development; flowering; fruit setting; growth correlation; senescence; sex expression; photoperiodism; vernalization; and environmental factors affecting growth.

**413 Kinds and Varieties of Vegetables** Fall, 3 credits. Offered in alternate years. Prerequisite: 211 or permission of instructor.

Lab, W F 2-4:25. P. A. Minges and staff. Designed to help students achieve proficiency in the evaluation of vegetable varieties through study of their origins, characteristics, adaptation, and usage. An important part of the course is the study of crops in the field. The vegetable seed industry is also discussed.

**421 Plant-Plant Interactions** Spring, 3 credits. Prerequisites: Agron 200, Bio Sci 242 and any crop production course.

Lec, M W F 8. P. L. Minotti. The manner in which plants affect the growth of other plants is examined using original literature on both competition and allelopathy to illustrate principles. Emphasis is on crop situations rather than natural plant communities and both weed-crop and crop-associate crop interactions are studied.

**601 Seminar.** Fall or spring, 1 credit. Required of graduate students majoring or minoring in this department.

Th 4:30. Staff.

**610 Special Topics in Vegetable Crops** Fall or spring, 1 credit. Prerequisite: permission of instructor. Hours to be arranged. J. L. Ozbun.

**612 Postharvest Physiology of Horticultural Commodities** Spring, 2 credits. Prerequisite: permission of instructor.

T Th 8. P. E. Brecht. Physiological and biochemical aspects of growth, maturation, ripening, and senescence of harvested

horticultural plants. Biochemical and physiological changes of quality and storage life of various species will be considered. Emphasis on comparative physiological studies of senescence, compositional and morphological changes, maturation, and physiological disorders in various plant structures.

**620 Teaching Experience** Fall or spring, 1 or more credits by arrangement with instructor.

Hours to be arranged. Staff. Participation in the teaching program of the department.

**629 Special Topics in Plant Science Extension** Spring, 2 credits.

F 1:25-4:25. P. A. Minges, W. D. Pardee. Designed for graduate students and advanced undergraduates who wish to acquire a knowledge of extension activities in preparation for careers in extension and associated work in both public and commercial organizations. Topics are related to extension in other countries as well as in the United States.

**630 Research Methods in Applied Plant Science** Spring, 3 credits. Offered in alternate years. Prerequisite: permission of instructor.

T Th 9:05-11. W. C. Kelly. The planning of research programs as influenced by various economic, administrative, and geographic environments. The advantages and limitations of conventional experimental designs as they apply to specific research problems. Discussions include a critical interpretation of experimental results from the literature.

**801 Master's Thesis Research** Fall or spring. Credit and time to be arranged.

Staff.

**901 Doctoral Thesis Research** Fall or spring. Credit and time to be arranged.

Staff.

# College of Architecture, Art, and Planning

## Architecture

### Architectural Design

#### Sequence Courses

**101-102 Design I and II** Fall or spring. 4 credits per term. Studio and seminar. Must be accompanied by Architecture 131-132. Open to department students only.

**201-202 Design III and IV** Fall or spring. 4 credits per term. Studio and seminar. Must be accompanied by Architecture 231-232. Open to department students only.

**301-302 Design V and VI** Fall or spring. 6 credits per term. Studio and seminar. Open to department students only.

**401-402 Design VII and VIII** Fall or spring. 6 credits per term. Studio and seminar. The studio options are offered in architectural design, urban design, or architectural technology and environmental science each term.

**501-502 Design IX and X** Fall or spring. 8 credits per term. Studio.

**503-504 Thesis-Research** Fall or spring. 8 credits per term. Independent study. Thesis to be prearranged with an adviser during the fourth year.

**505 Special Program** Fall or spring. 8 credits. To be arranged with faculty during the fourth year. Intended primarily for students applying to a graduate program in the College.

**200, 300, 400, 500 Elective Design** Fall or spring. Credit as assigned. Open by permission to students who wish to take additional work in design or for transfer students who have not been assigned to a sequence course. The student will be assigned to work with a class of appropriate level.

**111-112 Elective Design Studio** Fall or spring. Credit as assigned. Studio. Restricted to out-of-department students. Permission of instructor required. To be coordinated by the Department of Architecture Office. Must be accompanied by Arch 131-132.

#### Nonsequence Courses

**310 Special Problems in Architectural Design** Fall or spring. Independent study. Registration and credit by arrangement.

**610 Theory of Organic Architecture** Spring. 3 credits. Seminar. Open to undergraduate and graduate students.

W. G. Lesnikowski.  
Concepts of organic and cellular architecture, the world of biological forces, the concept of balance in architecture, the meaning of symbols and central forms, ideas of centrum and core, and morphological growth patterns and repetitions of architectural functions. Various concepts of habitation and planning as well as technical innovations will be discussed and researched.

**611-612 Urban Housing Developments** 611, fall; 612, spring. 2 credits per term. Seminar. Limited to fourth- and fifth-year students in architecture and graduate students. Prerequisite: permission of instructor.

O. M. Ungers.  
Concentrates on large-scale housing developments, particularly in relation to size, density, and problems of infrastructure.

**613 Transportation** Fall. 2 credits. Seminar. Prerequisite: permission of instructor.

P. Cohen, A. Meyburg.  
A seminar concerning the impact of various transportation forms upon the environment involving architects, engineers, planners, and human ecologists. Readings and discussions of past, current, and future transportation modes will focus on the aesthetic and physical aspects.

**614 Low-Cost Housing** Spring. 2 credits. Seminar. Prerequisite: permission of instructor.

F. O. Slate, P. Cohen, C. B. Daniels, H. W. Richardson.  
The major objectives of this course are to present aspects of low-cost housing involving engineering technology, architecture, physical planning, economics, and sociology.

#### Graduate Courses

**618-619 Seminar in Urban and Regional Design** 618, fall; 619, spring. 3 credits per term. Open to fifth-year and graduate students.

O. M. Ungers, staff, visitors.  
Deals with a broad range of issues and problems of urban and regional development and the context in which the designer functions. Selected case studies are presented by the participants and visitors.

**711-712 Problems in Architectural Design** 711, fall; 712, spring. 9 credits per term. Studio and seminar. Open to fifth-year undergraduate students by permission of chairman and instructor. The basic first-year design course for graduate students whose major concentration is architectural design.

**713-714 Problems in Urban Design** 713, fall; 714, spring. 9 credits per term. Studio and seminar. Open to fifth-year undergraduate students by permission of chairman and instructor. The basic first-year design course for graduate students whose major concentration is urban design.

**715-716 Problems in Regional Design** 715, fall; 716, spring. 9 credits per term. Studio and seminar. Open to fifth-year undergraduate students by permission of chairman and instructor. The basic first-year design course for graduate students whose major concentration is regional design.

**811 Thesis or Research in Architectural Design** Fall or spring. 9 credits. Second-year design course for graduate students whose major concentration is architectural design.

**812 Thesis or Research in Urban Design** Fall or spring. 9 credits. Second-year design course for graduate students whose major concentration is urban design.

**813 Thesis or Research in Regional Design** Fall or spring. 9 credits. Second-year design course for graduate students whose major concentration is regional design.

## Structures

#### Sequence Courses

**221 Mathematical Techniques** Fall. 3 credits. Two lectures and one recitation. Mathematics department staff. Introduction to mathematical concepts and operations utilized in architecture.

**222 Structural Concepts** Fall or spring. 4 credits. Lectures and seminars. Prerequisite: Arch 221 or

approved equivalent. Structures staff. Fundamental concepts of structural behavior. Statics and strength of materials.

**321 Structural Systems I** Fall. 3 credits. Lectures and seminars. Prerequisites: Arch 221 and 222. Structures staff. Structural design concepts and procedures for steel building construction.

**322 Structural Systems II** Spring. 3 credits. Prerequisite: Arch 222. Structures staff. Structural design concepts and procedures for reinforced concrete building construction.

#### Nonsequence Courses

**323 Advanced Steel Building Design** Fall. 3 credits. Seminar. Prerequisites: Arch 321 and permission of instructor. F. W. Saul. Design and investigation of advanced systems of steel building structure, plastic design of continuous beams, rigid frames, and high-rise buildings.

**324 Surface Structures** Spring. 3 credits. Seminar. Permission of instructor required. D. P. Greenberg. The qualitative and quantitative analysis and design of thin shell architectural structures including shells of revolution, cylindrical shells, hypars, and folded plates. Suspension structures. The architectural implications and problems of curvilinear forms. Construction techniques.

**326 Building Substructure** Spring. 3 credits. Seminar. Prerequisites: Arch 322 or concurrent registration and permission of instructor. F. W. Saul. The principles of soil mechanics and subsurface exploration. Design of building foundations—footings, piles, and subgrade walls.

**328 Advanced Reinforced Concrete Building Systems** Spring. 3 credits. Seminar. Prerequisites: Arch 322 and permission of instructor. Structures staff. Review of methods and specifications for the design and construction of reinforced concrete building systems. Two-way framing systems. Precast concrete construction. Discussion of ultimate strength and yield line theories. Quality control of reinforced concrete. Exploration of new techniques in concrete construction. Other selected topics.

## Architectural Principles, Theories, and Methods

#### Sequence Courses

**131-132 Introduction to Architecture** 131, fall; 132, spring. 2 credits per term. Lecture. Architecture students must register for this course with Arch 101-102. Also open to out-of-department students. Introduction to the field of architecture and its relation to other disciplines.

**231-232 Architectural Elements and Principles** 231, fall; 232, spring. 2 credits per term. Lecture. Architecture students must register for this course with Arch 201-202. Also open to out-of-department students. Prerequisites: Arch 131-132. Discussion of basic principles and components of architectural organization.

**630-631 Advanced Seminar in Architecture** 630, fall; 631, spring. 2 credits per term. Required for all fifth-year architecture students. Open to graduate students. Staff and visiting critics.

#### Nonsequence Courses

**333 Computer Applications** Fall. 3 credits.

Enrollment limited to third-year students and above.

D. P. Greenberg.  
Designed to acquaint the student with the current uses and potentials of electronic computers in the architectural profession. No prior knowledge of computers is assumed. Topics will include basic principles and logic of computing systems, computer programming (PL/1 and FORTRAN), architectural planning models, examples of linear programming problems, computer graphics, and data processing.

**335-336 Theory of Architecture** 335, fall; 336, spring. 3 credits per term. Lecture. First term not prerequisite to the second.

L. Hodgden.

**437-438 Special Projects in Computer Applications in Architecture** 437, fall; 438, spring. Variable credit. Prerequisite: Arch 333.

D. P. Greenberg.  
Advanced work in particular topics covered in Architecture 333, such as critical path method, urban models, and computer graphics.

**633-634 Introduction to Comparative Theories in Inquiry** 633, fall; 634, spring. 3 credits per term. Seminar. Third-year students and above.

D. M. Simons.  
The study of approaches to problem inquiry; the formal procedures of the fields of architecture, natural sciences, and applied sciences and the aesthetic and rational intelligences exemplified in these. Discussions of significant writings from the various fields.

**639 Principles of Design Process** Spring. 3 credits. Seminar. Third-year architecture students and above. Out-of-college students by permission of instructor.

A. Mackenzie.  
Analysis of the major theories and techniques of design developed during the past fifteen years, with special emphasis on application to the solution of whole problems in architectural design. Students are required to complete exercises and a paper or a project.

## Architectural History

### Sequence Courses

**141-142 History of Architecture I and II** 141, fall; 142, spring. 3 credits per term. Lecture. Students in other colleges may take either or both terms for credit.

History staff.  
History of architecture as social and cultural expressions of Western civilizations. The nature of the field is considered in the fall; history of modern architecture is discussed in the spring. Slide lectures, readings, short papers, and examinations.

### Non sequence Courses

**244 History of Preindustrial Building** Spring. 4 credits. Lecture.  
W. W. Cummer.  
The development of traditional architectural elements and forms: materials, methods, and design expression. Lectures, readings, and papers or exercises.

**[340 Architecture of the Ancient Near East** Spring. 3 credits. Lecture. Prerequisite: Arch 141 or permission of instructor. Not offered 1976-77.

W. W. Cummer.  
Architecture of the oldest historic civilizations associated with Western tradition, with emphasis on Egypt, Mesopotamia, and Anatolia.]

**341 Architecture of the Classical World** Fall. 4 credits. Prerequisite: Arch 141 or permission of instructor.

W. W. Cummer.  
Architecture of the ancient Mediterranean

civilizations, with emphasis on Greece and Rome.

**[342 The Early Middle Ages** 4 credits. Lecture. Prerequisite: permission of instructor. Not offered 1976-77.]

**343 Introduction to the History of Urban Planning (also CRP400)** Fall. 4 credits.

J. W. Reps, W. W. Cummer, S. W. Jacobs.  
Survey of urban planning in western civilization from the Greeks and Romans, through medieval, renaissance, and modern Europe, to colonial and nineteenth-century America. Lecture, discussion sessions, readings, and term paper.

**[344 Islamic Architecture** 4 credits. Lecture. Prerequisite: permission of the instructor. Not offered 1976-77.]

**346 The Renaissance** Fall. 4 credits. Lecture.

Prerequisites: Arch 141-142 or permission of instructor.  
C. Otto.  
European architecture of the fifteenth and sixteenth centuries.

**347 The Baroque** Fall. 4 credits. Lecture.

Prerequisites: Arch 141-142 or permission of instructor.  
C. Otto.  
European architecture of the seventeenth and eighteenth centuries.

**348 American Architecture** Fall or spring.

4 credits. Lecture. Prerequisite: permission of instructor.  
S. Jacobs.  
Building in the United States from colonial time to 1860, in the fall; after 1860, in the spring.

**349 Modern European Architecture** Fall.

4 credits. Prerequisite: permission of instructor.  
C. Otto.  
A survey of nineteenth- and twentieth-century architecture in Europe.

**442 Historical Seminars in Architecture** Fall or

spring. 2 credits. Prerequisite: permission of instructor.  
History staff.  
Students will prepare papers discussing problems relating to design or architecture using historical evidence as the basis.

**445 Special Investigations in the History of**

**Architecture** Fall or spring. Variable credit. Independent study. Prerequisite: permission of instructor.  
History staff.

**447 History Workshop** Fall or spring. Variable

credit. Seminar.  
History staff.

**448 Historical Lectures in Architecture** Fall or

spring. Variable credit. Lecture. Prerequisite: permission of instructor.  
History staff.  
A series of one or two lectures per week on topics related to architectural history.

**540 Architectural Problems in Archaeological**

**Fieldwork** Fall. Variable credit. Seminar.  
W. W. Cummer.  
A review and critique of students' participation in the excavation of ancient cities or historic sites during the previous summer. For students in architecture, the archaeology concentration, or related areas.

**541 Surveying for Archaeologists** Spring.

Variable credit.  
W. W. Cummer.  
The excavation architect on an archaeological theme. Methods of site survey, recording ancient buildings, and preparation of working, analytic, and restored drawings. For students in architecture or the

archaeology concentration who anticipate joining a summer excavation.

**542 Methods of Archival Research (also CRP404)** Spring. 3 credits. Lecture.

K. C. Parsons.  
Examination of methods of using archival materials for research in the history of architecture and urban development, using manuscripts, drawings, correspondence, and documents in the Cornell University archives and regional history collections.

**544 Case Studies in Preservation**

**Planning** Spring. 2 credits. Seminar.  
S. W. Jacobs, staff, visiting lecturers.  
A review and critique of preservation planning projects selected to indicate the range of current approaches.

**545 Design and Conservation (also**

**CRP844)** Fall. 2 credits. Seminar.  
S. W. Jacobs, B. Jones.  
Introductory course for preservation planning. The rationale for and methods of utilizing existing cultural and aesthetic resources in the planning and design of regions and cities.

**546 Documentation for Preservation Planning**

**(also CRP845)** Spring. 2 credits. Seminar.  
S. W. Jacobs, staff, visiting lecturers.  
Methods of collecting, recording, processing, and analyzing architectural survey materials.

**548 Problems in Modern Architecture** Spring.

2 credits. Lecture. Prerequisite: permission of instructor.  
C. Rowe.

**[640 Seminar in Architecture of the Ancient Near**

**East** Fall. 4 credits. Prerequisite: Arch 340 or permission of instructor. Not offered 1976-77.  
W. W. Cummer.  
Problems in Near Eastern architectural history.]

**641 Seminar in Architecture of the Classical**

**World** Spring. 4 credits. Seminar. Prerequisite: Arch 341 or permission of instructor.  
W. W. Cummer.  
Problems in Greek and Roman architectural history.

**[643 Seminar in Medieval Art and**

**Architecture** 4 credits. Seminar. Prerequisite: permission of instructor. Not offered 1976-77.]

**646 Seminar in Renaissance**

**Architecture** Spring. 4 credits. Seminar.  
Prerequisite: Arch 346 or permission of instructor.  
C. Otto.  
Historical problems of European architecture of the fifteenth and sixteenth centuries.

**647 Seminar in Baroque Architecture** Spring.

4 credits. Seminar. Prerequisite: Arch 349 or permission of instructor.  
C. Otto.  
Historical problems in European architecture of the seventeenth and eighteenth centuries.

**648 Seminar in the History of American**

**Architecture** Fall. 4 credits. Seminar. Prerequisite: permission of instructor.  
S. W. Jacobs.  
Investigation by means of reading, lectures, and reports of historical problems in architecture of the nineteenth and twentieth centuries in the United States.

**649 Seminar in the History of Modern**

**Architecture** Fall. 4 credits. Seminar. Prerequisite: permission of instructor.  
C. Rowe.  
Problems in modern art and architecture.

**650 Introductory Seminar in the History of**

**Architecture and Urban Development** Fall. 2 credits. Seminar.

S. W. Jacobs, C. F. Otto, staff.  
 Motives, methods, and resources for scholarly work in history of architecture and history of urban development. Lectures, readings, and reports. Required for graduate students entering the field, and undergraduates in BFA history of architecture program.

#### Graduate Courses

**740 Informal Study in the History of Architecture** Fall or spring. Variable credit. Independent study. Prerequisite: permission of instructor.

**840 Thesis in Architectural History** Fall or spring. Variable credit. Independent study for the master's degree.

**940 Dissertation in Architectural History** Fall or spring. Variable credit. Independent research by candidates for the Ph.D. degree.

### Design Communications

#### Sequence Courses

**151 Visual Communications I** Fall, 3 credits. Lecture.  
 R. E. Messick.  
 Fundamental problems of graphic representation related to the design process. Emphasis on drawing systems including axonometric and perspective forms.

**152 Visual Communications II** Spring, 3 credits. Lecture.  
 R. E. Messick.  
 Fundamental problems in design graphics including an introduction to the use of light and color in design.

**251 Visual Communications III** Fall or spring, 3 credits. Lecture.  
 S. Bowman.  
 Introduction to photographic tools and methods and their application to architectural presentation and design simulation.

#### Nonsequence Courses

**250 Beginning Photography (also Art 161)** Fall or spring, 3 credits. Lecture/studio.  
 S. Bowman.  
 A lecture-studio course in black and white photography for beginners. Emphasis on basic camera skill, darkroom techniques, and understanding of photographic imagery. Fee charged.

**350 Intermediate Photography (also Art 162)** Fall or spring, 3 credits. Studio. Prerequisite: Arch 250 or permission of instructor.  
 J. Livingston.  
 A studio course in black and white photography at the intermediate level. Emphasis on expanding camera and darkroom skills, image, content, and creative use of black and white photography. Fee charged.

**351 Photo Tools for Architects** Fall or spring, 3 credits. Lecture/studio. Prerequisite: Arch 152 or 250 or permission of instructor.  
 R. E. Messick.  
 A lecture-studio in the use of photography in architecture. Emphasis on architectural photography, photography as a graphic tool, photographic techniques in design, and photographic methods in presentation. Fee charged.

**352 Color Photography (also Art 262)** Spring, 3 credits. Studio. Prerequisite: Arch 250 or permission of instructor.  
 S. Bowman.

A studio course in color photography. Emphasis on camera skill, basic color darkroom techniques, image content, and creative use of color photography. Fee charged.

**353 Photo Processes (also Art 263)** Fall or spring, 3 credits. Studio. Prerequisite: Arch 250 or permission of instructor.  
 J. Livingston.

A studio course in early photo and nonsilver processes. Emphasis on camera skill, basic techniques and processes, image content, and creative use of photo processes. Fee charged.

**354 Fundamentals of Motion Film** Fall, 3 credits. Lecture/studio. Prerequisite: Arch 250 or permission of instructor.  
 Design communications staff.

A lecture-studio course in basic principles of motion film in 16mm format, black and white and color, including use of camera and basic editing techniques. Fee charged.

**355 Graphic Design Studio** Fall or spring, 3 credits. Lecture/studio. Prerequisite: Arch 152 or permission of instructor.  
 R. E. Messick.

An introduction lecture-studio course in design and preparation of materials for reproduction in print media. Studio in typography, available printing processes, and photomechanical methods of reproduction.

**356 Architectural Simulation Techniques** Spring, 3 credits. Lecture/studio. Prerequisite: Arch 152 or permission of instructor.  
 G. Hascup.

A lecture-studio course in two- and three-dimensional simulation techniques in architecture. Emphasis on simulation of environment, space, materials, and lighting as visual tools for architectural design.

**357 Large Format Architectural** Spring, 3 credits. Lecture/studio. Prerequisites: Arch 250 and one 300-level photography course or permission of instructor.

Design communications staff.  
 A lecture-studio course dealing with the special uses of large format view camera photography. Emphasis on the creative use of the view camera in architectural photography.

**450 Advanced Photography (also Art 261)** Fall, 3 credits. Studio. Prerequisite: Arch 350 or permission of instructor.  
 S. Bowman.

A studio course in black and white photography. Emphasis on advanced camera and darkroom skills, image content, and creative use of black and white photography. Fee charged.

**451 Advanced Graphic Design** Spring, 3 credits. Lecture/studio. Prerequisite: Arch 355 or permission of instructor.

R. E. Messick.  
 An advanced lecture-studio course in design and preparation of materials for reproduction in print media. Emphasis on specialized projects dealing with graphic processes.

**452 Media Environments Studio** Spring, 3 credits. Studio. Prerequisite: Arch 250 or permission of instructor.

R. E. Messick.  
 A studio course dealing with programmed multiple projection presentations as communication systems, including the use of multiscreen slides, motion film, and sound in the creation of media environment. Fee charged.

**454 Media Environments Studio** Spring, 3 credits. Studio. Prerequisite: Arch 250 or permission of instructor in design communications. Hours to be arranged.  
 Design Communications staff.

An independent study course for exploration of a special project. Written proposal required.

**457 Special Project in Photography** Fall or spring. Variable credit. Independent study. Prerequisite: permission of instructor in design communications.  
 Hours to be arranged. Design communications staff.

An independent study course for exploration of a special project. Written proposal required.

**458 Special Project in Design Communication** Fall or spring. Variable credit. Independent study. Prerequisite: permission of instructor in design communications.

Hours to be arranged. Design communications staff.  
 An independent study course for exploration of a special project. Written proposal required.

**459 Thesis Project in Design Communication** Spring, 6 credits. Independent study. Prerequisite: design communications majors only.

Hours to be arranged. Design communications staff.  
 A special study in design communication leading to a thesis project. Written proposal required.

### Architectural Science and Technology

#### Sequence Courses

**261 Introduction to Environmental Science** Fall, 2 credits. Lecture.

R. Crump.  
 The role of the architect in controlling environment. Natural influences and climatological factors. The body as an environmental control device. Theoretical aspects of behavioral science that relate to physical design.

**262 Introduction to Social Sciences in Design** Spring, 2 credits. Lecture.

R. D. MacDougall.  
 An introduction to concepts and methods in the social sciences for architects and how approaches from anthropology, environmental psychology, and sociology can be utilized in the study and design of the built environment.

**360 Building Technology, Materials, and Methods** Fall, 3 credits. Lecture. Prerequisites: Arch 261-262.

E. Dluhosch.  
 Properties of materials—their use and application to the design of buildings and building systems. Discussion of various methods of building construction and assembly.

**361 Environmental Technology Workshop I** Spring, 2 credits. Studio. Must be preceded or accompanied by Arch 362.

R. Crump.  
 The tasks of the acoustical consultant, the electrical engineer, and the illumination consultant in relation to the architect's work. Acoustical and lighting design studies utilizing full-scale mock-ups and specific building type studies. Cost factors.

**362 Environmental Controls I** Spring, 3 credits. Lecture. Prerequisite: Arch 360.

R. Crump.  
 Basic properties and principles of sound and light. Sound phenomena, noise control, absorption, acoustical design. Light, color, and form. Natural lighting possibilities and constraints. Artificial lighting with good and bad examples.

**461 Environmental Technology Workshop II** Fall, 2 credits. Studio. Must be preceded or accompanied by Arch 462.

R. Crump.

The mechanical engineer's task and its relation to the architectural design process. Mechanical equipment and its selection and potential developments. Heating and plumbing design studies of specific building types. Full-scale and model studies of the role of air movement and temperature in building design. Cost factors.

**462 Environmental Controls II** Fall, 2 credits. Lecture. Prerequisite: Arch 262.

R. Crump.  
Basic properties and principles of air movement and temperature. Criteria for health, comfort, and efficiency. Water use and return as an ecological factor.

**464 Technological Integration in Design** Spring, 2 credits. Lecture. Prerequisite: all preceding sequence courses in architectural science and technology, or permission of instructor.

E. Dluhosch.  
Integration of various aspects of architectural science and technology with issues of design. Discussion of new developments in the area of architectural science and technology.

#### Nonsequence Courses

**561-562 Special Problems in Architectural Science** 561, fall; 562, spring. Variable credit. Independent study. Prerequisite: permission of science staff instructor.

Science staff.

**662 Environmental Control Systems** Spring 3 credits. Lecture/seminar. Prerequisites: Arch 362 and 462.

R. Crump.  
A study of the influences of environment on the design of buildings and urban developments. Lectures and problems involving the relation and integration of environmental phenomena and psychophysical factors in the design of control systems.

**666 Human Factors in Architecture** Spring, 3 credits. Lecture. Open to upperclass and graduate students and to students in related design fields by permission of instructor.

A. Kira.  
Introduction to "Ergonomics" as it relates to problems of architectural design and detailing. Normal and special population groups, applications of anthropometric data, activity space requirements, controls, and hardware. Emphasis on architectural applications from the viewpoint of user requirements.

**667-668 Architecture in Its Cultural Context** 667, fall; 668, spring. 3 credits per term. Seminar. Prerequisite: permission of instructor.

R. D. MacDougall.  
Fall term, theory; spring term, method and problem solving. An examination of the relationship between architecture and other aspects of culture. Emphasis on the motivations for particular architectural forms and on theories of architecture. Examples from Asia and the United States.

**671 Introduction to Industrialized Building** Fall, 3 credits. Lecture/seminar. Prerequisite: permission of instructor.

E. Dluhosch.  
Definition of terms. Survey of the evolution of industrialization of the building industry to present. The influence of natural and man-made resources of building industrialization and systems building. Case studies.

**672 Industrialized Building** Spring, 3 credits. Lecture/seminar. Prerequisite: Arch 671 or permission of instructor.

E. Dluhosch.  
Conceptual and practical consequences of the industrialization of the building process on the design

and production of building systems. Development of user requirements, performance specifications, evaluation criteria, etc. as part of large series building systems.

#### Graduate Courses

**665 Visual Perception and Architecture** Fall, 3 credits. Seminar. Intended primarily for graduate students. Prerequisite: permission of instructor.

J. Gibson, R. Crump, R. E. Messick.  
A study of the visual perception of space and architecture. Discussions of the theories of perception, of the problem of the nature of visual depth, of the constancy of the characteristics of perceived objects in relation to geometric space, and other related topics. The course will be structured on a group discussion, problem-solving format involving architects and perception-oriented psychologists.

**761-762 Architectural Science Laboratory** 761, fall; 762, spring. 6 credits per term. Open to graduate students only.

Science staff.  
Projects, exercises, and research in the architectural sciences.

**763-764 Thesis or Research in Architectural Science** 763, fall; 764, spring. Variable credit. Independent study. Open to graduate students only.

### The Profession of Architecture

#### Sequence Course

**480 The Practice of Architecture** Spring, 2 credits. Seminar. Fourth-year students only.

Staff.  
Devoted to discussion of the organization of the profession of architecture, professional ethics, client relations, and the position of the architect within society. A summary of all the diverse aspects represented within the actual practice of architecture.

#### Nonsequence Course

**484 Controls and the Designer (also CRP432)** Fall, 3 credits. Lecture/seminar.

B. Kelly.  
Broad survey of public and private codes, regulations, and organizations influencing the design of urban areas, intended to give understanding of basic characteristics and to suggest innovations that encourage design advances while protecting public interests.

## Art

Most courses given in the Department of Art are open to students in any college of the University who have fulfilled the prerequisites and who have the consent of the instructor. All such students must register at the department office.

### Courses in Theory and Criticism

**110 Color, Form, and Space** Fall, 3 credits.

N. Daly.  
A study of traditional and contemporary ways of drawing and painting. An analysis of color theory and pictorial space.

**210 Seminar: Conceptual Intermedia** Spring, 3 credits

N. Daly.  
An experimental effort in which each student will correlate two distinct fields of study into the unified presentation of an original project (performance or exhibition).

**610 Seminar in Art Criticism** Fall or spring.

2 credits. May be repeated for credit. Four terms required of Master of Fine Arts candidates. Open to other graduate students.

J. Seley.  
A study of critical opinions, historical and modern, and their relation to problems in the theory of art.

### Studio Courses in Painting

**121-122 Introductory Painting** 121, fall; 122, spring. 3 credits per term.

Staff.  
An introduction to the problems of artistic expression through the study of pictorial composition; proportion, space, shapes, and color as applied to abstract and representational design.

**221-222 Second-Year Painting** 221, fall; 222, spring. 3 credits per term. Prerequisite: Art 121 or 122 or permission of instructor.

Staff.  
Study of traditional and contemporary media.

**321 Third-Year Painting** Fall, 4 credits. Prerequisite: nine to twelve studio hours, depending on major.

Staff.  
Continued study of the principles of painting and the selection and expressive use of materials and media. Group discussions and individual criticism.

**322 Third-Year Painting** Spring, 4 credits. Prerequisite: Art 321.

Staff.  
Continued study of the principles of painting and the selection and expressive use of materials and media. Group discussions and individual criticism.

**421 Fourth-Year Painting** Fall, 4 credits. Prerequisite: Art 322.

Staff.  
Further study of the art of painting through both assigned and independent projects, executed in various media. Instruction through group discussions and individual criticism.

**422 Senior Thesis in Painting** Spring, 4 credits. Prerequisite: Art 421.

Staff.  
Advanced painting project to demonstrate creative ability and technical proficiency.

**720 Graduate Painting** Fall or spring. Credit as assigned. May be repeated for credit. For Master of Fine Arts students in painting.

Staff.  
Students are responsible, under direction, for planning their own projects and selecting the media in which they are to work. All members of the staff are available for individual consultation.

### Studio Courses in Graphic Arts

**131 Introduction to the Graphic Arts** Fall or spring, 3 credits.

A. Singer.  
Students will explore the techniques of making impressions from the raised surface of the relief print, the lowered surface of the intaglio print, and the flat (planographic) surface of the lithograph.

**132 Introductory Silk-Screen Printing** Fall or spring, 3 credits.

S. Poleskie, P. Thompson.  
A basic introduction to the various methods used in fine art silk-screen printing. Students will explore the use of lacquer film, paper stencil, tusche and glue, and other commonly used procedures of serigraphy.

**230 Advanced Intaglio Printing** Fall or spring, 3 credits. Prerequisite: Art 131, 132, or permission of instructor.

P. Thompson.  
Continuation of the study and practice of methods of printing from below the surface with emphasis on

engraving, lift ground, experimental techniques, and color.

**232 Plate Lithography** Spring. 3 credits.  
Prerequisite: Art 131, 132, or permission of instructor.  
A. Singer.

The special problems relating to the use of the aluminum lithographic plate will be studied. Particular importance will be placed upon the role of the plate in color printing.

**233 Stone Lithography** Fall. 3 credits.  
Prerequisite: Art 131, 132, or permission of instructor.  
A. Singer.

The theory and practice of planography, utilizing limestone block. The basic lithographic techniques of crayon, wash, and transfer will be studied.

**330 Advanced Silk-Screen Printing** Fall or spring. 3 credits. Prerequisite: Art 132.  
S. Poleskie.

Continuation of Art 132 including photographic stencils, three-dimensional printing, and printing on metal, plastic, and textiles.

**331 Advanced Printmaking** Fall. 4 credits.  
Prerequisites: six hours of graphic art courses.  
P. Thompson.

Study of the art of graphics through both assigned and independent projects. Work may be concentrated in any one of the graphic media or in a combination of media.

**332 Advanced Printmaking** Spring. 4 credits.  
Prerequisite: six hours of graphic art courses.  
P. Thompson.

Continuation and expansion of Art 331.

**431 Senior Printmaking** Fall. 4 credits.  
Prerequisite: four courses in printmaking.  
P. Thompson.

Further study of the art of graphics through both assigned and independent projects executed in various media. Instruction through group discussions and individual criticism.

**432 Senior Thesis in Printmaking** Spring. 4 credits. Prerequisite: four courses in printmaking.  
Staff.

Advanced printmaking project to demonstrate creative ability and technical proficiency.

**731-732, 831-832 Graduate Printmaking**  
731 and 831, fall; 732 and 832, spring. Credit as assigned. May be repeated for credit. For Master of Fine Arts candidates in graphic arts. Prerequisite: permission of instructor.  
Staff.

Students are responsible, under direction, for planning their own projects and selecting the media in which they will work. Members of the staff are available for consultation; discussion sessions of work in progress are held.

## Studio Courses in Sculpture

**141-142 Introductory Sculpture** 141, fall; 142, spring. 3 credits per term.  
V. Colby, J. Seley, J. Squier.

A series of studio problems introducing the student to the basic considerations of artistic expression through three-dimensional design. Modeling in plasteline, building directly in plaster, and casting in plaster.

**241-242 Second-Year Sculpture** 241, fall; 242, spring. 3 credits per term. Prerequisites: nonmajors, none; majors, Art 141-142.  
V. Colby, J. Squier.

Various materials including clay, plaster, wood, and stone will be used for exercises involving figurative modeling, abstract carving, and other aspects of three-dimensional form and design.

**341 Third-Year Sculpture** Fall, 4 credits.

Prerequisite: Art 242.

V. Colby, J. Seley, J. Squier.  
Continued study of the principles of sculpture and the selection and expressive use of materials and media. Group discussions and individual criticism.

**342 Third-Year Sculpture** Spring. 4 credits.  
Prerequisite: Art 341.

V. Colby, J. Seley, J. Squier.  
Continuation and expansion of Art 341.

**441 Fourth-Year Sculpture** Fall. 4 credits.  
Prerequisite: Art 342.

V. Colby, J. Seley, J. Squier.  
Further study of the art of sculpture through both assigned and independent projects executed in various media. Instruction through group discussions and individual criticism.

**442 Senior Thesis in Sculpture** Spring. 4 credits.  
Prerequisite: Art 441.

V. Colby, J. Seley, J. Squier.  
Advanced sculpture project to demonstrate creative ability and technical proficiency.

**840 Graduate Sculpture** Fall or spring. Credit as assigned. May be repeated for credit. For Master of Fine Arts students in sculpture.

V. Colby, J. Seley, J. Squier.  
Students are responsible, under direction, for planning their own projects and selecting the media in which they are to work. All members of the staff are available for individual consultation and weekly discussion sessions of works in progress are held.

## Studio Courses in Photography

**161 Beginning Photography** Fall or spring. 3 credits.

S. Bowman  
A lecture-studio course in black and white photography for beginners. Emphasis upon basic camera skills, darkroom techniques, and understanding of photographic imagery. Fee charged.

**162 Intermediate Photography** Fall or spring. 3 credits. Prerequisite: Art 161 or permission of instructor.

S. Bowman, J. Livingston.  
A studio course in black and white photography at the intermediate level. Emphasis upon expanding camera and darkroom skills, image content, and creative use of black and white photography. Fee charged.

**261 Advanced Photography** Fall. 3 credits.  
Prerequisite: Art 162 or permission of instructor.

S. Bowman, J. Livingston.  
A studio course in black and white photography. Emphasis upon advanced camera and darkroom skills, image content, and creative use of black and white photography. Fee charged.

**262 Color Photography** Spring. 3 credits.  
Prerequisite: Art 161 or permission of instructor.

S. Bowman, J. Livingston.  
A studio course in color photography. Emphasis upon camera skill, basic color darkroom techniques, image content, and creative use of color photography. Fee charged.

**263 Photo Processes** Fall or spring. 3 credits.  
Prerequisite: Art 161 or permission of instructor.

S. Bowman, J. Livingston.  
A studio course in early photo and nonsilver processes. Emphasis upon camera skill, basic techniques and processes, image content, and creative use of photo processes. Fee charged.

**361-362 Third-Year Photography** 361, fall; 362, spring. 4 credits per term. Prerequisite: Art 261 or permission of instructor.

S. Bowman, J. Livingston.  
A studio course for photography majors and other

qualified students. Continued study of creative use of photography with emphasis upon specialized individual projects. Fee charged.

**461-462 Fourth-Year Photography** 461, fall; 462, spring. 4 credits. Prerequisites: Art 361-362 or permission of instructor.

S. Bowman, J. Livingston.  
A studio course for photography majors and other qualified students. Continued study of creative use of photography leading to thesis exhibition. Fee charged.

## Studio Courses in Drawing

**151-152 First-Year Drawing** 151, fall; 152, spring. 3 credits per term.

Staff.  
A basic drawing course in the study of form and techniques. Contemporary and historical examples of figure drawing are analyzed in discussion.

**251-252 Second-Year Drawing** 251, fall; 252, spring. 3 credits per term. Prerequisite: Art 151, 152, or permission of instructor.

Staff.  
A continuation of the basic studies undertaken in Art 151, but with a closer analysis of the structure of the figure and a wider exploitation of its purely pictorial qualities.

## Graduate Thesis

**712 Graduate Thesis** Spring. Credit as assigned.  
Staff.

For graduate students in their last term in the programs in painting, sculpture, and graphics.

## Special Studio Courses

**270 Special Studio** Fall or spring. Credit as assigned. May be repeated for credit. Permission of instructor required.

Staff.  
For transfer students and others whose standing in the professional sequence is to be determined. May be in painting, sculpture, graphics, or photography.

**370 Studio Concentration** Fall or spring. Credit as assigned. May be repeated for credit. Permission of instructor is required.

Staff.  
For B.F.A. degree candidates who wish a greater concentration in drawing, painting, sculpture, graphics, or photography in the upperclass years.

## City and Regional Planning

Most courses in the Department of City and Regional Planning are open to students in any college of the University who have fulfilled the prerequisites and who have the consent of the instructor.

\*Indicates courses open to upperclass undergraduate students and graduate students.

## Urban Development History and Preservation Planning

**400 Introduction to the History of Urban Planning (also Arch 343)** Fall. 4 credits.

J. W. Repps, W. W. Cummer, S. W. Jacobs.  
Survey of urban planning in Western civilization from the Greeks and Romans, through medieval, renaissance, and modern Europe, to colonial and nineteenth-century America. Lecture, discussion sessions, readings, and term paper.

**404 Methods of Archival Research (also Arch 542)** Spring. 3 credits.

K. C. Parsons.

Examination of methods of using archival materials for research in the history of architecture and urban development, using manuscripts, drawings, correspondence, and documents in the Cornell University archives and regional history collections.

**504 Seminar in the History of American City Planning** Fall or spring. 3 credits. Prerequisites: CRP 400 Arch 343, or permission of instructor.  
J. W. Repts.

**575 Historic Preservation Planning Workshop** Fall or spring. 4 credits.  
S. Stein.

Preparation of surveys, analyses, plans, and programs for preservation of historic areas of small, medium, or large communities. Fieldwork emphasized, working with real "clients" in their communities.

**576 Historic Preservation Planning Workshop—Advanced** Fall or spring. Credit variable. Prerequisite: 575.  
S. Stein.

In-depth exploration of special problems in historic preservation planning focusing on specific issues in existing towns, villages, cities, or regions.

**602 Seminar in American Urban History** Spring. 3 credits. Prerequisite: permission of instructor.  
I. R. Stewart.

Seminar in the historical evolution of the American city. Emphasis on factors in urban growth, the process of urbanization, urban reform movement, and intellectual and social responses to the city.

**679 Informal Study in Preservation Planning** Fall or spring. Credit as assigned.  
Staff.

**709 Special Problems in the Historical Development of Urban Areas** Fall or spring. Credit as assigned.  
Staff.

**809 Informal Study in Urban Development History** Fall or spring. Credit as assigned.  
Staff.

**844 Design and Conservation (also Arch 545)** Fall. 2 credits.  
B. G. Jones, S. W. Jacobs.  
The rationale for and methods of utilizing existing cultural and aesthetic resources in the planning and design of regions and cities.

**845 Documentation for Preservation Planning (also Arch 546)** Spring. 2 credits.  
S. W. Jacobs, staff, visiting lecturers.  
Methods of collecting, recording, processing, and analyzing architectural and cultural survey materials.

## Urban, Regional, and Planning Theory

**440 Introduction to Urban Planning Theory and Practice** Fall. 3 credits.  
B. G. Jones.

An undergraduate course designed to introduce the student to the practice of urban planning within the context of the major bodies of theory utilized in planning. Urban and regional theory and planning theory will be examined. Their usefulness and applications to planning activities and urban problems will be highlighted within the context of the process of urban growth and development.

**614 Neighborhood Theory** Spring. 3 credits.  
Open to graduate and upperclass students. Seminar course.

H. Hammerman.  
The role of neighborhoods and small communities in urban society from a sociological perspective. The social, design, and cultural determinants of "sense of community" will be applied to planning in cities and new towns.

**\*710 Introduction to Urban and Regional Theory** Fall. 4 credits.  
W. W. Goldsmith.

A first-year graduate course on the growth and structure of cities. Eclectic, borrowing theories from economics, sociology, and geography to explain size, functioning, and location of cities and their components integrated by a Marxist analysis of the shortcomings of planning.

**721 Introduction to Planning Theory** Spring. 3 credits.  
P. Clavel.

Normative and behavioral models of decision making for the provision of public goods and services. Theories of individual decision and choice are reviewed, followed by applications in institutional contexts stressing the impact of alternative organizational and political models on social-decision processes.

**820 Planning and Organizational Theory** Fall. 4 credits. Prerequisite: second-year graduate standing.  
P. Clavel.

A seminar examining organizational and administrative models relevant to plan formation and implementation. Applications are made to such programs as community development, regional administration, urban renewal, and land-use control.

**859 Informal Study in Urban Systems Planning** Fall or spring. Credit as assigned.  
Staff.

**915 Location Theory** Fall. 3 credits.  
Prerequisites: 710, 733, and Econ 311–312, or equivalent.  
W. Isard.

Traditional Weberian location doctrine; transport orientation, labor orientation, agglomeration, and urban rent theory will be examined. Interregional trade and market and supply area analysis will be treated. Particular attention paid to Loschian and Christaller systems of urban places.

**916 Advanced Seminar in Urban and Regional Theory I** Fall. 2 credits. Prerequisite: 710.  
B. G. Jones.

Seminar in the theory of urban spatial organization. Economic, technological, and social factors leading to urbanization and various kinds of spatial organizations will be explored. Major theoretical contributions to the understanding of intraregional and intraurban distribution of population and economic activity will be reviewed.

**917 Advanced Seminar in Urban and Regional Theory II** Spring. 2 credits. Prerequisite: 916.  
B. G. Jones.

A continuation of CRP 916 concentrating on recent developments.

**919 Informal Study in Urban, Regional, and Planning Theory** Fall or spring. Credit as assigned.  
Staff.

**920 Seminar in Planning Theory** Fall. 2 credits.  
Prerequisite: 820 or 821.  
B. G. Jones.

A survey of the works of scholars who have contributed to current thinking about planning theory. The course deals with alternative assumptions concerning models of man and theoretical concepts concerning the nature of planning today.

## Planning Analysis

**524 Gaming Simulation Workshop** Fall. 2 credits.  
H. Hammerman.

An eight-week course covering the major urban planning and social policy training games available. Fundamentals of game design and administration.

Students will design original games or modifications of existing operational games around their own interests.

**[525 Data Interpretation and Presentation in Urban Planning]** Fall. 3 credits. Not offered 1976–77.

H. Hammerman.  
The technique of making cogent arguments in applied statistical analysis. The processes of assembly and computer analysis of social and planning data. Simple statistical procedures and tabular presentation. Lectures and workshop.]

**\*730 Mathematical Concepts for Planning** Fall. 1, 2, or 3 credits. Prerequisite: permission of instructor.  
Staff.

An introductory course for students having little or no background in college mathematics. Basic concepts in matrix algebra, calculus, and probability will be covered in self-contained units of one credit hour each. Students may register for any or all of these topics. Mathematics 201, Mathematics for the Social Sciences, is an acceptable substitute.

**\*731 Statistical Analysis for Planning** Spring. 3 credits. Prerequisites: 730 or equivalent and permission of instructor.  
Staff.

An introduction to basic methods of statistical analysis with an emphasis on their use in the decision-making process in planning. Material in decision theory, sampling, estimation, hypothesis testing, and prediction will be introduced.

**\*733 Planning Analysis** Spring. 4 credits.  
Prerequisite: 731.  
B. G. Jones.

City planning applications of general analytical economic and spatial models.

**736 Introduction to Computers in Planning** Fall. 3 credits.  
Staff.

An introduction to the use of computers in the problem-solving and planning processes. Students will run programs on the Cornell computer using PL/1 or another appropriate programming language. Brief introduction to computer systems and the use of library routines. Advantages and limitations of using computers will be considered.

**751 Planning Information Systems** Spring. 3 credits. Prerequisite: 736 or equivalent.  
S. Saltzman.

Considers the design and use of computer-based information systems for planning and policy analysis, including conventional data processing and advanced data base systems. Technical aspects in the design and structure of such information systems are introduced along with a variety of applications.

**830 Quantitative Techniques for Policy Analysis** Fall. 4 credits.  
D. Lewis.

An examination of selected analytical techniques used in the planning and evaluation of public policy and public investments. Topics covered include simulation modeling, benefit-cost and cost effectiveness analysis (including capital budgeting), and optimization strategies.

**832 Simulation in Planning and Policy Analysis** Fall. 3 credits. Prerequisites: 731 and 736 or equivalent.  
S. Saltzman.

The design and use of simulation models in planning and policy analysis. Alternative approaches such as discrete stochastic simulation, econometric simulation, and urban dynamics will be evaluated. Applications in design, land use, regional development, and social policy will be considered. Students will run their own programs on the Cornell computer.

**839 Informal Study in Planning Analysis** Fall or spring. Credit as assigned.  
Staff.

**[855 Systems Analysis in Urban Policy Planning]** Spring. 3 credits. Prerequisite: permission of instructor. Not offered 1976-77.

S. Saltzman, D. F. Williams.  
An examination of the uses of systems analysis in policy-planning issues. Advantages and limitations of the uses of systems analysis methodology in public policy planning will be explored.]

**930 Seminar in Methods for Planning and Policy Analysis** Fall. 2 Credits. Prerequisite: permission of instructor.

S. Saltzman.  
A review and critical analysis of various analytical and computer methods of actual and potential use in planning and in the analysis of public policy. The material covered will vary each semester depending upon the interests of the members of the seminar.

## Social Policy Planning

**425 Theories and Strategies of Social Change** Spring. 4 credits.

C. Hershey.  
Broadly concerned with social change on both a theoretical and action level. The principal thrust will be to evaluate the possibilities for major social, cultural, and political changes within an emergent postindustrial society, including a critical evaluation of several current change strategies and an articulation of several alternative futures.

**\*513 Introduction to Human Ecology** Fall. 4 credits. Lectures and discussions.

H. Hammerman.  
An examination of man-environment relationships (including the resource, energy, food, population, and pollution crises) will be examined from sociological and systems analysis points of view. Solutions (in terms of social organization) will be suggested.

**\*526 Introduction to Survey Research** Spring. 3 credits.

H. Hammerman.  
The techniques of conducting a scientific social survey. Sampling, questionnaire writing, interviewing, and analysis of results. Students will conduct survey in local area. The course will qualify students to conduct professional surveys. Workshop.

**\*720 Policy Planning and Collective Choice** Fall. 4 credits.

D. F. Williams.  
An introductory course in the practical uses of planning theory with specific emphasis on the praxis of planning theory and planned action. The logic of individual and group behavior in collective action and public policymaking is applied in examining public policy effects of the intersocial transfer of material goods.

**\*770 Introduction to Social Policy Planning** Fall. 4 credits.

C. Hershey, D. F. Williams.  
An introduction to theories, methods, and processes of social policy planning. Recent social policies will be examined within the context of the evolution of the welfare state and the development of social science methodologies for policy analysis.

**824 Organizational Change and Public Service Delivery Systems** Fall. 3 credits.

C. Hershey.  
An examination of the operation of the urban political system and policymaking process with particular emphasis on the service outcomes of local public bureaucracies in the education, health, welfare, manpower, social service, and police fields.

**856 Urban Public Service Planning I** Fall. 3 credits.

D. F. Williams.  
Analysis of the function, distribution, and impact of urban public services. The major focus will be the problems and analytics of planning and resource allocation in nonmarket systems.

**857 Urban Public Service Planning II** Spring. 3 credits. Prerequisite: 856.

D. F. Williams.  
A seminar on application of selected methods of urban public service planning and analysis. Emphasis on analysis of real and simulated public service planning situations.

**871 Seminar in Social Policy Research and Analysis** Spring. 4 credits.

C. Hershey.  
The focus will be on examining contemporary methods of social policy analysis, especially their ideological implications, and developing multidisciplinary approaches to selected social policy issues. The dilemmas of action research and of implementing research findings will be explored.

**872 Housing and Urban Planning** Fall. 3 credits.

D. F. Williams.  
Examination of methods and strategies for planning, policy formation, and resource allocation in the urban housing sector. Emphasis on the housing element of urban plans, housing sector analysis, and analysis of the impact of development and development controls on housing costs.

**873 Housing Analysis and Research** Spring. 3 credits. Prerequisite: 872.

D. F. Williams.  
Intensive concentration on selected problems and methods of housing analysis, empirical housing research, and national and subnational housing policy formation.

**879 Informal Study in Social Policy Planning** Fall or spring. Credit as assigned.  
Staff.

## Urban Development Processes, Controls, and Implementation

**432 Controls and the Designer (also Arch 484)** Fall. 3 credits.

B. Kelly.  
Broad survey of public and private codes, regulations, and organizations influencing the design of urban areas, intended to give understanding of basic characteristics and to suggest innovations that encourage design advances while protecting public interests.

**434 The Impact and Control of Technological Change** (Cosponsored by the Program on Science, Technology, and Society) Spring. 4 credits. Visiting speakers and sections.

J. Milch.  
Social, environmental, and economic implications of technological change in the context of present policies and strategies of control. Several specific cases will be considered in detail, followed by investigation of the problems of a modern technological society. Alternative political-economic solutions will be explored.

**\*510 Introduction to Concepts and Principles of Urban Planning and Development** Fall. 4 credits. Upperclass undergraduates admitted by permission of instructors.

J. W. Reps, I. R. Stewart.  
A survey of the history of American planning, major problems of city development, and solutions advanced to improve the urban condition. Major emphasis is on physical development and related social, political, economic, and legal matters.

**531 Suburbanization and New Communities** Fall. 3 credits. Prerequisite: permission of instructor.

I. R. Stewart.  
Seminar concentrates on the major issues in suburban development and the role of new communities in accommodating expected future population. New towns programs are examined and current and proposed state and federal legislation is reviewed.

**533 The Politics of Technical Decisions** (Cosponsored by the Program on Science, Technology, and Society) Fall. 4 credits.

J. Milch.  
Political aspects of decision making in areas traditionally regarded as technical. Focus on site selection process of large-scale projects such as airports and power plants. Political nature of expert decision making and the rise of citizen opposition to technology.

**\*550 Seminar in Housing and Urban Development** Fall. 3 credits.

I. R. Stewart.  
An introductory course reviewing the evolution of governmental policy and programs in the area of housing, urban renewal, and development. Subjects will involve both theory and case-study analyses of recent American experience in these fields.

**551 Social Facilities for Large-Scale Housing Developments** Fall. 3 credits.

B. Kelly.  
Study of the need for a full range of community social facilities in large-scale housing developments and the procedures by which these needs may be met. Illustrations from experience in the United States and Europe.

**612 The Urban Development Process** Spring. 2 credits. Prerequisite: 510 or permission of instructor. Enrollment limited.

J. W. Reps.  
Examination of the goals, strategies, methods, and achievements of major participants in the urban land and building market; land owners, speculators, real estate brokers, developers, bankers, lawyers, nonprofit builders, and government agencies.

**631 Urban Land Policy and Programs** Fall. 3 credits. Prerequisite: 632 or permission of instructor.

J. W. Reps.  
Consideration of major problems of urban land control and management and possible solutions. Subjects for discussion include taxation, compensation and betterment, large-scale public land acquisition, subsidies and incentives, and acquisition of developmental rights.

**632 Legal Aspects of Land-Use Planning** Spring. 3 credits. Prerequisite: 510 or permission of instructor.

B. Kelly.  
Survey of leading cases and legal concepts in land-use planning, with particular attention to zoning, subdivision control, condemnation, growth control, and environmental issues.

**639 Informal Study in Urban Development Processes, Controls and Implementation** Fall or spring. Credit as assigned.  
Staff.

**\*650 Urban Politics and Planning** Spring. 3 credits.

I. R. Stewart.  
A consideration of the political dimension of planning and renewal activities. Emphasis on governmental mandate and structure, as well as interest group and power relationships as they are related to developmental decision-making processes. Theory and case-study analyses.

## 42 City and Regional Planning

**659 Informal Study in Housing, Renewal, and Community Development** Fall or spring. Credit as assigned.  
Staff.

**738 Special Problems in Urban Land Policy and Programs** Fall or spring. Credit as assigned.  
Staff.

**759 Special Problems in Housing, Renewal, and Community Development** Fall or spring. Credit as assigned.  
Staff.

**821 Politics of the Planning Process** Fall or spring. 4 credits.  
P. Clavel.

Analysis of planning and political institutions in selected subjects and policy areas, relating national and subnational levels. Subjects will be drawn from such areas as environmental control and use policy, industrial development, transportation, and community development. Theories of planning and politics are compared for their analytical usefulness in these areas.

### Physical Planning and Environmental Design

**\*522 Urban Land-Use Planning** Spring. 3 credits.  
S. Stein.

Surveys, analyses, and plan-making techniques for guiding physical expansion and renewal of urban areas; location requirements, space needs, interrelationships of land uses. Emphasis on residential, commercial, and industrial activities and community facilities; housing and neighborhood conditions.

**523 Urban Land-Use Planning—Special Topics** Fall. 3 credits. Prerequisite: 522 or permission of instructor.  
S. Stein.

Case-study explorations of some or all of the following: neighborhoods, central business districts, shorelines and waterfronts, new towns, planned-unit developments, high-density housing, highway-oriented uses, and others. Lectures, seminars, and field exercises.

**\*[530 Urban and Regional Transportation Planning** Fall. 3 credits. Not offered 1976–77.  
Staff.

An examination of the transportation planning process and its interrelationship with comprehensive urban and regional planning; to communicate the increasingly systematic knowledge about travel, land use, and transportation networks; to examine implications of transportation planning processes in metropolitan and regional planning.]

**[532 Socioeconomic Impacts of Transportation Investments** Spring. 3 credits. Not offered 1976–77.  
Staff.

Development of a comprehensive framework for the monitoring and evaluation of transportation programs and their social and economic impacts upon the immediate environments and the region as a whole. Seminar sessions deal with the construction/application of this frame to the evaluation of transportation impacts at the regional and community levels.]

**\*540 Introduction to Environmental Planning and Design** Fall. 3 credits. For graduate planning students; others by permission of instructor.  
K. Grey.

Planning and design of built environments as an aesthetic reflection of comparative values and needs. Lectures, seminars, and readings will explore basic concepts and issues related to architecture, landscape, urban design, and urban planning.

**541 Environmental Planning and Design Workshop** Spring. 4 credits. Prerequisite: 540 or

permission of instructor.

K. Grey.  
Studio-lecture course examining planning and design problems related to the built environment. An understanding of the design process will be developed and graphic communication techniques explored. No previous graphics experience required.

**542 Planning Design** Spring. 4 credits.  
Prerequisite: 541 or background in design with permission of instructor.

K. Grey.  
Studio course to explore in detail typical urban planning problems. Projects will be related to urban land-use activities. Field surveys, program development, design solutions, implementation programs, report preparation and presentation techniques will be emphasized.

**[543 Advanced Planning Design** Fall. 4 credits. Not offered 1976–77.  
K. Grey.

Continuation of the exploration of physical planning problems found in urban settings, building on the work begun in 542 Planning Design. Increasingly more complex problems will be undertaken to develop greater design skills.]

**561 College and University Planning** Spring. 3 credits. Prerequisite: permission of instructor.  
M. Toomey, K. C. Parsons.

An analysis of interactive elements in the planning process for colleges and universities. Topics include organizational and administrative theory, management objectives, evaluation, accountability/quantity and quality budgeting, and program planning. Governmental constraints will be stressed.

**[640 Seminar in Urban Design** Fall. 3 credits. Not offered 1976–77.  
S. Stein.

Investigation of historical and current thought on the visual aspects of cities, including evaluation of technological and cultural influences on urban design, perception of urban form, and relationships between contemporary city planning process and visual form in cities.]

**649 Informal Study in Physical Planning and Environmental Design** Fall or spring. Credit as assigned.  
Staff.

**669 Informal Study in Institutional and Public Facilities Planning** Fall or spring. Credit as assigned.  
Staff.

**728 Special Problems in Physical Planning** Fall or spring. Credit as assigned.  
Staff.

**749 Special Problems in Environmental Design** Fall or spring. Credit as assigned.  
Staff.

**769 Special Problems in Institutional and Public Facilities Planning** Fall or spring. Credit as assigned.  
Staff.

### Urban and Regional Economic Development Planning

**[457 The Public Economy of Urban Areas** Spring. 3 credits. Not offered 1976–77.  
D. F. Williams.

An examination of the structure, function, and impact of the local public sector with specific emphasis on the externalities and fiscal interactions in metropolitan areas.]

**460 Regional Economic Development** Fall. 4 credits.

W. W. Goldsmith.

A focus on problems of and theories about development of lagging, underdeveloped, or poor regions in industrial nations with emphasis on planning implementation.

**\*512 Urban Economic Analysis** Fall. 4 credits. Prerequisites: 730 and an introductory course in microeconomics.  
Staff.

Examination of the city as an economic entity with spatial characteristics. Urban phenomena are analyzed from an economic point of view, using economic analysis tools. Areas to be examined include patterns and determinants of urbanization, urban structure and location of activities, urban land and housing markets, the role of urban transportation, and urban public policy.

**\*740 Introduction to Planning Institutions** Fall. 3 credits.  
P. Clavel.

A survey of contemporary organizational forms and political forces facilitating and inhibiting the development of the planning profession at the city, state, and regional levels. The focus is on subnational planning in the United States, but the national context and other nations are dealt with where appropriate.

**777 Low-Cost Housing for Developing Nations** Spring. 3 credits.  
D. F. Williams.

A course on dimensions of the practice and problems of production, location, delivery, and use of shelter for low-income population groups in urban centers, peri-urban squatter settlements, and rural regions of developing nations.

**814 Urban Economics I** Fall. 2 to 4 credits. Prerequisites: 710 or Econ 311–312 or equivalent.  
Staff.

A series of lectures presenting broad aspects of urban economic development and planning, complemented by original research work carried out in working groups. The groups will report in seminars at approximately three-week intervals. Problems of race, poverty, the dual economy, and the urban ghetto are considered.

**815 Urban Economics II** Spring. 2 to 4 credits. Prerequisite 814.  
Staff.

**818 Regional Planning Methods I** Fall. 4 credits. Prerequisites: basic economics, some calculus, and statistics.  
S. Czamanski.

Study of problems in the formulation and testing of scientific hypotheses. Main focus will be depressed or underdeveloped regions, with some discussion of past and current work of participants and their dissertations. Topics covered include construction of models, main estimating techniques, and discussion of some applied regional models.

**822 Seminar in Regional Interindustry Analysis and Programming** Fall. 3 credits. Prerequisites: basic economics, elementary matrix algebra.  
S. Czamanski.

Advanced treatment of regional industrial structure, methods of construction and applications of input-output, linear programming, saturation and dynamic optimization. Examples of recent applications of the techniques discussed to the solution of actual regional problems will be analyzed.

**823 Regional Development Administration** Spring. 4 credits.  
P. Clavel.

A seminar on administrative institutions relevant to regional development policies, with attention to the United States, Western Europe, and Third World countries. Approaches to theory, measurement, and spatial distribution of institutions are covered with reference to the design of effective programs.

**860 Introduction to Regional Development**

**Planning** Fall. 4 credits. Prerequisite: second-year graduate standing.

W. W. Goldsmith.

Theories about development of lagging, underdeveloped, and poor regions of industrial nations. Readings survey various theoretical works upon which regional development planning is, or ought to be, based. Course will deal with difficult transition from theory to planning recommendations and policy. Brief case studies will be used.

**862 Seminar on Science and Technology Policy in Developing Nations**

Spring. 4 credits.

D. Lewis.

An examination of the issues facing developing countries as they endeavor to use technology in the pursuit of their national goals. Topics covered include alternative choices of technology and the associated impacts, the role of multinational corporations, government policymaking institutions, manpower development and utilization strategies, and policy instruments.

**863 Regional Planning and Development in Developing Countries**

Spring. 4 credits.

Prerequisite: second-year graduate standing.

W. W. Goldsmith.

Selected problems from 860 will be elaborated and applied. Extensive case studies of development planning will be analyzed. Focus will be on the process of regional development through urbanization and in particular the concepts of equity and efficiency, external economies, export linkages, and internal self-sufficiency and integration. Resource development, national integration, human development, and migration problems will be discussed.

**865 Seminar in Policy Planning in Developing Nations: Technology Transfer and Adaption**

Fall. 2 credits.

D. Lewis.

An exploration of the international transfer of technology to developing nations and the policies used to guide this process. Topics covered include the role of foreign aid and multinational corporations, economic rationale for choice of appropriate technology, and social benefit-cost analysis. Case studies emphasized.

**869 Informal Study in Comparative**

**Planning** Fall or spring. Credit as assigned.

Staff.

**[914 Metropolitan Land Use: Economic**

**Analysis** Fall. 3 credits. Prerequisites: 510, 815, 733, and/or permission of instructor. Not offered 1976-77.

Staff.

The housing market, land-use competition, and location of retail, service, wholesale, and manufacturing enterprises. The determination of land values, and urban structure and form. Public controls, urban redevelopment, and evaluation of social costs and benefits.]

**[932 Techniques of Regional Accounting**

Fall. 3 credits. Prerequisites: 733 and Econ 312 or equivalent. Not offered 1976-77.

Staff.

Methods of construction of the regional, social accounts and their application to regional planning. Measuring levels of activity within regions, such as income and product accounts, are emphasized as well as methods of estimating flows between regions, such as balance of payment accounts.]

**933 Methods of Regional Analysis**

Spring. 3 credits.

W. Isard.

Advanced applications of interregional and regional input-output and linear programming techniques to development problems. Applications of spatial interaction and growth (intertemporal) models to the analysis of urban and multiregional systems, with

particular reference to environmental quality management.

**963 Planning Techniques for Developing**

**Regions and Small Nations** Spring. 4 credits.

Prerequisite: 860 or 863.

W. W. Goldsmith.

Simulation of the work of a consulting team's proposals and analyses of policies for development of various sectors and problem areas such as manufacturing, agriculture, health, education and services, infrastructure, urbanization, and exports.

The final product will be a set of plans. Requirements include minimal reading, extensive research on a topic of interest, an interim report, and a written final report.

**969 Informal Study in Urban and Regional Economic Development Planning**

Fall or spring. Credit as assigned.

Staff

**Environmental Health and Health Systems Planning****452 Introduction to Environmental Health Policy**

Fall. 3 credits.

Staff.

An examination of some of the concepts and issues in environmental health planning, such as housing quality, occupational health and safety, and environmental protection.

**852 Environmental Health Planning**

Fall. 2 credits. Prerequisites: second-year graduate standing.

Staff.

Introduction to concepts and issues in environmental health planning. Topics covered include the planning problems involved in the control of water quality, liquid and solid waste disposal, air quality, and housing quality.

**853 Planning and Evaluation of Environmental Health Programs and Projects**

Spring. 3 credits.

Prerequisite: second-year graduate standing.

Staff.

The major focus is an examination of the use of quantitative methods and economic analysis as aids to social decision making for action in the area of environmental health. Applications of these methods to the study of particular problems of environmental health.

**[877 Health Systems Planning**

Spring. 3 credits.

Not offered 1976-77.

Staff.

This seminar is intended to increase understanding of issues, institutions, politics, economics, and social elements involved with planning and administration of health problems. Special emphasis will be placed on planning techniques and methodologies. Visiting practitioners in the field will be invited to make presentations.]

**959 Informal Study in Environmental Health**

**Planning** Fall or spring. Credit as assigned.

Staff.

**979 Informal Study in Health Systems**

**Planning** Fall or spring. Credit as assigned.

Staff.

**Planning Fieldwork and Professional Practice**

Fieldwork in urban planning and development problems may be taken upon completion of an appropriate academic course and approval of the instructor of that course. In certain cases, the appropriate course may be taken at the same time as the fieldwork. If the proposed fieldwork is not part of a regularly organized fieldwork course, arrangements

for faculty supervision and evaluation of the fieldwork must be approved in advance.

**441 Field Studies in Planning**

Spring. 3 credits.

Staff.

The student is offered the opportunity to apply theories and techniques of analysis and planning to real problem situations.

**570 Planning and Development Workshop**

Fall or spring. 4 credits. Prerequisite: 510.

Staff.

Research and analysis in an urban, suburban, or rural community leading to the preparation of spatial studies, plans, and programs. Individual and group reports. Fieldwork emphasized, working with real clients.

**571 Housing Renewal and Community Development Workshop**

Fall or spring. 4 credits.

S. Stein.

Surveys and analyses of housing renewal and community development problems in specific communities. Preparation of plans based upon existing legislation and funding mechanisms and the development of new programs. Fieldwork emphasized.

**572 Fieldwork in Community Social**

**Facilities** Spring. Credit as assigned. Prerequisite: 551.

B. Kelly.

Fieldwork follow-up to CRP 551

**579 Special Problems in Fieldwork**

Fall, spring, or summer. 4 to 6 credits.

Staff.

Arrangements for enrollment and credit must be made with the agreement of a faculty member and the approval of the entire city and regional planning faculty.

**670 Planning Practice Seminar**

Spring. 1 credit.

Staff.

Visiting lecturers and seminar discussions focusing on various roles and responsibilities for urban planners in society.

**742 Summer Internship in Planning**

Summer. 3 to 6 credits. Prerequisite: second-year graduate standing.

Staff.

[771 Summer Internship in Planning—New York City

Summer. 3 credits. Instruction limited to July and August. Graduate students in planning and others by permission. Not offered 1976-77.

S. Stein, staff, visiting lecturers.

Summer internship in the New York metropolitan area. Full-time work at current salaries, supplemented with evening lectures and discussions two evenings a week and field trips. Program offering dependent on economic conditions and availability of internship jobs in New York City.]

**890 Professional Planning Colloquium**

Fall or spring. 1 credit.

Staff.

Presentation of current professional and research problems in planning by visitors, faculty, and students.

**949 Informal Study in Planning Fieldwork and Professional Practice**

Fall or spring. Credit as assigned.

Staff.

**Research****490 Undergraduate Honors Research**

Fall or spring. Credit as assigned.

Staff.

**898 Thesis in the History of Urban**

**Development** Fall or spring. Credit as assigned.

Staff.

**899 Thesis in City and Regional Planning.** Fall or spring. Credit as assigned. Staff.

**990 Planning Research Seminar** Fall or spring. 1 credit. Staff. Registration limited to doctoral candidates in city and regional planning. Presentation and discussion of current research by advanced doctoral students and faculty.

**998 Dissertation in the History of Urban Development** Fall or spring. Variable to maximum of 10 credits. Staff.

**999 Dissertation in City and Regional Planning** Fall or spring. Credit as assigned. Staff. Advanced independent research by candidates for Ph.D. degree.

survey techniques for formulation of design criteria and /or evaluation of landscape architectural projects.]

**[683 State and Regional Landscape Planning** Fall. 3 credits. Not offered 1976-77. Staff. Case studies of land-use policies and programs that various states and localities have designed to protect environmental quality. Examination and evaluation of larger scale land-use planning methodologies.]

**689 Informal Study in Landscape Planning and Design** Fall or spring. Credit as assigned. Staff.

**889 Thesis Research and Preparation in Landscape Architecture** Fall or spring. 6 credits. Staff.

### Landscape Architecture Graduate Program

**481 Contemporary Issues in Landscape Architecture** Fall. 1 credit. L. Mirin, staff, visitors. Recent technological, methodological, and legislative developments are assessed in terms of their probable impact on the practice of landscape architecture.

**581 Landscape Planning and Design Workshop I** Fall. 6 credits. Staff. Analysis, planning, and design response to problems of environmental impact. Traditional and advanced techniques of landscape architecture applied to study of natural and cultural systems and processes.

**582 Landscape Planning and Design Workshop II** Spring. 6 credits. L. Mirin, staff, visitors. Application of planning and design techniques to environmental problems of increasing complexity.

**583 Urban Landscape Planning and Design** Fall. 4 credits. L. Mirin. Planning and design of the elements of urban open space, including arboriculture, graphics, vest pocket parks, playgrounds, and squares.

**[584 Landscape Recreation Planning and Design** Spring. 4 credits. Not offered 1976-77. Staff. Planning and design of general and specialized recreation facilities for state and regional service areas. Design based upon appropriate research.]

**585 Historic Development of Modern Landscape Architecture** Spring. 3 credits. L. Mirin. A survey of man's arrangement of outdoor space to meet his varied needs including Italian Renaissance, Versailles and LeNotre, English naturalistic movement, Olmsted and Central Park, and urban public space.

**681 Landscape Planning and Design Workshop III** Fall. 6 credits. Staff. Advanced study of problems in environmental design with an urban or regional focus. Emphasis on evolution of the design process as determined by physical and cultural restraints.

**[682 Social Factors in Landscape Design** Spring. 4 credits. Not offered 1976-77. Staff. An introduction to the use of social science findings, structured observational techniques, and social

# College of Arts and Sciences

## Introduction

The College of Arts and Sciences at Cornell is a liberal arts college, a university college, and a graduate school and research center. As a liberal arts college, it offers undergraduates the opportunity to increase their understanding of themselves and the world and prepares them for further, more specialized study.

As a university college, it is part of a wider university community which provides strength and diversity that are not available in an isolated, solely undergraduate institution. Here, students can draw upon the more highly specialized knowledge and facilities of the professional colleges to supplement their liberal studies. Because the College also serves students in other colleges of the University, its academic program is broad and flexible.

Finally, as a graduate school and research center, the College attracts a faculty whose active involvement in research and writing requires first-rate academic facilities, and whose energetic participation in undergraduate teaching brings to their students the most current and creative ideas in modern scholarship. It is this combination of functions that gives the College its distinctive character.

## The Program of Study

The Arts College curriculum gives students opportunity for breadth, experiment, and discovery in study and for focus on at least one field. To encourage students to take maximum advantage of the College's many offerings and programs, the College has set requirements in the following areas: (1) Freshman Seminars, (2) foreign language, (3) distribution, (4) the major, (5) electives, (6) residence, and (7) credit. These requirements provide the backbone of an undergraduate education in the College. (In addition to the College requirements, the University requires undergraduate students to complete four semesters of physical education.)

### Freshman Seminars

Each semester of their first year in the College, freshmen choose a Freshman Seminar from among more than thirty courses offered by more than a dozen departments. The primary purpose of the Freshman Seminar requirement is to help students improve their ability to write. This means developing every skill, from spelling and grammar to syntax and style; from the expansion of vocabulary to better organization of arguments. The stress is not merely on acquiring techniques, but on improving an intellectual process.

The enrollment in each section is limited so that every student may actively participate in the seminar, and so that the instructors may give individual help in writing. All of the sections stress writing, although the frequency and length of the assignments may vary. Special arrangements for foreign students are explained in the *College Guide*.

### Foreign Language

The College language requirement can be met by attaining qualification in two languages or proficiency in one. Three years of language study in high school or, in most languages, a 560 score on the reading portion of the College Entrance Examination Board Achievement examination, or completion of the 102, 112, or 134 language course at Cornell, will count as qualification.

Proficiency in most languages is achieved by completing a 200-level language course at Cornell or its equivalent. The 200-level courses have a 560 CEEB reading score as a prerequisite. For information about meeting the language requirement through the study of Hebrew or Classical languages, please consult the appropriate department or see the *College Guide*.

Native speakers of a language other than English can fulfill the language requirement by demonstrating their proficiency in both the spoken and written forms of that language in an interview with an appropriate faculty member. They may also receive as much as six credits in their native language, which can be counted toward the degree.

### Distribution

Designed to ensure the breadth desirable in a liberal education, the distribution requirement rules that students must complete at least six credits in related courses in one area in each of four groups: Group I, physical and biological sciences; Group II, social sciences and history; Group III, humanities and expressive arts; Group IV, mathematics or an area not used to fulfill the requirement in Group I, II, or III.

The physical sciences at Cornell are astronomy, chemistry, geological sciences, and physics. Social sciences include anthropology, economics, government, linguistics, psychology, and sociology and some courses in Africana studies and in Women's studies. Philosophy courses, some archaeology courses, and all literature courses, whether offered by the Department of English, Classics, or Comparative Literature, or in a foreign literature department, are counted as humanities. The expressive arts are music, history of art, theatre arts, and writing courses in English and Africana studies. The ways in which the distribution requirements can be met in the various departments are explained by each department before its course listings in this *Announcement*.

In general, the same course may not be used to fulfill more than one college requirement. A few exceptions to this rule and a complete listing of courses that can be used to meet the distribution requirements are contained in the *College Guide*.

### The Major

The major requirement is designed to direct students to focus on one field, or more if they choose. By their fourth semester, students select a major program to which they devote approximately half their time during their last two years. Prerequisites for admission and the requirements for each major are detailed by the individual departments listed alphabetically under Courses of Study in this *Announcement*.

Majors are offered by each of the departments, except astronomy, comparative literature, and computer science. There are also majors in Africana studies, American studies, archaeology, German area studies, Russian and Soviet studies, and social relations. In addition, the College offers the Independent Major, an interdisciplinary program which students design themselves, and the College Scholar Program, for students whose interests are unusually diverse. These programs are described in the section Special Programs and Interdisciplinary Studies on p. 118.

### Related Opportunities

**Honors Program.** Almost all departments offer honors programs for students who have demonstrated exceptional ability in the discipline and who seek an opportunity to explore branches of their subject not represented in the regular curriculum or to gain experience in original investigation. The honors programs are described by the individual departments in the next section of this *Announcement*.

**Concentrations.** Although not required, students may complete more than one major or elect a special concentration, some of which require as few as four courses. Special concentrations are available in ancient Mediterranean studies, Jewish studies, Latin American studies, law and society, medieval studies, religious studies, and Southeast Asian studies. Other curricular opportunities include early concentrations in German literature and in Russian literature and an intensive language program in Chinese and Japanese (FALCON).

**Teacher Preparation.** The College also provides several state-approved programs in teacher preparation. Undergraduate teacher education programs are available in English, mathematics, and modern languages. Full-year graduate programs leading to the Master of Arts in Teaching degree are offered in English and in mathematics. Because of changing certification procedures in New York State, it is not certain which programs will continue after 1976-1977.

**Fieldwork.** The fieldwork option permits students to receive academic credit for work experiences related to their major. A three-member faculty committee assesses the student's preparation for the project, arranges for ongoing supervision, and evaluates the outcome. Students on approved fieldwork projects pay Cornell tuition, often at a reduced level.

**Independent Study.** Students with interests that are not treated in regularly scheduled courses may devise their own courses. Independent study enables students to investigate such topics through reading and/or laboratory work in programs worked out with a professor.

**Student Initiated Courses.** Another way to accommodate one's interest in the College is through arranging student initiated courses. Information about these options is available at the Office of Special Programs, 159 Goldwin Smith Hall.

**In Absentia Study.** Some students may wish to enrich their programs by studying *in absentia*, either abroad or at an American institution which offers programs not available at Cornell. A request to study *in absentia* must have the support of the faculty adviser and the approval of each course by the appropriate chairperson. For information about *in absentia* procedures and fees, see the *College Guide*.

## Electives

Students must complete fifteen credits in courses offered outside the major department which are not used to satisfy other requirements.

## Residence

Candidates for the Bachelor of Arts degree normally spend eight terms in residence. However, students who have advanced placement credit or other additional Cornell credit can graduate in six or seven terms if their faculty adviser and major department chairperson approve their plan for acceleration. Students other than transfers are normally expected to earn at least ninety credits during regular terms at Cornell. Transfer students spend a minimum of three regular terms and one six-week summer session in residence at Cornell, earning at least sixty credits during those terms. For more information about acceleration, please see the *College Guide*.

**Double Registration Programs.** Programs which also involve accelerated study are the double registration programs. In these programs students who have completed 105 credits before their senior year, with at least 92 of those credits in Arts College courses, can, with the approval of the College and after acceptance by the second school, register simultaneously during their senior year in the College of Arts and Sciences and in either the Cornell Law School, the Cornell Medical College, or the State University of New York Upstate Medical Center in Syracuse. The students may then receive the Cornell A.B. degree at the end of the fourth year, and the J.D. or M.D. degree at the end of an additional two or three years respectively.

**Dual Degree Programs.** It is also possible to enter a five-year dual degree program with either the Department of Art in the College of Architecture, Art, and Planning at Cornell or the Cornell College of Engineering. Information about all these programs can be found in the *College Guide*.

**Leave of Absence.** Students in good standing who take a leave of absence by the end of the seventh week of the semester are welcome to return to the College upon request at least three weeks before the start of a semester. Five years is the maximum length of time students may be on leave and return without special permission. A conditional leave, which requires students to stay on leave for at least a year, is granted to students who are not in good standing or who, in unusual circumstances, are allowed to take a leave of absence after the seventh week of the term. For information about withdrawals, and about credit earned while on leave of absence, please see the *College Guide*.

## Credit

A total of 120 credits, with at least 100 of these credits earned in courses taught in the College of Arts and Sciences, must be completed to earn the Bachelor of Arts degree. Some courses taught in other colleges of the University, including those certified by the major adviser as part of a student's major program, may be counted toward the 100-credit requirement. Beginning in fall 1976, courses taken outside Cornell, during summers, or while on leave of absence, will not count as "Arts credit" unless approved as part of an *in absentia* plan or as part of the major requirement.

**Advanced Placement.** Advanced placement and advanced placement credit are available to entering students who have high scores in biology, chemistry, mathematics, modern languages, or physics, on either the CEEB Advanced Placement examinations or on departmental examinations given at Cornell during orientation week. The Departments of History and History of Art and some of the modern foreign literature departments honor the scores of the CEEB Advanced Placement tests but do not give departmental examinations. The Department of English offers no departmental exam but has its own criteria for determining advanced placement and credit: performance on the CEEB English Composition or Literature Achievement test, grades in high school English courses, and scores on the CEEB Advanced Placement examination, if available. Economics, psychology, and sociology award credit and placement for high scores on the College Level Examination Program (CLEP) examinations. The brochure, *Advanced Placement of Freshmen*, contains details and will be sent to all accepted freshmen in April. It is also available on request from the Office of Admissions, 410 Thurston Avenue.

All advanced placement and advanced placement credit are recommended by the individual departments. With few exceptions, the award of credit is not conditional upon further study of that subject at Cornell.

## Advising

To make the best use of college requirements and options, students need the advice and support of their faculty advisers. Faculty advisers, and student advisers as well, are assigned to new students before they come to Cornell. During orientation week, students meet with their advisers to plan their first term's program, and they continue to consult with them until they have been accepted into a major program.

After acceptance into a major program, students are assigned a major adviser with whom they make many of their most important decisions at Cornell. The adviser must approve the student's course of study and eventually certify the completion of the major. The major adviser should be consulted by the student about all academic plans including such aspects as acceleration and graduate study. The adviser's support is especially important when a student petitions for an exception to the requirements for the degree.

The Academic Advising Center, 134 Goldwin Smith Hall, serves as a resource center for faculty and student advisers and for students themselves, and welcomes all questions regarding the College. Through the advisers at the center and the faculty and student advisers, the College encourages its students to take maximum advantage of the many College programs and the University's diverse facilities.

## Courses of Study

### American Studies

R. H. Elias, chairman; M. J. Colacurcio, R. L. Moore, R. Polenber, F. Somkin, S. C. Strout.

The Cornell major in American studies is basically a program of coordinated study in history and literature, since the core faculty belong to the Department of History and the Department of English. It is not a "double major," but it does prescribe more credits than either history or English does. The prerequisites are minimal: one course in British or American literature at the 200 level and one course in British or American history at the 100 or 200 level. But the major itself is structured and demanding, and the student who expects to major in American studies should apply to the chairman of the committee as early as possible.

For the purposes of American studies, American history (including literary history) is divided into three periods: colonial, nineteenth century, and twentieth century. A student majoring in American studies ordinarily takes eight credits of work at the 300 level or above in each of two of these periods, and sixteen credits at the 300 level or above in the third period, the declared area of concentration. In addition, the student takes one of the specially designated interdisciplinary seminars at the 400 or 600 level. Any of the seminars not used to satisfy this four-credit requirement may, when appropriate, be taken to satisfy a period requirement. These thirty-six credits of work are to be divided between American history and American literature; they may be divided more or less equally, or they may be split into a division of a maximum of twenty-four credits in one department and twelve in the other.

Beyond the basic requirement of thirty-six credits in American history and American literature, twelve credits above the elementary level are required in allied subjects. Eight credits of work are in the history and/or literature of another (related) culture; and four credits are in American thought, society, or culture studied from the perspective of another discipline such as anthropology, economics, government, history of art, and sociology. (This last four-credit requirement may be satisfied outside the College.)

Candidates for honors must maintain an average of B-plus in courses pertinent to the major. To be eligible for a degree with honors in American studies a student must in the senior year (a) either write an honors essay for American Studies 493 (Honors Essay Tutorial) or submit to the American Studies Committee three term papers written for courses in the major, and (b) take an oral examination in the declared area of special interest.

The courses listed below will satisfy the thirty-two-credit requirement described in the second paragraph; a list of courses designated as interdisciplinary seminars can be secured from the chairman.

### American History

#### History

**311-312 The Structure of American Political History** J. H. Silbey.

**313-314 History of American Foreign Relations** W. LaFeber.

**[316 American Cultural and Intellectual History to 1820** F. Somkin. Not offered 1976-77.]

**317 American Cultural and Intellectual History: Thought and Feeling in the Nineteenth Century** F. Somkin.

**318 American Constitutional Development** M. B. Norton.

[**321 The Origins of American Civilization** M. G. Kammen. Not offered 1976-77.]

[**323-324 The American Indian in the American Experience** P. R. Metcalf. Not offered 1976-77.]

**325 Age of the American Revolution, 1763-1815** M. B. Norton.

**327-328 The American West** P. R. Metcalf.

[**330 The United States in the Middle Period, 1815-1850** J. H. Silbey. Not offered 1976-77.]

[**331 The American Civil War and Reconstruction** J. H. Silbey. Not offered 1976-77.]

[**323-333 The Urbanization of American Society** S. Blumin. Not offered 1976-77.]

**336 Survey of American Social History: Family, Community, Religion, Work, and Class, 1607-1860** S. Blumin.

**340-341 Recent American History, 1920 to the Present** R. Polenber.

**345 The Modernization of the American Mind** R. L. Moore.

**346 Major Themes in American Religious History** R. L. Moore

[**411 Undergraduate Seminar in American Political History** J. H. Silbey. Not offered 1976-77.]

**414 Motivations of American Foreign Policy** W. F. LaFeber.

**416 Undergraduate Seminar in American Cultural History** F. Somkin.

**418 Undergraduate Seminar in the History of the American South** J. H. Silbey.

[**419 Undergraduate Seminar in American Social History** S. Blumin. Not offered 1976-77.]

**423 Seminar in Native American Cultural History** P. R. Metcalf.

**424 Seminar in the History of Indian-White Relations** P. R. Metcalf.

[**426 Undergraduate Seminar in Early American History** M. B. Norton. Not offered in 1976-77.]

[**440 Undergraduate Seminar in Recent American History** R. Polenber. Not offered 1976-77.]

**445 Undergraduate Seminar: Deviance and Conformity in a Liberal Society** R. L. Moore.

## American Literature

### Africana Studies and Research Center

**340 Culture, Politics, and Black Writers** B. J. Parker.

**431 History of Afro-American Literature, 1619 to Present** R. P. Bell.

**432 Modern Afro-American Literature** B. J. Parker.

## English

**361 Early American Literature** M. J. Colacurcio.

**362 The American Renaissance** J. P. Bishop.

**363 The Age of Realism and Naturalism** R. H. Elias.

**364 American Literature in the Twentieth Century** W. J. Harris.

[**365 The Negro in American Literature.** Not offered 1976-77.]

**366 The Earlier American Novel: Brockden Brown to Henry James** D. E. McCall.

**367 The Modern American Novel** W. J. Slatoff.

**460 Studies in American Literature: Beat/Black Mountain Writers** W. J. Harris.

**462 American Poetry in the Nineteenth Century** R. Morgan.

**463 The Political Novel in America** S. C. Strout.

[**465 Black Literature** W. J. Harris. Not offered 1976-77.]

[**466 The International Theme in American Writing** S. C. Strout. Not offered 1976-77.]

[**467 Political Religion in America** S. C. Strout. Not offered 1976-77.]

**468 Seminar in American Culture: Literature and Technology** R. H. Elias.

[**469 Seminar in American Culture: The 1930s** R. H. Elias. Not offered 1976-77.]

[**661 The Puritan Tradition** M. J. Colacurcio. Not offered 1976-77.]

[**662 American Transcendentalism** M. J. Colacurcio. Not offered 1976-77.]

[**663 Twain, Howells, James, and the American Character** R. H. Elias. Not offered in 1976-77.]

[**664 American Naturalism: Howells to Dreiser** R. H. Elias. Not offered in 1976-77.]

**665 Topics in Twentieth Century American Literature** R. H. Elias.

[**666 Intellectual Origins of the Modern Consciousness in America** S. C. Strout. Not offered 1976-77.]

**668 Topics in Recent American Literature** A. M. Mizener.

**669 The James Family** S. C. Strout.

[**690 Studies in the Psychoanalytic Tradition in Literature and History** S. C. Strout. Not offered 1976-77.]

## Anthropology

R. J. Smith, chairman; R. Ascher, R. A. Borke, D. R. DeGlopper, V. R. Dyson-Hudson, D. J. Greenwood, J. S. Henderson, C. F. Hockett, K. A. R. Kennedy, A. T. Kirsch, B. Lambert, T. F. Lynch, J. V. Murra, J. T. Siegel.

Two majors are offered by the department: (1) a major in anthropology and (2) a major in social relations.

## Major in Anthropology

To fulfill requirements for a major in anthropology a student must take two of the following: Anthropology 101, 102, or 103 and an additional thirty-two credits chosen at the 200 level or above. Eight of these credits may be taken at a comparable level in related fields outside the department with the approval of the adviser.

The student's developing interests may lead to a concentration in the humanistic, social, or natural science aspects of anthropology, which as a broad field includes the subdivisions of archaeology, social anthropology, linguistics, psychological anthropology, and physical anthropology. The specific program of courses in the major and related subjects is designed by the student in consultation with the major adviser.

Students also are directed to pertinent course offerings in archaeology, biological sciences, and linguistics.

## Major in Social Relations

The major in social relations is described on p. 112.

## Human Biology Program

Human biology is a program of study offered by the Department of Anthropology in order to train students in a broad variety of subjects within the area of human biology. Such subjects include human evolution, ecology, genetics, behavior, anatomy, physiology, etc. The program is offered as a concentration to undergraduate students.

### Application

All inquiries about the concentration should be directed to the Department of Anthropology. Applicants will be assigned a biological anthropologist to serve as a temporary adviser with whom they may discuss their plans.

### Requirements

The requirements for the concentration in human biology are designed to ensure sufficient background in the physical sciences and mathematics to enable the student to pursue a wide range of interests in the area of modern biology. In the freshman year, two semesters of biology (Biological Sciences 101-103 and 102-104), two semesters of general chemistry (Chemistry 207-208), and two semesters of calculus (Mathematics 111-112, 111-122, or 107-108) will normally be completed. One lecture course in organic chemistry and one organic chemistry laboratory (Chemistry 253-251, or 357-358 and 301 or 251), a course in genetics (Biological Sciences 281), and a course in biochemistry (Biological Sciences 431 or 531-532) are requirements which can be completed by the middle of the sophomore year. Two semesters of physics (Physics 101-102 or 207-208) are required and should be completed early in the student's program.

The concentration in human biology requires a total of fourteen credits selected from the following: Anthropology 101, 102, 204, 221, 275, 372, 373, 374, 471, 472, and Biological Sciences 273, 361, and 476 (Section of Ecology, Evolution, and Systematics). Biological science courses included in the concentration requirement may not be used simultaneously to fulfill the breadth requirement.

Breadth requirements, designed to ensure that the student in human biology is familiar with areas of biology outside the concentration, specify that each student must pass a course in two of the following categories: (1) developmental biology (Biological Sciences 347); (2) ecology and evolution (Biological Sciences 361, 476); (3) geology (Geological

Sciences 101); (4) microbiology (Microbiology 290A); (5) morphology (Biological Sciences 311, 313, 316, 345); (6) neurobiology and behavior (Biological Sciences 321, 421); (7) physical sciences and mathematics (Chemistry 287, 289, 300; Mathematics 214, 215, 216, 218, 221; Statistics 510); (8) physiology (Biological Sciences 242 or 340, 410, 414); (9) taxonomy (Biological Sciences 273, 316, 344, 371; Entomology 212; Plant Pathology 309).

### Facilities

Cornell has a modern physical anthropology laboratory with a collection of osteological and fossil cast materials. Facilities for serology, anthropometry, primate dissection, and work physiology studies are available. Calculators and a statistical and reference library are maintained in the laboratory as well as drafting and photographic equipment.

### Special Programs

Specialized individual study programs are offered in Anthropology 497-498 (Topics in Anthropology), open to a limited number of juniors and seniors. Consent of the instructor is required.

The Department of Anthropology holds colloquia throughout the academic year. Faculty from Cornell and other universities participate in discussion of current research and problems in anthropology. Students are encouraged to attend.

### The Honors Program

Students of anthropology who are interested in the honors program should talk with Professor Ascher in the fall term of their junior year. Those admitted are advised to take the Senior Seminar (see Anthropology 391) in the fall term. Candidates for the degree of Bachelor of Arts with honors in anthropology must, in addition, complete a thesis in the spring term (see Anthropology 492). The decision to award honors and in what degree is based on the quality of the thesis and the student's overall record.

### Distribution Requirement

The distribution requirement in social sciences can be met by any two courses in the Department of Anthropology, or by Archaeology 100 and any anthropology course listed under Archaeology (see p. 50). Courses cross-listed from other departments do not satisfy the distribution requirement.

### Introduction to Archaeology (Archaeology 100)

**101-102 Nature, Culture, and Human History: An Introduction to Anthropology** 101 fall; 102 spring. 4 credits per term. An integrated two-semester course; 101 is prerequisite to 102.

M W F 11:15. C. F. Hockett.  
Anthropology is the study of human diversity and human origins, in cultural and biological perspective. In the fall term the approach is descriptive: What are the norms and extremes of ways of life of human communities? What is the human common denominator? What are the key differences between human and nonhuman? In the spring term the orientation is historical, beginning with Earth before man and tracing the origin of our species and the main contours of the human adventure down to the present.

### Introduction to the Scientific Study of Language (Linguistics 101-102)

**103 Introduction to Cultural Anthropology** Spring. 4 credits.

M W F 1:25. A. T. Kirsch.  
This course will develop a cultural evolutionary perspective on history, focusing particularly on the

role of religious values, ideas, and institutions in shaping the diversity of the political, economic, and kinship dimensions of human life.

**[108 Man's Place in Nature** Spring. 3 credits. Not offered 1976-77.]

**[109 Classics in Social Theory** Fall. 3 credits. Not offered 1976-77.]

**[143 China in Western Eyes: 1300-1976** Spring. 3 credits. Not offered 1976-77.]

**[150 The Discovery of America** Fall. 3 credits. Not offered 1976-77.]

### Subsistence Agriculture in Transition (Rural Sociology 157, College of Agriculture and Life Sciences)

**201 Social Anthropology** Fall. 4 credits. M W F 10:10. Staff.

Intended primarily for those not majoring in anthropology, the course will focus on the intellectual and cognitive problems of understanding alien cultures. Several attempted solutions to the basic problem will be examined.

**[202 Language and Culture** Fall. 4 credits. Not offered 1976-77.]

**[203 Prehistoric Archaeology** Spring. 4 credits. Not offered 1976-77.]

**204 Biological Anthropology** Spring. 4 credits. M W F 2:30. R. Dyson-Hudson.

Human origin, evolution, and present-day biological variability are examined from an adaptive perspective. Half of the course examines contemporary diversity within the human species utilizing an ecological and microevolutionary approach. Half of the course is concerned with infrahuman primate and hominid evolution.

**221 Human Biology** Spring. 3 credits. M W F 10:10. R. Dyson-Hudson.

A survey of important biological characteristics of the human species, with emphasis on evolution, anatomy, growth and development, and variation. The differences and similarities of humans and other animal species, and the functional relationships of human organs and organ systems in both contemporary and evolutionary contexts will be emphasized. The effects of natural selection and environmental factors on human variation will be discussed.

**224 Folklore** Spring. 4 credits. M W F 1:25. Staff.

An investigation of popular, orally transmitted lore (stories, anecdotes, jokes, etc.) in several cultures including our own, with particular emphasis on the collection of such folklore and on its analysis as a symbolic system.

**[230 Ethnology of Native North America** Spring. 4 credits. Not offered 1976-77.]

### Ancient Seafaring (Archaeology 275)

### Individual Study in Archaeology and Related Fields (Archaeology 300)

**305 Psychological Anthropology** Fall. 4 credits. T Th 8-9:55. Staff.

A consideration of problems selected to illustrate the mutual relevance of psychology and anthropology, and the interrelations of culture and personality.

### Archaeology of the Ancient Near East (Archaeology 310)

**313 Urban Anthropology** Spring. 4 credits. M W F 9:05. R. J. Smith.

An examination of sociocultural structure and process in urban settings, with emphasis on the role of rural migrants, the relationship of urbanism to political and economic development, the role of voluntary associations, and the adjustment of family and kinship groups to urban life. Emphasis on Asian, African, and Latin American urban centers.

**314 Applied Anthropology (also Rural Sociology 355)** Spring. 4 credits.

T Th M. L. Barnett.  
What anthropology knows or suspects about some general processes of cultural change; the application of these insights to practical and ethical problems faced in the planning, conduct, and evaluation of programs of intervention and change.

**[316 Human Biology for Performing Arts (also Theatre Arts 316)** Fall. 5 credits. Not offered 1976-77.]

**318 Oral Tradition and Written Sources in Ethnology and Archaeology** Fall. 4 credits.

M W F 9:05. J. V. Murra.  
Recent developments in ethnohistory of Andean, African, and Mesoamerican civilizations. Dynastic vs. popular oral traditions and how to evaluate them. Accounts by alien eyewitnesses. Materials tested against concepts derived from field anthropology: status lineages, rights-in-land, settlement pattern, structural time, and ethnogenesis.

**320 Art and Culture** Spring. 4 credits. M W F 2:30. Staff.

A comparative study of the arts of primitive and peasant peoples, with emphasis on the visual arts. Lectures will focus upon the contemporary native cultures of Africa, Oceania, and Latin America, and the impact of Westernization upon the traditional arts.

**321 The Anthropology of Women (also Women's Studies 321)** Fall. 4 credits.

M W F 12:20. R. A. Borker.  
Explores insights anthropology can provide for the study of women. Focus on a number of problems regarding aspects of women's position in society and culture and the ways in which these problems can be approached.

**322 Comparative Religious Systems** Spring. 4 credits.

M W F 1:25. R. A. Borker.  
A survey of anthropological perspectives on religion and associated phenomena.

**323 Kinship and Social Organizations** Fall. 4 credits.

M W F 11:15. B. Lambert.  
The development of kinship studies, analysis of the family, and unilineal and bilateral systems of kinship and marriage. The study of kinship terminology; kinship in small-scale and complex societies; political, economic, and religious aspects of kinship organization.

**326 Economic Anthropology** Spring. 4 credits. M W F 9:05. D. J. Greenwood.

Comparison of capitalist and noncapitalist economies and analysis of the cultural foundations of Western economic concepts.

**[329 Politics and Culture** Fall. 4 credits. Not offered 1976-77.]

**[332 Ethnology of South America** Fall. 4 credits. Not offered 1976-77.]

**333 Ethnology of the Andean Region** Fall. 4 credits.

M W F 2:30. J. V. Murra.  
Cultural continuities in the development of Andean societies. The ecological, archaeological, ethnohistorical and contemporary ethnological record. The Andean heritage as a resource for "modernization."

- 334 Ethnology of Island Southeast Asia** Spring. 4 credits.  
T 10:10–12:05, Th 11:15–12:05. J. T. Siegel.  
Peoples and cultures of Indonesia and the Philippines will be discussed focusing on kinship, politics, and language and cultures.
- 335 Ethnology of Mainland Southeast Asia** Fall. 4 credits.  
T 2:30–4:25, 1 disc, hour to be arranged. A. T. Kirsch.  
A survey of the peoples and cultures of mainland Southeast Asia from prehistoric to contemporary times.
- [336 Ethnology of Oceania** Fall. 4 credits. Not offered 1976–77.]
- [337 Ethnology of the Near East** Spring. 4 credits. Not offered 1976–77.]
- [338 Ethnology of Africa** Spring. 4 credits. Not offered 1976–77.]
- [341 Culture and Society in South Asia** Fall. 4 credits. Not offered 1976–77.]
- 343 Traditional Chinese Society and Culture** Fall. 4 credits.  
M W F 1:25. D. R. DeGlopper.  
Chinese society in the nineteenth and early twentieth centuries is considered as a complex, premodern society. Major topics include family and kinship; villages and their integration into local systems; voluntary and formal organizations; social stratification and mobility; and religion, ideology, and values.
- 344 Modern Chinese Society** Spring. 4 credits.  
Prerequisite: Anthro 343 or permission of instructor.  
M W F 11:15. D. R. DeGlopper.  
The culture is on changes in Chinese society and culture among the Overseas Chinese, in Hong Kong and Taiwan, and in mainland China.
- 345 Japanese Culture and Society** Fall. 4 credits.  
M W F 9:05. R. J. Smith.  
A survey of the social structure of Japan and a discussion of trends in urban and rural life during the past century. Topics to be emphasized include the family, ancestor worship, community and social organization, and urbanism and modernization.
- 347 Peasant Cultures** Fall. 4 credits.  
M W F 10:10. D. R. DeGlopper.  
Anthropological approaches to the study of complex, premodern, or peasant societies. The economic, cultural, and social life of peasants; local systems and their integration with larger political and cultural units; change, development, modernization, and revolution.
- 348 Iberian Culture and Society** Spring. 4 credits.  
M W F 11:15. D. J. Greenwood.  
A topical survey of the anthropology of Spain: municipal and regional social structures; customary and national law; ethnicity and regionalism. Attention is given to Catholicism, folk religion, witchcraft, the Inquisition, cryptojudaism, rural exodus, and international tourism.
- 350 The Earliest Civilizations** Fall. 4 credits.  
T Th 10:10. J. S. Henderson.  
Archaeological approaches to non-Western civilizations. A survey of the beginnings of civilization in Mesopotamia, Egypt, India, and China, and the emergence of complex societies in the New World. The problems of defining and recognizing civilizations archaeologically and explaining their emergence will be discussed.

**[354 Archaeology of the Americas I** Fall. 4 credits. Not offered 1976–77.]

- 355 Archaeology of the Americas II** Spring. 4 credits.  
M W F 10:10. J. S. Henderson.  
A consideration of the origins, development, and spread of the native civilizations of North and South America. Prehistoric cultural developments in Mesoamerica and the Andes from the emergence of settled village life to the European discovery of the New World will be emphasized.
- 356 Mesoamerican Thought and Culture** Fall. 4 credits.  
T 12:20–2:15. J. S. Henderson.  
A consideration of the aspects of Mesoamerican culture revealed in pre-Columbian painted books—especially religion, astrology, and concepts of time and space. Historical and ethnohistorical sources will also be discussed.
- 358 Archaeological Research Methods (also Archaeology 358)** Fall. 4 credits.  
Hours to be arranged. T. F. Lynch.  
Techniques of archaeological survey, excavation, and analysis and their theoretical foundations. A wide variety of methods and problems will be considered, with emphasis on situations encountered in South America.
- 361 Field Archaeology in South America (also Archaeology 361)** Fall. 10 credits.  
Hours to be arranged. T. F. Lynch.  
Participation in archaeological survey excavation, and laboratory work in Northern Chile. This practical training session is part of a collaborative program with the Universidad del Norte. Research will focus on the reconstruction of prehistoric seasonal migration patterns and early subsistence systems. Training in diverse archaeological field methods will be emphasized, as students take part in various aspects of a regional research project.
- 373 Physical Anthropology of the Living** Fall. 4 credits.  
Hours to be arranged. Staff.  
A survey of the biological histories of human populations from the evidence of their prehistoric skeletal records and their contemporary genetic, immunological, and physiological adaptive features. The traditional concept of race is examined in the light of modern approaches to the study of human biology.
- 374 Human Palaeontology** Fall. 4 credits.  
Hours to be arranged. Staff.  
A broad survey of the fossil evidence for human evolution with special attention to skeletal-dental anatomy, geological contexts, palaeoecology, dating methods, archaeological associations, and current theories of primate phylogeny.
- 375 Ecology and Human Adaptation** Fall. 4 credits.  
T Th 8–9:55. R. Dyson-Hudson.  
An analysis of human interactions with the physical, biological, and social environment, based on the principles of general ecology. Changes over time in human interactions with the environment will be discussed, as well as differences in adaptive strategies of contemporary human groups living in similar and different environments.
- Theories of Personality (Sociology 385)**
- 391 Senior Seminar** Fall. 4 credits. Limited to anthropology majors in their senior year. Strongly recommended for students planning to take honors.  
T 2:30–4:25. R. Ascher with the anthropology faculty.  
An in-depth examination of about twelve topics of interest to students and faculty members representing different approaches to anthropology.
- 405 Analysis and Care of Artifacts** Fall. 4 credits. Prerequisite: permission of instructor.  
Th 12:20–2:15. E. Herscher.

A practical course in the classification, care, and analysis of artifacts and ethnographic materials. Students will become familiar with a broad range of field and laboratory techniques and their applications. A project dealing with departmental collections will be required.

- 412 Contemporary Anthropological Theory** Spring. 4 credits.  
M W F 10:10. B. Lambert.  
A survey of the assumptions social anthropologists make concerning the nature of society and culture, and the explanations they have proposed for regularities in social behavior, values, and belief systems. Among the approaches considered are processual analysis, the use of the concept of transaction, the historical method, ethnohistory, and structuralism.
- [413 The History of Anthropology in the United States** Fall. 4 credits. Not offered 1976–77.]
- [414 Anthropology and History** Fall. 4 credits. Not offered 1976–77.]
- 415 Classic Ethnographies** Spring. 4 credits.  
Enrollment limited to undergraduate majors and graduate students in the Department of Anthropology.  
T 2:30–4:25. D. R. DeGlopper.  
The reading and reanalysis of some major ethnographies.
- Pre-Columbian Art and Archaeology (History of Art 415)**
- 416 Explorations in General Anthropology** Fall. 4 credits.  
T 10:10–12:05. D. J. Greenwood.  
Recent major works aimed at a synthesis of biological, historical, evolutionary, and cultural approaches to the study of *Homo sapiens* are evaluated.
- 417 Social Thought and Social Studies** Fall. 4 credits.  
Hours to be arranged. Staff.  
Notions of self and sign in anthropological thought will be the topics discussed. The course will focus on Saussure, Lévi-Strauss, Mauss, and their critics.
- 420 Development of Anthropological Thought** Fall. 4 credits. Prerequisites: Intended for, but not restricted to, junior and senior anthropology majors. Assumes general familiarity with various facets of anthropology.  
T Th 11:15–12:05; 1 disc, hour to be arranged.  
A. T. Kirsch.  
Developing a paradigmatic perspective, this course will survey continuities and changes in anthropological theory and method from the mid-nineteenth century to the present.
- 422 Special Problems in the Anthropology of Women (also Women's Studies 422)** Spring. 4 credits.  
Th 2:30–4:25. R. A. Borker.  
Each year this seminar will focus on a particular area of concern within the anthropology of women, building upon the work done in Anthropology/Women's Studies 321. The basic orientation of the course will be research and exploration.
- 424 Myth, Ritual, and Symbol** Fall. 4 credits.  
M W F 1:25. B. Lambert.  
This course is concerned with the nature of consciousness of those peoples usually studied by anthropologists. The starting point is the analysis of ritual, especially rites of passage, and of conceptions of time. Topics such as myth, curing rites, and millenarianism will be considered in the light of various interpretations.

**426 The Ethnography of Communication** Fall 4 credits.

T 2:30-4:25 R. A. Borker.

Course will focus on recent work attempting to place communication within a social and cultural context and the relevance of this work for social anthropological research. Cultural, social, and aesthetic approaches to communicative performance will be considered.

**[432 Indians of Mexico and Central America** Spring, 4 credits. Not offered 1976-77.]**[437 Islam and Islamic Societies** Spring, 4 credits. Not offered 1976-77.]**[448 The Anthropology of the Nation State** Fall, 4 credits. Not offered 1976-77.]**[451 Anthropological Boundaries** Fall, 4 credits. Not offered 1976-77.]**452 Portraits, Profiles, and Life Histories**

Spring, 4 credits. S-U grades strongly recommended. Enrollment by permission and limited to 20 students.

T 2:30-4:25 R. Ascher.

The goal is the *creation*, by each student, of a portrait or life history of one person. Freedom is granted in the form of recording and presentation. As a point of departure, a study is made of books such as *Ishi*, films such as *Betty*, and portraits by Giacometti and Arbus.

**453 Constructions and Visualizations** Spring, 4 credits. S-U grades only. A work plan by one person or a few people planning to work together must be submitted before the start of the term.

Graduate students interested in this approach should consider Anthro 653.

Th 2:30-4:25 R. Ascher.

This course is composed of projects initiated by students. The projects must be attempts to develop anthropological ideas through three-dimensional constructions, sound tapes, dance, drawings, photographs, model building, or other essentially nonwritten forms. Examples are a sculpture about kinship and a photographic essay about myth in America.

**[471 Laboratory and Field Methods in Biological Anthropology I** Fall, 5 credits. Not offered 1976-77.]**[472 Laboratory and Field Methods in Biological Anthropology II** Spring, 5 credits. Not offered 1976-77.]**475 Physical Anthropology: History and Theory** Spring, 4 credits.

Hours to be arranged. Staff.

A survey of the historical background of present-day concepts of man's evolutionary variations and adaptations in space and time. The formation of biological anthropology as an area of scientific inquiry within the social sciences.

**476 Human Behavior in Anthropological Perspective** Fall, 4 credits.

T Th 2:30-4:25 R. Dyson-Hudson.

An attempt to look at human social behavior as possible adaptive responses to past and present environments. General categories of behavior discussed will include aggression, territoriality, dominance and hierarchy, bonding, and sex-role differences.

**492 Honors Thesis** Spring, 4 credits.

Prerequisites: admission to the honors program; Anthro 391 is strongly recommended.

Hours to be arranged. R. Ascher with the anthropology faculty.

Independent work under the close guidance of a faculty member selected by the student. The topic and work plan must be mutually agreed upon before the start of the spring term. The thesis is read by at

least one member of the faculty in addition to the thesis adviser. To allow time for criticism and revision, a good first draft must be completed by April 1.

**494 Seminars in Archaeology: The Maya** Spring, 4 credits

T 2:30-4:25 J. S. Henderson.

A consideration of the problem of reconstructing the history of Maya culture and the varieties of evidence that must be used: archaeological, ethnohistorical, ethnographic, and linguistic.

**495 Social Relations Seminar (also Sociology**

497) Spring, 4 credits. Open only to seniors majoring in social relations.

Hours to be arranged. Staff.

**497-498 Topics in Anthropology** 497 fall; 498

spring. Credit to be arranged. Prerequisites: permission of instructor.

Hours to be arranged. Staff.

**Graduate Seminars**

600-level courses are open to undergraduates who have fulfilled the prerequisites or by consent of the instructor.

**Southeast Asia Seminar: Burma (Asian Studies 601)****Southeast Asia Seminar: Philippines (Asian Studies 602)****[602 The Design of Field Research** Spring, 4 credits. Not offered 1976-77.]**Social Change in Community and Region (Rural Sociology 606, College of Agriculture and Life Sciences)****607-608 Special Problems in Anthropology**

607 fall; 608 spring. Credit to be arranged.

Hours to be arranged. Staff.

**[610 The Anthropological Study of Art** Spring, 4 credits. Not offered 1976-77.]**[612 History of Anthropological Thought**

Spring, 4 credits. Not offered 1976-77.]

**613 Contemporary Anthropological Theory** Fall, 4 credits.

Th 2:30-4:25 J. T. Siegel.

Readings from the work of Freud.

**619 Anthropological Approaches to the Study of Buddhism in Asia** Spring, 4 credits.

Hours to be arranged. A. T. Kirsch.

The seminar deals with Buddhism in southeast Asia, as it has been studied by anthropologists and other social scientists.

**[620 Ethnolinguistics** Spring, 4 credits. Not offered 1976-77.]**626 Problems in Economic Anthropology** Fall, 4 credits. Prerequisite: Anthro 326.

Th 10:10-12:05 D. J. Greenwood.

A seminar dealing in the historical sources of disputes in economic anthropology; analysis of major recent case studies; and the assessment of approaches to economic problems being developed in other fields (such as "total" history or "social exchange" theory).

**628 Political Anthropology: Culture and Revolution in Indonesia (also Government 647)** Spring, 4 credits.

Th 2:30-4:25 J. T. Siegel, B. R. O'G. Anderson.

The seminar will be devoted to the analysis of literary and other texts produced during the Indonesian Revolution, with particular emphasis on the work of

Pramudya Ananta Tur. Reading knowledge of Indonesian required.

**[632 Tribal Peoples of Lowland South America** Spring, 4 credits. Not offered 1976-77.]**633 Andean Research** Fall, 4 credits.

Hours to be arranged. J. V. Murra.

**634-635 Southeast Asia: Readings in Special Problems** 634, fall; 635, spring. Credit to be arranged. 634 not prerequisite to 635.

Hours to be arranged. M. L. Barnett, A. T. Kirsch, L. Sharp, J. T. Siegel.

**[640 South Asia** Spring, 4 credits. Not offered 1976-77.]**[648 Comparative Study of Complex Societies** Spring, 4 credits. Not offered 1976-77.]**[651 Anthropological Boundaries: Graduate** Spring, 4 credits. Not offered 1976-77.]**653 Constructions and Visualizations:**

**Graduate** Fall, 4 credits. S-U grades recommended. Undergraduates admitted by permission.

Th 2:30-3:45 R. Ascher.

The question is: How to build a time capsule? The first half of the term is devoted to design; the second half to construction. Engineers, design majors, artists, and people in similar fields are most welcome.

**[664 Problems in Archaeology: Europe** Spring, 4 credits. Not offered 1976-77.]**[666 The Discovery of America** Spring, 4 credits. Not offered 1976-77.]**[667 Origins of Mesoamerican Civilization** Fall, 4 credits. Not offered in 1976-77.]**Architecture in its Cultural Context (Architecture 667-668)****[677 Seminar in Ecological Anthropology: Food Production and Social Organization** Spring, 4 credits. Not offered 1976-77.]**[698-699 The Teaching of Anthropology** 698 fall; 699 spring, 2 credits. Not offered 1976-77.]**Macrosocial Accounting (Rural Sociology 715, College of Agriculture and Life Sciences)****Peasants, Water, and Development (Rural Sociology 754, College of Agriculture and Life Sciences)****901-902 Field Research** 901, fall; 902, spring. Credit to be arranged.

Hours to be arranged. Staff.

**Archaeology**

T. F. Lynch (anthropology) and A. Ramage (history of art), codirectors; A. L. Bloom (geological sciences), J. E. Coleman (Classics), W. W. Cummer (architecture), R. T. Farrell (English), J. S. Henderson (anthropology), E. Herscher (archaeology), S. W. Jacobs (architecture), J. V. Murra (anthropology), G. W. Olson (soil sciences), D. I. Owen (Semitics), I. Rabinowitz (biblical and Hebrew studies), J. F. Scott (history of art).

Archaeology at Cornell is an interdisciplinary subject. The major draws upon the teaching and research interests of faculty from many departments in order to present a broad view of the archaeological process. Hence, a student interested in the archaeology major should discuss his or her course of study with a participating faculty member as early as possible. In some areas of specialization, intensive language

training should be coordinated with other studies as early as the freshman year.

As prerequisites to the major a student must complete Archaeology 100 and another introductory archaeology course with grades of C or better.

Once admitted to the major, the student must take an additional thirty credits in courses from the archaeology list, chosen in consultation with the major adviser. These courses should provide exposure to a broad range of archaeologically known cultures and the methods of revealing and interpreting them. They must be distributed as follows:

- A) At least 20 of the credits at the 300 level or above.  
 B) At least 6 credits in each of the categories below:
- 1) Theory and interdisciplinary approaches
  - 2) Old World archaeology
  - 3) New World archaeology

Beyond these 30 credits, a student must elect at least 6 credits in related subjects outside the major, such as computer science, statistics, ethnology and history of appropriate areas, draftsmanship, photography, surveying and map-making, interpretation of aerial photographs, paleography, and epigraphy.

Finally, every student should gain some practical experience in archaeological fieldwork on a project authorized by his or her adviser. This requirement may be waived in exceptional circumstances. The Jacob and Hedwig Hirsch bequest provides support for a limited number of students to work at excavations sponsored by Cornell and other approved institutions.

Only students in other Cornell schools and colleges may elect a concentration in archaeology; they are eligible for Hirsch scholarships in support of fieldwork. To concentrate in archaeology, the student must complete Archaeology 100 with a grade of C or better and at least four advanced courses in archaeology distributed among the three groups stipulated in (B) above.

## Distribution Requirement

The distribution requirement can be satisfied in the social sciences, humanities, or expressive arts by taking Archaeology 100 and a second archaeological course chosen from the College of Arts and Sciences courses listed below. Specifically the distribution requirement in the social sciences can be fulfilled with Archaeology 100 and any one of the following: Anthropology 150, 203, 318, 333, 350, 354, 355, 356, 493, 494, 664, 666, or 667; in the humanities with Archaeology 100 and any one of the following: Archaeology 275, Classics 220, 221, 320, 629, or 630; Semitics 243, 244, 282, 330, or 345; and in the expressive arts with Archaeology 100 and any one of the following: History of Art 210, 220, 315, 316, 320, 322, 323, 324, 325, 415, 431, or 488.

**100 Introduction to Archaeology** Spring, 3 credits.

M 4:15, W F 1:25. E. Herscher.

An introduction to the history, aims, techniques, and problems of archaeology around the world. The interrelation and mutual contributions of both humanistic and scientific aspects will be emphasized. Guest lectures will help illustrate the variety of archaeological methods, sites, and discoveries.

**300 Individual Study in Archaeology and Related Fields** Fall or spring. Credit to be arranged. Prerequisites: Archaeology 100 and permission of instructor.

Hours to be arranged. Staff.

With the guidance of a faculty member, students pursue topics of particular interest.

## Theory and Interdisciplinary Approaches

**Earth Science (Geological Sciences 103)**

**Earth Science Laboratory (Geological Sciences 105)**

**[Introduction to Art History: Beginnings of Civilization (History of Art 210)** Not offered 1976-77.]

**[301 Archaeological Ceramics** Not offered 1976-77.]

**Oral Tradition and Written Sources in Ethnology and Archaeology (Anthropology 318)**

**Geomorphology (Geological Science 345)**

**The Earliest Civilizations (Anthropology 350)**

**Analysis and Care of Artifacts (Anthropology 405)**

**[Ceramics (History of Art 423)** Not offered in 1976-77.]

**Numismatics (History of Art 424)**

**[Contemporary Archaeological Theory (Anthropology 464)** Not offered 1976-77.]

**Use of Soil Information and Maps as Resource Inventories (Agronomy 506)**

**Architectural Problems in Archaeological Fieldwork (Architecture 540, College of Architecture, Art, and Planning)**

**Surveying for Archaeologists (Architecture 541, College of Architecture, Art, and Planning)**

**Design and Conservation (Architecture 545, College of Architecture, Art, and Planning)**

**Documentation for Preservation Planning (Architecture 546, College of Architecture, Art, and Planning)**

**Glacial and Quaternary Geology (Geological Science 642)**

**[Problems in Archaeology: Agricultural Origins (Anthropology 664)** Not offered 1976-77.]

**Justification for Studies in the Caedmon Manuscript (English 715)**

## Old World Archaeology

**Prehistorical Archaeology (Anthropology 203)**

**Introduction to Art History: The Classical World (History of Art 220 and Classics 220)**

**Minoan-Mycenaean Art and Archaeology (Classics 221)**

**History of Ancient Israel: From Earliest Times to the Babylonian Exile (Semitics 243)**

**History of Ancient Israel: From the Babylonian Exile Through the Fall of Masada and the Bar Kochba Rebellion (Semitics 244)**

**History of Preindustrial Building (Architecture 244, College of Architecture, Art, and Planning)**

**275 Ancient Seafaring** Fall, 3 credits.

M W F 11:15. E. Herscher.

Nautical technology within the context of ancient Mediterranean and Near Eastern societies. Archaeological and literary evidence will be utilized to

trace the development of ships and navigational methods and to explore its historical and cultural ramifications. The themes of sea power, ethnic interchange, trade, and exploration will be emphasized.

**[Ancient Near Eastern Literature (Semitics 282)** Not offered 1976-77.]

**310 Archaeology of the Ancient Near East** Spring, 4 credits. Prerequisite: Archaeology 100 or permission of instructor.

T Th 12:20-1:35. E. Herscher.

Ancient civilizations between the Indus and the Mediterranean, from the first stone tool to the palace at Persepolis. Sumerian, Assyrian, Babylonian, Israelite, Phoenician, and Persian remains in terms of indigenous developments and cross-cultural contacts. Emphasis upon the artifacts of daily life.

**Art of the Ancient Near East (History of Art 316)**

**The Archaeology of Classical Greece (Classics 320 and History of Art 320)**

**[Arts of the Roman Empire (History of Art 323)** Not offered 1976-77.]

**[Painting in the Greek and Roman World (History of Art 323)** Not offered 1976-77.]

**[Architecture in the Greek and Roman World (History of Art 324)** Not offered 1976-77.]

**Greek Vase Painting (History of Art 325)**

**The Literature of Ancient Israel (Semitics 330 and Comparative Literature 323)**

**The Architecture of the Ancient Near East (Architecture 340, College of Architecture, Art, and Planning)**

**The Architecture of the Classical World (Architecture 341, College of Architecture, Art, and Planning)**

**[Age of the Patriarchs (Semitics 344)** Not offered 1976-77.]

**History of the Ancient Near East in Biblical Times (Semitics 345)**

**[Problems in Minoan and Mycenaean Archaeology (Classics 629)** Not offered 1976-77.]

**Seminar in Classical Greek Archaeology (Classics 630)**

**Seminar in Minoan-Mycenaean Architecture (Architecture 640, College of Architecture, Art, and Planning)**

**Seminar in Roman Architecture (Architecture 641, College of Architecture, Art, and Planning)**

**[Problems in Archaeology: Europe (Anthropology 664)** Not offered 1976-77.]

## New World Archaeology

**[The Discovery of America (Anthropology 150)** Not offered 1976-77.]

**Pre-Columbian Art (History of Art 315)**

**Ethnology of the Andean Area (Anthropology 333)**

**[Archaeology of the Americas I (Anthropology 354)** Not offered 1976-77.]

**Archaeology of the Americas II (Anthropology 355)**

**Mesoamerican Thought and Culture (Anthropology 356)****358 Archaeological Research Methods (also Anthropology 358)** Fall, 4 credits.

Hours to be arranged. T. Lynch.  
Techniques of archaeological survey, excavation, and analysis and their theoretical foundations. A wide variety of methods and problems will be considered, with emphasis on situations encountered in South America.

**361 Field Archaeology in South America (also Anthropology 361)** Fall, 10 credits.

Hours to be arranged. T. Lynch.  
Participation in archaeological survey, excavation, and laboratory work in Northern Chile. This practical training session is part of a collaborative program with the Universidad del Norte. Research will focus on the reconstruction of prehistoric seasonal migration patterns and early subsistence systems. Training in diverse archaeological field methods will be emphasized, as students take part in various aspects of a regional research project.

**[Seminar in Pre-Columbian Art and Archaeology (History of Art 415)** Not offered in 1976-77.]**Seminar in Archaeology: The Maya (Anthropology 494)****[The Discovery of America (Anthropology 666)** Not offered 1976-77.]**[Origins of Mesoamerican Civilization (Anthropology 667)** Not offered 1976-77.]**Related Courses for Archaeology Majors****Art and Culture (Anthropology 320)****Ethnology of South America (Anthropology 332)** Not offered 1976-77.]**[Ethnology of Oceania (Anthropology 336)** Not offered 1976-77.]**[Culture and Society in South Asia (Anthropology 341)** Not offered 1976-77.]**Human Paleontology (Anthropology 374)****Indians of Mexico and Central America (Anthropology 432)****[Laboratory and Field Methods in Biological Anthropology (Anthropology 471)** Not offered 1976-77.]**[Palaeoanthropology: South Asia (Anthropology 678)** Not offered 1976-77.]**[Introduction to Asian Civilizations (History 190)** Not offered 1976-77.]**Latin American History to 1825 (History 210)****Classical Antiquity (History 261-262)****[American Indian History (History 323-324)** Not offered 1976-77.]**History of China up to Modern Times (History 393)****Southeast Asian History to the Fourteenth Century (History 395)****Seminar on Interpretation of Coin Finds (Society for the Humanities 414)****Seminar in Native American Cultural History (History 423)****Seminar in the History of Indian-White Relations (History 424)****[The Roman Revolution (History 461)** Not offered 1976-77.]**[Early Imperial Rome (History 462)** Not offered 1976-77.]**Classical Greece: 510-404 B. C. (History 463); 404-338 B. C. (History 464)****Science in Classical Antiquity (History 481-482)****Seminar in Ancient Classical History (History 661-662)****[Economic History of Ancient and Medieval Europe (Economics 321)** Not offered 1976-77.]**Introduction to Art History: Asian Traditions (History of Art 280)****The Arts of Early China (History of Art 383)****[Studies in Indian and Southeast Asian Art (History of Art 386)** Not offered in 1976-77.]**[Traditional Arts in Southeast Asia (History of Art 488)** Not offered in 1976-77.]**Greek Civilization (Classics 211)****Roman Civilization (Classics 212)****[Greek Mythology (Classics 236 and Comparative Literature 236)** Not offered 1976-77.]**[Women in Classical Antiquity (Classics 363)** Not offered 1976-77.]**Seminar on Coded Communications (Comparative Literature 423)****Readings in the New Testament (Comparative Literature 429)****The Literature of Ancient Israel (Semitics 330)****Introduction to the Scientific Study of Language (Linguistics 101-102)****Comparative Methodology (Linguistics 404)****Comparative Indo-European Linguistics (Linguistics 631-632)****Introductory Geological Science (Geological Sciences 101)****Introduction to Historical Geology (Geological Sciences 102)****Structural Geology and Sedimentation (Geological Sciences 325)****Historical Geology and Stratigraphy (Geological Sciences 376)****Nature and Properties of Soils (Agronomy 200)****Identification, Appraisal, and Geography of Soils (Agronomy 301)****Geography and Appraisal of Soils of the Tropics (Agronomy 401)****[Soil Clay Mineralogy (Agronomy 405)** Not offered 1976-77.]**Morphology, Genesis, and Classification of Soils (Agronomy 603)****[Plants and Time (Biological Sciences 448)** Not offered 1976-77.]**Engineering Surveying and Evaluation (Civil and Environmental Engineering A380)****Photogrammetry (Civil and Environmental Engineering A661)****Advanced Physical Environment Evaluation (Civil and Environmental Engineering A686)****Analyses and Interpretation of Aerial Photographs (Civil and Environmental Engineering A687)****Plane Surveying (Agricultural Engineering 221)****Scientific Illustration (Floriculture and Ornamental Horticulture 417)****Beginning Photography (Architecture 250, Art 161)****Intermediate Photography (Architecture 350, Art 162)****Color Photography (Architecture 352, Art 262)****Elementary Statistics (Mathematics 370)****Statistics (Mathematics 472-473)****Computer Science 100, 101, 102, 104, 211**  
(See department listing in College of Engineering section for sequence and combinations.)**Asian Studies**

T. L. Mei, chairman; B. R. Anderson, D. E. Ashford, M. L. Barnett, M. G. Bernal, N. C. Bodman, K. Brazell, R. D. Colle, D. R. DeGlopper, A. T. Dotson, J. M. Echols, E. C. Erickson, R. T. Freeman, J. W. Gair, M. D. Glock, F. H. Golay, A. B. Griswold, D. G. E. Hall, F. E. Huffman, R. B. Jones, E. H. Jorden, G. McT. Kahin, G. B. Kelley, K. A. R. Kennedy, E. Kinmonth, A. T. Kirsch, J. B. Long, R. D. MacDougal, J. McCoy, J. W. Mellor, G. M. Messing, D. P. Mazingo, B. D. Nee, S. J. O'Connor, T. J. Pempel, C. A. Peterson, J. T. Siegel, R. J. Smith, E. Terasaki, J. U. Wolff, O. W. Wolters, K. M. Wong, D. K. Wyatt, M. W. Young.

The applicant for admission to the major in Asian studies must have completed at least one course selected from among those listed under the Department of Asian Studies and must be recommended by the instructor in charge of that course. The student must have received a minimum grade of C in this course and in all other courses taken in the department. The candidate for the A. B. degree with a major in Asian studies is required to complete two courses at the 200 level in one of the Asian languages offered at Cornell. The major consists of at least 30 additional credits (which may include further language work) selected by the student in consultation with his or her adviser from among the courses listed under the Department of Asian Studies numbered 300 and above. Majors normally concentrate their work in at least one of the disciplines and in one of the following areas: China, Japan, South Asia, Southeast Asia. The student may also consider a double major combining Asian studies with one of the disciplines.

**Honors Program**

Honors are awarded those students who have completed a successful honors essay and who meet the other requirements established by the department as follows. They must maintain a cumulative average of B+ in Asian studies courses. They should take at least one of the seminars listed below, selected in consultation with their adviser; or they may, with the approval of their adviser, substitute an advanced course in which they complete a considerable body of independent work. Honors candidates will also take Asian Studies 402 in which they write the honors

essay. They may also enroll in Asian Studies 401 in the senior year, but this course is not required. Selection of an essay topic, normally at the end of the junior year, should be made in consultation with two interested professors, one of whom will become the student's essay adviser. At the end of the junior year, students should consult with the professor with whom they plan to write their paper.

### Distribution Requirement

The distribution requirement in the humanities may be satisfied in Asian studies by six credits of any 300-level courses which form a sequence, listed under Asia—Literature and Religion.

### Concentration in Southeast Asia Studies

A candidate for the Bachelor of Arts or Bachelor of Science degree at Cornell may take a concentration in Southeast Asia studies by completing fifteen credits of course work, including a history course and three courses or seminars at the intermediate or advanced level, two of which may be Southeast Asian language courses. Students taking a concentration in Southeast Asia studies are members of the Southeast Asia Program and are assigned an adviser from the program faculty. Such students are encouraged to commence work on a Southeast Asian language and to take advantage of summer intensive language training.

### Intensive Language Program

#### (FALCON)

For those students desiring to accelerate their acquisition of Chinese, Japanese, or Indonesian, Cornell offers a full-time, intensive language program. FALCON students spend six hours a day, five days a week, for periods up to a full year studying language only and thus are able to complete as many as 1,200 hours of supervised classroom and laboratory work in one year.

### Freshman Seminar

#### 101 Ideas and Images in Japanese Culture

Fall, 3 credits.  
T Th 2:30–4. B. D. Nee.

An introduction to traditional Japanese culture through such topics as the Shinto view of man and nature, the way of the warrior, court ladies and courtesans, and Zen and the arts.

### Asia—Literature and Religion Courses

#### 203 Introduction to the Study of Religion.

Spring, 4 credits.  
T Th 1:25–3. J. B. Long.

A study of various theories (anthropological, historical, psychological, phenomenological, etc.) about the nature and function of religion. Includes readings on myths, rituals, and symbols from the world's religions.

#### 301 Introduction to Hinduism

Fall, 4 credits.  
M W F 2:30. J. B. Long.  
An introduction to the beliefs and practices in Hinduism from the beginning to the present time.

#### 302 Introduction to Buddhism

Spring, 4 credits.  
M W F 2:30. J. B. Long.  
A study of the development of the various systems of thought and practice in India, China, and Japan.

#### 371 Chinese Philosophical Literature

Fall, 4 credits.  
M W F 10:10. T. L. Mei.  
Readings in English translation of Confucian, Taoist, and Buddhist works.

#### 372 Chinese Imaginative Literature

Spring, 4 credits.  
M W F 10:10. K. M. Wong.  
Readings in English translation of poetry, classical prose, fiction, and drama.

#### 373 Twentieth-Century Chinese Literature

Fall, 4 credits.  
M W F 9:05. K. M. Wong.  
A study of the modern vernacular that has reflected and promoted political, social, and cultural change in China.

#### 375 Japanese Poetry and Drama

Fall, 4 credits.  
Lec T 11:15; sem Th 11:15–1. B. D. Nee.  
A study of selected poets and dramatists in English translation. The course covers works from the eighth through the eighteenth century.

#### 376 Modern Japanese Fiction

Spring, 4 credits.  
Lec T 11:15; sem Th 11:15–1 or 2:30–3:45.  
B. D. Nee.

A study in English translation of the major novelists and short story writers of the twentieth century.

#### [377 Japanese Narrative Literature

Fall, 4 credits. Not offered 1976–77.]

#### 379 Southeast Asian Literature in Translation

Fall, 4 credits.  
T 2:30–4:25. J. M. Echols.  
A survey of the literatures of Southeast Asia with special attention to several masterpieces.

#### [400 Japanese Nō Theater

Spring, 4 credits. Not offered 1976–77.]

#### 405 Issues and Problems in Indian Philosophy

Fall, 4 credits.  
T Th 11:15. J. B. Long.  
A study of the central philosophical ideas in the Upanishads, Bhagavad Gītā, and in the writings of Shankara and Rāmānuja.

#### 406 Paths of Liberation in the Bhagavad

Gītā

Spring, 4 credits.  
T Th 11:15. J. B. Long.

A detailed study of the religious and philosophical teachings of the Bhagavad Gītā.

#### [410 Myths and Symbols in Indian

Religion

Spring, 4 credits. Not offered 1976–77.]

### Asia—General Courses

#### 401 Asian Studies Honors Course

Fall, 4 credits. Staff.  
Intended for seniors who have been admitted to the honors program. Supervised reading and research on the problem selected for honors work.

#### 402 Asian Studies Honors: Senior Essay

Fall or spring, 4 credits. Prerequisite: admission to the honors program.  
The student, under faculty direction, will prepare an honors essay.

#### 403–404 Asian Studies Supervised

Reading

Either or both terms. Credit arranged. Prerequisite: permission of instructor. Open to majors and other qualified students. Provides the opportunity to read intensively under the direction of a member of the staff.

#### Economics of Agricultural Development (Agricultural Economics 464, College of Agriculture and Life Sciences)

Food, Population, and Employment (Agricultural Economics 660, College of Agriculture and Life Sciences)

Communication in the Developing Nations (Communication Arts 524, College of Agriculture and Life Sciences)

Comparative Mass Media (Communication Arts 526, College of Agriculture and Life Sciences)

Philippine Agricultural Development: Policy and Administration (International Agriculture 601, College of Agriculture and Life Sciences)

Applications of Sociology to Development Programs (Rural Sociology 651, College of Agriculture and Life Sciences)

Architecture and Planning in the Orient (Architecture 345/Planning 403, College of Architecture, Art, and Planning)

The seven courses listed above will count as College of Arts and Sciences credit for Asian studies majors only.

[Urban Anthropology (Anthropology 313)

Not offered 1976–77.]

Comparative Religious Systems (Anthropology 322)

[Politics and Culture (Anthropology 329)

Not offered 1976–77.]

Anthropological Approaches to the Study of Buddhism in Asia (Anthropology 619)

[Politics and Modernization (Government 338) Not offered 1976–77.]

Chinese Government and Politics (Government 347)

[Politics of Industrial Societies (Government 348) Not offered 1976–77.]

Political Role of the Military (Government 349)

Comparative Politics (Government 350)

The United States and Asia (Government 387)

Seminar in Comparative Communism (Government 446)

Policymaking in Industrial Societies (Government 456–457)

Seminar in the Politics of Communalism (Government 642)

Seminar in the International Relations of Asia (Government 687)

[Introduction to Asian Civilization: Origins to 1600 (History 190) Not offered 1976–77.]

[Introduction to Asian Civilizations: from 1600 (History 191) Not offered 1976–77.]

Supervised Reading (History 703–704)

Introduction to Art History: Asian Traditions (History of Art 280)

[Studies in Indian and Southeast Asian Art (History of Art 386) Not offered 1976–77.]

Ceramic Art of Asia (History of Art 482)

[Studies in Buddhist Art (History of Art 483) Not offered 1976–77.]

[Problems in Asian Art (History of Art 580)  
Not offered 1976-77.]

Supervised Readings (History of Art 591-592)

### China—Area Courses

Traditional Chinese Society and Culture  
(Anthropology 343)

Modern Chinese Society (Anthropology 344)

The Foreign Policy of China (Government 390)

Readings on the Great Cultural Revolution  
(Government 447)

Politics of China (Government 645)

Readings from Mao Tse-tung (Government 651)

Culture and the Mass Line in China (Government  
654)

History of China up to Modern Times (History 393)

History of China in Modern Times (History 394)

Undergraduate Seminar in Medieval Chinese  
History (History 492)

[Self and Society in Late Imperial and  
Twentieth-Century China (History 493)  
Not offered 1976-77.]

Undergraduate Seminar: The First Chinese  
Revolution, 1880-1930 (History 494)

Chinese Historiography and Source Materials  
(History 691)

Problems in Modern Chinese History (History  
693-694)

Seminar in Medieval Chinese History (History  
791-792)

Seminar in Modern Chinese History (History  
793-794)

Art of China (History of Art 383)

Chinese Painting (History of Art 385)

[Problems in Chinese Art (History of Art 584)  
Not offered 1976-77.]

[Studies in Chinese Painting (History of Art  
586) Not offered 1976-77.]

Sino-Tibetan Linguistics (Linguistics 662)

Other courses dealing extensively with China are  
Anthropology 322, Government 338, 347, 348, 350,  
387, 456-457, 687; History 190, 191; History of Art  
280, 580; Architecture 345/Planning 403 (College of  
Architecture, Art, and Planning).

### China—Language Courses

Basic Course (Chinese 101-102)

Cantonese Basic Course (Chinese 111-112)

Intermediate Chinese I (Chinese 201-202)

Chinese Conversation (Chinese 203-204)

Intermediate Cantonese (Chinese 211-212)

Introduction to Classical Chinese (Chinese  
213-214)

Intermediate Chinese II (Chinese 301)

Intermediate Chinese III (Chinese 302)

Chinese Conversation—Intermediate (Chinese  
303-304)

FALCON (full-time intensive course, Chinese  
161-2)

Chinese Philosophical Texts (Chinese 314)

T'ang and Sung Poetry (Chinese 320)

History of the Chinese Language (Chinese  
401-402)

Linguistic Structure of Chinese: Phonology and  
Morphology (Chinese 403)

Linguistic Structure of Chinese: Syntax (Chinese  
404)

Chinese Dialects (Chinese 405)

Readings in Modern Chinese Literature (Chinese  
411-412)

Classical Chinese Prose (Chinese 413)

Pre-T'ang Poetry (Chinese 416)

[Chinese Poetic Drama (Chinese 418-419)  
Not offered 1976-77.]

Traditional Fiction (Chinese 420)

Directed Study (Chinese 421-422)

[Readings in Shorter Works of Fiction (Chinese  
423) Not offered 1976-77.]

Readings in Literary Criticism (Chinese 424)

Readings in Folk Literature (Chinese 430)

Seminar in Chinese Poetry and Poetics (Chinese  
603)

Seminar in Chinese Fiction (Chinese 605) (Also  
Government 654)

Seminar in Chinese Folk Literature (Chinese 609)

Advanced Directed Reading (Chinese 621-622)

### Japan—Area Courses

Japanese Culture and Society (Anthropology 345)

[Introduction to the Japanese Economy  
(Economics 366) Not offered 1976-77.]

Politics in Contemporary Japan (Government 346)

Japanese History to 1615 (History 397)

History of Modern Japan (History 398)

Art of Japan (History of Art 384)

[Masters of Japanese Prints (History of Art  
481) Not offered 1976-77.]

Nō as a Performing Art (Society for the  
Humanities 422)

Literary and Performing Arts of Medieval Japan  
(Society for the Humanities 423)

Other courses dealing extensively with Japan are  
Anthropology 322, Government 348, 387, 456-457,

605, 687; History 190, 191; History of Art 280, 481,  
580; and Architecture 345/Planning 403 (College of  
Architecture, Art, and Planning).

### Japan—Language Courses

Basic Course (Japanese 101-102)

Accelerated Introductory Japanese (Japanese  
121-122)

Intermediate Japanese I (Japanese 201-202)

Japanese Conversation (Japanese 203-204)

Intermediate Japanese II (Japanese 301-302)

Japanese Conversation—Intermediate (Japanese  
303-304)

Introduction to Literary Japanese (Japanese  
305-306)

Advanced Japanese (Japanese 401-402)

Linguistic Structure of Japanese (Japanese 404)

Intermediate Literary Japanese (Japanese  
405-506)

Directed Readings (Japanese 421-422)

Introduction to Japanese Reading for Students of  
Chinese (Japanese 432)

FALCON (full-time, intensive course, Japanese  
161-2)

### South Asia—Area Courses

[Culture and Society in South Asia (Anthropology  
341) Not offered 1976-77.]

[Seminar: South Asia (Anthropology 640) Not  
offered 1976-77.]

[South Asia: Readings in Special Problems  
(Anthropology 641-642) Not offered 1976-77.]

[Palaeoanthropology: South Asia (Anthropology  
678) Not offered 1976-77.]

Architecture in its Cultural Context (Architecture  
667-668, College of Architecture, Art, and  
Planning)

Studies in Indian and Southeast Asian Art (History  
of Art 386)

India as a Linguistic Area (Linguistics 341)

Dravidian Structures (Linguistics 440)

Indo-Aryan Structures (Linguistics 442)

Comparative Indo-European Linguistics  
(Linguistics 631-632)

[Elementary Pali (Linguistics 640) Not offered  
1976-77.]

Elementary Sanskrit (Linguistics 641-642)

[Comparative Indo-Aryan (Linguistics 644)  
Not offered 1976-77.]

[Comparative Dravidian (Linguistics 646)  
Not offered 1976-77.]

Seminar (Linguistics 700)

Directed Research (Linguistics 701-702)

Other courses dealing extensively with South Asia are Anthropology 322; Asian Studies 201, 202, 203, 405, 406, 410; Government 338, 387, 605, 687; History 190, 191; History of Art 280, 386, 482, 483, 580; Agricultural Economics 464; Communication Arts 524, 526; and Rural Sociology 751 (College of Agriculture and Life Sciences).

### South Asia—Language Courses

- Basic Course (Hindi-Urdu 101–102)
- Hindi Reading (201–202)
- Composition and Conversation (Hindi 203–204)
- Readings in Hindi Literature (Hindi 301–302)
- Advanced Composition and Conversation (Hindi 303–304)
- Advanced Hindi Readings (Hindi 305–306)
- History of Hindi (Hindi 401)
- Seminar in Hindi Linguistics (Hindi 700)
- Basic Course in Sinhala (Sinhalese 101–102)
- Sinhala Reading (Sinhalese 201–202)
- Composition and Conversation (Sinhalese 203–204)
- Basic Course (Tamil 101–102)
- Basic Course (Telegu 101–102)
- Telegu Reading (Telegu 201–202)

### Southeast Asia—Area Courses

- Ethnology of Mainland Southeast Asia (Anthropology 335)
- Special Problems in Anthropology (Anthropology 608)
- The Anthropological Study of Art (Anthropology 610)
- [Conceptual Systems in Anthropology (Anthropology 617) Not offered 1976–77.]
- Southeast Asia: Readings in Special Problems (Anthropology 634–635)
- 601 Southeast Asia Seminar: Burma Fall. Credit arranged.
- 602 Southeast Asia Seminar: Philippines Spring. Credit arranged.
- 676 Southeast Asia Research Training Seminar
- [Economic Policy and Development in Southeast Asia (Economics 365) Not offered 1976–77.]
- Process of Economic Development (Economics 371/571)
- [Economic Growth in Southeast Asia (Economics 678) Not offered 1976–77.]
- Seminar on Indochina (Government 300)
- Government and Politics of Southeast Asia (Government 344)
- Political Role of the Military (Government 349)
- Modernization and Development, Malaysia and Philippines (Government 499)

Political Problems of Southeast Asia (Government 652)

Southeast Asian History to the Fourteenth Century (History 395)

Southeast Asian History from the Fifteenth Century (History 396)

[Undergraduate Seminar in Southeast Asia in the Nineteenth Century (History 497) Not offered 1976–77.]

Undergraduate Seminar in Southeast Asian History (History 498)

The Historiography of Southeast Asia (History 695–696)

Seminar in Southeast Asian History (History 795–796)

[Studies in Indian and Southeast Asian Art (History of Art 386) Not offered 1976–77.]

Traditional Arts in Southeast Asia (History of Art 488)

Comparative Thai (Linguistics 578)

Burmese Field Methods (Linguistics 600)

Old Javanese (Linguistics 651–652)

Seminar in Southeast Asian Languages (Linguistics 653–654)

Malayo-Polynesian Linguistics (Linguistics 655–656)

Seminar: Mon-Khmer Linguistics (Linguistics 657)

Directed Research (Linguistics 701–702)

Thai Dialectology (Linguistics 751)

Comparative Thai (Linguistics 752)

Tibeto-Burman Linguistics (Linguistics 753)

Rural Development and Cultural Change (Rural Sociology 355)

Peasants, Water, and Development (Rural Sociology 754)

Other courses dealing extensively with Southeast Asia are Anthropology 322, 619; Asian Studies 201–202; Government 338, 348, 350, 387, 605, 687; History 190, 191; History of Art 280, 482, 483, 580; Agricultural Economics 464; Communication Arts 524, 526; International Agriculture 601; Rural Sociology 157 (College of Agriculture and Life Sciences); and Architecture 345/Planning 403 (College of Architecture, Art, and Planning).

### Southeast Asia—Language Courses

- Basic Course (Burmese 101–102)
- Burmese Reading (Burmese 201–202)
- Composition and Conversation (Burmese 203–204)
- Advanced Burmese Reading (Burmese 301–302)
- Basic Course (Cambodian 101–102)
- Cambodian Reading (Cambodian 201–202)
- Composition and Conversation (Cambodian 203–204)

Advanced Cambodian (Cambodian 301–302)

Directed Individual Study (Cambodian 401–402)

Structure of Cambodian (Cambodian 404)

Basic Course (Cebuano Bisayan 101–102)

Basic Course (Indonesian 101–102)

Indonesian Reading (Indonesian 201–202)

Composition and Conversation (Indonesian 203–204)

Linguistic Structure of Indonesian (Indonesian 300)

Readings in Indonesian and Malay (Indonesian 301–302)

Advanced Indonesian Conversation and Composition (Indonesian 303–304)

Advanced Readings in Indonesian and Malay Literature (Indonesian 305–306)

Linguistic Structure of Indonesian (Indonesian 403–404)

FALCON (full-time, intensive course, Indonesian 161–162)

Elementary Javanese (Javanese 131–132)

Intermediate Javanese (Javanese 133–134)

Basic Course (Tagalog 101–102)

Tagalog Reading (Tagalog 201–202)

Linguistic Structure of Tagalog (Tagalog 403–404)

Basic Course (Thai 101–102)

Thai Reading (Thai 201–202)

Composition and Conversation (Thai 203–204)

Advanced Thai (Thai 301–302)

Thai Literature (Thai 305–306)

Directed Individual Study (Thai 401–402)

Basic Course (Vietnamese 101–102)

Vietnamese Reading (Vietnamese 201–202)

Composition and Conversation (Vietnamese 203–204)

Advanced Vietnamese (Vietnamese 301–302)

Directed Individual Study (Vietnamese 401–402)

## Astronomy

K. Greisen, chairman; J. Burns, F. D. Drake, P. J. Gierasch, T. Gold, M. O. Harwit, J. R. Houck, R. Lovelace, J. Rankin, C. E. Sagan, E. E. Salpeter, S. Shapiro, Y. Terzian, S. Teukolsky, J. Veverka. Undergraduates interested in graduate work in astronomy should major in either physics or mathematics and take astronomy courses as electives.

### Distribution Requirement

The distribution requirement in physical sciences is met by Astronomy 101–102 or 111–112.

**101 The World: Universe, Earth,**

**Environment** Fall. 4 credits. Prerequisite: high school algebra.

Lec. M W F 9:05; lab. M T W or Th 7:30–10:30 p.m. J. Rankin.

Determination of the size, mass, and shape of the galaxy and the universe. The behavior of light and matter due to the large scale evolution of the universe. The evolution of stars and the formation of chemical elements.

**102 The World: Universe, Earth,**

**Environment** Spring. 4 credits. Prerequisites: high school algebra and 101 or permission of instructor.

Lec. M W F 12:20; lab. M T W Th or F 2–4:25 and some night labs to be arranged. C. Sagan.

Formation of the solar system. Environments and internal structures of planets. Formation and structure of the earth and its atmosphere. Evolution of the earth's surface and climate. Origin of life. The effect of man on his planet. The existence of life and intelligence in the universe.

**103–104 The World: Universe, Earth,**

**Environment** 103, fall, 104, spring. 3 credits per term.

This course is identical to 101–102 except without the laboratory. See description above. (This course does not satisfy the distribution requirement in physical sciences.)

**111 Theories of the World: Stars, Galaxies, and Cosmology**

Spring. 4 credits. Intended for first-year engineering and physical sciences students. Prerequisite: introductory calculus or coregistration in Math 111 or 191.

Lec. M W F 10:10; rec. M T W Th or F 2–4:25 and some evening labs to be arranged. J. Houck.

The formation and evolution of stars. Special relativity. Supernovae, pulsars, quasars, and black holes. The interstellar medium. The structure and evolution of galaxies. Cosmology.

**112 Theories of the World: The Solar System, Planets, and Life**

Fall. 4 credits. Intended for first-year engineering and physical sciences students. Prerequisite: introductory calculus or coregistration in Math 111 or 191.

Lec. M W F 10:10; rec. M T W Th or F and some evening labs to be arranged. J. Burns.

The origin and formation of the solar system, celestial mechanics. The evolution of planetary atmospheres. Prebiology and the origin of life. The detection of life elsewhere in the universe.

**332 Elements of Astrophysics**

Fall. 3 credits. Prerequisites: calculus and elementary physics, or permission of instructor.

M W F 11:15. Y. Terzian.

A modern approach to astrophysical topics. Physical laws of radiation. Theories of the solar system. Distance, size, mass, and age of stars, galaxies and the universe; stellar evolution and nucleosynthesis; interstellar matter and star formation. Supernovae, pulsars, and black holes. Galaxies and quasars. Introduction to cosmology. Intended for students interested in astronomy, physics, and engineering.

**340 Independent Study in Astronomy**

Fall or spring. 2–4 credits. Prerequisite: permission of instructor; a knowledge of 332; 431–432 recommended.

Staff.

Individual work on selected topics. A program of study is devised by the student and instructor.

**Courses for Advanced Undergraduate and Graduate Students****431 Introduction to Astrophysics and Space Sciences I**

Fall. 3 credits. Prerequisites: Physics 214 and 318 or the equivalent. There are no astronomy course prerequisites.

M W F 10:10. S. Shapiro.

A systematic development of modern astrophysical concepts for physical science majors. The cosmic distance scale; dynamics and masses of astronomical bodies; atomic and electromagnetic processes in space. Introduction to stellar structure, the interstellar medium, and cosmology. Star formation; black holes, pulsars, and quasars. At the level of *Astrophysical Concepts* by Harwit.

**432 Introduction to Astrophysics and Space Science II**

Spring. 3 credits. Prerequisite: 431 or permission of instructor.

M W F 10:10. J. Houck.

A continuation of 431. At the level of *Astrophysical Concepts* by Harwit.

**433 The Sun**

Fall. 3 credits. Prerequisites: Physics 214 and 318 or permission of instructor.

M W F 9:05. P. Gierasch.

Emphasis on physical processes important in the sun, including interior, convection zone, photosphere, chromosphere, and corona. Topics covered include the solar spectrum, magnetic fields, flare phenomena, convection, differential rotation, origin of solar wind, atmospheric waves. Intended for students interested in geophysics or general solar system physics.

**434 The Evolution of Planets**

Spring. 3 credits. Prerequisites: Physics 214 and 318 or permission of instructor.

M W F 9:05. J. Veverka.

An introduction to the physical and chemical processes that have been active in altering the environments of planets from their original to their present state. Theories of the formation of the solar system are reviewed, with special emphasis on chemical differentiation of the primeval solar nebula.

**490 Senior Seminar**

Fall. 2 credits. S-U grades only. Intended primarily for physical sciences majors in their senior year. Prerequisites: Physics 214 and 318 or equivalent.

Hours to be arranged. T. Gold.

Selected topics of solar system and stellar astronomy; topics of high-energy astrophysics and cosmology.

**Courses for Graduate Students****509 General Relativity (also Physics 553)**

Fall. 3 credits. Prerequisite: knowledge of special relativity at the level of *Classical Mechanics* by Goldstein.

T Th 8:30–9:55. S. Teukolsky.

A systematic introduction to Einstein's theory, with emphasis on modern coordinate-free methods of computation. Topics include review of special relativity, modern differential geometry, foundations of general relativity, laws of physics in the presence of a gravitational field, experimental tests of gravitation theories. At the level of *Gravitation* by Misner, Thorne, and Wheeler.

**510 Applications of General Relativity (also Physics 554)**

Spring. 3 credits. Prerequisite: 509.

T Th 8:30–9:55. S. Teukolsky.

A continuation of Astronomy 509 with emphasis on applications to astrophysics and cosmology. Topics include relativistic stars, gravitational collapse and black holes, gravitational waves, cosmology.

**511 High-Energy Astrophysics**

Spring. 3 credits.

Hours to be arranged. S. Shapiro.

The physics of white dwarfs, neutron stars, and black holes. The formation of compact objects; equilibrium configurations, equations of state, stability criteria, and mass limits; the influence of rotation and magnetic fields. Pulsar phenomena. Mass flow in binary systems; spherical and disk accretion; high-temperature radiation processes. Compact X-ray sources and X-ray bursts.

[515 Cosmology Not offered 1976–77.]

**[516 Galactic Structure and Stellar Dynamics**

Not offered 1976–77.]

**520 Radio Astronomy**

Fall. 3 credits.

T Th 2–3:30. F. Drake, J. Rankin.

Radio astronomy telescopes and electronics; antenna theory; observing procedures and data analysis; concepts of interferometry and aperture synthesis. Radar astronomy techniques. Theories of radio emission; synchrotron emission, and thermal emission; applications to the theory of radio sources. Radio astronomy of the solar system.

**521 Radio Astrophysics**

Spring. 3 credits.

T Th 2–3:30. Y. Terzian.

Thermal and nonthermal radiation processes. Interstellar emission, reflection, dark nebulae. Planetary nebulae, novae, supernova shells, pulsars. Galactic 21-cm emission, galactic structure, kinematics. Radio emission from normal and abnormal galaxies. Observations and theories of quasi-stellar objects. Universal background radiation. Cosmological models.

**[530 Nuclear Astrophysics**

Not offered 1976–77.]

**[550 Radiative Transfer; Stellar and Solar Atmospheres**

Not offered 1976–77.]

**555 Theory of the Interstellar Medium**

Fall. 3 credits.

Hours to be arranged. E. E. Salpeter.

Summary of observational data theories of ionization and thermal equilibrium of the gas; grain formation and destruction; cloud structure and star formation; interstellar effects of cosmic rays.

**[560 Theory of Stellar Structure and Evolution**

Not offered 1976–77.]

**[570 Physics of the Planets**

Not offered 1976–77.]

**[571 Planetary Rotation, Tides, and Physics of Interiors (also T & AM 673 Mechanics of the Solar System)**

Not offered 1976–77.]

**575 Motions in Planetary Atmospheres**

Fall. 3 credits. Prerequisites: vector calculus, elementary fluid mechanics.

Time to be arranged. P. Gierasch.

The equations of motion. Scaling and geophysical approximations: hydrostatic, quasigeostrophic, Boussinesq, Hadley circulations. Barotropic and baroclinic instability. The role of eddies in the terrestrial atmosphere. Observation and theory for the other planets.

**[579 Celestial Mechanics (also T & AM 672 Space Flight Mechanics)**

Not offered 1976–77.]

**620 Seminar: Advanced Radio Astronomy**

Fall. 2 credits.

Hours to be arranged. Y. Terzian, J. Rankin,

F. Drake

Advanced topics in radio astrophysics and radio astronomical data accumulation and processing methods.

**[633 Infrared Astronomy**

Not offered 1976–77.]

**640 Advanced Study and Research**

Fall or spring. 2–4 credits.

Staff.

Upon sufficient demand, guided reading and seminars arranged from time to time on topics not currently covered in regular courses.

**660 Plasma Astrophysics**

Spring. 2 credits.

Hours to be arranged. R. V. Lovelace.

**[671 Special Problems in Planetary Astronomy**

Not offered 1976–77.]

**672 Seminar: Planetary Studies** Spring, 2 credits.

Hours to be arranged. T. Gold, C. Sagan, J. Veverka.

**[673 Seminar: Current Problems in Planetary Fluid Dynamics** Not offered 1976–77.]

**[678 Interplanetary Matter** Not offered 1976–77.]

**680 Seminar: Cosmic Rays and High-Energy Electromagnetic Radiation (also Physics)**

**680** Spring, 3 credits.

Hours to be arranged. K. Greisen.

**699 Seminar: Current Problems in Theoretical Astrophysics** Fall, 2 credits.

Hours to be arranged. T. Gold.

Study of latest problems in theoretical astrophysics. Therefore, contents change from year to year.

Students may wish to take the course more than once for credit.

## Biological Sciences

See p. 128.

## Chemistry

M. E. Fisher, chairman; A. C. Albrecht, S. H. Bauer, J. M. Burlitch, B. K. Carpenter, W. D. Cooke, E. L. Elson, R. C. Fay, J. H. Freed, B. Ganem, M. J. Goldstein, G. G. Hammes, R. Hoffmann, P. L. Houston, R. E. Hughes, F. A. Long, G. M. Loudon, F. W. McLafferty, J. Meinwald, W. T. Miller, G. H. Morrison, E. L. Muetterties, R. F. Porter, H. A. Scheraga, A. G. Schultz, M. F. Semmelhack, M. J. Sienko, D. A. Usher, B. Widom, J. R. Wiesenfeld, C. F. Wilcox.

### Chemistry Major

A major in chemistry permits considerable flexibility in the detailed planning of a course program. The required courses can be completed in three years, leaving the senior year open for advanced and independent work in all areas of chemistry; physical, organic, inorganic, analytical, theoretical, bioorganic, biophysical. A major in chemistry can also provide the necessary basis for significant work in related areas such as molecular biology, chemical physics, geochemistry, chemical engineering, solid state physics, and medicine.

The courses are arranged as a progression with some courses (including mathematics and physics) prerequisite to those that are more advanced. During the first year the student should normally register for general chemistry (preferably but not necessarily Chemistry 215), mathematics, a Freshman Seminar course, a foreign language if necessary or, in some instances, physics. Although Chemistry 215–216 is preferred, students may begin their programs with Chemistry 207–208. Chemistry 215–216 is a limited enrollment course for those students with excellent preparation; students who are uncertain as to their preparation should consult the instructor. In the second year the student should complete calculus, take physics and organic chemistry, Quantitative Chemistry 300, if needed, and Experimental Chemistry 301. Physical Chemistry 389 and 390 and Experimental Chemistry 302 and 303 should be completed in the third year. Advanced work in chemistry and related subjects can be pursued in the fourth year and, to some extent, in the earlier years as well. The opportunity for independent research is also available. All students with questions about details of a major program are encouraged to consult with the chairman of the Department of Chemistry or the

chairman's representative. Entering students exceptionally well prepared in chemistry may receive advanced placement credit for Chemistry 207–208 and proceed to a more advanced program.

Prerequisites for admission to a major in chemistry are (1) Chemistry 215–216 or 207–208 plus 300; (2) Physics 207; and (3) Mathematics 111. Students are not encouraged to undertake a major in chemistry unless they have passed those prerequisite courses at a good level of proficiency. A knowledge of simple computer programming is essential. This may be achieved either by self-study (a syllabus is available) or by taking courses such as Computer Science 100. As a minimum the following additional courses must then be completed for a major in chemistry: (1) Chemistry 301, 302, 303, 357–358, 389–390; (2) Mathematics 112 or 122, 214, 215, 216, and 218 or 221–222; and (3) Physics 208. This sequence is a core program in chemistry. It is anticipated that the student will, through elective courses, extend it substantially in whatever direction suits his or her own needs and interests. It is particularly important that those going on to do graduate work in chemistry recognize that these requirements are minimal, and such students are strongly urged to supplement their programs, where possible, with Chemistry 404, 405, 605, 606, 607, 668, 681, and German (or Russian). Even students not planning graduate work in chemistry should consider advanced work in physics and mathematics, courses in the biological sciences, and advanced work in chemistry as possible extensions of the basic program.

### The Honors Program

The honors program in chemistry offers superior students an opportunity to study independently in seminars and to gain additional experience by engaging in research during the senior year. It is particularly recommended to those who plan graduate work in chemistry. Prospective candidates should complete the introductory organic chemistry and physical chemistry sequences by the end of the junior year. However, failure to have completed those courses in the junior year does not in itself disqualify a student from the honors program. Completion of the program at a high level of performance leads to the degree of Bachelor of Arts with honors in chemistry. The requirements for admission to the honors program are an above-median cumulative average and permission of the department. Prospective candidates should discuss their plans with their advisers by March 1 of their junior year. To be awarded honors, candidates must show outstanding performance in one of the following: 421, 433, 461, 477, and, in addition, 498.

### Distribution Requirement

The distribution requirement in physical science is satisfied in chemistry by Chemistry 103, 207, or 215 and 104, 208, or 216.

General identification of the courses listed below is as follows:

Inorganic: 421, 605, 606, 607, 716.

Analytical: 300, 433, 625, 627, 628.

Organic: 253, 357–358, 461, 665–666, 765, 766, 770, 774.

Physical and theoretical: 287–288, 289–290, 389, 390, 477, 678, 681, 789, 794, 796, 798.

Bioorganic and biophysical: 668, 672, 677, 686, 782.

Experimental: 251, 252, 301, 302, 303, 404, 405.

Environmental: 200.

*Note the following:*

Students registered for laboratory courses who do not appear at the first meeting of the laboratory will forfeit their registration.

Students and members of the teaching staff are required to wear safety glasses or approved eye-protective devices in all chemistry laboratories. Those who fail to cooperate with the safety program may be asked to leave the laboratories.

Preliminary examinations for all courses may be given in the evening.

**103–104 Introduction to Chemistry** 103, fall; 104, spring, 3 credits per term. Enrollment limited. Recommended for students who have not had high school chemistry and for those needing a less mathematical course than Chemistry 207–208. 103 is prerequisite to 104.

Lec, M W 11:15 or 12:20; lab, T or Th 8–11, F 10:10–1:10, M W or F 1:25–4:25. Fall, M. J. Sienko; spring, B. Ganem.

An introduction to chemistry with emphasis on the important principles and facts of inorganic and organic chemistry.

**200 Man in his Chemical Environment** Fall, 3 credits. Enrollment limited. Prerequisites: 103–104 or 207–208.

Lec, T Th 12:20; rec, T 1:25. F. W. McLafferty.

The chemical aspects of the human environment including the composition and properties of materials as these affect man's environment. Chemical limitations on the balance between survival and quality of living.

**207–208 General Chemistry** 207, fall; 208, spring, 4 credits per term. Enrollment limited. Recommended for those students who will take further courses in chemistry. Prerequisite: high school chemistry; 207 or 103–104 is prerequisite to 208.

Lec: fall, T Th 9:05, 10:10, or 12:20; spring, T Th 9:05 or 10:10; lab: fall, T Th or F 8–11; M T W Th or F 1:25–4:25; lab: spring, M T W Th F 12:20–4:25, or S 8–12. Fall, R. Hoffmann, A. C. Albrecht; spring, R. C. Fay.

The important chemical principles and facts are covered, with considerable attention given to the quantitative aspects and to the techniques important for further work in chemistry. Second-term laboratory includes a systematic study of qualitative analysis. Note: Entering students exceptionally well prepared in chemistry may receive advanced placement credit for Chemistry 207–208 by demonstrating competence in the Advanced Placement examination of the College Entrance Examination Board or in the departmental examination given at Cornell before classes start in the fall.

**215–216 General Chemistry and Inorganic Qualitative Analysis** 215, fall; 216, spring. Fall, 4 credits; spring, 5 credits. Enrollment limited. Recommended for students who intend to specialize in chemistry or in closely related fields. Prerequisites: high school chemistry and physics at a grade of 90 or higher. 215 is prerequisite to 216. Coregistration in a calculus course at the level of Math 111 or 191 and/or high school calculus is required.

Lec: fall, M W F 12:20; one lab period, T 10:10–1:10, or T W Th or F 1:25–4:25. Lec or rec: spring, M W F, 12:20; two lab periods, M T 1:25–4:25, T Th 10:10–1:10, W F 8–11, W F 1:25–4:25, Th 1:25–4:25, and S 8–11. Fall, E. L. Elson, P. L. Houston; spring, J. M. Burlitch.

An intensive, systematic study of the laws and concepts of chemistry, with considerable emphasis on mathematical aspects. Laboratory work will cover both qualitative and quantitative analysis.

**251 Introduction to Experimental Organic Chemistry** Fall, 2 credits. Recommended for nonchemistry majors. Prerequisite or parallel: 253 or 357 or permission of instructor.

Lec, M 8; lab, M T W or Th 1:25–4:25, or T or Th 8–11. B. K. Carpenter.

An introduction to synthesis and the separation and handling of materials including applications of many types of chromatography, simple and fractional distillation, crystallization, extraction, and others.

**252 Elementary Experimental Organic**

**Chemistry** Spring, 2 credits. Recommended for nonchemistry majors. Prerequisite: 251.

Lec, M 8; lab, M T W or Th 1:25-4:25.

A. G. Schultz.

A continuation of Chemistry 251.

**253 Elementary Organic Chemistry**

Fall or spring, 4 credits. Primarily for students in the premedical and biological curricula. Prerequisite: 104 with grade of C or better, or 208, or 216.

Lec, M W F S 10:10. Make-up lec may be given in the evening. Fall, G. M. Loudon; spring, M. F. Semmelhack.

A study of the occurrence and properties of organic molecules and the mechanisms of organic reactions, including a brief introduction to the organic chemistry of biological systems. The student should determine the entrance requirements of the particular medical school he or she wishes to enter. Students may obtain six credits by taking Chemistry 251-253 or eight credits by taking 253-301 or 253, 251, and 252.

**287-288 Introductory Physical Chemistry**

287, fall; 288, spring, 3 credits per term. Prerequisites: 208 or 216 and Math 111-112, or permission of instructor. 287 is prerequisite to 288.

Lec, M W F 9:05; rec, M W or F 1:25. Fall,

B. Widom; spring, A. C. Albrecht.

A systematic treatment of the fundamental principles of physical chemistry.

**289-290 Introductory Physical Chemistry**

Laboratory 289, fall; 290, spring, 2 credits per term. 289 is prerequisite to 290. Coregistration in 287-288 is required.

Lab-lec, W 7:30; two lab, M T or W Th 1:25-4:25 or, if warranted by sufficient registration, F 1:25-4:25 and S 8-11. First hours of lab on M W F devoted to Chemistry 287 rec. R. E. Hughes.

The development of needed skills in the experimental aspects concerned with the fundamental principles of physical chemistry.

**300 Quantitative Chemistry**

Fall, 2 credits. Prerequisite: 208 or advanced placement in chemistry.

Lec, F 12:20; 1 lab, M T W Th or F 1:25-4:25 or T Th 8-11. Organizational meeting of this course on first class day of semester, 12:20. G. H. Morrison.

A laboratory course designed to emphasize the more common quantitative procedures and techniques essential to laboratory work in sciences. The relationship between theory and application will be stressed.

**301 Experimental Chemistry I**

Spring, 4 credits. Prerequisite: 216 or 300, and 253 or 357. Parallel registration with 253 is not recommended.

Lec, M W 8; 2 lab periods, M W 1:25-4:25, T Th 8-11, T Th 1:25-4:25. D. A. Usher.

An introduction to synthesis and the separation and handling of materials including applications of many types of chromatography, simple and fractional distillation, crystallization, extraction, and others.

**302 Experimental Chemistry II**

Fall, 4 credits. Prerequisite: 301.

Lec, M W 9:05; 2 lab periods, M W 1:25-4:25, T Th 9-12, or T Th 1:25-4:25. R. F. Porter, M. F. Semmelhack.

A survey of the various aspects of qualitative and quantitative analysis of both inorganic and organic compounds including optical spectroscopy, NMR, mass spectroscopy, statistical analysis of data, and electrochemical methods.

**303 Experimental Chemistry III**

Spring, 3 credits. Prerequisites: 302 and 389 and coregistration in 390; a knowledge of computer programming is essential. Each lab section limited to 18 students.

Lec, M W 8, 2 lab periods, M W 1:25-4:25, T Th 8-11, T Th 1:25-4:25. P. L. Houston, G. H. Morrison.

An introduction to the techniques of vacuum line

construction and operation; the principles and assembly of electronic measuring devices, optics, and kinetics.

**357-358 Introductory Organic Chemistry**

357, fall; 358, spring, 3 credits per term. Prerequisites: 208, or 216, or advanced placement in chemistry; 357 is prerequisite to 358; parallel registration in 251 or 301 is recommended.

Lec, M W F 9:05. Optional rec may be offered.

C. F. Wilcox.

A systematic study of the more important classes of carbon compounds—reactions of their functional groups, methods of synthesis, relations, and uses.

**389-390 Physical Chemistry I and II**

389, fall; 390, spring, 4 credits per term. Prerequisites: Math 214, 215, 216, 218 or ideally, 221-222; Physics 208, Chem 208 or 216 or permission of instructor. 389 is prerequisite to 390.

Lec, M W F 10:10; make-up lec, W 7:30 p.m.; examinations, Th 7:30 p.m. Fall, H. A. Scheraga; spring, S. H. Bauer.

A study of the principles of physical chemistry from the standpoint of the laws of thermodynamics, kinetic theory, and quantum chemistry. At the level of *Thermal Properties of Matter* by W. L. Kuzmann and *Quantum Mechanics in Chemistry* by M. W. Hanna.

**[404 Advanced Measurements Laboratory**

Fall, 4 credits. Prerequisite: 303. Not offered 1976-77.]

**405 Techniques of Modern Synthetic**

**Chemistry** Spring, 4 credits. Enrollment limited. Selection will be based on grades in Chemistry 301 and 302. Prerequisite: 302.

Lab time required: 12 hours each week including at least 2 four-hour sessions in 2 sections: M W 1:25, T Th 1:25. First meeting will be at 4:30 p.m. on first class day of semester. Lec, first week only, at times to be arranged. J. M. Burlitch.

The syntheses of complex organic and inorganic molecules will be carried out with emphasis on the following techniques; vacuum line; high pressure; high temperature solid state; inert atmosphere; nonaqueous solvents; radioactive labeling; photochemical and electrochemical methods; solid phase peptide synthesis; and macro and micro techniques.

**421 Introduction to Inorganic Research**

Fall or spring, 2-4 credits. Prerequisites: 303 and 389-390, or 287-288, and 289-290 with an average of B- or better, or permission of instructor.

Selected faculty.

Informal advanced laboratory and library work, planned individually in consultation with a staff member, involving the preparation and characterization of inorganic substances. A written report is required.

**433 Introduction to Analytical Research**

Fall or spring, 2-4 credits. Prerequisites: 303 and 390 with an average of B- or better, or permission of instructor.

Selected faculty.

Informal research in the field of analytical chemistry involving both laboratory and library work.

**461 Introduction to Organic Research**

Fall or spring, 2-4 credits. Enrollment limited to those having a record of B- or better in prerequisite courses. Prerequisites: 302 and 358, or permission of instructor.

Selected faculty.

Informal research in the field of organic chemistry involving both laboratory and library work.

**477 Introduction to Research in Physical**

**Chemistry** Fall or spring, 2-4 credits. Prerequisite: 390 at an average of B- or better and permission of instructor.

Selected faculty.

Informal laboratory and library work in physical chemistry, planned individually in consultation with a staff member.

**498 Honors Seminar and Research** Spring, 4 credits. Prerequisites: an outstanding performance in one of the following: 421, 433, 461, or 477, and admission to the honors program.

G. M. Loudon.

The seminar will be an informal presentation and discussion of selected topics in which all members participate. Individual research will be on advanced problems in chemistry under the guidance of a staff member. A written report on the research results is required.

**600 General Chemistry Seminar**

Fall or spring. Noncredit. Required of all graduate students except those majoring in organic or bioorganic chemistry. Open to qualified juniors and seniors. Th 4:40.

A series of talks representative of all fields of current research interest in chemistry other than organic chemistry, given by research associates, faculty members, and distinguished visitors.

**605 Advanced Inorganic Chemistry I (Symmetry and Structure)**

Fall, 4 credits. Prerequisite: 389-390 or equivalent, or permission of instructor.

Lec, M W F 11:15. R. C. Fay.

This is the first of a three-term sequence. Symmetry and structure of discrete molecules, translational symmetry of arrays of molecules in crystals. Group theory at the level of *Cotton's Chemical Application of Group Theory*, *Schönland's Molecular Symmetry*, and *Hall's Group Theory and Symmetry in Chemistry*. Applications include molecular orbital theory, hybridization, and molecular vibrations. Outside readings in the chemistry of nontransition elements at the level of *Wilkinson's Advanced Inorganic Chemistry* will be assigned.

**606 Advanced Inorganic Chemistry II (Structure and Dynamics)**

Fall, 4 credits. Prerequisite: 605 or permission of instructor.

Lec, M W F 11:15. E. L. Muetterties.

The second of a three-term sequence. The development of a general background and systematics through which structure, stereochemistry, and reaction mechanism can be understood and anticipated. Outside readings at the level of *Murrell, Kettle, and Tedder's Valence Theory*, *Balhausen's Introduction to Ligand Field Theory*, *Basolo and Pearson's Inorganic Reaction Mechanisms*, and *Langford and Gray's Ligand Substitution Processes*.

**607 Advanced Inorganic Chemistry III (Structure and Properties)**

Spring, 4 credits. Prerequisite: 605 or permission of instructor.

Lec, T Th 10:10-11:40. M. J. Sienko.

The third of a three-term sequence introduction to ligand field theory and solid state structure and properties at the level of *Figgis' Introduction to Ligand Fields*, *Kreb's Fundamentals of Inorganic Crystal Chemistry* and *Sach's Solid State Theory*. Outside readings in transition metal chemistry will be assigned at the level of *Cotton and Wilkinson's Advanced Inorganic Chemistry*.

**622 Chemical Communication (also Biological Sciences 622)**

Spring, 3 credits. Offered in alternate years. Enrollment limited to thirty students.

Intended primarily for research-oriented students. Prerequisites: 358, Bio Sci 102, and Biochemistry 231.

Lec, M W F 12:20. J. Meinwald, T. Eisner, W. Roelofs, and guest speakers.

The production, transmission, and reception of chemical signals in communicative interactions of animals, plants, and microorganisms. Specific topics treated with varying emphasis on chemical, biochemical, neurobiological, ecological, and evolutionary principles.

**625 Advanced Analytical Chemistry I**

Fall, 4 credits. Open to undergraduates with permission of instructor. Prerequisite: 288 or 390 or equivalents.

Lec, M W F 8; examinations will be held T 7:30 p.m. W. D. Cooke.

The application of molecular spectroscopy to chemical problems. Topics discussed include ultraviolet, infrared, NMR, Raman, and mass spectroscopy.

**627 Advanced Analytical Chemistry II** Spring. 3 credits. Offered in alternate years. Primarily for graduate students. Prerequisite: 288 or 390 or equivalents.

Lec, T Th 9:05; problem sessions and examinations, T 7:30 p.m. F. W. McLafferty. Modern analytical methods, including electron, Mössbauer, and Fourier spectroscopy; mass spectrometry; methods applicable to macromolecules; and applications of on-line computers.

**[628 Advanced Analytical Chemistry III** Spring. 3 credits. Offered in alternate years. Primarily for graduate students. Prerequisite: 288 or 390 or equivalents. Not offered 1976-77.

Lec, T Th 9:05. G. H. Morrison. Modern trace, micro, and surface methods of analysis, including atomic spectrometry, solids mass spectrometry, activation analysis, ion selective electrodes, microprobes, and electron spectroscopy.]

**650-651 Seminar in Organic Chemistry** 650, fall; 651 spring. Noncredit. Required of all graduate students majoring in organic chemistry. Open to qualified juniors and seniors.

M 8:15 p.m.  
A series of talks representative of all fields of current research interest in organic chemistry, given by research associates, faculty members, and distinguished visitors.

**665 Advanced Organic Chemistry** Fall. 4 credits. Primarily for graduate students and upperclass undergraduates. Prerequisites: 253 or 358 and 390, or equivalents, or permission of instructor.

Lec, M W F 12:20; make-up lectures and examinations, Th 7:30 p.m. M. J. Goldstein. An analysis of the simplest organic reactions. The principal aim is to provide the student with the skills and background needed to predict the reactivity patterns and stereochemical preferences of new molecules in a variety of experimental environments.

**666 Synthetic Organic Chemistry** Spring. 4 credits. Primarily for graduate students and upperclass undergraduates. Prerequisites: 665 or permission of instructor.

Lec, T Th 12:20 and W 4:40. A. G. Schultz. Modern techniques of synthesis; applications of organic reaction mechanisms to the problems encountered in rational multistep synthesis, with particular emphasis on newer developments.

**668 Chemical Aspects of Biological Processes** Fall. 4 credits. Prerequisites: 358 and 389-390, or 287-288, or equivalents.

Lec, M W F 10:10. D. A. Usher. Biochemical systems, bioenergetics, enzymes, metabolic pathways, chemical evolution. This course forms the chemical basis for the graduate program in molecular biology.

**672 Enzyme Catalysis** Spring. 4 credits. Primarily for graduate students in chemistry and biochemistry. Prerequisites: 357-358 and 389-390, or equivalents, and a course in general biochemistry.

Lec, M W F 11:15. G. G. Hammes. Enzymes, coenzymes, and model systems.

**[677 Chemistry of Nucleic Acids** Spring. 4 credits. S-U grades only. Offered in alternate years. Primarily for graduate students. Prerequisites: 358 and 390 or equivalents. Not offered 1976-77.

Lec, M W F 8. E. L. Elson. Properties, synthesis, and reactions of nucleic acids.]

**678 Thermodynamics** Spring. 4 credits. Primarily for graduate students. Prerequisite: 288 or 390 or

equivalents.

Lec, T Th S 10:10; disc. hours to be arranged. R. F. Porter.

Development of the general equations of thermodynamics from the first, second, and third laws. Applications to the study of physicochemical equilibria in gases, liquids, solids, and liquid solutions. Problems.

**681 Physical Chemistry III** Fall. 4 credits. Prerequisites: 288 or 390; Math 214, 215, 216, 218; and Phys 208; or equivalents.

Lec, M W F 9:05. J. H. Freed. A discussion of advanced topics in physical chemistry, including an introduction to the principles of quantum theory and statistical mechanics, atomic and molecular spectra, and elementary valence theory. At the level of *Advanced Physical Chemistry* by J. C. Davis.

**686 Physical Chemistry or Proteins** Spring. 4 credits. Offered in alternate years. Primarily for graduate students. Prerequisites: 288 or 390 or equivalents.

Lec, M W F 8, S 11:15 and occasional lec. W 7:30 p.m. H. A. Scheraga. Chemical constitution, molecular weight, and structural basis of proteins; thermodynamic, hydrodynamic, optical, and electrical properties; protein and enzyme reactions; statistical mechanics of helix-coil transition in biopolymers; conformation of biopolymers.

**700 Baker Lectures** Noncredit.

Lec, T Th 11:15. Distinguished scientists who have made significant contributions to chemistry present lectures for periods varying from a few weeks to a full term.

**701-702 Introductory Graduate Seminar in Analytical, Inorganic, and Physical Chemistry.** 701, fall; 702, spring. Noncredit. Required of all first-year graduate students majoring in analytical, inorganic, physical, theoretical, biophysical, and bioorganic chemistry.

Hours to be arranged. J. R. Wiesenfeld.

**[716 Selected Topics in Advanced Inorganic Chemistry** Fall. 3 credits. S-U grades only.

Prerequisite: 390 or equivalent. Not offered 1976-77. Lec, T Th 12:20. Topics vary from year to year.]

**765 Physical Organic Chemistry I** Spring. 4 credits. Primarily for graduate students.

Prerequisite: 665 or permission of instructor. Lec, M W F 12:20; make-up lec, W 7:30 p.m. B. K. Carpenter.

Continues and extends the approach of 665 to more complicated organic reactions. Particular emphasis will be placed on the applications of reaction kinetics and isotope effects to an understanding of reaction mechanisms.

**[776 Physical Organic Chemistry II** Spring. 3 credits. Primarily for graduate students. Prerequisite: 765 or permission of instructor. Not offered 1976-77. Lec, T Th 12:20.

Quantitative aspects of organic chemistry.]

**770 Selected Topics in Organic Chemistry** Fall. 3 credits. Primarily for graduate students.

Prerequisites: 665-666 or permission of instructor. Lec, T Th 12:20. B. Ganem. Topics vary from year to year.

**[774 Chemistry of Natural Products** Fall. 3 credits. Primarily for graduate students.

Prerequisites: 665-666. Not offered 1976-77. Lec, T Th 12:20. Particular attention will be devoted to methods of structure determination and synthesis as applied to selected terpenes, steroids, alkaloids, and antibiotics.]

**780 Principles of Chemical Kinetics** Fall. 4 credits. Prerequisites: 681 and 678 or permission of instructor.

Lec, M W F 9:05. G. G. Hammes. Principles and theories of chemical kinetics; special topics including fast reactions in liquids, enzymatic reactions, shock tubes, and molecular beams.

**782 Special Topics in Biophysical and Bioorganic Chemistry** Spring. Noncredit. Primarily for graduate students.

Lec, T Th 11:15. Dates to be announced. Topics, which are presented by distinguished visitors, vary from year to year.

**789 X-ray Crystallography** Fall. 4 credits. Prerequisite: Phys 325 or permission of instructor.

Lec, M W F 12:20. Offered only when sufficient registration warrants. Space groups, reciprocal lattices, three-dimensional diffraction, interpretation of X-ray diffraction data, structural determination by Fourier synthesis.

**793 Quantum Mechanics I** Fall. 4 credits.

Prerequisites: 681 and coregistration in Math 421, and Phys 431, or equivalents, or permission of instructor.

Lec, T Th S 9:05. J. R. Wiesenfeld. Schrödinger's equation, wave packets, uncertainty principle, WKB theory, matrix mechanics, orbital and spin angular momentum, exclusion principle, perturbation theory, variational principle, Born-Oppenheimer approximation. At the level of Bohm's *Quantum Theory*.

**794 Quantum Mechanics II** Spring. 4 credits.

Prerequisites: 793 or equivalent and coregistration in Phys 432 and Math 422, or permission of instructor. Lec, M W F 10:10. R. Hoffmann.

Time-dependent phenomena in quantum mechanics and interaction with radiation. Spectroscopy. Elementary theory of ESR and NMR. Electronic structure of atoms and molecules.

**796 Statistical Mechanics** Spring. 4 credits.

Primarily for graduate students. Prerequisite: 793 or equivalent. Lec, T Th 8-9:50. M. E. Fisher.

Ensembles and partition functions. Thermodynamic properties of ideal gases and crystals. Third law of thermodynamics, equilibrium constants, vapor pressures, imperfect gases, and virial coefficients. Distribution and correlation functions, structure and properties of liquids. Lattice statistics and phase transitions. Bose-Einstein and Fermi-Dirac ideal gases. At the level of Hill's *Statistical Thermodynamics*.

**798 Selected Topics in Physical Chemistry**

Spring. 3 credits. Lec, T Th S 9:05. J. H. Freed. Topics vary from year to year.

## The Classics

F. M. Ahl, chairman; E. Asmis, A. Betensky, K. Clinton, J. E. Coleman, J. R. Ginsburg, W. R. Johnson, G. M. Kirkwood, P. Kirkwood, P. Kuniholm, D. L. Malone, G. M. Messing, P. Pucci, F. Williams.

The Department of classics offers majors in Classics, Greek, Latin, and Classical civilization.

## Classics

Those whose major study is in Classics must complete twenty-four credits in advanced courses in Greek or Latin (courses numbered above 201) and fifteen credits in related subjects, selected after a conference with the adviser.

## Classical Civilization

Those whose major study is in Classical civilization must complete (a) qualification in Latin and Greek or proficiency in either; (b) twenty-four credits selected from the courses listed under Classical civilization, Classical archaeology, Latin, and Greek; and (c) fifteen credits in related subjects. Related subjects for this purpose may be any courses in the humanities selected in conference with the adviser.

## Greek

Those whose major study is in Greek must complete twenty-four credits of advanced courses in Greek and fifteen credits in related subjects (including Latin). One or more courses offered by the Department of Comparative Literature may be counted towards the required twenty-four credits of Greek if students obtain the prior approval of their major adviser.

## Latin

The major in Latin is parallel to the major in Greek.

## Study Abroad

Cornell is a participant in the Intercollegiate Center for Classical Studies in Rome, which offers courses in Latin, Greek, ancient history, art, archaeology, and Italian. Detailed information on the center is available in the Department of Classics office, 120A Goldwin Smith Hall.

## The Honors Program

Candidates for the degree of Bachelor of Arts with honors in Classics, Greek, Latin, or Classical civilization must fulfill the requirements of the appropriate major study, as prescribed in the foregoing paragraphs, and also must complete successfully the special honors courses 370, 471, and 472. Credit for honors courses may be included in the credits required for the major study. Students who wish to become candidates for honors, who have a cumulative average of B- or better, and have demonstrated superior performance in Classics courses (Greek, Latin, and Classical civilization) should, after consulting a member of the department, submit an outline of their proposed honors work to the honors committee during the first month of their fifth semester.

## Ancient Mediterranean Studies

See p. 120.

## Distribution Requirement

The distribution requirement in the humanities is satisfied in Classics by (a) any two courses in Greek beginning with 201 or in Latin beginning with 207 that form a reasonable sequence; or (b) any two of the following: Classics 119, 120, 121, 200, 211, 212, 220, 221, 222, 224, 225, 236, 300, 304, 320, 331, 332, 333, 336, 337, 339, 340, 345, 360, 363, 430, 465, 465A. This requirement is also satisfied by Archaeology 100 and any one of the courses listed under classical archaeology.

## Greek

### 101 Greek for Beginners Fall. 4 credits.

M T W F 9:05, A. Betensky; M T W F 12:20, F. Williams.

Introduction to Attic Greek. Designed to enable the student to read the ancient authors as soon as possible.

### 103 Attic Greek Fall or spring. 3 credits.

Prerequisite: Greek 101 or equivalent.

Fall: M W F 1:25, E. Asmis. Spring: M W F 9:05, W. R. Johnson.

### 104 Intensive Greek Spring. 7 credits.

M T W Th F 12:20, D. L. Malone.

This course combines in one semester Greek 101 and 103.

### 111 Modern Greek Fall. 3 credits.

M W F 9:05, G. M. Messing.

### 112 Modern Greek Spring. 3 credits. Prerequisite: Greek 111.

M W F 9:05, G. M. Messing.

### 201 Attic Authors: Plato and Xenophon Fall. 3 credits. Prerequisite: Greek 103.

M W F 12:20, W. R. Johnson.

Attention is given both to the exact understanding of the Greek texts and to relevant broad literary and historical questions.

### 202 New Testament Greek Spring. 3 credits.

Prerequisite: Greek 103.

M W F 9:05, F. M. Ahl.

Selected readings from the Gospels and Paul's Epistles.

### 203 Homer Spring. 3 credits. Prerequisite: Greek 103.

Greek 103

M W F 10:10, J. R. Ginsburg.

Readings in Homeric epic; consideration of such literary problems as the authorship, unity, and style of the epics and their relation to oral and literary epic.

### [209-210 Greek Composition 209 fall; 210 spring. 2 credits per term. Prerequisite: Greek 103 or the equivalent. Not offered 1976-77.]

### [301 Greek Historians Fall. 4 credits.

Prerequisite: Greek 203 or the equivalent. Not offered 1976-77.]

### [302 Greek Tragedy Spring. 4 or 5 credits. An extra meeting once a week for an additional credit will be used for related reading in translation.

Prerequisite: Greek 203 or the equivalent. Not offered 1976-77.]

### 305 Attic Comedy Fall. 4 credits. Prerequisite: Greek 203 or the equivalent.

T Th 8:45-10, P. Pucci.

### [306 Greek Melic, Elegiac, and Bucolic Poetry Spring. 4 credits. Prerequisite: Greek 203 or the equivalent. Not offered 1976-77.]

### 307 Plato Spring. 4 credits.

M W F 11:15, E. Asmis.

Readings from the *Republic*.

### 401-402 Independent Study For qualified majors.

### 417 Homer Spring. 4 credits. Prerequisite: two terms of Greek at the 300 level or permission of instructor.

M W F 10:00, F. Williams.

The *Odyssey*.

### 419 Advanced Greek Composition Fall. 1 credit. Prerequisite: 209-210 or the equivalent. Students who register in Greek 419 must also register in Classics 420, History of the Greek Language.

G. M. Messing.

### [421 Advanced Readings in Greek Orators Spring. 4 credits. Prerequisite: two terms of Greek at the 300 level or permission of instructor. Not offered 1976-77.]

### [442 Greek Philosophy 4 credits. Prerequisite: two terms of Greek at the 300 level or permission of instructor. Not offered 1976-77.]

### 671 Seminar Fall. 4 credits.

T 3:35, E. Asmis.

The pre-Socratic philosophers.

### 672 Seminar Spring. 4 credits.

T 3:35, J. R. Ginsburg.

## 701-702 Independent Study for Graduate Students

## Latin

Placement of first-year students in Latin courses is determined by an examination given by the Department of Classics during Orientation Week, or, if necessary, in the second half of the fall term. Tentative placement is made on the basis of the previous training listed below as prerequisite for each course and the College Board Achievement Test scores.

### 105 Latin for Beginners Fall. 4 credits.

M T W F 8 or 10:10, P. Kirkwood; M T W F 1:25.

An introductory course in the essentials of the Latin language, designed for rapid progress towards reading the principal Latin writers.

### 106 Elementary Latin Spring. 3 credits.

Prerequisite: Latin 105 or placement by departmental examination.

M W F 8; M W F 1:25.

Continues the work of Latin 105, followed by readings from various authors.

### 107 Intensive Latin Spring. 7 credits.

M T W Th F S 8.

This course combines in one semester Latin 105 and 106.

### 108 Latin in Review Fall. 3 credits. Prerequisite: two years of high school Latin.

M W F 11:15.

A comprehensive review of the fundamentals of Latin followed by readings in Caesar. Analysis of the man, his milieu, and his style.

### 207 Catullus and Cicero Fall. 3 credits.

Prerequisite: Latin 106, 108, or three years of high school Latin.

M W F 10:10, J. R. Ginsburg; M W F 11:15,

D. L. Malone.

The course will examine, through the speeches and correspondence of Cicero and the poetry of Catullus, the tumultuous events, both political and literary, of the late Republic.

### 208 Literature and Life of Rome Spring. 3 credits. Prerequisite: Latin 108, 207, or 215, or the equivalent.

T Th 12:20-1:35, J. R. Ginsburg.

Readings from Ovid's *Metamorphoses* and Petronius' *Satyricon*.

### [215 Roman Comedy Fall. 3 credits. Prerequisite: Latin 106 or 108 or three units of entrance Latin. Not offered 1976-77.]

### 216 Vergil Spring. 3 credits. Prerequisite: Latin 207 or 215 or the equivalent.

M W F 12:20; M W F 11:15, F. Williams.

Selections from Vergil's *Eclogues*, *Georgics*, and *Aeneid*.

### 241-242 Latin Composition 241 fall; 242 spring. 2 credits per term. Prerequisite: for 241, Latin 106 or 108 or permission of instructor; for 242, Latin 241 or permission of instructor.

M 2:30, A. Betensky.

### 315 Roman Satire Fall. 4 credits. Prerequisite: Latin 208 or 216.

M W F 1:25, P. Pucci.

Horace's *Epistles*.

### 316 Roman Philosophical Writers Spring. 4 credits. Prerequisite: Latin 208 or 216 or equivalent.

M W F 1:25, A. Betensky.

Lucretius: the poetic aspects of *De Rerum Natura* will

be stressed in Latin readings and in discussion.

**[317 Roman Historiography: Sallust, Livy, Tacitus]** Spring. 4 credits. Prerequisite: Latin 318 or equivalent. Not offered 1976-77.]

**[318 Roman Elegy: Tibullus, Propertius, Ovid]** Fall. 4 credits. Prerequisite: Latin 208 or 216. Not offered 1976-77.]

**[367 Introduction to Medieval Latin]** 4 credits. Prerequisite: the equivalent to three semesters of intensive college-level Latin or permission of instructor. Not offered 1976-77.]

**368 Medieval Latin Literature** Fall. 4 credits. Prerequisite: Latin 367 or permission of instructor. T Th 10:10, plus a third session to be arranged. W. Wetherbee.  
Close study of medieval Latin texts and their historical and cultural contexts. The course will concentrate each term on two or three topics which may be authors, genres, periods, etc. A sample term's work might cover, for example, the sermons of St. Augustine, early medieval hagiography, and twelfth-century Latin lyric.

**[411 Advanced Readings in Latin Literature]** Fall. 4 credits. For upperclass and graduate students. Prerequisite: two terms of Latin at the 300 level or permission of instructor. Not offered 1976-77.]

**[441 Advanced Latin Composition]** Fall. 2 credits. For undergraduates who have completed Latin 241-242 and for graduate students. Not offered 1976-77.]

**451-452 Independent Study** For qualified majors.

**679 Seminar** Fall. 4 credits.  
Th 3:35. W. R. Johnson.  
Tacitus: *Historiae*. Studies in style and narrative technique.

**680 Seminar** Spring 4 credits.  
Th 3:35. D. L. Malone.  
Roman rhetoric. The seminar will stress 1) the aims and methods of rhetoric as the foundation of Roman education and possible discrepancies between theory and practice; 2) the interaction between rhetoric and literature.

**751-752 Independent Study for Graduate Students**

### Honors Courses

**370 Honors Course** Spring. 4 credits. To be taken in the junior year.  
A program of readings and conferences centered on an author or topic chosen in accordance with the special interests of the students and instructor.

**471 Honors Course** Fall. 4 credits. To be taken in the senior year.  
E. Asmis.  
Continuation of 370, with change of author or topic.

**472 Honors Course: Senior Essay** Spring. 4 credits. For students who have successfully completed Classics 471. Topics must be approved by the honors adviser at the end of the first term of the senior year.  
F. M. Ahl.

### Classical Linguistics

**420 History of the Greek Language** Fall. 3 credits. Graduate students in Classics will be expected, in addition, to register in Advanced Greek Composition, Greek 419.  
M W F 12:20. G. M. Messing.  
Lectures and assigned readings will cover the evolution of Greek from Indo-European and its subsequent development up to the Koine.

**[423 Vulgar Latin]** Fall. 4 credits.  
G. M. Messing. Not offered 1976-77.]

**[424 Italic Dialects]** Spring. 4 credits.  
G. M. Messing. Not offered 1976-77.]

**[425 Greek Dialects]** Fall. 4 credits.  
G. M. Messing. Not offered 1976-77.]

### Comparative Indo-European Linguistics (Linguistics 631-632)

### Classical Archaeology

The following courses may be used toward satisfaction of the intercollege concentration in archaeology; see archaeology, p. 00 and below, under Classical civilization, for other courses dealing with Classical art and architecture.

**220 Introduction to Classical Archaeology (also History of Art 220)** Spring. 3 credits.

M W F 9:05. A. Ramage.  
The sculpture, vase painting, and architecture of the ancient Greeks, from the Geometric period through the Hellenistic; and the art of the Romans, from the early Republic to the late Empire.

**221 Minoan-Mycenaean Art and Archaeology** Spring. 3 credits.

M W F 10:10.  
The early age of Greece from the Neolithic period to the end of the Bronze Age, with special emphasis on Minoan and Mycenaean civilizations.

**320 The Archaeology of Classical Greece (also History of Art 320)** Spring. 4 credits.

M W F 11:15. A. Ramage.  
Detailed study of the monuments and crafts of Athens, from the Geometric to the Roman period; the Acropolis and the Agora and Attic poetry and sculpture considered within their cultural context. Lectures and student reports.

**629 Problems in Minoan and Mycenaean Archaeology** Fall. 4 credits.

Th 1:25. P. Kuniholm.

**630 Seminar in Classical Greek Archaeology** Spring. 4 credits. Open to advanced students and with permission of instructor.

Th 1:25. P. Kuniholm.

### Classical Civilization

No knowledge of Greek or Latin is needed for these courses.

**119 Freshman Seminar in Greek Literature** Fall or spring. 3 credits.

Fall: M W F 9:05. J. R. Ginsburg. T Th 8:45-10.  
Spring: M W F 10:10. E. Asmis.

**120 Freshman Seminar in Latin Literature** Fall or spring. 3 credits.

Fall: M W F 12:20. D. L. Malone. Spring: M W F 12:20.

**121 Freshman Seminar: Aspects of Greek Thought** Fall. 3 credits.

T Th 10:10-11:25. L. Abel.

**211 The Greek Experience** Fall. 3 credits.

M W F 11:15. F. M. Ahl.  
An introduction to the literature and thought of ancient Greece with emphasis on their oral and dramatic presentation and intellectual and visual contexts. There will be analysis of tragedy and comedy, satire, and epic and lyric poetry; also selected prose works, augmented by films, slides, playreadings, and individual student interpretations.

**212 The Roman Experience** Spring. 3 credits.

M W F 11:15. F. M. Ahl.  
An introduction to the literature and thought of Rome

with emphasis on their oral and dramatic presentation and intellectual and visual contexts. There will be analysis of Roman comedy, tragedy, epic, lyric, satire, and forensic rhetoric, augmented by films, slides, playreadings, and individual student interpretations.

**220 Introduction to Classical Archaeology** See above under Classical archaeology.

**221 Minoan-Mycenaean Art and Archaeology** See above under Classical archaeology.

**[224 Greek Philosophy—Plato and Predecessors]** Fall. 3 credits. Not offered 1976-77.]

**[225 Greek Philosophy—Aristotle and Successors]** Spring. 3 credits. Not offered 1976-77.]

**236 Greek Mythology (also Comparative Literature 236)** Fall. 3 credits.

M W F 10:10. W. R. Johnson.  
A survey of the Greek myths, with emphasis on myths that have entered the postclassical Western tradition. Of the aspects of mythology to be studied the following will be among the most important: what "myth" meant to the Greeks; the factors and influences involved in the creation of myths; and the significance of myths in daily life, religion, and thought. Comparison and contrast with Roman attitudes to myth.

**[300 Greek and Roman Drama (also Comparative Literature 300)]** Spring. 4 credits. Not offered 1976-77.]

**[304 Introduction to Roman Law]** Fall. 4 credits. Not offered 1976-77.]

**320 The Archaeology of Classical Greece** See above under Classical archaeology.

**[331 Greek Foundations of Western Literature (also Comparative Literature 331)]** Fall. 4 credits. Not offered 1976-77.]

**[332 Pagan and Christian at Rome (also Comparative Literature 332)]** Spring. 4 credits. Not offered 1976-77.]

**[333 Latin Foundations of Western Literature (also Comparative Literature 333)]** Spring. 4 credits. Not offered 1976-77.]

**[336 Foundations of Western Thought (also Comparative Literature 336)]** Spring. 4 credits. Not offered 1976-77.]

**337 Ancient Philosophy of Science** Fall. 4 credits.

T Th 12:20-1:35. E. Asmis.  
The development of scientific method by the ancient Greeks: the pre-Socratic philosophers, Aristotle, the ancient atomists, and the medical writers (Hippocrates, the empiricists, Galen).

**339 Ancient Wit: An Introduction to the Theory and Form of Comic and Satiric Writing in Greece and Rome (also Comparative Literature 339)** Spring. 4 credits.

M W F 10:10. F. M. Ahl.  
The aim is not only to provide an introduction to comedy, satire, and other humorous writing in Greek and Roman literature, but to discuss the ancient works in the light of modern theories of comedy and laughter. Discussion of the nature of laughter itself in the light of both ancient and modern scholarship on the subject, from Plato's *Philebus* to Freud's *Wit and its Relation to the Unconscious* and Koestler's *The Act of Creation*. Examination of select works and passages of Homer, Euripides, Aristophanes, Hierocles, Lucian, Nonnus, Plautus, Horace, Martial, Juvenal, and Petronius.

**340 Greek Tragedy: Writing on Violence and Violence of Writing** Fall, 4 credits.

T Th 10:10-11:25 P. Pucci.  
Reading (in translation) of Aeschylus' *Oresteia*, Sophocles' *Oedipus*, Euripides' *Medea*. Starting from Aristotle's statement on the tragic catharsis, the course investigates the violent modes by which the tragic discourse aims at a reassuring vision of the world.

**345 Greek Historians** Fall, 4 credits.

M W F 11:15.  
Discussion of the origin and development of Greek historiography, and the method, style, and accuracy of the major Greek historians (Herodotus and Thucydides).

**[360 Greek Religion** Spring, 4 credits.

Prerequisite: any course in Classical civilization, Greek history, or Greek language or permission of instructor. Not offered 1976-77.  
A survey of Greek religion from the Bronze Age to the Roman period. Topics to be discussed include the nature of Greek worship and religious beliefs; religious centers and sanctuaries; religion in daily life; oracles; mystery religions; the influence of religion on literature; and changes in beliefs and in attitudes towards religion and the gods.]

**363 Women in Classical Greece and Rome**

Spring, 4 credits.  
T Th 10:10-11:25 L. Abel.  
In this course students will examine the evidence about the social and political position of women in ancient Greece and Rome. The purpose will be to trace the origins of some Western attitudes about women and to address general historical questions about the nature of evidence, basic chronology, and the development of political systems.

**415-416 Greek and Roman Mystery Cults** 415,

fall; 416, spring, 4 credits. Prerequisite: permission of instructor.  
W 3:25 K. Clinton.  
The development and character of Mystery cults from the original *Mysteria* of Demeter and Persephone to the Christian "Mysteries." These cults include the Kabiroi, the Great Gods of Samothrace, Dionysus, the Great Mother (Cybele), Roman Bacchus, Isis and Osiris, and other cults of Asia Minor and the Near East. Investigation will focus on the distinctive features of the Mystery cults which contributed to their success.

**[430 Genre and Period in Greek and Roman Literature (also Comparative Literature**

**430)** Spring, 4 credits. Prerequisite: one upper division course in Classics, comparative literature, English, or the modern foreign languages; senior standing or permission of instructor. Not offered 1976-77.]

**465 Cicero and His Age (also History**

**465)** Spring, 4 credits.  
W R. Johnson, A. Bernstein.  
An interdisciplinary examination of the final decades of the Roman Republic as seen through the eyes of the period's most prolific writer. Selections from Cicero's speeches, his personal correspondence, and his philosophical, political, and oratorical essays will be studied for the light they throw on both the man and his times.

**465A Readings in Cicero (also History**

**465A)** Spring, 4 credits. Student must be enrolled in Classics 465 (History 465). Students who are enrolled in History/Classics 465 and know Latin may read selected texts in the original in an additional section each week.

**711-712 Independent Study for Graduate Students**

See also:

**Architecture of the Ancient Near East (Arch. 340)****Architecture of the Classical World (Arch. 341)****Seminar in Architecture of Ancient Near East (Arch 640)****Seminar in Architecture of Classical World (Arch 641)****Classical Antiquity (History 261-262)**

[The Roman Revolution 146-44 B. C. (History 461) Not offered in 1976-77.]

[Early Imperial Rome 44 B. C.-A. D. 70 (History 462) Not offered 1976-77]

**Classical Greece, 510-404 B. C. (History 463)****Classical Greece, 404-338 B. C. (History 464)**

[Science in Classical Antiquity (History 481-482) Not offered 1976-77]

[Seminar in Ancient Classical History (History 661-662) Not offered 1976-77]

[Arts of the Roman Empire (History of Art 322) Not offered 1976-77]

[Painting in the Greek and Roman World (History of Art 323) Not offered 1976-77]

**Greek Vase Painting (History of Art 325)****Numismatics (History of Art 424)****Ancient Thought (Philosophy 210)**

[Ancient Philosophy (Philosophy 211) Not offered 1976-77]

**Plato (Philosophy 309)****Aristotle (Philosophy 310)**

[Topics in Ancient Philosophy (Philosophy 314) Not offered 1976-77]

[Plato and Aristotle (Philosophy 413) Not offered 1976-77]

**Ancient Philosophy (Philosophy 611)****Seminar on Interpretation of Coin Finds (414 Society for the Humanities)****Comparative Literature**

W. J. Kennedy, chairman; C. M. Carmichael, W. W. Holdheim, A. M. Kovacs, B. Pedersen, R. R. Roopnaraine, E. Rosenberg (English and comparative literature).

Also cooperating: M. H. Abrams; F. M. Ahl, C. Morón-Arroyo, J. P. Bishop, E. A. Blackall, A. F. Caputi, P. J. Carden, M. A. Carlson, K. M. Clinton, D. D. Eddy, E. G. Fogel, G. Gibian, S. L. Gilman, R. O. González, A. V. Grossvogel, D. I. Grossvogel, T. D. Hill, T. L. Jeffers, W. R. Johnson, C. Kaske, R. E. Kaske, G. M. Kirkwood, G. Mazzotta, J. R. McConkey, H. S. McMillin, E. P. Morris, I. Rabinowitz, B. O. States, J. L. Walker.

The Department of Comparative Literature offers no undergraduate major program. Certain of its courses may, however, be counted toward the major requirements of other departments at their option. For information consult the Classics, English, Germanic studies, Romance studies, and Russian sections in this *Announcement*. For information about other

courses, consult the offerings in Africana studies, Asian studies, Classics, English, history, history of art, modern languages, literatures, and linguistics, music, philosophy, Semitics, and theatre arts.

**Distribution Requirement**

The distribution requirement in the humanities may be satisfied by any two of the 200- or 300-level courses in comparative literature; 400-level courses may be applied with the permission of the instructor. Any of the 100-level courses may be used towards satisfying the Freshman Seminar requirement.

**101 The Writer as Mythmaker** Fall or spring.

3 credits. Freshman Seminar.  
T Th 10:10-11:25 Staff.  
The artist draws on and often creates traditions and myths in fabricating imaginative literary worlds. This seminar will first take a brief look at some Classical and Judaeo-Christian writings to examine the processes through which fictional worlds are created and the special ways in which these worlds comment on ethical, social, and political issues. Then it will focus on rejections, reaffirmations, and transformations of this mythmaking in nineteenth- and twentieth-century literature.

**102 Tales of Mystery, Quest, and**

**Self-discovery** Fall or spring, 3 credits. Freshman Seminar.  
M W F 10:10; M W F 11:15; T Th 12:20-1:35 Staff.  
On the premise that storytelling always begins with an appeal to the reader's curiosity, this course deals with three kinds of mystery and discovery: psychological fiction (How does a writer involve the reader in a character's discovery of his own nature?); detective stories (How does the writer tease or satisfy our curiosity about hidden events?); and allegorical narrative (How can a writer's creation of fantastic or terrifying worlds lead the reader to new perceptions about his own world?). Readings include *Oedipus Rex*, Dostoevsky, Edgar Allen Poe, and science fiction.

**103 Inner Worlds, Outer Worlds, Other**

**Worlds** Fall or spring, 3 credits. Freshman Seminar.  
M W F 9:05; M W F 11:15; T Th 12:20-1:35 Staff.  
Discussion of a series of dramatic and narrative works starting with the most "realistic" and moving towards various grotesque, fantastic, and romantic forms. Such a progression raises the question of literary reality: How does the writer perceive the world and how does the writer's imagination function in transforming and deforming it? Readings include Cervantes, Kafka, theatre of the absurd. Nonliterary media (film, music, art) also will be incorporated.

**216 The Reshaping of Tradition in European Literature** Fall, 3 credits. Limited to 20 students.

M W F 10:10 W. J. Kennedy.  
Study and discussion of the telling and the retelling of landmark motifs in selected great books of the Western tradition, 1976: comparison of ancient and modern, for example, Aeschylus' *Oresteia*, Sartre's *The Flies*, Homer's *Odyssey*, Joyce's *Ulysses*.

**293 Aspects of Modern Fiction** Fall, 3 credits.

Lectures and discussion.  
M W F 12:20 R. Roopnaraine.  
A systematic introduction to the narrative techniques of the twentieth-century novel. Writers to be studied will include Gide, Cela, Beckett, Svevo, Sartre, Pavese.

[312 Comedy Fall, 4 credits. W. J. Kennedy. Not offered 1976-77.]

**314 Crime and the Nature of Fiction (also French 309)** Fall, 4 credits.

M W F 11:15 D. Grossvogel.  
Crime as the central concern in "serious" and "escapist" literatures. Guilt and cleansing, exploration of external and internal mystery, deciphering the

clues and the text, etc. Proposed readings: Sophocles, Poe, Kafka, Robbe-Grillet, Pirandello, Christie, etc.

**[319 The Humanities in Liberal Education (also Spanish 390)]** Fall. 4 credits. C. Morón-Arroyo. Not offered 1976-77.]

**323 The Literature of Ancient Israel (also Semitics 330)** Fall. 4 credits. Not open to freshmen. M W F 9:05. I. Rabinowitz.

The ancient Israelite beliefs and cultural assumptions needed to comprehend the Bible as literature will be discussed. All readings in English.

**325 Biblical Law** Fall. 4 credits. Not open to freshmen.

M W F 11:15. C. M. Carmichael.  
A study of biblical laws, proverbs, and narratives against the background of ancient Near Eastern law and custom.

**326 Studies in Christian Origins** Spring. 4 credits. Not open to freshmen.

M W F 11:15. C. M. Carmichael.  
The religious and moral ideas, customs, and conventions found in the New Testament will be traced in the Old Testament and other Jewish writings.

**329 Literature and Religion (also Spanish 399)** Spring. 4 credits.

T Th 10:10-11:25. C. Morón-Arroyo.  
Three sections: (1) basic themes: religion and the epic (commitment and collective faith), religion and tragedy, religion and the psychological novel (freedom, determinism), literature and love (erotic, Christian, Neoplatonic); (2) basic sentiments (aestheticism, mysticism, nihilism, and the tragic sense of life); (3) the common roots of philosophy, art, and religion. Readings and class discussion in English.

**339 Ancient Wit: An Introduction to the Theory and Form of Comic and Satiric Writing in Greece and Rome (also Classics 339)** Spring. 4 credits.

M W F 10:10. F. M. Ahl.  
The aim is not only to provide an introduction to comedy, satire, and other humorous writing in Greek and Roman literature, but to discuss the ancient works in the light of modern theories of comedy and laughter. Discussion of the nature of laughter itself, in the light of both ancient and modern scholarship on the subject, from Plato's *Philebus* to Freud's *Wit and its Relation to the Unconscious* and Koestler's *The Act of Creation*. Examination of select works and passages of Homer, Euripides, Aristophanes, Hierocles, Lucian, Nonnus, Plautus, Horace, Martial, Juvenal, and Petronius.

**343 Medieval Literature** Fall. 4 credits.

M W F 12:20. R. E. Kaske.  
Analysis and interpretation of great medieval literary works in translation. Though readings will vary somewhat from year to year, a typical program would be *Beowulf*; *Chanson de Roland*; *Njála*; *Saga*; a romance of Chrétien; Wolfram's *Parzival*; Gottfried's *Tristan*, and/or *Sir Gawain and the Green Knight*; *Pearl*; *Piers Plowman*.

**[344 Dante in Translation** Spring. 4 credits. G. Mazzotta. Not offered 1976-77.]

**352 Classic and Renaissance Drama (also Theatre Arts 325)** Fall. 4 credits.

M W F 10:10. B. States.  
Readings in world drama from the Greeks to Shakespeare, including such dramatists as Aeschylus, Sophocles, Aristophanes, Plautus, Seneca, Machiavelli, Lope de Vega, Calderón, Marlowe, Shakespeare, Jonson, and Webster.

**353 European Drama, 1660-1900 (also Theatre Arts 326)** Spring. 4 credits.

T Th 10:10-11:25. M. Carlson.  
Readings from major dramatists from Molière to

Ibsen, including such authors as Racine, Congreve, Sheridan, Schiller, Goethe, Hugo, Büchner, Gogol, Turgenev, Zola, Hauptmann, and Chekhov.

**354 Modern Drama (also Theatre Arts 327)** Spring. 4 credits.

M W F 10:10. H. S. McMillin.  
Major dramatists of the modern period, including Ibsen, Chekhov, Shaw, Pirandello, Brecht, O'Neill, Miller, and Beckett.

**356 The Literature of Europe in the Renaissance** Fall. 4 credits.

M W F 10:10. P. Gottschalk.  
A study of English and Continental works, both literary and intellectual. The course will be organized around three or four major issues confronting the Renaissance, such as the intellectual ferment brought about by the voyages of discovery, and the elation or anxiety evoked by the rise of science, secular humanism, and political pragmatism. Readings will include such authors as Erasmus, More, Castiglione, Machiavelli, Cellini, Montaigne, Marlowe, and Shakespeare.

**357 The Literature of Europe Since 1800** Spring. 4 credits.

M W F 10:10. T. L. Jeffers.  
A study of European writers' search for values. The class not only contemplates the books as historical documents or aesthetic objects, but also attends to their present uses. There is much emphasis on students' abilities to speak to one another in discussions and essays. Authors include Balzac, Tolstoy, Ibsen, Mann, Malraux.

**363-364 The European Novel** 363, fall; 364, spring. 4 credits per term.

M W F 11:15. Fall: J. R. McConkey. Spring: B. Pedersen.  
Fall: readings of selected novels, romances, and autobiographical prose from 400 A.D. through the early nineteenth century. A typical listing of books to be read would include *The Confessions of Augustine*, *Tristan and Iseult*, *Don Quixote* (both volumes), *Candide*, *Les Liaisons dangereuses*, *The Sorrows of Young Werther*, and *The Charterhouse of Parma*. Though each work will be considered as an entity, certain recurrent themes provide a focus for the course, the most important being the effect of visionary insights upon the individual—a matter which brings up questions of personal identity, human meaning, and the seeming similarity between creative and destructive impulses.

Spring: the modern novel from Flaubert to Beckett. This course will discuss texts from the mid-nineteenth century to the present by such writers as Flaubert, Dostoevsky, Proust, Mann, Nabokov, and Beckett. Themes to be developed include realism and its breakdown, the criticism of the Novel (or of Literature) as an integral part of the novel itself, versions of irony and the grotesque, relations to society and history.

**369 Fiction as Satire in the Eighteenth Century** Spring. 4 credits.

T Th 12:20-1:35. A. M. Kovacs.  
A study of the beginning of the novel in England and France. Texts: *Lazarillo*; Cervantes, short selections from *Don Quixote*; Swift, *Gulliver's Travels*; Defoe, *Roxana*; Lesage, *Gil Blas*; Fielding, *Joseph Andrews*; Montesquieu, *Lettres persanes*; Smollet, *Roderic Random*; LaClos, *Liaisons dangereuses*.

**383 The City in Literature** Spring. 4 credits.

T Th 2:30-3:45. A. M. Kovacs.  
The course will examine attitudes to the city itself as well as the effects of urbanization and industrialization on man's philosophy and psychology. Readings include Dostoevsky's *Crime and Punishment*, Dickens' *Oliver Twist*, Camus' *The Plague*, Mishima's *Runaway Horses*, Zola's *L'assommoir*, Gogol's *The Overcoat and Other Tales of Good and Evil*, Defoe's *Moll Flanders*, and Barth's *The End of the Road*.

**400 Seminar in the Theory and Practice of Translation (also English 607)** Spring. 4 credits. Limited to 15 students. Prerequisite: reading knowledge of a foreign language, ancient or modern. T 3:35-5:30. E. G. Fogel.

Students will be expected to produce finished translations from writers of their choice and, with the aim of clarifying their principles of translation, to evaluate the work of notable modern translators. Topics to be considered: literal, free, and faithful translation; paraphrase and "imitation"; problems of prosody, rhetoric, and style; archaic, colloquial, and "standard" diction; self-translation (Nabokov and others); translation as interpretation and vice versa; translation and literary influence.

**[413 The Detective Story: Form and Function** Spring. 4 credits. R. R. Roopnaraine. Not offered 1976-77.]

**414 The Novella in World Literature** Spring. 4 credits

T Th 2:30-3:45. W. W. Holdheim.  
The art of the novella from Boccaccio to modern times. Readings will include works of Cervantes, Hoffmann, Kleist, Melville, James, Gogol, Pushkin, Mérimée, Maupassant. The theory of the novella and the genre's relation to other short narrative forms.

**417 James Joyce and the European Tradition** Spring. 4 credits.

W 2:30-4:25. W. J. Kennedy.  
A careful study of *Ulysses* from the point of view of its relationship to continental European texts from the Classical, medieval, Renaissance, and modern periods with particular reference to Homer, Dante, Rabelais, Ibsen, Svevo.

**419-420 Independent Study** Fall or spring. Credit to be arranged.

Staff.  
First term not prerequisite to second.

**423 Seminar on Coded Communication** Spring. 4 credits. Limited to 20 students.

Th 1:25-3:20. C. M. Carmichael.  
Fables, parables, laws and proverbs, prophetic cryptograms, oracles, and riddles from antiquity (biblical and Greek material) with an analysis of their cryptic element, division of mankind into outsiders and insiders, political and psychological function.

**424 Italy and the Transalpine Renaissance: Ariosto, Spenser, and Rabelais** Spring. 4 credits.

T 3:35-5:30. W. J. Kennedy.  
The impact of Italian literature upon English and French literature of the sixteenth century studied through the interrelationships among *Orlando Furioso*, *The Faerie Queene*, and *Gargantua and Pantagruel*.

**428 The Deuteronomistic School of Writers** Fall. 4 credits. Limited to 20 students.

Th 1:25-3:20. C. M. Carmichael.  
A detailed investigation of its contribution to biblical literature (Pentateuchal material, Joshua, Judges, Samuel, and Kings) with particular emphasis on the role of law and wisdom in the construction of the narratives.

**429 Readings in the New Testament** Fall. 4 credits. Prerequisite: upper class standing.

T Th 1:25-2:40. J. P. Bishop.  
Close readings of representative texts from the New Testament in modern scholarly editions, with the help of appropriate commentary, introductory and specialized. In 1976 the focus will be on Acts and the letters of Paul. All readings will be in English, but some reference to the Greek original will be made. Students in other colleges are welcome. The approach will be chiefly academic and literary but with hope of staying open to scholarly and religious issues alike.

**441 The Other World in Medieval Romance** Fall.

4 credits. A reading knowledge of either French or Latin is recommended.

T 2:30-4:25. T. D. Hill.

Consideration of the problems involved in the dialectic between this world and the other world in a variety of medieval romances. The texts to be considered will include the *Mabynogian*; the *Lais* of Marie de France, the works of Chrétien de Troyes, and *Gawain and the Green Knight*. Relevant aspects of other medieval romances also may be considered.

**446 Allegory and Symbolism** Spring. 4 credits.

M W F 10:10. C. Kaske.

Definitions and models drawn from the *Divine Comedy* will be related to a reading of works ranging from Classical to modern: the myths of Plato, the *Romance of the Rose*, mystical lyrics of St. John of the Cross, selections from *The Faerie Queene*, and *Faust, Part II*.

**[456 Utopias and Imaginary Voyages from the Renaissance to the Enlightenment** Fall. 4 credits. W. J. Kennedy. Not offered 1976-77.]

**[458 Petarch, Ronsard, and Donne** Fall. 4 credits. W. J. Kennedy. Not offered 1976-77.]

**463 The Picaresque Novel (also Spanish**

**455)** Fall. 4 credits. Prerequisite: permission of instructor.

W 3:35-5:30. R. González.

A detailed study of the picaresque novel in Europe from its Spanish models in the sixteenth century to Lesage and Fielding. Readings will include *Lazarillo de Tormes*, Mateo Alemán's *Guzmán de Alfarache*, Quevedo's *Buscón*, and Grimmelhausen's *Simplicissimus*. Discussion devoted to critical controversies about the picaresque, the concept of realism, the development of the novel, the feminine picaresque, and early manifestations of the picaresque in Latin America. Readings in English and in the original. Class conducted in English.

**[468 Three Novelists: Cervantes, Rabelais, Sterne** Spring. 4 credits. Prerequisites: reading knowledge of French or Spanish.

R. R. Roopnaraine.

Not offered 1976-77.]

**472 Ibsen and Strindberg (also Theatre Arts 442)** Fall. 4 credits.

T Th 10:10-11:25. M. Carlson.

Study of the major dramas of Ibsen and Strindberg in historical perspective and as illustrations of the development of each author's dramatic technique.

**[473 Autobiography as a Literary Form** Spring. 4 credits.

W. W. Holdheim.

Not offered 1976-77.]

**476 Myth and Literature** Spring. 4 credits.

W 2:30-4:25. B. Pedersen.

A discussion of the manner in which the concept of myth has been understood in modern literary theory and praxis (from Romanticism). Literary and critical texts will be read in close conjunction in order to describe the structures and functions of *mytho-poesis*. Readings from N. Frye, J. Campbell, Levi-Strauss, Friedrich Schlegel, Nietzsche, Thomas Mann, Freud, Melville, Yeats, Eliot, Barth.

**479 Fiction and the Irrational** Fall. 4 credits.

Limited to 12 students. Mainly for upperclass students.

W 2:30-4:25. E. Rosenberg.

Intensive study of seven or eight novels and novellas including Dostoevsky's *The Devils*, Tolstoy's *Kreutzer Sonata*, Flaubert's *Madame Bovary*, DeQuincey's *Confessions of an English Opium Eater* or Kierkegaard's *Diary of a Seducer*, Mann's *Death in Venice* and *Mario and the Magician*, and (time permitting) *Dr. Faustus*. Foreign works may be read either in the original or in translation. Two short papers and oral reports.

**481 Studies in Modern Poetry** Fall. 4 credits.

Some reading knowledge of French required.

T Th 12:20-1:35. J. Walker.

A study of the work of Yeats, Eliot, and Stevens in relation to the poetry and poetics of Mallarmé, Laforgue, and Valéry. In addition to analysing formal and thematic elements in the works of the individual poets, the course will attempt to assess the extent to which the French symbolists provided contexts and models for the development of modern-British and American poetry.

**483 Masterpieces of a Decade** Spring. 4 credits.

Limited to 12 students. Mainly for upperclass students.

W 2:30-4:25. E. Rosenberg.

Study of five novels written during the 1860's with a view towards exploring the different "values" expressed concurrently in diverse Western literatures. Texts: Turgenev, *Fathers and Sons*; Dickens, *Our Mutual Friend*; Dostoevsky, *The Idiot*; Eliot, *Felix Holt*; and Flaubert, *L'Education sentimentale*.

**488 Studies in the Literature of the Third World: The Caribbean Novel in English** Fall. 4 credits.

F 2:30-4:25. R. Roopnaraine.

The course will aim at a formulation and analysis of the relationships operating between the structures of colonialism and artistic production. Particular focus on problems of language and artistic form, history, and fantasy. Texts: Lamming, *In the Castle of Our Skin*, *The Emigrants*; Harris, *Palace of the Peacock*; Naipaul, *A House for Mr. Biswas*, *The Loss of El Dorado*; Hearne, *Faces of Love*; Selvon, *A Brighter Sun*; Mais, *Brother Man*.

**491 Twentieth-Century Poetry in America and Russia** Fall. 4 credits.

T 3:35-6. E. G. Fogel.

The development of modernism in American and Russian poetry in the first four decades of the twentieth century. The achievement of such American poets as Pound, Eliot, Williams, and especially Wallace Stevens; and of such Russian poets as Blok, Akhmatova, Pasternak, and especially Osip Mandelstam. Among the topics to be considered: the special problems of the American and Russian poet; the influence of French symbolism; Imagism in America and Acmeism in Russia; traditional and innovative prosody; problems of diction and voice; modernism in poetry and the fine arts; nationalism and cosmopolitanism; the artist and politics. Foreign poets will be read in translation or in bilingual texts.

**493 Modern Variations of the Picaresque Novel** Spring. 4 credits.

F 2:30-4:25. R. Roopnaraine.

An important feature of much twentieth-century fiction has been the resurgence of the old picaresque mode. From an intensive study of some recent novels, the course aims at identifying (a) the precise nature of this resurgence (parodic, analogical, etc.); (b) the significance of this particular resurgence at this particular time, with special emphasis on the evolution of the modern novel. Texts: Mann, *The Confessions of Felix Krull*; Céline, *Journey to the End of Night*; Cary, *The Horse's Mouth*; Ellison, *The Invisible Man*; Below, *The Adventures of Augie March*; Grass, *The Tin Drum*; Hawkes, *The Lime Twig*; Boll, *The Clown*.

**497 Samuel Beckett** Fall. 4 credits. Reading knowledge of French required.

Th 2:30-4:25. B. Pedersen.

A study of Beckett's novels, stories, plays, and poems which will attempt to place them formally and historically in English and French traditions. Problems to be considered: the bilingual dimension in his texts (his translations from French and English), his continuing critique of earlier texts (his own and others'), the reduction of fictions, parody, the desire for silence.

**[499 Origins of the Avant Garde** Spring. 4 credits. P. J. Carden. Not offered 1976-77.]

**[611 Studies in the Lyric: Dante, Scevè, and Yeats** Spring. 4 credits. W. J. Kennedy. Not offered 1976-77.]

**[683 The Historical Novel** Fall. 4 credits. W. W. Holdheim. Not offered 1976-77.]

**[684 Theories of Interpretation: the Marxist Perspective** Spring. 4 credits. R. Roopnaraine. Not offered 1976-77.]

**691 Seminar on F. G. Lorca** Spring. 4 credits.

Reading knowledge of Spanish essential.

M 3:35-5:30. R. Roopnaraine.

An examination of Lorca's poetic and dramatic production with an emphasis on its historical relations.

**698 Topics in Modern Literature: From Formalism to Structuralism** Fall. 4 credits.

Reading knowledge of French or German required.

M 1:25-3:20. B. Pedersen.

A reading of critical theoretical texts by Tynjanov, Eichenbaum, Shklovsky, Todorov, Barthes, Foucault, Kristeva, N. Frye, and others. Questions and problems to be considered in this course include: the status of a critical discourse—its strategies, values, and limits; notions of form and structure; the dependence upon linguistic models and the gradual problematization of the concept of the sign.

**699 Topics in Modern Literature: Hermeneutics** Spring. 4 credits.

M 1:25-3:20. W. W. Holdheim

Study of the thought of H. G. Gadamer, centering on his chief work, *Truth and Method* (in translation).

See also:

**Chinese Imaginative Literature (Asian Studies 372)**

**Modern Japanese Fiction (Asian Studies 376)**

**Japanese Nō Theatre (Asian Studies 400)**

**Problems of Interpretation in the Human Sciences (French 381-382)**

**Don Juan: Rank and Other Files (French 400)**

**Yiddish Literature in English Translation (German Literature 350)**

**Twentieth Century German Drama in English Translation (German Literature 362)**

**Topics in German Literature I: The Modern German Novel in English Translation (German Literature 413)**

**The Northern Renaissance and Reformation (German Literature 625)**

**Alessandro Manzoni and the Nineteenth-Century Historical Novel (Italian 486)**

**Russian Literature (Russian 207-208)**

**Background of Russian Culture (Russian 312)**

**Russian Theatre and Drama (Russian 332)**

**Soviet Literature in Translation (Russian 368)**

**Dostoevsky (Russian 369)**

**Revolution and the Individual in Russian Literature—Nineteenth and Twentieth Century (Russian 370)**

**Themes in Modern Hebrew Literature: The Holocaust (Semitics 266)**

**The Hebrew Creative Mind: Survey of Hebrew Literature in Translation (Semitics 267)****Seminar in Modern Hebrew Literature: The National Renaissance (1881-1914) (Semitics 361-362)****Hebrew Poetry of the Twentieth Century (Semitics 365)****Agnon and Hazaz (Semitics 368)****Seminar on the Confidence Man, the Bard, and the Savants (Society for the Humanities 415)****Leibniz and Modern Linguistic Theory (Society for the Humanities 420-421)****Literary and Performing Arts of Medieval Japan (Society for the Humanities 423)**

## Computer Science

G. Salton, chairman; G. Andrews, R. L. Constable, R. W. Conway, A. Demers, J. E. Dennis, Jr., J. Donahue, D. Gries, S. P. Han, J. Hartmanis, J. E. Hopcroft, R. Teitelbaum, C. Van Loan, J. Williams.

At Cornell, computer science is concerned with fundamental knowledge in automata, computability, and programming languages and systems programming, as well as with subjects such as numerical analysis and information processing that underlie broad areas of computer applications. Because of the wide implications of research in the field, the department is organized as an intercollege department in the College of Arts and Sciences and the College of Engineering.

Even though there is as yet no formal undergraduate major in computer science, the department offers a comprehensive set of undergraduate and graduate courses from which students can select the appropriate sequences to fit their major interests. It is possible to take a strong computer science minor through the Mathematics Department (option II), or to include small amounts of computer science as part of an independent major with substantial work in other fields—as in the case of a sociology student who wants to learn to use computers. Such majors must be approved by the Independent Major Board.

Introductory courses: CS 100 is a first course in programming using PL/1; it is given during the first eight weeks of each semester. CS 102, 104, and 106 are one-credit courses that rely on 100 but that can be taken the same term. Students can assemble a one-, two-, three-, or four-credit introduction to programming to fit their interests by appropriately selecting from this group. CS 211 is a foundations course in computers and programming that leads to more advanced courses.

Students who want a strong minor in computer science should take the following courses: 211, 280, 314, 410, and two out of 321, 322, 414, 481, 482, 611, 612.

Courses are listed in College of Engineering section under Computer Science.

## Economics

E. Thorbecke, chairman; E. A. Blackstone, W. Brock, M. G. Clark, T. E. Davis, R. H. Frank, R. T. Freeman, W. Galenson, F. H. Golay, M. R. Haines, G. H. Hildebrand, W. Isard, A. E. Kahn, M. Majumdar, P. D. McClelland, D. C. Mueller, P. Pestieau, U. M. Possen, R. E. Schuler, S. M. Slutsky, G. J. Staller, S. C. Tsiang, J. Vanek, H. Y. Wan, Jr.

Students who wish to major in economics must have

completed Economics 101-102 or its equivalent with an average of C or better. Students who have completed only one semester of the introductory course may be accepted as provisional majors provided their grade was at least C. Prospective majors should report to the Department of Economics office.

The requirements for a major are: (1) Economics 311 and 312; (2) twenty credits of other economics courses listed by the Department of Economics in this Announcement, except that, with the permission of the major adviser, two economics courses outside the College of Arts and Sciences may be used to fulfill this requirement; and (3) three courses above the introductory level in subjects related to economics selected, with the approval of the major adviser, from the offerings of the Departments of Anthropology, Asian Studies, Government, History, Mathematics, Philosophy, Psychology, and Sociology, and the Center for International Studies.

In addition to the courses required for the major, many students will find it valuable to take statistics (the diverse possibilities include Agricultural Economics 310, Industrial and Labor Relations 210, Industrial Engineering 9170 and 9370, and Mathematics 370 and 371, 472, 475). Mathematics courses are not needed for an undergraduate major. However, students planning graduate work in economics are strongly advised to take mathematics at least through calculus and linear algebra.

### The Honors Program

Candidates for the degree of Bachelor of Arts with honors are required to have: A) a grade-point average in economics courses of A- or better except in exceptional circumstances; B) enrollment in at least two of the following three courses: (i) International Economics, (ii) Quantitative Methods or Mathematical Economics, (iii) Economics of Public Issue or Public Finance; C) enrollment in the senior year in Economics 391 and 392.

### Distribution Requirement

The distribution requirement in social sciences is satisfied in economics by Economics 101-102.

All Department of Economics courses listed below are subject to change and should be checked against departmental supplements which are available in the Economics Department before the start of each semester. These supplements will also include the day and time of each course.

**101 Introductory Economics** Fall or spring. 3 credits. Lectures and discussion.

Fall, W. Galenson, P. D. McClelland; spring, G. J. Staller.

Analysis of aggregate economic activity in relation to the level, stability, and growth of national income. Topics discussed may include the determination and effects of unemployment, inflation, balance of payments deficits, and economic development, and how these may be influenced by monetary, fiscal, and other policies.

**102 Introductory Economics** Fall or spring. 3 credits. Lectures and discussion.

Fall, R. E. Frank; spring, E. A. Blackstone, L. Johnson.

Explanation and evaluation of how the price system operates in determining what goods are produced, how goods are produced, and who receives income, and how the price system is modified and influenced by private organizations and government policy.

### General Courses

**[301 Economics of Market Failure** 4 credits. Prerequisite: 102. Not offered 1976-77.]

**302 The Impact and Control of Technological Change** Spring. 4 credits.

D. C. Mueller.

Examines social, environmental, and economic implications of technological change in the United States in the context of possible policies and strategies of control. Several specific cases will be considered in detail followed by a broader investigation of the problems of a modern technological society. Alternative political-economic solutions will be explored.

**304 Economics and the Law** Fall. 4 credits.

Prerequisite: 311 or permission of instructor.

J. P. Brown.

**307 Economic Analysis of the Private Sector (also C&EE B301, College of Engineering)** Fall. 4 credits. Prerequisite: one year of college-level mathematics.

R. E. Schuler

Intermediate microeconomic analysis similar to Economics 311 but emphasizing mathematical techniques. Theory of households, firms, monopoly and competitive markets, distribution and equilibrium. A liberal elective for engineers.

**308 Economic Analysis of Government (also C&EE B302, College of Engineering)** Spring. 4 credits. Prerequisite: one year of college level mathematics plus C&EE B301 or Econ 311.

R. E. Schuler.

Analyzes government intervention in a market economy. Public goods, public finance, cost-benefit analysis, environmental regulation, and macroeconomic topics are covered.

**309 Capitalism and Socialism (also Industrial and Labor Relations 347)** Fall. 4 credits.

Prerequisites: 101-102.

G. H. Hildebrand.

Capitalism as a type of economic organization and as an idea system. Smith's view and Marx's critique. The achievements of capitalism. Some current issues. Socialist criticisms. Recent appraisals of capitalism and socialism by Schumpeter, von Mises, Sweezy, Pigou, Galbraith, and Friedman.

**311 Intermediate Microeconomic Theory** Fall or spring. 4 credits. Prerequisites: 101-102 or permission of instructor.

Fall, P. Pestieau, L. Gosse; spring, S. M. Slutsky, R. Ehrenberg.

Analysis of the pricing processes in a private enterprise economy under varying competitive conditions, their role in the allocation of resources, and the functional distribution of national income.

**312 Intermediate Macroeconomic Theory** Fall or spring. 4 credits. Prerequisites: 101-102 or permission of instructor.

Fall, R. T. Freeman, M. R. Haines; spring, U. M. Possen.

An introduction to the theory of national income determination and economic growth in alternative models of the national economy; the interaction and relation of aspects of these models of empirical aggregate economic analysis.

**315 History of Economic Thought**

Fall. 4 credits. Prerequisites: 101-102 or permission of instructor.

L. Johnson.

Survey of development and economic thought from the early modern period to early twentieth century. Emphasis placed on English classical economic thought, with attention to divergent and dissident schools, terminating with the work of Alfred Marshall. Students have the option of writing an approved term paper or taking the final.

**317 Intermediate Mathematical Economics I**

Fall. 4 credits.

W. Brock.

Introduction of calculus and matrix algebra; problems

of maximization of a function of several variables. Economic examples are used to illustrate and teach the mathematical concepts.

### 318 Intermediate Mathematical Economics II

Spring. 4 credits.

M. Majumdar.  
Advanced techniques of optimization and application to economic theory.

### 319 Quantitative Methods

Fall. 4 credits.  
Prerequisite: good control of microeconomic and macroeconomic theory and some very elementary knowledge of calculus, linear algebra, and probability, or permission of instructor.

G. J. Staller.  
Introduction of quantitative procedures and measures central to economic analysis. Topics to be covered include national income accounts, input-output tables, flow of funds, industrial structure, economic stability, and changes in output, prices, and employment. Both American and European examples will be considered.

### 320 Quantitative Methods

Spring. 4 credits.  
Prerequisite: good control of microeconomic and macroeconomic theory and some very elementary knowledge of calculus, linear algebra, and probability, or permission of instructor.  
Staff.

The application of quantitative analysis to the testing of economic theories, largely at the macroeconomic level. This framework will provide a basis for the study and evaluation of cross-sectional and time-series data, methodology and theory of economic measurement, statistical techniques, empirical studies, and economic forecasting.

## Economic History

### [321 Economic History of Ancient Medieval Europe

4 credits. Prerequisite: permission of instructor. Not offered 1976-77.]

### 322 Economic History of Modern Europe: 1750 to the Present

Fall. 4 credits. Open to upperclass students with some background in economics or history, or with permission of instructor.

M. R. Haines.  
Covers and analyzes the background, origins, and character of the industrialization and modernization of Europe since 1750. Topics include the agricultural revolution and the role of technology in historical economic change; the importance of trade, institutional, and structural change; the social and demographic aspects of modernization; and the geographic diffusion of modern growth.

### 323 American Economic History

Spring. 4 credits. Prerequisites: 101-102, or permission of instructor.

P. D. McClelland.  
A survey of the problems of development in the American economy from first settlement to early industrialization.

### [324 American Economic History

Spring. 4 credits. Prerequisites: 101-102, or permission of instructor.

P. D. McClelland.  
A survey of problems in American economic history from the Civil War to World War I. Not offered 1976-77.]

### 325 Economic History of Latin America

Fall. 4 credits. Open to upperclass students with some background in economics or history, or with permission of instructor.

T. E. Davis.  
A survey emphasizing the processes and problems of economic growth and the evolution of economic institutions.

## Money, Banking, and Public Finance

### 331 Money and Credit

Fall. 4 credits.

Prerequisites: 101-102.  
U. M. Possen.  
A systematic treatment of the determinants of the money supply and the volume of credit. Economic analysis of credit markets and financial institutions in the United States.

### 333 Theory and Practice of Asset Markets

Fall. 4 credits. Prerequisites: 311-312.

E. T. Butron.  
This course is designed to acquaint students with the theory of decision making in presence of uncertainty and the practical aspects of particular asset markets.

### 335 Public Finance: Resource

Allocation Spring. 4 credits. Prerequisites: 101-102.

P. Pestieu.  
Analysis of the role of government in allocating resources through taxes and expenditures. Criteria for evaluation will be developed and applied to specific policies. Attention will focus on the federal government.

### [336 Collective Choice: Theory and

Applications Fall. 4 credits. Prerequisite: 311, or permission of instructor. Not offered 1976-77.]

### 338 Macroeconomic Policy

Spring. 4 credits. Prerequisite: 312.

U. M. Possen.  
A study of the use of fiscal and monetary policies for achieving full employment, price level stability, and appropriate economic growth.

## Labor Economics

### 342 Problems in Labor Economics (also Industrial and Labor Relations 343)

Spring. 4 credits. Prerequisites: 101-102; ILR 240 recommended.

G. H. Hildebrand.  
An advanced course concerning the institutional organization of labor markets, economic analysis of their operation, and major policy questions involved. Principal topics include wage and employment theory, determinants of wage level and structure, technological change, unemployment, poverty and income distribution, inflation and incomes policy.

## Organization, Performance, and Control of Industry

### 351 Industrial Organization

Fall. 4 credits. Prerequisites: 101-102.

E. A. Blackstone.  
An analysis of the prevalence and effectiveness of competition in the American economy centering on the structure, conduct, and performance of American industry. Case studies of industries and firms will be read, and emphasis will be placed on relating theories of monopoly, oligopoly, and competition to specific firms and industries.

### 352 Public Regulation of Business

Spring. 4 credits. Prerequisite: 351, or permission of instructor.

E. A. Blackstone.  
A continuation of Economics 351, concentrating mainly on public policies of enforcing, supplementing, or replacing competition, with specific studies of selected industries and recent legal cases.

### [354 Economics of Regulation

Spring. 4 credits. Not offered 1976-77.]

### 355 Economics of the American System of

Private Enterprise Fall. 4 credits. Prerequisites: 101-102, 311-312, or equivalent.

G. H. Hildebrand.

A critical examination of the private sector of the United States economy: its history, some leading current issues involving it, and its relation to theoretical and philosophical interpretations of the market economy.

### 356 Economics of the American System of

Private Enterprise Spring. 4 credits. Prerequisites: 101-102, 311-312, or equivalent.

G. H. Hildebrand.  
For course description, see Economics 355.

## International and Comparative Economics

### 361 International Trade Theory and Policy

Fall. 4 credits. Prerequisites: 101-102, or permission of instructor.

R. T. Freeman.  
Survey of the principles that have served as guides in the formulation of international trade and commercial policies. The evolution of the theory of international trade, principles and practices of commercial policy problems of regional integration and customs unions, and institutions and practices of state trading.

### 362 International Monetary Theory and

Policy Spring. 4 credits. Prerequisites: 101-102, or permission of instructor.

R. T. Freeman.  
Survey of the principles that have served as guides in the formulation of international financial policies. The evolution of the theory of balance of payments adjustment, international monetary standards, international capital movements, economic aid, international monetary institutions, and proposals for international monetary reforms.

### [364 The United States in the World

Economy Spring. 4 credits. Prerequisites: 101-102, or permission of instructor. Not offered in 1976-77.]

### [365 Economic Policy and Development in

Southeast Asia Spring. 4 credits. Prerequisite: permission of instructor. Not offered 1976-77.]

### [366 Introduction to the Japanese

Economy Spring. 4 credits. Not offered 1976-77.]

### 367 Comparative Economic Systems: Soviet

Union and Europe Fall. 4 credits.

G. J. Staller.  
Discussion of rationality and feasibility of economic planning (von Mises, Hayek, Lange). Examination of the various approaches to planning, including discussion of the planning techniques in Europe, Yugoslavia, and the Soviet Union (with emphasis on the Soviet Union). Consideration of economic competition between the market and the planned systems.

### [368 Contemporary Brazil (also Sociology

368) Spring. 4 credits. Prerequisites: two courses in social sciences. Not offered 1976-77.]

## Economic Growth and Development

### 371 Process of Economic Development

Fall. 4 credits.

F. H. Golay.  
The process of economic development in developing countries. Theories and explanations of the growth and development process. The role of the state in development planning. Strategies of economic and social development to achieve higher income growth, increased employment, and a more equitable income distribution.

### 372 Applied Economic Development

Spring. 4 credits.

F. H. Golay.  
Empirical study of the development process. Case studies of a few developing countries. The relationship between traditional and modern sectors

in the growth process. Performance of developing countries with respect to income, employment, and income distribution.

**378 Economics, Population, and Development** Spring, 4 credits.

M. R. Haines.

An introduction to the economic aspects of population and the interaction between population change and economic change. Particular attention will be paid to economic views of fertility, mortality, and migration, and to the impact of population growth on economic growth, development, modernization, resources, and the environment.

**382 Economics of Workers' Management in Yugoslavia** Spring, 4 credits. Prerequisites:

311-312, or permission of instructor.

J. Vanek.

Examines the worker-managed economy of Yugoslavia. Organization and the theoretical and practical implications of worker management will be studied in detail. Special attention given to outcome of decision-making process at firm level, the consistency of these outcomes with the national plans, and the policies used to implement them.

### Honors Program

**391 Honors Seminar** Fall, 4 credits. Required of all senior honors candidates.

R. H. Frank.

Selected readings in the economics of public issues.

**392 Honors Seminar** Spring, 4 credits. Required of all senior honors candidates.

R. T. Freeman.

Continuation of 391.

**399 Readings in Economics** Fall or spring.

Variable credit.

Any member of the department.

**Comparative Economic Systems: Soviet**

**Russia** Spring, 4 credits.

G. M. Clark.

See ILR 647 for description.

**Location Theory**

W. Isard.

See CRP 933 for description.

**Economics of Evaluation**

R. Ehrenberg.

See ILR 647 for description.

### Graduate Courses and Seminars

**504 Economics and the Law** Fall, 4 credits.

J. P. Brown.

See 304 for course description.

**509 Microeconomic Theory I** Fall, 4 credits.

W. Brock.

Topics in consumer and producer theory.

**510 Microeconomic Theory II** Spring, 4 credits.

R. E. Schuler.

Additional topics in consumer and producer theory, equilibrium models and their application, externalities and public goods, intertemporal choice, simple dynamic models and resource depletion, choice under uncertainty.

**[511 Microeconomic Theory** Fall, 4 credits. Not offered 1976-77.]

**[512 Macroeconomic Theory** Spring, 4 credits. Not offered 1976-77.]

**513 Macroeconomic Theory: Static Income Determination** Fall, 4 credits.

E. M. Gramlich

**514 Macroeconomic Theory: Dynamic Models, Growth, and Inflation** Spring, 4 credits.

R. H. Frank.

**517 Intermediate Mathematical Economics I**

Fall, 4 credits.

W. Brock.

See 317 for course description.

**518 Intermediate Mathematical Economics II**

Spring, 4 credits.

M. Majumdar.

See 318 for course description.

**519 Quantitative Methods** Fall, 4 credits.

Staff.

**520 Quantitative Methods** Spring, 4 credits.

Staff.

**[521 Economic History of Ancient Medieval Europe** Fall, 4 credits. Not offered 1976-77.]

**522 Economic History of Modern Europe: 1750 to the Present** Fall, 4 credits.

M. R. Haines.

See 322 for course description.

**523 American Economic History** Spring, 4 credits.

P. D. McClelland.

See 323 for description.

**[524 American Economic History** Not offered 1976-77.]

**525 Economic History of Latin America** Fall, 4 credits.

T. E. Davis.

See 325 for course description.

**[536 Collective Choice: Theory and Applications** Spring, 4 credits. Not offered 1976-77.]

**551 Industrial Organization** Fall, 4 credits.

E. A. Blackstone.

See 351 for course description.

**552 Public Regulation of Business** Spring, 4 credits.

E. A. Blackstone.

See 352 for course description.

**555 Economics of the American System of Private Enterprise** Fall, 4 credits. Prerequisites:

101-102, 311-312, or equivalent.

G. H. Hildebrand.

See 355 for course description.

**556 Economics of the American System of Private Enterprise** Spring, 4 credits. Prerequisites:

101-102, 311-312, or equivalent.

G. H. Hildebrand.

See 356 for course description.

**561 International Trade Theory and Policy** Fall, 4 credits. Prerequisites: Economics 101-102, or permission of instructor.

R. T. Freeman.

See 361 for course description.

**562 International Monetary Theory and Policy** Spring, 4 credits. Prerequisites: 101-102, or permission of instructor.

R. T. Freeman.

See 362 for course description.

**565 Economic Problems of Latin America** Spring, 4 credits.

T. E. Davis.

**[566 Introduction to the Japanese Economy** Spring, 4 credits. Not offered 1976-77.]

**567 Comparative Economic Systems: Soviet Union and Europe** Fall, 4 credits.

G. J. Staller.

See 367 for course description.

**[568 Contemporary Brazil** Spring, 4 credits. See 368 for course description. Not offered 1976-77.]

**571 Process of Economic Development** Fall, 4 credits.

F. H. Golay.

See 371 for course description.

**572 Applied Economic Development** Spring, 4 credits.

F. H. Golay.

See 372 for course description.

**578 Economics, Population, and Development** Spring, 4 credits.

M. R. Haines.

See 378 for course description.

**582 Economics of Workers' Management in Yugoslavia** Spring, 4 credits. Prerequisites:

311-312, or permission of instructor.

J. Vanek.

See 382 for course description.

**611 Advanced Microeconomic Theory** Fall, 4 credits.

S. M. Slutsky.

**612 Advanced Macroeconomic Theory** Spring, 4 credits.

E. M. Gramlich.

**[617 Mathematical Economics** Fall, 4 credits. Not offered 1976-77.]

**618 Mathematical Economics** Spring, 4 credits.

M. Majumdar.

**619 Econometrics** Fall, 4 credits.

Staff.

**620 Econometrics** Spring, 4 credits.

Staff.

**[623 American Economic History** Fall, 4 credits. Not offered 1976-77.]

**[624 American Economic History** Spring, 4 credits. Not offered 1976-77.]

**[626 Methods in Economic History** Spring, 4 credits. Not offered 1976-77.]

**[631 Monetary Theory and Policy** Fall, 4 credits. Not offered 1976-77.]

**[632 Monetary Theory and Policy** Spring, 4 credits. Not offered 1976-77.]

**635 Public Finance: Resource Allocation and Fiscal Policy** Fall, 4 credits.

S. M. Slutsky.

**636 Public Finance: Resource Allocation and Fiscal Policy** Spring, 4 credits.

P. Pestieau.

**638 Public Finance: Local Government and Urban Structure** Fall, 4 credits.

R. E. Schuler.

Integrates urban and regional theory with the economics of local government. Topics include urban spatial and hierarchical models, optimal governmental organization, spatial allocation of facilities, service spill-overs, revenue transfers, and regional growth.

**[641 Labor Economics** Fall, 4 credits. Not offered 1976-77.]

**642 Labor Economics** Spring. 4 credits. Not offered 1976–77.]

**644 The Labor Market and Public Policy: A Comparative View** Spring. 4 credits.  
W. Galenson.

Incomes policies; collective bargaining and fiscal policy; financing unemployment; employee capital sharing; codetermination and similar schemes; trade unions and national economic policy.

**648 Issues in Latin America** Spring. 4 credits. Not offered 1976–77.]

**651 Industrial Organization and Regulation** Fall. 4 credits.  
D. C. Mueller.

**652 Industrial Organization and Regulation** Fall. 4 credits.  
E. A. Blackstone.

**661 International Economics: Pure Theory and Policy** Fall. 4 credits.  
J. Vanek.

**664 International Economics: Balance of Payments and International Finance** Spring. 4 credits.  
Staff.

**670 Economic Demography and Development** Spring. 4 credits.  
M. R. Haines.

Covers the literature on economic aspects of population dynamics with emphasis on interaction between population change and economic development. Includes a survey of material on the role of economic factors in fertility, mortality, and migration during the development and modernization process. Covers policy implications of rapid versus slow or zero population growth.

**671 Economics of Development** Spring. 4 credits.  
E. Thorbecke.

**672 Economics of Development** Fall. 4 credits.  
F. H. Golay.

**674 Economic Systems** Spring. 4 credits.  
G. J. Staller.

**678 Economic Growth in Southeast Asia** Spring. 4 credits. Not offered 1976–77.]

**679 Theory of Quantitative Economic Policy Applied to Development** Fall. 4 credits. Not offered 1976–77.]

**681 Economics of Participation and Labor-Managed Systems: Theory** Fall. 4 credits.  
J. Vanek.

**682 The Practice and Implementation of Self-Management** Spring. 4 credits.  
J. Vanek.

**684 Seminars in Advanced Economics** Fall or spring. Variable credit. Not offered 1976–77.]

## English

A. Caputi, chairman; M. H. Abrams, B. B. Adams, A. R. Ammons, J. P. Bishop, J. F. Blackall, S. Budick, M. J. Colacurcio, D. D. Eddy, R. H. Elias, S. B. Elledge, A. V. Ettin, R. T. Farrell, E. G. Fogel, P. A. Gottschalk, W. J. Harris, N. H. Hertz, T. D. Hill, K. Hume, R. D. Hume, T. L. Jeffers, C. V. Kaske, R. E. Kaske, C. S. Levy, A. Lurie, P. L. Marcus, D. E. McCall, K. A. McClane, J. R. McConkey, H. S. McMillin, D. M. Mermir, J. B. Merod, A. M. Mizener, R. Morgan, S. J. Morgan,

D. Novarr, A. R. Parker, S. M. Parrish, B. Rosecrance, E. Rosenberg, P. L. Sawyer, D. R. Schwarz, S. Siegel, W. J. Slatoff, B. O. States, S. C. Strout, J. L. Walker, W. Wetherbee.

## Majors

Any student considering a major in English should see the director of undergraduate studies in English to arrange an assignment to a major adviser. Copies of a brochure containing suggestions for English majors and prospective English majors are available in the department's office, 252 Goldwin Smith Hall.

Prospective English majors should take one or more courses from the group English 270, 271, 272, 280, 281 as early as possible. All these courses are open to sophomores; English 270, 271, 272 are also open to second-term freshmen and may be used to satisfy the Freshman Seminar requirement. First-term freshmen with advanced placement in English may enroll in English 270, 271, or 272 as space permits, and prospective English majors are encouraged to do so. As soon as students have completed one of these courses they may declare themselves as English majors, provided they have achieved a letter grade of C or better in this and any other English course they may have taken.

English majors are required to complete six credits of foreign language study (preferably in the literature of a foreign language) in courses for which qualification is a prerequisite. Majors are urged to complete this requirement by the end of their sophomore year, and those who enter Cornell without sufficient preparation should therefore begin their language study at once.

In addition to satisfying the requirements outlined above, English majors must take a minimum of thirty-six credits in courses approved for the major and complete them with passing letter grades. Courses approved for the major are English 201, 202, and all English courses numbered 300 or above except English 478, English 479, English 496, and English 678. A student may also offer in satisfaction of the major as many as three courses numbered 300 or above in a foreign literature, in comparative literature or in special courses such as those sponsored by the Society for the Humanities, provided these alternatives are approved by the adviser as relevant to the major.

Among the courses approved for the major, English 201 and 202 are especially recommended for English majors and should be taken by the end of the sophomore year. Students who do not take English 201–202 should choose their major courses with a view toward covering the historical range of English and American literature. Literature courses at the 300 level are intended to provide such coverage.

Of the thirty-six credits required for the major, at least eight must be in English or American literature written before 1800.

## The Honors Program

Students with good records in their English courses who would like to compete for a degree with honors should consult the chairperson of the honors committee during the spring term of their junior year, preferably before preregistration. If they are accepted into the program they may compete for honors in one of two fashions: (1) by writing a long essay during the fall term of the senior year (English 493), or (2) by submitting to a written examination on a previously chosen reading list at the end of the fall term of the senior year. The choice of (1) or (2) should be made in consultation with the chairperson of the honors committee during preregistration in the spring term of the junior year. More information about the program may be found in the department's brochure for prospective majors.

## Distribution Requirement

The distribution requirement in the humanities may be

satisfied with any two courses in English at the 200 level or above other than those numbered in the 80s, those required for teacher certification (English 478, 479, and 678), and English 496.

The distribution requirement in the expressive arts may be satisfied with any two courses in English at the 200 level or above numbered in the 80s.

## Nonmajors

For students not majoring in English, the department makes available a variety of courses at all levels. Some courses at the 200 level are open to qualified freshmen, and all of them are open to sophomores. Courses at the 300 level are open to juniors and seniors, and to underclass students with permission of the instructor. The suitability of courses at the 400 and 600 levels for nonmajors will vary from topic to topic, and permission of the instructor is required.

## Teacher Preparation

Prospective teachers of English in secondary schools who seek provisional certification in New York State must fulfill all the requirements of the major. In addition, they elect a special program of professional courses. A detailed statement about programs for teachers is available in the office of the Department of English.

## Courses for Freshmen

As part of the Freshman Seminar Program, the Department of English offers many one-semester courses. The courses are concerned with various forms of writing (narrative, biographical, expository), with the study of specific areas in English and American literature, and with the relation of literature to culture. Students may elect any two of these courses during their first year to satisfy the Freshman Seminar requirement (see p. 45). See also English 270, 271, and 272, below.

## Courses for Sophomores

Although courses numbered in the 200s are primarily for sophomores, some of them are open to qualified freshmen and to upperclass students.

**201–202 The English Literary Tradition** 201, fall; 202, spring. 4 credits per term. Open to all undergraduates. English 201 not a prerequisite to English 202. May be counted toward the English major.

Fall: M W F 11:15, S. B. Elledge, T. D. Hill. Spring: M W F 11:15, R. D. Hume, S. M. Parrish. Interpretation of major works from *Beowulf* through Yeats. Fall term will include Old English poetry, Chaucer, medieval romances, Spenser, Shakespeare, Donne, and Milton. Spring term will include Dryden, Swift, Pope, Samuel Johnson, Blake, Jane Austen, the major romantic and Victorian poets, Shaw, and Yeats. The course will be conducted by a combination of lectures and intensive seminars in special topics.

**205–206 Readings in English and American Literature** 205, fall; 206, spring. 3 credits per term. Open to all undergraduates. English 205 not prerequisite to English 206. Primarily for students who do not expect to major in English.

Fall: M W F 10:10, A. R. Parker. Spring: M W F 10:10, A. V. Ettin. Fall: representative major works by English and American writers to the mid-nineteenth century with some emphasis on those who raise questions about the authority of the imagination, the trustworthiness of art, and the morality of romantic enthusiasm, and who see the artist as an ambiguous figure, potentially at odds with society or nature. Readings in Shakespeare, Milton, Blake, Wordsworth, Hawthorne, Poe, Melville, and others, possibly including one or two influential works, in translation, from other literatures.

Spring: some changes in British and American literature since the middle of the nineteenth century, through novels and poems dealing with the personal and social problems impinging on love and marriage. The novels will be: Emily Brontë's *Wuthering Heights*, Eliot's *Middlemarch*, James's *The Ambassadors*, Hemingway's *The Sun Also Rises* and *A Farewell to Arms*, Fitzgerald's *The Great Gatsby*, and Margaret Drabble's *The Realms of Gold*. The poetry similarly will include contemporary as well as older works. Informal lectures; essay exams; no prerequisites.

**227 Shakespeare** Fall or spring, 3 credits. Primarily for students who do not expect to major in English. Sections limited to 25.

M W F 9:10 or 1:25 or T Th 10:10–11:25.  
S. B. Elledge, C. S. Levy, A. M. Mizener, and others.

A critical study of representative plays for the principal periods of Shakespeare's career.

**253 The Modern Novel** Fall, 3 credits. Primarily for students who do not expect to major in English.

M W F 9:05. R. D. Hume.  
Full-length novels by English and American writers, including Hemingway, Faulkner, Barth, Updike, Pynchon, Joyce, Woolf, Cary, and Burgess. A few foreign works will be read in translation, including Thomas Mann's *Dr. Faustus*. Requirements: two papers (written for special short discussion courses), plus a final exam.

**270 The Reading of Fiction** Fall or spring, 3 credits. Recommended for prospective majors in English. Primarily for sophomores. Upperclass students admitted as space permits. Fall: open to freshmen who have received advanced placement in English. Spring: open to other qualified freshmen. May be used to satisfy either the Freshman Seminar requirement or the distribution requirement in the humanities, but not both. Sections limited to 22.

M W F 1:25 or 2:30; or T Th 12:20–1:35.  
E. Rosenberg, D. R. Schwarz, and others.  
Forms of modern fiction, with emphasis on the short story and novella. Critical studies of works by English, American, and continental writers from 1880 to the present—Chekhov, James, Conrad, Faulkner, Mann, Kafka, and others.

**271 The Reading of Poetry** Fall or spring, 3 credits. Recommended for prospective majors in English. Primarily for sophomores. Upperclass students admitted as space permits. Fall: open to freshmen who have received advanced placement in English. Spring: open to other qualified freshmen. May be used to satisfy either the Freshman Seminar requirement or the distribution requirement in the humanities, but not both. Sections limited to 22.

Fall: M W F 9:05 or 10:10 or 11:15; spring: M W F 9:05, 10:10. P. L. Marcus, J. L. Walker, and others.  
Designed to sharpen the student's powers to understand and respond to poetry. Readings in the major periods, modes, and genres of poetry written in English.

**272 Introduction to Drama** Fall or spring, 3 credits. Recommended for prospective majors in English. Primarily for sophomores. Upperclass students admitted as space permits. Fall: open to freshmen who have received advanced placement in English. Spring: open to other qualified freshmen. May be used to satisfy either the Freshman Seminar requirement or the distribution requirement in the humanities, but not both. Sections limited to 22.

Fall: M W F 12:20 or 2:30; spring: M W F 12:20 or 2:30. T. Postlewait, B. O. States, and others.  
A study of how drama molds feeling and comprehension by integrating such means available to the dramatist as action, language, and artistic design. Critical examination of plays of all periods, including the twentieth century, with major emphasis on plays written in English, but with collateral examples of outstanding plays from the European tradition. The syllabus will be adjusted from year to year to include plays produced on campus under the sponsorship of the Department of Theatre Arts.

**280–281 Creative Writing** 280, fall; 281, spring, 3 credits per term. Recommended for prospective majors in English. Recommendation of 280 instructor is prerequisite for admission to 281. Sections limited to 16.

M W F 9:05 or 3:35; T Th 9:05 or 12:20.

A. R. Ammons, W. J. Slatoff, and others.

An introductory course in the theory and practice of writing narrative, poetry, and allied forms.

**288–289 Expository Writing** 288, fall; 289, spring, 3 credits per term. English 288 or permission of instructor prerequisite to 289. Sections limited to 15.

M W 9:05 or T Th 9:05, and conferences to be arranged. T. L. Jeffers and others.

Primarily for non-English majors who practice in various kinds of expository writing—definition, analysis, comparison, contrast, argument—applied to students' particular disciplines and interests. Frequent short essays, complemented by discussion of writings by good authors.

## Courses for Sophomores, Juniors, and Seniors

Courses at the 300 level are open to juniors and seniors, and to others with the permission of the instructor. There are no prerequisites, except as noted for English 382–383 and 384–385.

### Major Periods of English Literature

**313 Middle English Literature** Fall, 4 credits.

M W F 2:30. T. D. Hill.

A survey of Middle English literature (in translation). The course will include *Gawain and the Green Knight*, *Pearl*, selections from Chaucer's *Canterbury Tales*, *Piers Plowman*, romances, lyrics, drama, and Malory. There will be an opportunity for those students who are interested to learn to read and pronounce Middle English poetry in the original.

**320 Renaissance Literature** Spring, 4 credits.

M W F 10:10. B. B. Adams.

Interpretations of major Renaissance writers of poetry (Spenser, Donne, Milton, and others), drama (Marlowe, Shakespeare, Jonson, and others) and prose (Bacon, Hooker, and others). Lectures on these writers will be combined with class discussions of such topics as the Elizabethan sonnet, music and lyric poetry, nature and science in Renaissance literature, order and rebellion in a Christian society, Shakespeare and the Elizabethan stage.

**330 Restoration and Eighteenth-Century Literature** Fall, 4 credits.

M W F 1:25. S. Budick.

Particular attention to Rochester, Dryden, Pope, Swift, Defoe, Fielding, Sterne, Johnson, and Blake; a study of the literature in its social, philosophical, and political contexts.

**340 The Romantic Period** Fall, 4 credits.

M W F 11:15. A. R. Parker.

A critical study of the writings of Blake, Coleridge, Wordsworth, Byron, Shelley, and Keats.

**345 The Victorian Period** Spring, 4 credits.

T Th 12:20–1:35. D. M. Mermin.

The course will center on Tennyson, Browning, Arnold, and a few major novels; other readings will include autobiographical, aesthetic, political, and scientific prose, poetry by Swinburne and the Pre-Raphaelites, and a play by Shaw. Lectures and discussion.

**350 The Early Twentieth Century (to 1914)** Fall, 4 credits.

M W F 10:10. D. R. Schwarz.

Critical study of major works by Hardy, Conrad, Lawrence, Joyce, Eliot, Yeats, Hopkins, Wilde, and others. While the emphasis will be upon individual works, some attempt will be made to place the

authors and works within the context of literary and intellectual history.

**351 Modern Literature Since World War I** Spring, 4 credits.

M W F 9:05. P. L. Marcus.

Interpretations of modern English and Anglo-Irish poetry, fiction, and drama. Lectures and discussions. Some attention will be given to intellectual history and to parallel movements in the other arts. Authors will include Joyce (*Ulysses*), Yeats, Shaw, Eliot, Lawrence, Woolf, O'Casey, Auden, and Beckett.

### Major English Authors

**319 Chaucer** Fall, 4 credits.

M W F 12:20. W. Wetherbee.

Though the main emphasis will be on *Troilus* and the *Canterbury Tales*, some attention will also be given to the early poems and the question of Chaucer's development as a poet.

**327 Shakespeare** Spring, 4 credits.

M W F 11:15. P. A. Gottschalk.

An introduction to the works of Shakespeare, based on a selection of plays representative of the stages of his artistic development and the range of his achievement. Throughout, the effort will be to discover the special qualities of each play through an understanding of Shakespeare's constructive power, his dramatic and theatrical technique, his insight into humanity, and his relation to the thought and culture of his time and ours.

**329 Milton** Fall, 4 credits.

M W F 9:05. S. Budick.

Milton's English poems, including *Paradise Lost* and *Paradise Regained*, and selections from his prose.

### Major Periods of American Literature

**361 Early American Literature** Fall, 4 credits.

M W F 11:15. M. J. Colacurcio.

The literature of ideas produced by America's Puritan and Enlightenment writers: Bradford, Taylor, Edwards, Franklin. And the first achievements of the national literature: Irving, Cooper, Poe, Hawthorne.

**362 The American Renaissance** Spring, 4 credits.

M W F 11:15. J. P. Bishop.

America's literary maturity at mid-century: the individual masterpieces and the interrelated careers of Emerson, Thoreau, Hawthorne, Melville, Whitman, and Dickinson.

**363 The Age of Realism and Naturalism** Fall, 4 credits.

M W F 10:10. R. H. Elias.

The literary expression of new attitudes toward American society and the individual between the Civil War and the early years of the twentieth century, primarily as exemplified in representative writings by Mark Twain, W. D. Howells, Henry James, Kate Chopin, Charles W. Chesnut, Henry Adams, Stephen Crane, and Theodore Dreiser.

**364 American Literature in the Twentieth Century** Spring, 4 credits.

M W F 1:25. W. J. Harris.

Works by Frost, Eliot, Hughes, W. C. Williams, Hemingway, Faulkner, Mailer, and others. Although some attempt will be made to view the period as a whole and to trace patterns within it, the emphasis will be on the works themselves.

[365 **The Negro in American Literature** Not offered 1976–77.]

### Genres and Special Topics

**366 The Earlier American Novel: Brockden Brown to Henry James** Fall, 4 credits.

T Th 2:30–3:45. D. E. McCall.

A survey of major American novels of the nineteenth

century. Writers studied will include Poe, Cooper, Hawthorne, Melville, Mark Twain, Howells, Chopin, and James.

**367 The Modern American Novel** Spring. 4 credits.

M W F 10:10. W. J. Slatoff.  
A survey of major American novels of the twentieth century. Writers studied will include Dreiser, Fitzgerald, Hemingway, West, Wright, Faulkner, Agee, Warren, and Percy.

**370 The Nineteenth-Century British Novel** Spring. 4 credits.

M W F 12:20. J. F. Blackall.  
Representative works by major nineteenth-century British novelists. Books to be read in 1977 will be Austen, *Emma*; Thackeray, *Vanity Fair*; E. Brontë, *Wuthering Heights*; C. Brontë, *Villette*; Eliot, *The Mill on the Floss*; Dickens, *Bleak House*; Hardy, *The Mayor of Casterbridge*; Wells, *Tono-Bungay*.

**[372 Representative English Dramas** Not offered 1976-77.]

**Creative Writing**

**382-383 Narrative Writing** 382, fall; 383, spring. 4 credits per term. Sections limited to 15. Prerequisite: English 280-281, or permission of instructor.

T Th 11:15, and conferences to be arranged. A. Lurie, D. E. McCall, and others.  
The writing of fiction; study of models; analysis of students' work.

**384-385 Verse Writing** 384, fall; 385, spring. 4 credits per term. Sections limited to 15. Prerequisite: English 280-281, or permission of instructor.

T 2:30-4:25. A. R. Ammons and others.  
The writing of poetry; study of models; analysis of students' poems; personal conferences.

**388-389 The Art of the Essay** 388, fall; 389, spring. 4 credits per term. Sections limited to 18. First term not prerequisite to the second.

T Th 11:15 and a third hour to be arranged.  
For both English and non-English majors who have done well in the Freshman Seminar Program (or in equivalent courses elsewhere) and who desire additional practice in writing literary, autobiographical, and expository essays.

**Advanced Undergraduate Courses**

Most courses at the 400 level are limited in enrollment and require the permission of the instructor.

**403 Irony and Literature** Spring. 4 credits. Limited to 15.

M W F 1:25. S. Siegel.  
An examination of a few authors who explore the nature of irony, but also of some others whose poems and plays are motivated by an underlying ironic view of the world. Much of the course will be devoted to a discussion of the literary and interpretative adjustments required of poets and readers when an ironic view comes into play. Authors will include Kierkegaard, Kenneth Burke, William Empson, Bert States; also Shelley, Browning, Hardy, and Yeats.

**404 Voice and Tone in Fiction** Spring. 4 credits. Limited to 15.

T Th 10:10-11:25. J. R. McConkey.  
A close reading of selected fiction to explore authorial attitudes and values as they are revealed in style and structure. The emphasis will be on the relationships among individual words within the paragraph, and among the parts of the larger fictional structure. Texts will include an anthology of short fiction and one novel. Writing will consist of a number of short papers and one long paper. The writer to be discussed in the long paper will be chosen by the student in consultation with the instructor.

**406 The Literature of Fantasy** Spring. 4 credits. Unlimited enrollment.

M W F 9:05. K. Hume.  
A study of departures from reality and their literary functions. Examples (mainly modern) will be read of *psychological* fantasy (where the departure is in the mind of the character), *escapist* (where the reader is induced to suspend contact with reality), *expressionist* (symbolic and stylistic fantasy used to heighten lyric emotional protest), and *cognitive* fantasy (explorations of possible futures, satire, perspectivist manipulations). Relevant movies that come to campus will be discussed. The reading list will include authors like Barthelme, Calvino, Heinlein, H. James, Kafka, Shakespeare, Swift, Vonnegut, and Zelazny. Requirements: two typed drafts of a fifteen-page paper and a final exam.

**407 Studies in Biography** Fall. 4 credits. Limited to 15.

T Th 10:10-11:25. D. Novarr.  
Study of lives by Plutarch, Walton, Johnson, Boswell, Carlyle, Freud, Strachey, Virginia Woolf, Erikson, and others. Some emphasis on the relation of biography to the novel and to history, psychology, autobiography, and other disciplines in order to explore the main theoretical and critical problems which the art of biography poses.

**408 The Eden Myth in Literature** Fall. 4 credits. Limited to 15.

M W F 1:25. P. L. Sawyer.  
Reading of selected British and American works in which the loss or recovery of Eden is a dominant motif. Particular attention to recent works in which the loss of the Garden reflects the author's judgment on the history of his own nation or culture. Authors will include Milton, Blake, Tennyson, Melville, Lawrence, Faulkner, T. S. Eliot, and Barth.

**411 Old English in Translation** Spring. 4 credits. Unlimited enrollment.

M W F 11:15. T. D. Hill.  
Cultural backgrounds, reading, and a critical analysis of Anglo-Saxon poetry in translation; pagan and Christian epic, elegy, heroic legend, and other forms.

**415 The English Language** Spring. 4 credits. Limited to 15.

T Th 3:35-4:50. R. T. Farrell.  
Intended as a basic course for those interested in the historical development of English, starting with the Anglo-Saxon period. The primary method will be the study of short literary texts from each period. If time permits and there is sufficient interest, general topics, such as semantics and linguistic study of literary texts, will be discussed. Graduate students who already have preparation in Old and Middle English should consult with the professor about taking the course as English 796, Research and Teaching: Problems in the Study of the English Language.

**426 Poetry and Music in the English Renaissance** Spring. 4 credits. Limited to 15.

B. Rosecrance.  
A survey of English poems and their musical settings from medieval times to the early seventeenth century, with emphasis on questions of the interrelations of poetic and musical forms. The historical context and the functions of poetry and music in English society will also be explored. The course will consider selected medieval lyrics, the words and music of the early Tudor songbooks, Elizabethan lyrics associated with the theatre, the settings of the great madrigal composers, and the poetic texts of the English ayres.

**427 Shakespeare: King Lear and the Stages of History (also Theatre Arts 427)** Spring. 4 credits. Limited to 15.

M W F 1:25. M. Carlson, H. S. McMillin.  
An interdisciplinary study of theatre history and dramatic criticism from Shakespeare's time to our own, focused on *King Lear*.

**452 Lawrence** Spring. 4 credits. Limited to 15. M W F 2:30. J. P. Bishop.

The principal works of D. H. Lawrence, roughly in chronological order, including at least *Sons and Lovers*, *The Rainbow*, *Women in Love*, *Aaron's Rod*, and *Lady Chatterly's Lover* among the novels; the most interesting longer stories; most of the short stories; and selections from the criticism, the travel writings, and the philosophy. Opportunities to investigate the remaining minor fiction, the poetry, or the plays will be provided. Some additional background reading in the standard biographies and critical studies may be assigned. The course is meant especially for those who have read one or two of the novels and know they want to read as much of the rest as possible. Brief in-class exercises on the units of reading assigned for discussion, oral reports, and a reasonably ambitious paper on some topic of special interest.

**460 Studies in American Literature** Fall. 4 credits. Limited to 15.

T Th 2:30-3:45. W. J. Harris.  
Topic for 1976-77: Beat/Black Mountain Writers. An extensive and close reading of the works of Charles Olson, Robert Creeley, Allen Ginsberg, and Jack Kerouac, four important and representative writers of the Beat/Black Mountain Movements. These movements not only radically altered the mid-twentieth century conception of American poetry, but also resuscitated the great but mostly discontinued avant-garde tradition of William Carlos Williams and Ezra Pound.

**462 American Poetry in the Nineteenth Century** Spring. 4 credits.

M W F 12:20. R. Morgan.  
The course will begin with a study of the development of American poetics in the poems and essays of Bryant and Emerson, and such lesser figures as Tuckerman, Jones Very, and Thoreau before moving on to the major work of the semester with Whitman and Dickinson. The purposes of the course will be at once to survey poetry written in America during the period and to concentrate on the development and definition of the distinctively American elements in the work studied.

**463 The Political Novel in America** Fall. 4 credits. Limited to 15.

M W 2:30-4. S. C. Strout.  
Critical study of radical, conservative, and liberal politically oriented novels by important writers from 1869 to 1971. Examples from Adams, Twain, James, Steinbeck, Dos Passos, Hemingway, Warren, Ellison, Doctorow, and others. The novel will be considered both as a source of insight and as an historical source. Common readings and interpretive papers.

**468 Seminar in American Culture: Literature and Technology** Spring. 4 credits. Limited to 15.

Th 1:25-3:20. R. H. Elias.  
An exploration and critical assessment of the response of American writers since the mid-nineteenth century to the sense of anonymity produced by scientific thought and the application of technology to social conditions and political problems. Consideration of such topics as the demands of urban life, the architects' "cities of tomorrow," the nationalization of politics, the standardization of consumption, and the rise of multiversities will help define the context. Readings representative of American naturalism, twentieth-century irony, and contemporary satire will help define the response. Three or four class reports and a term paper.

**470 Studies in the Novel** Fall. 4 credits. Limited to 15.

M W F 12:20. D. R. Schwarz.  
A critical study of major fiction of Conrad, Lawrence, and Joyce. Readings will focus on Conrad and Joyce, but will include one major novel by Lawrence. Works will include *Lord Jim*, *The Secret Agent*, *Heart of Darkness*, *The Secret Sharer*, and *The Rainbow*. The last six weeks will be spent on *Ulysses*. An effort will be made to show how the innovations that each

author brings to the novel form derive from the demands of his characteristic themes.

**472 Irish Literature** Fall. 4 credits. Limited to 15.  
M W F 10:10. P. L. Marcus.

The topic for 1976 will be literature and nationalism in modern Ireland. The Irish theatre movement and the 1916 Rising will serve as focal points for an examination of the relationship between the demands of art and those of country. Particular attention will be given to Yeats, Synge, Lady Gregory, Moore, Joyce, Pearse, and O'Casey. The early weeks of the term will be devoted to study of the relevant literary and historical background from the medieval bardic era to the patriotic poetry of Young Ireland.

**474 The English Bildungsroman: Dickens to Joyce** Fall. 4 credits. Limited to 15.

M W F 9:05. T. L. Jeffers.  
Study of English novels about growing up. Authors will include Dickens, G. Eliot, Hardy, Butler, Joyce, and others. The class will discuss the books not only as "pure" fictions, but as reflections of biographical histories and, perhaps, of psychological theories.

**476 The Child in Literature** Fall. 4 credits.  
Limited to 15; with permission of instructor.

T Th 2:30-3:45. A. Lurie.  
A survey of the changing idea of childhood as reflected in significant works of British and American literature for both children and adults from 1800 to the present. Among books read will be Alcott, *Little Women*; Aldrich, *The Story of a Bad Boy*; Blake, *Songs of Innocence and Experience*; Burnett, *The Secret Garden*; Grahame, *The Golden Age*; James, *The Turn of the Screw*; McCullers, *The Member of the Wedding*; Stevenson, *A Child's Garden of Verses*; and Twain, *Tom Sawyer*.

**478 Observation and Practice Teaching** Fall or spring. 6 credits. Prerequisites: senior standing and admission to the department's undergraduate teacher preparation program. Ordinarily taken concurrently with English 678, The Teaching of English; both courses are offered either term. Neither course may be used in satisfaction of the English major.

J. B. Merod.

**479 Directed Study: Problems in Teaching English Language and Literature** Fall or spring. 4 credits. May not be used in satisfaction of English major.

J. B. Merod  
Students will undertake to deal with specific problems in the teaching of English on the secondary level. They will be expected to combine practical classroom work at the high school or junior high school level with background readings and research. A term paper will be expected that reviews both the research and the practical work the student has undertaken.

**480-481 Seminar in Writing** 480, fall; 481, spring. 4 credits. Prerequisites: 382-383 or 384-385, and permission of instructor. Limited to 15.

T 12:20-2:15. R. Morgan.  
Intended for those writers who have already gained a basic mastery of technique. Students normally enroll for both terms and should be capable of a major project—a collection of stories or poems, a group of personal essays, or perhaps a novel—to be completed by the end of the second semester. In general, the weekly seminars will be used for discussions of the manuscripts of its members and of certain published works that individual members have found of exceptional value.

**493 Honors Essay Tutorial** Fall. 5 credits.  
Prerequisite: senior standing and permission of the chairperson of the Honors Committee.  
Staff.

**494 Independent Study** Fall or spring. 2 or 4 credits. Prerequisite: completion of English honors

requirement, or acceptance in the Independent Major Program and consent of a department adviser.

Students who do not meet these prerequisites may apply to the director of undergraduate studies for permission to take independent study. Permission will be granted only to students who present an acceptable prospectus of the study to be undertaken and who have secured the agreement of a faculty member to serve as adviser for the project throughout the term.

**496 Teaching and Research** Fall or spring. 1-2 credits. May not be used in satisfaction of the English major.  
Staff.

For students who, with the consent of a professor, assist in the teaching of that professor's course.

## Courses Primarily for Graduate Students

Permission of the instructor is a prerequisite for admission to courses numbered in the 600s. These are primarily intended for graduate students, although qualified undergraduates are not excluded. Undergraduates seeking admission to a 600-level course should consult the appropriate instructor. The list of courses given below is illustrative only; a definitive list, together with course descriptions and class-meeting times, will be published in a separate departmental brochure at preregistration time each term.

**611 Readings in Old English** Fall. 4 credits.  
T. D. Hill.

**612 Beowulf** Spring. 4 credits.  
R. T. Farrell, T. D. Hill.

**613 Middle English Literature** Fall. 4 credits.  
R. E. Kaske.

**619 Chaucer** Spring. 4 credits.  
R. E. Kaske.

**621 Spenser** Fall. 4 credits.  
C. V. Kaske.

**623 Metaphysical Poets** Spring. 4 credits.  
D. Novarr.

**627 Shakespeare** Fall. 4 credits.

**632 Samuel Johnson** Spring. 4 credits.

**641 Studies in Romantic Poetry** Spring. 4 credits.  
A. R. Parker.

**646 Studies in Victorian Prose** Spring. 4 credits.  
D. M. Mermin.

**648 Studies in Victorian Fiction** Fall. 4 credits.  
J. F. Blackall.

**662 American Transcendentalism** Fall. 4 credits.  
M. J. Colacurcio.

**663 Twain, Howells, James, and the American Character** Fall. 4 credits.  
R. H. Elias.

**664 American Naturalism: Howells to Dreiser** Spring. 4 credits.  
R. H. Elias.

**665 Topics in Twentieth-Century American Literature** Fall. 4 credits.  
R. H. Elias.

**668 Topics in Recent American Literature** Fall. 4 credits.  
A. M. Mizener.

**669 The James Family**  
S. C. Strout.

**678 The Teaching of English** Fall or spring. 4 credits.  
J. B. Merod.

## Graduate Seminars

Permission of the instructor is a prerequisite for admission to any course numbered in the 700s; most of these courses are limited in enrollment at the discretion of the instructor. For course descriptions see the mimeographed supplement published by the department.

**710 Seminar in Medieval Literature (also German 650)** Fall. 5 credits.  
A. Groos.

**718 Graduate Seminar in Medieval Literature** Spring. 5 credits.  
R. E. Kaske.  
Topic for 1977: *Piers Plowman*.

**742 Graduate Seminar in Wordsworth** Fall. 5 credits.  
S. M. Parrish.

**751 Graduate Seminar in Modern Literature** Spring. 5 credits.  
S. Siegel.  
Topic for 1977: Yeats

**760 Colloquium in American Literature** Fall. 4 credits.  
Staff.

**762 Graduate Seminar in the American Renaissance** Fall. 5 credits.  
M. J. Colacurcio.  
Topic for 1977: Melville or Hawthorne.

**780-781 Creative Writing** 780, fall; 781, spring. 5 credits per term.

**793 Master's Essay** Fall or spring. Noncredit.  
Staff.

**794 Directed Study** Fall or spring. 5 credits.  
Staff.

**795 Group Study** Fall or spring. 5 credits.  
Staff.

**796 Teaching and Research** Fall or spring. 5 credits.  
Staff.

The following courses offered by other departments will be of particular interest to English majors and graduate students.

## Courses in Classical and Ancient Literature

**The Literature of Ancient Israel (Comparative Literature 323, Semitics 330)**

**Ancient Wit: An Introduction to the Theory and Form of Comic and Satiric Writing in Greece and Rome (Comparative Literature 339, Classics 339)**

**The Deuteronomistic School of Writers (Comparative Literature 428)**

**Readings in the New Testament (Comparative Literature 429)**

## Courses in Dramatic Literature

**Classic and Renaissance Drama (Comparative Literature 352, Theatre Arts 325)**

European Drama 1660–1900 (Comparative Literature 353, Theatre Arts 326)

Modern Drama (Comparative Literature 354, Theatre Arts 327)

American Drama and Theatre (Theatre Arts 335)

## Courses in the Literature of Europe and America

Crime and the Nature of Fiction (Comparative Literature 314, French 309)

Literature and Religion (Comparative Literature 329, Spanish 399)

Medieval Literature (Comparative Literature 343)

Medieval Latin Literature (Classics 368)

The Literature of Europe Since 1800 (Comparative Literature 357)

The European Novel (Comparative Literature 363–364)

Fiction as Satire in the Eighteenth Century (Comparative Literature 369)

The City in Literature (Comparative Literature 383)

The Novella in World Literature (Comparative Literature 414)

Seminar on Coded Communication (Comparative Literature 423)

Italy and the Transalpine Renaissance: Ariosto, Spenser, and Rabelais (Comparative Literature 424)

The Other World in Medieval Romance (Comparative Literature 441)

Allegory and Symbolism (Comparative Literature 446)

Petrarch, Ronsard, and Donne (Comparative Literature 458)

The Picaresque Novel (Comparative Literature 463, Spanish 455)

Myth and Literature (Comparative Literature 476)

Fiction and the Irrational (Comparative Literature 479)

Studies in Modern Poetry (Comparative Literature 481)

Masterpieces of a Decade (Comparative Literature 483)

Studies in the Literature of the Third World: The Caribbean Novel in English (Comparative Literature 488)

Twentieth-Century Poetry in America and Russia (Comparative Literature 491)

Modern Variations of the Picaresque Novel (Comparative Literature 493)

Samuel Beckett (Comparative Literature 497)

Seminar on F. G. Lorca (Comparative Literature 691)

Topics in Modern Literature: From Formalism to Structuralism (Comparative Literature 698)

Topics in Modern Literature: Hermeneutics (Comparative Literature 699)

Seminar on the Confidence Man, the Bard, and the Savants (Society for the Humanities 415)

Seminar on Elizabethan Prose Fiction (Society for the Humanities 418–419)

Seminar: Short Poems (Society for the Humanities 416)

Seminar: Long Poems (Society for the Humanities 417)

Culture, Politics, and Black Writers (Black Journals as Sources for Afro-American Literature) (Africana Studies 340)

African Literature (Africana Studies 422)

History of Afro-American Literature (Africana Studies 431)

Modern Afro-American Literature (Africana Studies 432)

## Geological Sciences

J. E. Oliver, chairman; J. M. Bird, A. L. Bloom, B. Bonnicksen, J. L. Cisne, B. L. Isacks, D. E. Karig, S. Kaufman, G. A. Kiersch, W. B. Travers, D. L. Turcotte.

The Department of Geological Sciences is an intercollege department in the College of Arts and Sciences and the College of Engineering.

### Distribution Requirement

The distribution requirement in physical sciences is met by Geological Sciences 101–102.

### Geological Sciences Major

Prerequisites to admission to a major in geological sciences are completion of Geological Sciences 101–102 and two of the two-semester sequences of courses chosen from the following, or their equivalents: Biological Sciences 101–102 and 103–104; Chemistry 207–208; Mathematics 191–192; and Physics 112–213. A student with a strong foundation in mathematics and science may be accepted as a major without completion of Geological Sciences 101–102.

Majors take the six core courses in geological sciences, a summer field geology course, one additional course in geological sciences numbered 400 or above, and a third two-semester sequence chosen from the courses in biological sciences, chemistry, mathematics, and physics listed above plus an additional course in one of these fields at an intermediate or advanced level. In addition, majors must complete a senior thesis. The core courses in geological sciences include 325, 345, 355–356, 376, and 388. A prospective major should consult the departmental major adviser, W. B. Travers, 219 Kimball Hall, as soon as possible for advice in planning a program. Students majoring in geological sciences should attend the departmental seminars and take advantage of cruises, field trips, and conferences offered through the Department of Geological Sciences.

The Department of Geological Sciences also offers a degree program in the College of Engineering. Courses are listed in the College of Engineering section under Department of Geological Sciences.

## Government

G. H. Quester, chairman; B. R. O'G. Anderson, D. E. Ashford, M. G. Bernal, D. J. Danelski, W. J. Dannhauser, A. T. Dotson, E. J. Eisenach, M. J. Esman, B. Ginsberg, G. McT. Kahin, M. Katzenstein, P. Katzenstein, E. W. Kelley, E. G. Kenworthy, I. Kramnick, P. Leeds, T. J. Lowi, D. P. Mozingo, T. J. Pempel, S. D. Resnick, R. H. Rosecrance, M. Rush, L. Scheinman, M. Shefter, S. G. Tarrow, N. T. Uphoff, D. E. Van Houweling, L. F. Williams.

For a major in government the following courses must be completed: (1) three of the following introductory courses: Government 111, Government 131, Government 161, and Government 181; (2) a minimum of twenty-four additional credits in government department courses numbered 300 or above; (3) in related subjects, a minimum of twelve credits selected with the approval of the adviser from courses numbered 300 or above in the Departments of Anthropology, Economics, History, Philosophy, Psychology, and Sociology. (S-U options are not allowed in any course needed to fulfill the government major.)

Juniors and seniors majoring in the Department of Government who have superior grade records may apply for supervised study in government with a particular instructor, whose consent is required. See the description for Government 499 (Supervised Study). To accommodate new courses or course changes, a supplementary announcement is maintained by the department. Before preregistering or registering each term, students are requested to consult the current *Supplementary Announcement of Courses in Government* available in 125 McGraw Hall.

### The Honors Program

A small number of exceptionally well-qualified students are accepted each year in the honors program. Admission is by application and is competitive. Students who wish to be considered must complete an application in the spring semester of their sophomore year. Those who are admitted will register for Government 400. Successful completion of Government 400 entitles the student to write an honors thesis (Government 494, eight credits) or honors paper (Government 494, four credits) in the senior year, provided other requirements have been met. (See honors courses, p. 00, for a description of these courses.) The decision to award honors and in what degree will be based on the quality of the thesis or paper, the student's record in government courses, and the student's overall record at Cornell.

Interested students should consult the *Supplementary Announcement* available in the departmental office in 125 McGraw Hall. Further inquiries may be addressed to the Director of Undergraduate Studies, 130 McGraw Hall.

### European Studies Concentration

Government majors may elect to group some of their required and optional courses in the area of European studies, drawing from a wide variety of courses in relevant departments. Students are invited to consult Professors Katzenstein, Scheinman, and Tarrow for advice concerning course selection, foreign study programs, etc.

### Distribution Requirement

The distribution requirement in the social sciences is satisfied in government by taking two of the following courses: Government 111, 131, 161, and 181; or by taking one of 111, 131, 161, or 181 followed by a 300-level course in the same area.

## Introductory Courses

### 111 The Government of the United States Fall, 3 credits.

T. J. Lowi.  
An introduction to government through the American experience. Concentration on analysis of the institutions of government and politics as mechanisms of social control.

### 131 Introduction to Comparative Politics Spring, 3 credits.

An investigation of the foundations of politics under different political regimes: totalitarian governments and autocracy; the bases of political conflict; social movements and party systems; political processes and policy outcomes; revolutionary versus evolutionary change; political development in the Third World; the modern corporate state.

### 161 Introduction to Political Theory Spring, 3 credits.

W. J. Dannhauser.  
A survey of the development of Western political theory from Plato to the present. Readings from the work of the major theorists; an examination of the relevance of their ideas to contemporary politics.

### 181 Introduction to International Relations Fall, 3 credits.

R. H. Rosecrance.  
An introduction to the basic concepts and practice of international politics.

## Freshman Seminars

**100 Freshman Seminars** Fall or spring, 3 credits.  
Five such seminars will be offered in each of the fall and spring terms. Consult the Supplementary Announcement and the Freshman Seminar booklet for course descriptions and instructors.

## Major Seminars

**300 Major Seminars** Fall or spring, 4 credits.  
Consult the Supplementary Announcement for course descriptions and instructors. Forms are provided each term to indicate seminar preferences. Nonmajors may be admitted, but government majors are given priority. Majors in the department are encouraged to take at least one seminar course during the junior or senior year.

The following courses are open to sophomores, juniors, and seniors without prerequisite unless otherwise indicated.

## American Government and Institutions

Government 111 is recommended.

### 302 The Impact and Control of Technological Change (also CRP 434 and Economics 302) Spring, 4 credits.

J. Milch, D. Nelkin.  
The use, impact, and control of technological change. Emphasis is on the dilemmas of public choice in a technological society marked by specialization and rational planning. Specific problem areas in which the problems of control are controversial will be examined.

### 309 Elite Theory, Power, and American Democracy Fall, 4 credits.

L. Williams.  
This course will examine the arguments and evidence advanced by "ruling power-elite" theorists. Pluralist and Marxist criticisms leveled against the power-elite hypothesis will be analyzed as well. The focus will be on such topics as: who are the elites; whom do they rule; business and government; recruitment, circulation, and accountability of elites; and the relationship between elites and nonelites in the American context.

**[310 Politics and Society** Fall, 4 credits. Not offered 1976-77.]

### 311 Urban Politics Spring, 4 credits.

D. E. Van Houweling.  
The interaction between urban problems and the politics of city government has resulted in important public policy issues in the United States. This course provides an introduction to the politics of metropolitan areas. The first part of the course is devoted to the central institutions and processes of urban government such as mayors, city councils, elections, and the criminal justice system. The remainder of the course analyzes specific public policy problem areas such as race relations, education, housing, law enforcement, and civil disorder.

### 312 Urban Affairs Laboratory Fall or spring (if there is a minimum registration of 40 students), 3 credits. Open to both undergraduate and graduate students.

D. E. Van Houweling and staff.  
An interdisciplinary course in urban affairs which emphasizes learning by experience in an urban game rather than lectures or reading assignments. By playing roles in a simulated city, students test their solutions for environmental and other urban problems. The roles include city councilperson, city manager, environmental quality agency director, newspaper editor, industrialist, community organizer, land speculator, and planner.

### 313 The Nature, Functions, and Limits of Law Spring, 4 credits.

This general education course for nonlaw students presents law as a set of varied techniques for resolving conflict and dealing with social problems, not as a body of rules. The course analyzes the roles of courts, legislatures, and administrative agencies in the legal process, considering also constitutional limits on their power and practical limits on their effectiveness.

### [314 Common Law and Lawyers in America 4 credits. Not offered 1976-77.]

### 316 The American Presidency Fall, 4 credits.

A. T. Dotson.  
Analysis of the politics of the presidency and the executive branch with emphasis on executive-legislative relations, executive branch policymaking and the problems of the modern presidency.

### 317 Political Parties and Elections Spring, 4 credits.

B. Ginsberg.  
The relationship between citizen participation and public policy is one of the central questions of democratic politics. This course will focus on American voting behavior, the role of political parties, and the links between citizens' choices at the polls and the behavior of public officials.

### 318 The American Congress Spring, 4 credits.

M. Shefter.  
The role of Congress in the American political system. Topics to be discussed: the political setting within which Congress operates, the structure of Congress, the salient features of the legislative process, and recent congressional behavior in a number of policy areas.

### 319 American Political Behavior Spring, 4 credits.

P. Leeds.  
Examines the political beliefs and behavior of Americans. Particular attention will be given to trends in partisanship, ideology, and other background factors in voting behavior.

### 320 Public Opinion and American Democracy Spring, 4 credits.

L. Williams.  
An analysis of the political beliefs of Americans in the

context of alternative democratic theories. Examination of the ways Americans acquire their beliefs and the consequences, if any, of these beliefs for public policy. The goal will be to appraise existing opinion formation and implementation in terms of the requirements of alternative democratic theories.

**321 Politics and Public Policy** Spring, 4 credits.  
Examination of the relationship between public policy in the United States and certain characteristics of the political system, such as ideology and public opinion, the structure of political institutions, and the distribution of political resources. Policymaking in the realm of the economic system will be emphasized particularly. Substantive topics will include the distribution of wealth, regulatory politics, and taxation.

### 322 Criminal Justice Spring, 4 credits.

B. Ginsberg.  
Crime and law enforcement are major political issues and involve important questions of public policy. This course will examine selected aspects of the distribution of justice in American society. It will focus on the institutional structure of the criminal justice system, the uses of law as an instrument of social control, and the foundations and implications of alternative policy choices.

### 323 The "Fourth" Branch Spring, 4 credits.

A. T. Dotson.  
An examination of the national administrative branch. Particular attention will be given to the constitutional and political problems that result from the rise of administrative power.

**324-325 Law and Social Science** 324, fall; 325, spring, 4 credits per term. Open, upon application, to first-semester juniors. Registration limited to 20. Students are expected to take both terms.

D. J. Danelski and others.  
An intensive interdisciplinary seminar that views law and its operation in society from the perspectives of several of the social sciences. During the first term, the seminar will focus on the basic literature concerning law and social science, and students will write a series of short analytical papers. During the second term, the seminar will focus on research problems and students will write research papers.

### [327 Civil Liberties in the United States 4 credits. Not offered 1976-77.]

### 329 Politics, Race, and Education Spring, 4 credits.

E. W. Kelley.  
The political role of education in organizing and preparing individuals for expected social and economic roles is considered. Educational and occupational barriers to entry as well as the actual causes of academic success are emphasized. The use of race as an overt and covert criterion for segregating individuals into different social and economic roles as well as other aspects of institutional racism will be dealt with.

### 401-402 America and World Community (also Ag Orientation 401-402) 401, fall; 402, spring, 3 credits per term.

T. J. Lowi, M. Bernal, and others; N. Awa, coordinator; fall. Instructors to be announced; C. Mbata, coordinator; spring.  
The theme of "World Community" will be examined in terms of the directions which the concept suggests, with special reference to the role of the United States in translating the concept to reality. The course seeks to examine the American experience against the background of world community which requires analysis by the humanities, the social sciences, the natural sciences, and religious studies.

**413 Seminar in American Urban Politics** Fall, 4 credits. Open to qualified undergraduate and graduate students with permission of instructor.

D. E. Van Houweling.  
Provides the advanced student an opportunity to

analyze the important American urban politics literature and develop an individual perspective on the field in preparation for further scholarly and professional work. Extensive reading, discussion focused on the main theoretical approaches and public policy issues, and synthetic papers characterize this seminar.

**427 Constitutional Politics** Spring, 4 credits.

Prerequisite: 327.

D. J. Danelski.  
A political analysis of constitutional decisionmaking in the United States. Among the topics covered are separation of powers, judicial review, Congressional investigations, presidential powers, and state-federal relations.

**428-429 Government and Public Policy: An Introduction to Analysis and Criticism** 428, fall; 429, spring, 4 credits per term. Open to undergraduates with permission of instructor.

T. J. Lowi.  
The first semester stresses analysis and criticism of public policies and the governments and politics responsible for them. Second semester will be comprised of a weekly workshop for a smaller group, concentrating on problems for research, writing, and publication.

### Comparative Government

Government 131 is recommended.

**332 Society and Politics in France and Italy** Fall, 4 credits.

S. G. Tarrow.  
A comparative analysis of two Latin countries with centralized states, multiparty systems, and low political consensus, with particular emphasis on the development of historical cleavages, the modern party system and its conflicts, and the growing role of the state.

**333 Government and Politics of the Soviet Union** Fall, 4 credits.

M. Rush.  
A focus on the politics of the top leaders, the institutions through which they operate, and the impact of their policies on the Soviet people. Emphasis also on phases in the development of the Soviet system and on the ways in which the Soviet Union served as the prototype for all subsequent Communist states, as well as on the variant forms that have appeared in other states.

**[334 The Politics of Underdevelopment in Africa** 4 credits. Not offered 1976-77.]

**336 The Ethnic Dimension in Politics** Fall, 4 credits.

M. J. Esman.  
The expression and regulation of political conflicts arising from ethnic, linguistic, racial, and religious pluralism. The political problems of communally divided societies are examined in a comparative perspective. Data are drawn from several countries including Canada, Malaysia, South Africa, and Yugoslavia as well as the United States.

**337 Women, Race, and Politics (also Women's Studies 337)** Spring, 4 credits.

M. Katzenstein, L. Williams.  
An initial consideration of the meaning of liberation for black and white women. The relationship between race, sex, and politics will then be examined by looking at the ways in which black and white women affect, and are affected by, the processes of political socialization, organization, and legislation.

**[338 Politics and Modernization** 4 credits. Not offered 1976-77.]

**339 The Government and Politics of Israel** Fall, 4 credits.

G. Shefter.

Analysis of the political and social processes and policy outcomes of the Israeli government since 1948, with some reference to the background of Zionist political thought and practice during and before the Mandate.

**340 Government and Politics of Latin America** Spring, 4 credits.

E. G. Kenworthy.  
An introduction to the national politics of the larger Latin nations in recent decades, offering alternative conceptions of power relations (e.g., pluralist, oligarchic). While external influences are not ignored, the focus is upon domestic politics.

**343 Politics and Anthropology** Spring, 4 credits.

D. E. Ashford.  
A comparison of how authority is used in small communities and traditional societies in relation to the larger political systems. The views of political scientists on culture and of anthropologists on politics will be compared. Their ideas will be used in analyzing a number of community studies in both industrial and traditional societies to trace the relationship, if any, between community and national politics in various countries.

**344 Government and Politics of Southeast Asia** Fall, 4 credits.

B. R. O'G. Anderson.  
Analysis of the organization and functioning of the political systems of Southeast Asia, with special attention to the problems of postcolonial social and political development.

**346 Politics in Contemporary Japan** Fall, 4 credits.

T. J. Pempel.  
The focus will be on the political, social, and economic delimiters of policymaking in postwar Japan, with some particular attention given to ideological conflict, political parties and elections, the bureaucracy, the consumer movement, student protest, defense policy, and economic penetration of Southeast Asia.

**347 Chinese Government and Politics** Fall, 4 credits.

M. G. Bernal.  
An examination of the politics of modern China including the breakdown of the traditional order and the revolutionary struggle of the Chinese Communist party. Primary emphasis on the institutions, methods, policies, and problems of the Communist regime since 1949.

**[348 Politics of Industrial Societies.** 4 credits. Not offered 1976-77.]

**349 Political Role of the Military** Spring, 4 credits.

B. R. O'G. Anderson.  
Comparative study of selected modern states and types of political systems in which the military have played a major role in domestic politics. Attention will be given to the social and ideological character of the "politicized" military and various forms of military government.

**350 Comparative Revolutions** Fall, 4 credits.

D. P. Mozingo.  
An analysis of major revolutionary movements since World War II; their social-political origins, ideology, and organization, with special emphasis on contrasting strategies and roads to power.

**353 Women and Politics (also Women's Studies 353)** Fall, 4 credits.

M. Katzenstein.  
Will consider the following questions: What factors propel women into politics? Why are the rates of political participation among women high in certain countries, low in others? In what ways are women's attitudes toward participation in politics distinct from their male counterparts? What effect does public

policy and women's participation in policymaking have on the status of women in different countries?

**[354 The Politics of Population** 4 credits. Not offered 1976-77.]

**355 From Politics to Policy: The Political Economy of Choice** Fall, 4 credits.

N. T. Uphoff.  
Examination of the realities, dilemmas, and strategies of policymaking in the United States, the Third World, and international relations. The environment of political action and policy choice will be considered analytically from the perspective of actors and choosers, using the framework of a new political economy.

**356 Elites and Society: The Political Economy of Power** Spring, 4 credits.

N. T. Uphoff.  
For students who have an interest in the nature and uses of power in politics. Consideration of how power has been treated by earlier political thinkers and by contemporary social scientists. Propositions will be formulated and critiqued about the distribution and consequences of power in America, other industrialized societies, and in the Third World, and their implications for the making of public policy. A game-simulation, "Third World Power Play," is undertaken at the end of the course.

**[357 Political Development in Western Europe** 4 credits. Not offered 1976-77.]

**[358 Politics of the Middle East** 4 credits. Not offered 1976-77.]

**435 Politics of Decentralization and Local Reform (also Business and Public Administration NPA 506)** Fall, 4 credits. Open to both undergraduate and graduate students.

Graduate students attend lectures and meet weekly as arranged to review research on decentralization and local politics.

D. E. Ashford.  
Comparative analysis of municipal and local government policies in Britain, France, and selected developing countries. Emphasis is on national-local linkage and how decentralization policies affect the power structure, economic planning, and representative government. The major efforts to reform urban, local, and regional planning and procedures since World War II will be examined and their effects assessed.

**446 Comparative Communism** Spring, 4 credits.

D. P. Mozingo.  
This seminar deals with regimes that claim to be committed to the Marxist-Leninist program for the realization of socialism and communism. After considering several approaches to the subject, the seminar will investigate similarities and differences among countries of the Soviet Bloc, China, and Yugoslavia. This is mainly a reading and discussion seminar.

**447 Readings on the Great Cultural Revolution** Spring, 4 credits. Prerequisite: 2 years of Chinese.

M. G. Bernal.  
Readings in Chinese of articles, directives, and circulars published during the Cultural Revolution.

**451 India: A Political Experiment** Fall, 4 credits.

M. Katzenstein.  
Will consider whether the goals of national unity, rapid economic growth, and social equality can be realized in India through democratic means.

**456-457 Policymaking in Industrial Societies** 456, fall; 457, spring, 4 credits per term. Students may register for either term.

D. Ashford, P. Katzenstein, T. J. Pempel.  
Examines the consequences of policy formation and modern governmental bureaucracy for the expression

and revisions of democratic political norms. Cases will include Great Britain, Germany, Japan, and France and will involve policy information in the areas of local government, education, labor relations, minorities, economic policy, and administrative reform. Students will work with primary materials on administrative decisionmaking in each case study.

## Political Theory

Government 161 is recommended.

**[360 Greek Political Philosophy** 4 credits. Not offered 1976-77.]

**[361 Liberalism and Its Critics** Spring, 4 credits. I. Kramnick.

Since the rise of capitalism, one political ideology has been dominant in the Western world—liberalism. Its hegemony has been questioned, however, by a series of critics—conservatism, democracy, socialism, anarchism, fascism, Freudianism, and feminism. This course will study the tensions between liberalism and these critics and speculate on the possible survival or extinction of this venerable and very American ideology.

**[362 Revolutions and Revolutionary Theory** 4 credits. Not offered 1976-77.]

**[363 Classics in Political Thought** Fall, 4 credits. W. J. Dannhauser.

Close textual analysis of a select number of basic texts in political thought. Topic for 1976: The Problem of Socrates; Reading and discussion of Aristophanes, *The Clouds*; Plato, *The Republic*; and Nietzsche, *The Twilight of the Idols*.

**[365 Ideologies and Social Movements** Spring, 4 credits. S. G. Tarrow.

The ways that thought and action interact in selected modern social movements, including German fascism, Italian communism, and American liberalism. Students will work on group projects relating to the theory and strategy of social movements under crisis situations.

**[366 Human Nature and Political Theory** Fall, 4 credits. S. D. Resnick.

A wide-ranging examination of alternative concepts of the self. Readings selected from the history of political speculation in the West; Plato, Hobbes, Marx, Freud, Marcuse, R. D. Laing, and others.

**[367 The Logic of Liberalism** 4 credits. Not offered 1976-77.]

**[368 Economic Models of Politics** Fall, 4 credits. E. W. Kelley.

Economic factors influencing the structure of political systems and economic models of such systems will be considered. The rationalistic presumptions underlying some such models will be introduced and modified. Applications to enduring policy arenas made.

**[371 The American Revolution in Comparative Perspective** Fall, 4 credits. I. Kramnick.

Was the American Revolution a revolution? What are we commemorating? This course will address these questions by investigating the nature of that event in terms of contemporary social science and other literature on revolution. Comparisons will be made with other revolutions and the revolutionary phenomenon in general.

**[374 Political Authority in Mass Society** Fall, 4 credits. E. J. Eisenach.

Eighteenth- and nineteenth-century origins of ideology and mass man. Theories of the disintegration of political authority in the nineteenth

and twentieth centuries: mass society as political pathology. Modern elitist theory as a response to mass society.

**[375 American Political Thought** Spring, 4 credits. E. J. Eisenach.

Survey of American political thought with stress on puritan thought, constitutional theory, selected nineteenth-century literature, and contemporary political science.

**[376 Marx and Socialist Thought** Spring, 4 credits. S. D. Resnick.

An examination of the writings of Karl Marx and the socialist tradition of the nineteenth and twentieth centuries.

## International Relations

Government 181 is recommended.

**[383 Theories of International Relations** Spring, 4 credits. R. H. Rosecrance.

A survey of relevant theories of international relations emphasizing war prevention and conflict resolution. Theories will be tested against the international experience of the past two centuries.

**[385 Contemporary American Foreign Policy** Fall, 4 credits. R. H. Rosecrance.

An analysis of the dilemmas which have confronted American foreign policy since 1945, both individual problems and more general questions of capabilities, priorities, and morality.

**[387 The United States and Asia** Spring, 4 credits. G. McT. Kahin.

An analysis of the relations of the United States with the major states of Asia and with those smaller countries (especially Vietnam) with which it has been particularly concerned; attention is also given to the relationship of American policy to the Asian policies of France, Great Britain, and Soviet Russia.

**[388 The United States and Western Europe** 4 credits. Not offered 1976-77.]

**[389 International Law** Fall, 4 credits. L. Scheinman.

Characteristics of international law, its theoretical foundations, principles, processes, and relationship to international politics. Emphasis on law-in-action. Attention to both traditional problems (intervention, coercion, the scope and limits of adjudication) and contemporary trends and processes (arms control, outer space, exploitation of seabed resources, the individual in international law, and cooperative patterns of socio-economic relations at global and regional level). Content may vary according to international events.

**[390 The Foreign Policy of China** Spring, 4 credits. D. P. Mozingo.

An analysis of Chinese concepts of foreign relations and the policymaking process in the People's Republic of China. Emphasis will be placed on such topics as the contemporary Chinese view of their position in the international community and a comparison of the making and implementation of contemporary Chinese policies with respect to such areas as the Soviet bloc, Afro-Asian countries, and the West.

**[480 Foreign Economic Policies of Advanced Industrial Societies** Spring, 4 credits. Open to undergraduates with permission of instructor. P. J. Katzenstein.

An examination of the contemporary crisis of the international economy. Of primary concern is the

manner in which domestic politics condition the foreign economic policies of the United States, Britain, France, and the Federal Republic of Germany. Case studies to be considered will include agricultural, commercial, financial, and energy policy.

**[481 Foreign Policy of the U.S.S.R.** Spring, 4 credits. M. Rush.

An analysis of Soviet foreign policy as it developed out of the revolution and accommodated to the prevailing international system, with a focus on the period since 1945. Particular topics include: causes and prospects of the cold war, impact of nuclear weapons on Soviet defense and foreign policy, sources and goals of Soviet hegemony in East Europe, causes of the dispute with China, and impact of domestic politics on the formation of foreign policy.

**[484 Defense Policy and Arms Control** Spring, 4 credits. F. A. Long, G. H. Quester.

An analysis of the requirements for military defense and the problems caused thereby. Subjects to be covered will include nuclear deterrence reasoning, military strategy, approaches to disarmament, the working of military-industrial complexes, and defense budgeting and policy procedures. Lectures and discussion sessions, with guests from among participants in the Cornell Peace Studies Program.

## Political Methodology

**[391 Human and Social Statistics** 4 credits. Not offered 1976-77.]

## Honors Courses

See earlier note on honors program.

**[400 Honors Seminar: Political Analysis** Fall, 4 credits. M. Shefter.

The application of behavioral and structural models to the analysis of three problems in political science: the social foundations of democratic regimes; the emergence of mass political movements and their institutionalization, suppression, or decay; and the politics of race and ethnicity.

**[494 The Honors Thesis** Fall or spring, 4 or 8 credits.

In their senior year, honors students will be required to take Government 494, in which they will prepare and write an honors thesis or honors paper. An honors thesis is an extended piece of original, independent research, while an honors paper is an extended analytical or synthesizing essay. Students will have the option of either format but will be required to obtain the consent of the faculty member supervising their work. Before the end of the semester which precedes the semester in which the thesis or paper is to be written, each participant must submit an approved proposal to the department office. Proposal forms may be obtained from the undergraduate secretary in 125 McGraw Hall. Both honors theses and honors papers will be given to a second reader for evaluation and students will be examined orally on their work by the two faculty members involved. In cases where students feel the need for a period of preparatory work before undertaking an honors thesis or paper, they may make use of the option available under Government 499 (see below).

## Supervised Study

Juniors and seniors majoring in government who have superior grade records may apply for supervised study in government with a particular instructor. The applicant must present a well-defined program of study that cannot be satisfied by taking regular courses. Emphasis will be placed on the capacity to subject a body of related readings to

analysis and criticism. The consent of the instructor is required.

**499 Readings** Fall or spring. Credit variable (1 to 6 credits).  
Staff.

### Graduate Seminars

Qualified undergraduates are encouraged to apply for seminars listed with 600 course numbers. Consult Supplementary Announcement of Graduate Courses available in the department office.

### Field Seminars

**602 Field Seminar in Methodology** Fall.  
4 credits.

E. W. Kelley.  
Some attention will be given to general problems of research design and hypothesis formulation. The main emphasis will be on measurements and hypothesis testing. Topics to be covered include: statistics, both parametric and nonparametric; unidimensional and multidimensional scaling; data theory; and causal modeling.

**603 Field Seminar in American Politics** Fall.  
4 credits.

B. Ginsberg.  
Introduction to the basic issues and institutions of American government and the various subfields of American politics. The focus is on substantive information and theoretical analysis, and on problems of teaching and research.

**605 Field Seminar in Comparative Politics** Fall.  
4 credits.

M. G. Bernal, M. Katzenstein.  
An introduction to selected theoretical problems in the study of comparative politics and to their application in empirical analysis. Basic problems are social class and politics; authority and legitimacy; participation and mobilization; economic development and democracy; authoritarian and totalitarian politics; corporatism and pluralism; nation-building and political integration.

**606 Field Seminar in International Relations** Spring. 4 credits.

R. H. Rosecrance.  
A general survey of the literature and propositions of the international relations field. Criteria will be developed for judging theoretical propositions. These will be applied to the major findings. Participants will be expected to do extensive reading in the literature as well as engage in certain research activities.

**607 Field Seminar in Political Thought** Fall.  
4 credits.

I. Kramnick.  
An introduction to political theory through a reading of selected classics in political thought from Plato to Marx.

### American Government and Institutions

**611 Research Seminar in American Urban Politics: Applications of Gaming and Simulation** Spring. 4 credits. Open to highly qualified undergraduates with permission of instructor.

D. E. Van Houweling.  
Provides a background in the general field of gaming simulation and an opportunity to participate in a research project utilizing these tools, with special emphasis on urban policy applications. The first four weeks are devoted to an intensive study of gaming simulation techniques and applications to social science. The remainder of the term is devoted to projects related to an interactive urban gaming simulation.

**621 Elections and Public Policy** Spring.  
4 credits.

P. Leeds.

The relationship between citizen voting and public policy is one of the central questions of democratic politics. This course will focus on American voting behavior, the role of political parties, and the linkages between citizen choices and the behavior of public officials.

**624 American Political Development** Spring.  
4 credits.

M. Sheffer.  
An analysis of the sources of change in American politics, focusing upon periodic realignments in American politics and the consequences of such changes for the nation's political institutions. The applicability of cross-national theories of political development to the United States will be considered. Implications for recent changes in the party system and legislative-executive relations will be discussed.

**625 Political Sociology** Fall. 4 credits.

L. Williams.  
This course is concerned with the social background of political action. It will deal with both substantive topics (e.g., the study of class structure, formal organizations, secondary groups, communication, ideology, political socialization) and also make use of research methods (e.g., interviewing, survey analysis, aggregate data and model construction).

### Public Policy

**629 Politics of Technical Decisions (also Business and Public Administration NPA 513)** Fall.

D. Nelkin and J. Milch.  
The political aspects of public policy decisions traditionally regarded as "technical" problems. Exploration of the concept of technical decisions and the characteristics of a technological society, with discussion of how decisions are determined or limited by the technologies involved, the institutions of technical decisionmaking, the sources and implications of depoliticization, and the rise of citizen opposition to technological development.

**630 Science, Technology, and Development (also Business and Public Administration NCE 510)** Spring. 4 credits.

M. J. Esman.  
The issues involved in the formulation and implementation of national science and technology policies in developing countries. Choices of technologies and the instruments and channels for the transfer of technology from industrialized to less industrialized societies. The implications of science policy and technology transfer for economic growth, social equity, political integration, and international cooperation.

### Comparative Government

**638 European Political Development** Fall.  
4 credits.

S. G. Tarrow.  
The rise of the modern state in the West. Theories of development applied to Western Europe, the rise of modern social cleavages and their expression in party conflicts. A reading seminar with term paper or examination option to be exercised by the student.

**642 The Politics of Communalism** Fall. 4 credits. Offered in conjunction with Govt 336. There will be an extra session for graduate students.

M. J. Esman.  
Investigation of the politics of racial, ethnic, religious, linguistic, and cultural pluralism. Emphasis is on subnational pluralism, the implications of communal cleavages for political and economic development, and strategies for the management of various expressions of communal conflict. Seminar focuses on relationships between modernization and communal pluralism, but does not exclude the manifestation of these phenomena in contemporary United States experience.

**645 Politics of China** Spring. 4 credits.

M. G. Bernal.  
Seminar on post-1949 Chinese political system. Each student prepares a substantial research paper on some aspect of contemporary Chinese politics.

**647 Political Anthropology: Culture and Revolution in Indonesia (also Anthro 628)** Spring.  
4 credits. Reading knowledge of Indonesian required.

B. R. O'G. Anderson, J. T. Siegel.  
This seminar will be devoted to the analysis of literary and other texts produced during the Indonesian Revolution, with particular emphasis on the work of Pramudya Ananta Tur.

**651 Readings from Mao Tse-tung** Spring.  
4 credits. Prerequisite: 2 years of Chinese or permission of instructor.

M. G. Bernal.  
Articles written in Chinese by Mao read and analyzed linguistically and politically.

**652 Political Problems of Southeast Asia** Fall.  
4 credits.

G. McT. Kahin.  
Focus will be on the genesis and development of political forces in South Vietnam since World War II and on the establishment and shaping of the Saigon regime, 1954 to 1975.

**654 Culture and the Mass Line in China** Spring.  
4 credits.

M. G. Bernal.  
Origins of Great Proletarian Cultural Revolution. Investigation along two related lines: impact of culture and "superstructure" on Chinese revolutionary process and Chinese society as a whole since mid-1960s; and character of tensions and other relationships that developed between party leadership and spontaneous mass action during the Cultural Revolution.

**655 Latin American Society and Politics (also Sociology 655)** Fall. 4 credits. Reading knowledge of Spanish or Portuguese recommended.

E. G. Kenworthy, J. Kahl.  
Reading and discussion of various recent books on the social and political situation in Latin America.

**659 Politics of Contemporary Europe** Spring.  
4 credits.

S. G. Tarrow.  
An exploration of the relationships between social conflicts, political cleavages, and political parties and policies in selected Western European political systems. Students will write term papers oriented towards original research.

### Political Theory

**666 The Political Philosophy of Nietzsche** Fall.  
4 credits.

W. J. Dannhauser.  
A close textual analysis of *Thus Spoke Zarathustra* and readings in other texts by Nietzsche.

**668 Foundations of English Liberalism** Spring.  
4 credits.

E. J. Eisenach.  
Analysis of the political, religious, and legal theories of Hobbes and Locke and the relationship of those writings to the Puritan Revolution of 1688.

**673-674 Economic Models of Politics** 673, fall; 674, spring. 4 credits per term. 673 prerequisite for 674, except with permission of instructor.

E. W. Kelley.  
Both economic factors influencing the structures of political systems and economic models of such systems will be considered. The rationalistic presumptions underlying such models will be introduced and modified. There will be applications to enduring policy arenas.

**675 Social Statistics and Hypothesis Testing** Spring. 4 credits.

E. W. Kelley.

This course will cover multivariate analysis including correlational measures, regression, analysis of variance, factor analysis, path analysis, sampling, compiling distributions of various statistics, and possible probit analysis.

**678 The Political Theory of German Idealism** Spring, 4 credits.

S. D. Resnick.  
The seminar will focus on the development of political and legal theory in the works of Kant and Hegel.

**International Relations**

**681 Transnational Relations and World Politics** Spring, 4 credits.

L. Scheinman.  
The study of interaction between governments and transnational actors in economic and political contexts. The character of transnational relations and organizations as well as particular issue areas will be given consideration.

**685 Analysis of Foreign Policy** Fall, 4 credits.

G. H. Quester.  
Analysis of how the processes and outputs of foreign policies may be studied and compared. Case studies from superpower, middle-power, and small-power foreign policies will be used to attempt to determine whether the determining factor is the international arena or the "linkage politics" of domestic environments.

**687 International Relations of Asia** Spring, 4 credits.

G. McT. Kahin.  
American Southeast Asian policies: their genesis, character, impact and long-term consequences. Elements involved in the formation of American policies toward Southeast Asia by the several postwar administrations (Truman through Ford), including international factors and considerations of American domestic politics. The ways in which these policies have been applied and their influence on political forces within the countries of Southeast Asia.

## History

R. Polenberg, acting chairman; D. A. Baugh, A. H. Bernstein, S. Blumin, S. G. Cochran, L. Engelstein, E. W. Fox, R. Gellately, T. H. Holloway, C. Holmes, J. J. John, M. Kammen, S. L. Kaplan, E. H. Kinmonth, D. C. LaCapra, W. F. LaFeber, P. R. Metcalf, R. L. Moore, J. Najemy, M. B. Norton, C. A. Peterson, W. M. Pintner, W. B. Provine, J. H. Silbey, F. Somkin, B. Tierney, J. Weiss, L. P. Williams, O. W. Wolters, D. K. Wyatt.

To complete the history major, a student should (1) have completed either the Introduction to Western Civilization (History 151-152) or the introduction to Asian Civilizations (History 190-191); (2) have taken history courses totalling thirty-four credits, completing all these courses with a grade of C or better; of the thirty-four credits, sixteen must be in courses numbered above 300, and of these sixteen, eight must be in one particular field of history (e.g. modern American, ancient, early modern European); (3) have taken two courses above the elementary level offered by other departments that relate to the eight-credit concentration in one particular field of history.

Prospective majors may wish to discuss their projected program with the director of undergraduates studies before formally enrolling with the department.

### The Honors Program

Prospective candidates for the degree of Bachelor of Arts with honors in history should consult with Professor Najemy or Professor Kaplan during the

spring term of their sophomore year or early in their junior year.

Honors candidates will take History 400 during either the fall or the spring semester of their junior year. In the other semester, candidates should take a seminar in their major area of interest. At the beginning of the senior year, candidates normally choose a faculty adviser and register in the fall term for History 302. In the spring term of the senior year they register for History 401, a four-credit course that permits them to complete the honors essay and prepare to defend both the essay and their understanding of the general historical interests they have pursued within the major. However, under the direction of their advisers and with the consent of the honors committee, students may revise and expand a paper written in any upper-level history course into an honors essay. In appropriate cases, this may be done for credit by registering for History 301 or 302.

The text of the honors essay may not exceed sixty pages except by permission of the chairperson of the honors committee and the student's adviser. Two copies will be due during the third week of April. In May each honors candidate will be given an oral examination administered by the major adviser and one or both of the essay readers. The examination will focus on the specific issues of the essay as well as the broad field of history in which the student has concentrated his or her research (e.g. Periclean Athens, seventeenth-century science, nineteenth century America).

To qualify for a Bachelor of Arts degree with honors in history, a student must 1) sustain at least a B+ cumulative average in all history courses; and 2) earn at least a *cum laude* grade on the honors essay and on the oral examination.

### Distribution Requirement

The distribution requirement in history is satisfied by any one-year sequence in history 100- through 300-level courses, or by taking any two related history courses (as specified in a listing of options on file in the Arts College office). Students must consult the department's director of undergraduate studies for approval of any other possibilities.

### American History

**201 Introduction to American History: From the Beginning to 1865** Fall, 3 credits.

Lec. T Th 9:05; disc. hours to be arranged.  
M. B. Norton and staff.

A survey for both prospective majors and others. Substantial emphasis will be placed on such subjects as the role of blacks and women in the American past, the founding of the republic, and the character of American society in the pre-Civil War years.

**202 Introduction to American History: From the Civil War to Recent Times.** Spring, 3 credits.

M W F 1:25. Staff.  
A survey for both prospective majors and others. Lectures and discussions.

**203-209 Freshman Seminars in American History** Open to all qualified freshmen. Permission of instructors required. Consult Freshman Seminar booklet for course descriptions.

**311-312 The Structure of American Political History** 311, fall; 312, spring, 4 credits per term. Offered in alternate years. 311 is not prerequisite to 312.

Lec. T Th 10:10. Disc. hours to be arranged.  
J. H. Silbey.  
The first semester examines the course of American politics from 1787 to the Civil War, focusing on the nature of decision making, popular and legislative voting behavior, and the role of interest groups, political parties, and political elites in shaping our political history. The second semester surveys 1865 to the present.

**313-314 History of American Foreign Relations** 313, fall; 314, spring, 4 credits per term. 313 is not prerequisite to 314.

T Th S 11:15. W. LaFeber.  
History 313 covers the period from 1750-1914; 314 from 1914 to the present. Emphasis is placed on the main policymakers (Franklin through Kissinger) and the domestic sources of foreign policy.

**[316 American Cultural and Intellectual History to 1820** F. Somkin. Not offered 1976-77.]

**317 American Cultural and Intellectual History: Thought and Feeling in the Nineteenth Century** Fall, 4 credits.

M W F 2:30. F. Somkin.  
Ideas, movements, and thinkers, including the conflict between ideas and reality; the individual against society; Mormonism; reform movements such as temperance, women's rights, communitarianism, and antislavery; science and evolution, the Gospel of Wealth; the rise of originality and radicalism in art and social thought.

**318 American Constitutional Development** Spring, 4 credits.

M W F 9:05. M. B. Norton.  
A study of the major themes of the constitutional history of the United States. Among the topics to be considered are: the drafting of the Constitution, the Marshall and Taney courts, civil rights decisions of the nineteenth century, the rise of substantive due process, and the Warren court.

**[321 The Origins of American Civilization** M. Kammen. Not offered 1976-77.]

**[323-324 The American Indian in the American Experience** P. R. Metcalf. Offered in alternate years. Not offered 1976-77.]

**325 Age of the American Revolution, 1763-1815** Fall, 4 credits.

T Th 12:20-2. M. B. Norton.  
An examination of the process by which the thirteen English colonies became an independent and united nation, with emphasis on political thought and practice, social and economic change, and cultural development.

**327-328 The American West** 327, fall; 328, spring, 4 credits per term. Offered in alternate years. History 327 not prerequisite to 328.

T Th 2:30-4. P. R. Metcalf.  
History of the frontier and westward expansion, emphasizing the trans-Mississippi region. First term covers early explorations and settlements, frontier rivalries of European imperial powers, and Anglo-American expansion from the colonial period through the mid-nineteenth century. The second term covers the settlement and growth of the trans-Mississippi West from the era of the California gold rush until the present. Topical lectures with emphasis on reading and discussion.

**[330 The United States in the Middle Period** Fall. J. H. Silbey. Offered in alternate years. Not offered 1976-77.]

**[331 The American Civil War and Reconstruction** Spring. J. H. Silbey. Offered in alternate years. Not offered 1976-77.]

**[332-333 The Urbanization of American Society** 332, fall; 333, spring. S. Blumin. Not offered 1976-77.]

**336 Survey of American Social History: Family, Community, Religion, Work, and Class, 1607-1860** Spring, 4 credits.

M W F 11:15. S. Blumin.  
This course will survey the changing social circumstances of "anonymous Americans" from the early European settlements to the Civil War. Emphasis will be placed on the last four or five

decades of this period, and on the changes in class, community, and institutional structures accompanying the revolution in transportation and industry.

**340-341 Recent American History, 1920 to the Present** 340, fall; 341, spring. 4 credits per term. 340 is not prerequisite to 341.

Lec, T Th 12:20; disc, hours to be arranged.  
R. Polenberg.

Fall term topics include individualism and conformity in the 1920s; class, race, and ethnicity in the 1930s; Franklin Roosevelt and the New Deal; domestic and diplomatic aspects of World War II. Spring term topics include the Supreme Court, civil liberties, and civil rights; society and thought in the 1950s; John F. Kennedy and the New Frontier; the impact of the war in Vietnam and Watergate.

**345 The Modernization of the American Mind** Fall. 4 credits.

Lec, M W 11:15; disc, hours to be arranged.  
R. L. Moore.

American thought and culture from 1890 to the present. Course emphasizes ideas in the context of a Western intellectual community, the cultural impact of major political and economic events, and the adaptation of social ideas and values to new conditions.

**346 Major Themes in American Religious History** Spring. 4 credits.

Lec, M W 11:15; disc, hours to be arranged.  
R. L. Moore.

Religious thought and practice in America from the seventeenth century, related to intellectual, social, and political trends. Special emphasis on the interaction between religion and the cause of social reform.

**[411 Undergraduate Seminar in American Political History]** J. H. Silbey. Not offered 1976-77.]

**414 Motivations of American Foreign Policy** Fall. 4 credits. Prerequisite: 314 and permission of instructor.

Hours to be arranged. W. F. LaFeber.  
Topic and bibliography will be posted at McGraw 432 during preregistration in the spring.

**416 Undergraduate Seminar in American Cultural History** Fall. 4 credits. Prerequisite: permission of instructor.

Th 2:30-4:25. F. Somkin.  
The quest for an authentic democratic culture from the Civil War to World War I. Concentration will be upon the life and thought of America's first master of modern architecture, Louis H. Sullivan, and the technological, social, and intellectual context of his era.

**418 Undergraduate Seminar in the History of the American South** Spring. 4 credits. Prerequisite: permission of instructor.

T 2:30-4:25. J. H. Silbey.  
Topic for 1976-77: Slavery, the Slave System, and the Crisis of the Union, 1846-1861.

**[419 Undergraduate Seminar in American Social History]** S. Blumin. Not offered 1976-77.]

**423 Seminar in Native American Cultural History** Fall. 4 credits. Offered in alternate years. Prerequisite: 323-324 or permission of instructor.

W 1:25-3:20. P. R. Metcalf.  
Topical analysis of the origins and development of aboriginal American Indian cultures, their responses to the encroachment of European and American civilizations, and the changes and continuities that resulted. Intensive reading and a research essay required.

**424 Seminar in the History of Indian-White Relations** Spring. 4 credits. Offered in alternate years. Prerequisite: 323-324 or permission of instructor.

W 1:25-3:20. P. R. Metcalf.  
Topical analysis of the attitudes, policies, and practices of European and American civilizations regarding native Americans. Areas of emphasis include differences among the English, Spanish, and French approaches to Indian cultures and affairs; the development and history of United States Indian policy; the evolution of scholarly and literary images of the Indian; and the effects upon American society of interaction with native Americans. Intensive reading and a research essay required.

**[426 Undergraduate Seminar in Early American History]** M. B. Norton. Not offered 1976-77.]

**[440 Undergraduate Seminar in Recent American History]** Fall. 4 credits. Prerequisite: permission of instructor. R. Polenberg. Not offered in 1976-77.]

**445 Undergraduate Seminar: Deviance and Conformity in a Liberal Society** Spring. 4 credits. Prerequisite: permission of instructor.

W 2-4. R. L. Moore.  
Historical reading and research on the constraints placed upon individual and group behavior in a democratic America. Topics of special study drawn from all periods of American history.

**[613-614 Seminar in the History of American Foreign Relations]** W. LaFeber. Not offered 1976-77.]

**615 Seminar in American Cultural and Intellectual History** Fall. 4 credits.  
Hours to be arranged. F. Somkin.

**[616 Seminar in American Cultural and Intellectual History]** F. Somkin. Not offered 1976-77.]

**[617-618 Seminar in Recent American Cultural History]** R. L. Moore. Not offered 1976-77.]

**[619 Seminar in American Social History]** S. Blumin. Not offered 1976-77.]

**[621-622 Seminar in American History]** M. Kammen. Not offered 1976-77.]

**626-627 Seminar in the History of American Women** 626, fall; 627, spring. 4 credits per term.  
Hours to be arranged. M. B. Norton.

**633-634 Seminar in Nineteenth-Century American History** 633, fall; 634, spring. 4 credits per term.  
Hours to be arranged. J. H. Silbey.

## Asian History

**[190 Introduction to Asian Civilization: Origins to 1600]** C. A. Peterson, O. W. Wolters. Not offered 1976-77.]

**[191 Introduction to Asian Civilizations in the Modern Period]** S. G. Cochran, E. H. Kinmonth, D. K. Wyatt. Not offered 1976-77.]

**393 History of China up to Modern Times** Fall. 4 credits. Open to sophomores.  
Lec, T Th 10:10; disc, hours to be arranged.  
C. A. Peterson.

A broad examination of the major aspects of Chinese culture and civilization from earliest times to the late imperial period. Seeks to expose both those features maintaining continuity and the significant (but frequently overlooked) instances of change.

**394 History of China in Modern Times** Spring. 4 credits. Open to sophomores.  
Lec, M W 10:10; disc, hours to be arranged.  
S. G. Cochran.  
A survey which concentrates on the rise of the last

imperial dynasty in the seventeenth and eighteenth centuries, the upheavals resulting from domestic rebellions and foreign imperialism in the nineteenth century, and the twentieth-century efforts to create a strong and unified nation.

**395 Southeast Asian History to the Fourteenth Century** Fall. 4 credits.

Lec, T Th 11:15; disc, hours to be arranged.  
O. W. Wolters.

A survey of early Southeast Asian history with particular reference to questions raised in the source material concerning religious beliefs and political and social assumptions.

**396 Southeast Asian History from the Fifteenth Century** Spring. 4 credits.

T Th 11:15-12:30. D. K. Wyatt.  
A survey focusing on cultural, social, and economic change in Southeast Asia.

**397 Japanese History to 1615** Fall. 4 credits.  
Lec, M W 1:30; disc, hours to be arranged

E. H. Kinmonth.  
An introductory survey of economic, cultural, and social patterns in Japan from pre-historical times to the seventeenth century.

**398 History of Modern Japan** Spring. 4 credits.  
Lec, M W 1:30; disc, hours to be arranged.

E. H. Kinmonth.  
A survey of the social, cultural, and political history of Japan from the early seventeenth century through World War II, with emphasis given to the Tokugawa and Meiji eras.

**487 Origins of the Modern Japanese State** Fall. 4 credits. Prerequisite: 398 or permission of instructor.

Hours to be arranged. E. H. Kinmonth.  
The background and consequences of the Meiji Restoration with emphasis on alternative approaches and interpretations.

**488 Japanese Thought and Society in the Meiji Era** Spring. 4 credits. Prerequisite: permission of instructor.

Hours to be arranged. E. H. Kinmonth.  
An intensive examination of nineteenth-century Japanese thought concerning selected social and historical issues.

**492 Undergraduate Seminar in Medieval Chinese History** Fall. 4 credits. Prerequisite: 190, 393, or permission of instructor.

Hours to be arranged. C. A. Peterson.  
Topic for 1976-1977: The social and cultural life of the literati in medieval China.

**[493 Self and Society in Late Imperial and Twentieth-Century China]** S. G. Cochran. Not offered 1976-77.]

**[494 Undergraduate Seminar: The First Chinese Revolution 1880-1930]** Spring. 4 credits. Prerequisite: 394 or permission of instructor. S. G. Cochran. Not offered in 1976-77.]

**[497 Undergraduate Seminar in Southeast Asia in the Nineteenth Century]** D. K. Wyatt. Not offered 1976-77.]

**498 Undergraduate Seminar in Southeast Asian History.** Fall. 4 credits. Prerequisite: 395 or permission of instructor.

Hours to be arranged. O. W. Wolters.  
Systematic consideration of selected problems and episodes in Southeast Asian history, utilizing indigenous historical sources in translation and relevant secondary sources.

**691 Chinese Historiography and Source Materials** Fall. 4 credits. Prerequisite: permission of instructor.

Hours to be arranged. C. A. Peterson.

**[694 Problems in Modern Chinese History]** Spring, 4 credits. Prerequisite: permission of instructor. S. G. Cochran. Not offered 1976-77.]

**695-696 The Historiography of Southeast Asia** 695, fall; 696, spring, 4 credits per term. Prerequisite: permission of instructor. Hours to be arranged. O. W. Wolters, D. K. Wyatt.

**791 Seminar in Medieval Chinese History** Fall, 4 credits. Hours to be arranged. C. A. Peterson.

**[794 Seminar in Modern Chinese History]** Spring, 4 credits. S. G. Cochran. Not offered 1976-77.]

**795-796 Seminar in Southeast Asian History** 795, fall; 796, spring, 4 credits. Hours to be arranged. O. W. Wolters, D. K. Wyatt.

## European History

**151-152 Introduction to Western Civilization** 151, fall; 152, spring, 4 credits per term. 151 is not prerequisite to 152. Freshmen may count either term or both toward satisfaction of the Freshman Seminar requirement.

Fall: lec, W F 10:10; disc, hours to be arranged, A. H. Bernstein; spring: Lec, T Th 10:10; disc, hours to be arranged, L. P. Williams. A survey of European history. 151 covers from antiquity to the Reformation. 152 from the sixteenth century to the present day. Attention is given equally to the major political and social developments and to the intellectual heritage of the West. A considerable portion of the reading is contemporary sources.

**271 Freshman Seminar: Revolution and Society in Russia** W. M. Pintner. Consult Freshman Seminar booklet for course description.

## Ancient European History

**261-262 Classical Antiquity** 261, fall; 262, spring, 3 credits per term. 261 not prerequisite to 262. Lec, W F 12:25; disc, hours to be arranged. A. H. Bernstein.

261: Classical Greece. Will deal with such problems as the rise of the polis, the birth of philosophy and humanism, the origins and development of democracy, liberal and conservative attitudes in fifth- and fourth-century political thought, and the final crisis of confidence in the Hellenistic period. Portions of Homer, Aeschylus, Sophocles, Euripides, Aristophanes, Herodotus, Thucydides, Plato, and Aristotle will be read in translation. 262: ancient Rome. Will deal with such problems as Roman imperial expansion, the Roman revolution, the maintenance of autocracy, and the decline and fall of the Roman empire.

**[461 The Roman Revolution, 146-44 B. C.]** A. H. Bernstein. Not offered 1976-77.]

**[462 Early Imperial Rome, 44 B. C.-A. D. 70.]** A. H. Bernstein. Not offered 1976-77.]

**463 Classical Greece, 510-404 B. C.** Fall, 4 credits. Prerequisite: 261 or permission of instructor. An undergraduate seminar; enrollment limited to 25. Hours to be arranged. A. H. Bernstein.

**464 Classical Greece, 404-338 B. C.** Spring, 4 credits. Prerequisite: 261 or permission of instructor. An undergraduate seminar; enrollment limited to 25. Hours to be arranged. A. H. Bernstein.

**465 Cicero and His Age. (also Classics 465)** Spring, 4 credits. Hours to be arranged. A. H. Bernstein, W. R. Johnson.

An interdisciplinary examination of the final decades of the Roman Republic as seen through the eyes of the period's most prolific writer. Selections from Cicero's speeches, his personal correspondence, and his philosophical, political, and oratorical essays will be studied for the light they throw on both the man and his times.

**465A Readings in Cicero** Spring, 1 credit. Students who are enrolled in History 465 and have Latin will read selected texts in the original in an additional section each week.

**661-662 Graduate Seminar in Ancient Classical History** 661, fall; 662, spring, 4 credits per term. 661 is prerequisite to 662. Hours to be arranged. A. H. Bernstein. Topic 1976-1977: Livy and Polybius.

## Medieval and Early Modern European History

**[257 English History from Anglo-Saxon Times to the Revolution of 1688]** C. Holmes. Not offered 1976-77.]

**263 The Earlier Middle Ages** Spring, 4 credits. M W F 12:20. J. J. John. A survey of medieval civilization from c. 300 to c. 1100, dealing with religious, intellectual, political, and economic developments in Western Europe.

**264 The High Middle Ages** Fall, 4 credits. T Th 10:10-11:25. B. Tierney. A survey of medieval civilization from c. 1100 to c. 1450. The main trends of political, religious, intellectual, and economic development will be considered.

**350 Early Renaissance Europe** Fall, 4 credits. Lec, T Th 1:25; disc, hours to be arranged. J. Najemy.

An examination of the major problems of the political, economic, social, cultural, intellectual, and religious history of Western Europe. Readings about evenly divided between Italy and the North.

**[351 Later Renaissance and Reformation Europe, 1450-1600]** Not offered 1976-77.]

**[359 The Early Development of the Anglo-American Common Law]** C. Holmes. Not offered 1976-77.]

**[365 Medieval Culture, 400-1150]** J. J. John. Not offered 1976-77.]

**366 Medieval Culture, 1100-1300** Spring, 4 credits. Prerequisite: 264 or permission of instructor. T Th 2:30-3:45. J. J. John. The origin and development of the universities will be studied as background for a consideration of such thinkers as Abelard, Bonaventure, and Thomas Aquinas, with special attention devoted to the relations between the scholastic mentality of the universities and the literature, science, art, and script of the period.

**367 Church and State During the Middle Ages** Fall, 4 credits. Prerequisite: 263 or 264; also open to graduate students or by permission of instructor. T Th 3:10-4:25. B. Tierney.

The course will deal with relationships between ecclesiastical and secular authorities and with the ways in which these relationships influenced the growth of government in the Middle Ages. Particular attention will be given to the growth of medieval constitutionalism.

**[368 Undergraduate Seminar on Religion and Culture in the Middle Ages]** B. Tierney. Not offered 1976-77.]

**369 The History of Florence, 1250-1530** Spring,

4 credits. Lec, T Th 1:25; disc, hours to be arranged. J. Najemy.

Florentine politics and society from communal origins through the guild republic to the Medicean regime and the establishment of the principate. Attention to problems of economy and social structure, cultural and religious development, and political and historical ideas, as well as to the evolution of Florentine government and institutions.

**[371 History of England Under the Tudors and Stuarts]** C. Holmes. Not offered 1976-77.]

**[468 Undergraduate Seminar in Renaissance History]** J. Najemy. Not offered 1976-77.]

**469 Seminar on European History in the Age of the Reformation and Counter Reformation** Spring, 4 credits. Hist 350 recommended but not required. Open to undergraduates and graduates. W 1:25-3:30. J. Najemy.

A reading and discussion course on the major developments of Western Europe in the sixteenth century, with special attention to the intellectual, social, and political aspects of the religious question in both Protestant and Catholic Europe. Readings will include primary sources (Luther, Calvin, Loyola, Montaigne, etc.) and selected secondary works.

**[663 Graduate Seminar in Renaissance History]** Spring, 4 credits. J. Najemy. Not offered 1976-77.]

**[664-665 Seminar in Latin Paleography]** J. J. John. Not offered in 1976-77.]

**668-669 Seminar in Medieval History** 668, fall; 669, spring, 4 credits. Hours to be arranged. B. Tierney.

## Modern European History

**253 Survey of Russian History to 1860** Fall, 3 credits. T Th 10:10-11:25. W. M. Pintner. Deals with the origin of the autocratic state, the serf system, and the reasons for the divergence of Russian and Western European culture.

**254 Survey of Russian History Since 1860** Spring, 3 credits. T Th 10:10-11:25. L. Engelstein.

Examines the failure of the Tsarist system to deal successfully with the social and economic changes of the nineteenth century and the differing approach of the Soviet regime to similar problems.

**258 English History from the Revolution of 1688 to the Present** Fall, 3 credits. M W F 12:20. D. A. Baugh.

An introduction. Major themes are aristocratic society and government, imperial expansion, English radicalism, the Victorian transformation, and the significance of the labor movement. Emphasis is on people who shaped England's political destiny in eighteenth and nineteenth centuries.

**[353-354 European Intellectual History in the Nineteenth and Twentieth Centuries]** D. LaCapra. Not offered in 1976-77.]

**355 The Old Regime, France in the Seventeenth and Eighteenth Centuries** Fall, 4 credits. T Th 2:30-3:50. S. L. Kaplan.

A systematic examination of the social structure, economic life, political organization, and collective mentalities of a society which eclipsed all others in its time and then, brutally and irreversibly, began to age. France, in European perspective, from the Wars of Religion through the Age of Voltaire.

**356 The Era of the French Revolution and Napoleon** Spring, 4 credits. T Th 2:30-3:50. S. L. Kaplan.

A study of the failure of the traditional system, its

dismantling and replacement in France, and the international consequences. Focus will be on the meaning of the revolutionary experience, the tension between the desires to destroy and create, and the implications of the Revolution for the modern world.

**357-358 Modern German History** 357, fall; 358, spring. 4 credits per term. 357 is not prerequisite to 358.

T Th 10:30-12:05. R. Gellately  
The making of Modern Germany. A survey of the major political, social, and economic forces that shaped the fate of the German people from the age of the Reformation to the present time. The fall term covers the period from 1500 to 1848; the spring term from 1848 to the present.

**370 Europe in the Twentieth Century** Fall. 4 credits.

M W F 1:25. J. H. Weiss.  
An investigation of the major developments in European history since 1900. Emphasis upon the development of democratic political systems and their alternatives. Topics to include the transforming effects of war and depression, the dynamics of fascism, the European response to the economic and ideological influence of America and Russia, and the politics of culture.

**372 Social and Cultural History of Contemporary Europe.** Spring. 4 credits. Prior enrollment in History 370 is recommended.

T Th 12:20-2:20. J. H. Weiss.  
An examination of certain subjects in the experience of twentieth-century Europe that fall outside both the usual history of political structures and the higher realms of intellectual history. These include such topics as the family and demographic change, rural societies and city development, work and leisure, social welfare and planning, education and social stratification, and aspects of popular culture.

**374 War, Trade, and Empire, 1585-1815** Spring. 4 credits.

M W F 12:20. D. A. Baugh.  
Maritime enterprise, imperial policy, and naval power in the age of expansion. The accent is on English, French, and Dutch rivalry in the Atlantic and Caribbean.

**375 Twentieth-Century Britain** Spring. 4 credits. Primarily a discussion seminar; open to sophomores

T Th 10:10-12. D. A. Baugh.  
Topics include: Irish and Ulster questions, World Wars I and II and their impact, appeasement, decline of Liberalism and rise of Labour, and historical background of economic decline.

**376 Russian Cultural and Intellectual History** Fall. 4 credits.

M W F 10:10. L. Engelstein.  
Russian culture and its relation to social change, viewed as part of the broader European context; literature, social thought, and political ideology under the old regime and after the revolution.

**378 Europe from the End of the Ancient Regime** Fall. 3 credits. Open to sophomores.

W F 10:10. E. W. Fox.  
Europe in the nineteenth century. A lecture course with brief required and suggested supplementary reading. The principal focus of the course is on the major political and economic developments of the century and their impact on European society.

**[451 Lord and Peasant in Europe: A Seminar in Social History** S. L. Kaplan. Not offered 1976-77.]

**456 Seminar in the Social History of Germany, 1871-1914** Spring. 4 credits. Prerequisite: 357 or 358 or permission of instructor.

W 1:25-3:30. R. Gellately.  
Examination of major developments in the years from the foundation of the second German Empire dominated by Bismarck, to the outbreak of World War I.

**457 Germany in the Weimar Republic, 1919-1933** Fall. 4 credits. Prerequisite, 357 or 358 or permission of instructor.

W 1:25-3:30. R. Gellately.  
A study which focuses upon the period beginning with a lost war and revolution and ending with the Nazi seizure of power.

**[470 Seminar in Twentieth-Century Europe** J. H. Weiss. Not offered 1976-77.]

**471 Undergraduate Seminar in Russian Social and Economic History** Fall. 4 credits. Prerequisite: permission of instructor.

Th 2:30-4:25. W. M. Pintner.  
The major emphasis is on how the autocracy shaped the social and economic systems from very early times. Important topics include the serf system, the service aristocracy, the rapid economic growth in pre-and post-revolutionary periods.

**472 Undergraduate Seminar of Russian Foreign Relations** Spring. 4 credits.

T 2:30-4:25. W. M. Pintner.  
From the fifteenth century to the revolution. Stresses the interconnection of domestic and foreign affairs.

**473 Undergraduate Seminar in Twentieth-Century Russian History** Spring. 4 credits.

Hours to be arranged. L. Engelstein.  
Topics in modern Russian intellectual history.

**[474 Topics in Modern European Intellectual History** D. LaCapra. Not offered 1976-77.]

**476 The Depression on Film** Spring. 4 credits. Prerequisite: permission of instructor.

Hours to be arranged. J. H. Weiss.  
An exploration of topics from the experience of Britain and America in the 1930s which are illuminated by the evidence of films and film culture: work and leisure; technology; social services provided by government and the private sector; the role of intellectuals; and industrial conflict.

**[477 The Politics of the Enlightenment** S. L. Kaplan. Not offered 1976-77.]

**[478 Seminar on Eighteenth-Century French Social History** S. L. Kaplan. Not offered 1976-77.]

**655 Seminar in Eighteenth-Century British History** Fall. 4 credits.

Hours to be arranged. D. A. Baugh.

**[656 Seminar in Nineteenth-Century British History** D. A. Baugh. Not offered 1976-77.]

**[671 Seminar in the French Revolution** S. L. Kaplan. Not offered 1976-77.]

**[672-673 Seminar in Modern European Intellectual History** D. LaCapra. Not offered 1976-77.]

**675 Seminar in Modern German History** Spring. 4 credits.

Hours to be arranged. R. Gellately.

**677 Seminar in Russian History** Spring. 4 credits.

Hours to be arranged. W. M. Pintner.

**[678 Seminar in the Modernization of Europe** E. W. Fox. Not offered 1976-77.]

**679 Seminar in European History** Spring. 4 credits. Reading knowledge of French and permission of instructor required.

Hours to be arranged. S. L. Kaplan.  
Research seminar. Topic 1976-1977, the origins of the French working class.

## History of Science

**280 Freshman Seminar in the History of Technology** Fall. 4 credits.

J. H. Weiss.  
Consult Freshman Seminar booklet for detailed description.

**281-282 Science in Western Civilization** 281, fall; 282, spring. 4 credits each term. 281 is not prerequisite to 282.

T Th 10:10-11:25. W. B. Provine.  
The development of scientific thought from antiquity to the present. Reading in original sources, with discussions.

**284 Undergraduate Seminar in the History of Biology (also Biological Sciences 204 and College Scholar 284)** Spring. 3 credits. Designed for sophomores and juniors; limited to 20. Prerequisite: one year of college biology.

T 1:25-3:20. J. M. Fessenden-Raden, W. Provine.  
Biological determinism, focusing on issues related to race, sex, and intelligence.

**287-288 History of Biology** 287, fall; 288, spring. 4 credits per term. Prerequisite: one year of college biology; 287 is not prerequisite to 288. Both 287 and 288 satisfy the biological sciences breadth requirement.

Lec. T Th 9:05; disc. hours to be arranged  
W. Provine.

An examination of the history of biology, emphasizing the interaction of biology and culture. Original writings of biologists will constitute the bulk of reading assignments. First semester covers the period from Classical antiquity to 1900. Second semester is devoted entirely to twentieth-century biology.

**[386 Problems in the History of Biology** Spring. 4 credits. Prerequisite: one year of college biology. Conducted as a seminar. W. Provine. Not offered 1976-77.]

**481-482 Science in Classical Antiquity** 481, fall; 482, spring. 4 credits per term. Prerequisite: permission of instructor.

T Th 2:30-4:25. L. P. Williams.  
A study of original texts in translation in ancient mathematics, physics, astronomy, and medicine. Emphasis will be placed on the mutual influence of science and society in Greece and Rome.

**[680-681 Seminar in the History of Science During the Nineteenth and Twentieth Centuries** L. P. Williams. Not offered 1976-77.]

## Latin American History

**210 Latin American History to 1825** Fall. 3 credits.

M W F 9:05. T. H. Holloway.  
Survey of Latin America from the rise of pre-Columbian civilizations through the European conquest, establishment of the Spanish and Portuguese colonial societies, imperial rivalries in the New World, background of the independence movements, and the achievement of political independence.

**211 Latin American History since 1825** Spring. 3 credits.

M W F 9:05. T. H. Holloway.  
Survey of the Latin American nations from independence to the present. Major themes include the persistence of neocolonial economic patterns and social institutions, the development of nationalist and populist politics, revolutionary movements of the twentieth century, and United States-Latin American relations.

**347 Agrarian Societies in Latin American History** Spring. 4 credits.

M W F 1:25. T. H. Holloway.  
The development of rural patterns of wealth, status,

and power, focusing on the role of country people in the larger society. Topics include disruption of the conquest, evolution from encomienda to hacienda, rise of plantation agriculture and export enclaves, decline of Indian communities, peasant protest, and land reform and development programs of the recent past.

**[348 Contemporary Brazil (also Sociology 368)]** T. H. Holloway, J. Kahl. Not offered 1976-77.]

**449 Undergraduate Seminar in Latin American History** Fall. 4 credits. Prerequisite: permission of instructor.  
M 2:30-4:30 T. H. Holloway.

**649 Seminar in Latin American History** Fall. 4 credits. Prerequisite: permission of instructor.  
Hours to be arranged, T. H. Holloway.

## Reading, Research, Interdisciplinary, and Comparative Courses

**301 Supervised Reading** Fall or spring. 2 credits. Open only to upperclass students. Prerequisite: permission of instructor.

**302 Supervised Research** Fall or spring. 3 or 4 credits. Open only to upperclass students. Prerequisite: permission of instructor.

**[360 Warfare in Premodern Societies** C. A. Peterson. Not offered 1976-77.]

**405 Population and History** Fall. 4 credits. Seminar format. Open to sophomores.  
M 2:30-4:30. S. L. Kaplan.

An examination of the impact of the methodology and findings of demography on historical scholarship and the implications of historical research for the study of population. Focus will be on the relationship of population to family and social structure, economic growth, political stability, collective mentality, etc. Readings in European and American history from the Black Plague through the Industrial Revolution.

**601 A Sociology of History** Fall. 4 credits. A seminar open to students who have taken at least 6 credits of history above the 300 level.  
Hours to be arranged. E. W. Fox.  
The course will begin with the introduction of a system of sociological analysis and its applicability to selected periods and areas of Western history. This will be followed by the presentation of papers by members of the class, testing the proposed method in their special field of interest and competence.

**703-704 Supervised Reading** 703, fall; 704, spring. 4 credits per term. For graduate students only.

## Honors Courses

**400 Honors Proseminar** Fall or spring. 4 credits. For prospective honors students with permission of instructor.  
Fall: W 1:25-3:20. J. Najemy. Spring: Hours to be arranged. S. L. Kaplan.  
An introduction to historical writing and modes of research, emphasizing the possibilities and limitations of historical inquiry.

**401 Honors Guidance** Fall or spring. 4 credits. Prerequisite: 400

## History of Art

R. G. Calkins, chairman; T. M. Brown, E. G. Dotson, J. V. Falkenheim, H. P. Kahn, T. W. Leavitt, S. J. O'Connor, A. Ramage, A. S. Roe, J. F. Scott, M. W. Young.

Students who wish to major in the history of art should plan to have completed two courses in the Department of the History of Art by the end of their sophomore year. Students who have taken only one course may petition the chairman to major in the department if that course is at the 200 level or above and is completed with a grade of C or better. Students should also have completed the distribution requirements, but exceptions will be considered upon petition to the department chairman at the time of application to the major.

In their junior and senior years, majors will work closely with their major advisers to determine acceptable programs of courses in the major field. Normally the program will include at least thirty additional credits in courses, of which twenty-four should be at the 300 or 400 level (chosen from those listed below) and a minimum of two additional courses in the department or a related area approved by the major adviser. Courses at the 200 or 300 level taken in the department during the freshman or sophomore years may be counted toward the major, providing such courses are in addition to the two courses offered in satisfaction to the prerequisite to the major. Majors are encouraged to take studio courses in painting and sculpture offered by the Department of Architecture, Art, and Planning; but such courses will be considered electives and may not count toward the basic thirty credits normally required in the major.

## The Honors Program

In order to become a candidate for the degree of Bachelor of Arts with honors in the history of art, a student must have a cumulative average of B for all courses in the Department of the History of Art. Admission into the program requires the consent of the department chairman during the second term of the student's junior year. In the senior year the honors candidate will include among the regular requirements Art History 493-494, involving the preparation of a senior thesis under faculty supervision.

## Distribution Requirement

The distribution requirement in expressive arts is satisfied by a combination of any two history of art courses at the 200 level or above, or Archaeology 100 and one of the history of art courses listed under archaeology on p. 00.

## Freshman Seminars

**103 Freshman Seminar in Visual Analysis** Fall or spring. 3 credits. Offered in the Freshman Seminar Program and as a freshman elective but not in satisfaction of the distribution requirement.  
M W F 9:05, 10:10, 11:15, 12:20. Staff.  
Understanding the nature of man-made objects, from tools to cities and including conventional categories of painting, sculpture, and architecture. An introduction to the problems of perceiving such objects and articulating the visual experience. A supplement, not a prerequisite, to art history, organized by media and themes rather than chronologically.

**104 How to Look at Works of Art** Fall or spring. 3 credits. Offered in the Freshman Seminar Program and as a freshman elective but not in satisfaction of the distribution requirement.  
Fall: M W F 12:20, J. V. Falkenheim. Spring: T Th 2:30-3:45, H. P. Kahn.  
A detailed examination of several major works of art, primarily paintings, taking into consideration the cultural and historical contexts in which the works were created, as well as their unique qualities as works of art.

**[105 Roman Cities, People, and Monuments** Spring. 3 credits. Offered in the Freshman Seminar Program and as a freshman

elective but not in satisfaction of the distribution requirement. A. Ramage. Not offered 1976-77.]

## Introductory Courses

The following courses are designed to introduce students to the processes and methods of art history by means of a systematic examination of a closely related body of visual material. The courses need not be taken in any particular sequence. One 200-level course is normally the prerequisite to courses at the 300 level.

**[210 Introduction to Art History: Beginnings of Civilization** Spring. 3 credits. J. F. Scott. Not offered 1976-77.]

**220 Introduction to Art History: Art of the Classical World (Also Classics 220)** Spring. 3 credits.

M W F 9:05. A. Ramage.  
The sculpture, vase painting, and architecture of the ancient Greeks, from the Geometric period through the Hellenistic; and the art of the Romans, from the early Republic to the late Empire.

**Minoan-Mycenaean Art and Archaeology (Classics 221)**

**[230 Introduction to Art History: Medieval Art** Spring. 3 credits. R. G. Calkins. Not offered 1976-77.]

**240 Introduction to Art History: The Renaissance** Spring. 3 credits.

M W F 10:10; 1 disc, M 1:25, 2:30, 3:35, or T 12:20. E. G. Dotson.

A study of selected works of architecture, sculpture, and painting in Italy and northern Europe from about 1300 to about 1575. Major artists considered will include Donatello, Jan van Eyck, Michelangelo, and Bruegel. Various approaches to the understanding of works of art, and various interpretations of the Renaissance will be explored.

**[250 Introduction to Art History: The Baroque Era** Spring. 3 credits. A. S. Roe. Not offered 1976-77.]

**260 Introduction to Art History: Nineteenth Century Art** Fall. 3 credits.

M W F 11:15. J. V. Falkenheim.  
The development of nineteenth-century European painting from its origins in the classical tradition of Western art to the emergence of modern art. Emphasis will be on French painting from David to impressionism, with special attention given to the historical context in which the works of art were created and to the conventions and visual vocabulary used by the artists.

**270 Introduction to Art History: American Art of the Colonial Period and of the Nineteenth Century** Fall. 3 credits.

M W F 10:10. A. S. Roe.  
Art in the British Colonies and in the United States from its beginning to the early years of the present century.

**280 Introduction to Art History: Asian Traditions** Fall. 3 credits.

M W F 9:05. S. J. O'Connor.  
Designed to introduce students to the varied responses of the Asian artist in differing times and geographical contexts, the course will include material on the Buddhist tradition, the Hindu temple, miniature paintings, Chinese Bronze Age art, and the development of Chinese landscape painting.

**290 Introduction to Art History: Architecture and Environment** Spring. 3 credits.

M W F 12:20. T. M. Brown.  
Emphasis is placed on the social and humanistic aspects of nineteenth- and twentieth-century design. After a lengthy introduction to the architectural

categories of space, form, function, and structure, the course will concentrate on the ideas and forms that have influenced the physical shape of the contemporary world.

### Intermediate Courses

The following courses are intended primarily for upperclass students and qualified sophomores, and, except as noted, all require as a general prerequisite one course at the 200 level. Some of the courses have discussion sections.

**[314 Art in Primitive Societies** Fall, 4 credits. J. F. Scott. Not offered 1976-77.]

**315 Pre-Columbian Art** Fall, 4 credits. T Th 10:10-11:25. J. F. Scott.

The evolution of the arts of the high cultures of the American Indian, beginning with the appearance of representational art and ceremonial architecture and terminating with the Spanish Conquest in the sixteenth century. Emphasis will be on the two major foci of civilization: the Central Andes and the Mexican-Maya area.

**316 Art of the Ancient Near East** Spring, 4 credits.

M W 10:10; disc, hour to be arranged. J. F. Scott. The evolution of the architecture, sculpture, and painting of Egypt and Mesopotamia from the beginning of urban society until they became incorporated into the Greco-Roman tradition. Reference will be made to neighboring areas (Anatolia, Palestine, Iran, Crete) when they have influenced the styles of these two centers.

**320 The Archaeology of Classical Greece (also Classics 320)** Spring, 4 credits.

M W F 11:15. A. Ramage. Detailed study of the monuments and crafts of Athens, from the Geometric to the Roman period; the Acropolis and the Agora and Attic poetry and sculpture considered within their cultural context. Lectures and student reports.

**[322 Arts of the Roman Empire** Spring, 4 credits. A. Ramage. Not offered 1976-77.]

**[323 Painting in the Greek and Roman World** Fall, 4 credits. A. Ramage. Not offered 1976-77.]

**[324 Architecture in the Greek and Roman World** Spring, 4 credits. A. Ramage. Not offered 1976-77.]

**325 Greek Vase Painting** Fall, 4 credits. M W F 9:05. A. Ramage.

A stylistic and iconographical approach to an art in which the Greeks excelled. The course will be arranged chronologically from the early (eleventh century B. C.), anonymous beginnings to the "personal" hands of identifiable masters of the fifth and fourth centuries B.C.

**[332 Architecture of the Middle Ages** Fall, 4 credits. R. G. Calkins. Not offered 1976-77.]

**[333 Early Medieval Art and Architecture** Fall, 4 credits. R. G. Calkins. Not offered 1976-77.]

**[334 Romanesque Art and Architecture** Fall, 4 credits. R. G. Calkins. Not offered 1976-77.]

**[335 Gothic Art and Architecture** Spring, 4 credits. R. G. Calkins. Not offered 1976-77.]

**[336 Italian Medieval Art and Architecture** Fall, 4 credits. R. G. Calkins. Not offered 1976-77.]

**337 The Medieval Illuminated Book** Spring, 4 credits. Prerequisite: a course in medieval art. Lec and disc, M W F 11:15. R. G. Calkins. A study of selected major examples of medieval

illuminated manuscripts dating between A. D. 300 and 1500. Facsimiles and actual manuscripts will be examined.

**[341 Flemish Painting** Spring, 4 credits. R. G. Calkins. Not offered 1976-77.]

**342 Medieval and Renaissance German Art** Fall, 4 credits.

M W F 11:15. R. G. Calkins. A study of the German contribution in panel painting, graphic art, and sculpture in the fourteenth, fifteenth, and sixteenth centuries with emphasis on the art of Bohemia and the works of Meister Bertram, Schongauer, Dürer, Grunewald, Baldung Grien, Cranach, and Holbein.

**343 Italian Renaissance Art of the Fifteenth Century** Fall, 4 credits.

M W F 12:20. A. S. Roe. The development of Renaissance style in Florence with emphasis on major masters from Donatello and Masaccio to the work of Leonardo da Vinci at the end of the century. Works of art will be considered within the context of historical and intellectual trends that marked the transition between medieval and modern times.

**344 Italian Renaissance Art of the Sixteenth Century** Spring, 4 credits. This course will form a sequence with History of Art 343, but 343 is not a prerequisite.

M W F 9:05. A. S. Roe. The course will commence with a study of the culmination of the High Renaissance in Rome as exemplified primarily in the work of Raphael and Michelangelo. The emphasis will then shift to Venetian art, with full consideration of the artistic careers of the major masters: Giovanni Bellini, Giorgione, Titian, Tintoretto, and Veronese.

### The Renaissance (Architecture 346)

**355 French Art of the Sixteenth and Seventeenth Centuries** Fall, 4 credits.

M W F 10:10. E. G. Dotson. Painting, sculpture, and architecture in France from the introduction of Renaissance art under Francis I to French domination of European culture in the reign of Louis XIV. Special attention will be given to the artistic personality and development of Nicolas Poussin and his importance as formulator of the French tradition.

**[357 European Art of the Eighteenth Century** Fall, 4 credits. E. G. Dotson. Not offered 1976-77.]

**[363 Modern Painting** Spring, 4 credits. Prerequisite: 260 or equivalent background in nineteenth-century art. J. V. Falkenheim. Not offered 1976-77.]

**374 American and European Decorative Arts of the Renaissance and Early Nineteenth Century** Spring, 4 credits.

M W 12:20-1:35. A. S. Roe. The evolution of the successive major styles in European interior design and furnishing will be studied in relation to their impact upon the arts and crafts of the colonies and of the United States, from the earliest period until the advent of mechanized production.

**376 Painting and Sculpture in America: 1850-1950** Spring, 4 credits. Prerequisite: at least one 200-level art history course.

T Th 10:10-11:25. T. W. Leavitt. The main currents in American painting and sculpture from the Hudson River school to abstract expressionism will be studied in the context of the intellectual history of America.

**[378 American Architecture, The City, and American Thought: 1850-1950** Spring, 4 credits. Prerequisite: 290; a background in nineteenth- and twentieth-century American history and literature

is presupposed. T. M. Brown. Not offered 1976-77.]

**383 The Arts of Early China** Fall, 4 credits. No prerequisite.

M W 12:20; additional discussion/museum hour to be arranged. M. W. Young. An introduction to the arts of China from the late Neolithic age to the Mongol conquest in the thirteenth century. The impact of Confucianism, Taoism, and Buddhism on pottery, painting, and sculpture will be considered. Term paper option for the final exam.

**384 The Arts of Japan** Spring, 4 credits. No prerequisite.

M W 11:15; additional discussion/museum hour to be arranged. M. W. Young. The arts of Japan from the earliest beginnings to the rise of popular art in the Tokugawa period will be considered in their historical and cultural context. Term paper option available.

**385 Chinese Painting** Spring, 4 credits. No prerequisite.

T Th 1:25. M. W. Young. A consideration of painting in China from the Mongol conquest in the thirteenth century to the modern age. A chronological continuation of History of Art 383, but 383 is not a prerequisite. A term paper is expected.

**[386 Studies in Indian and Southeast Asian Art** Spring, 4 credits. S. J. O'Connor. Not offered 1976-77.]

**[392 Latin American Art** Spring, 4 credits. J. F. Scott. Not offered 1976-77.]

### Seminars

Courses at the 400 level are open to upperclass students and majors; seminars at the 500 level are for qualified upperclass and graduate students. All seminars involve the writing and presentation of research papers. Enrollment is limited, and consent of the department or instructor is normally required. The 500-level courses with announced topics may be repeated.

**401 Independent Study** Fall or spring, 2 credits. Prerequisite: permission of a department faculty member.

Hours to be arranged. Staff. Individual investigation and discussion of special topics not covered in the regular course offerings, by arrangement with various members of the department. May be repeated for credit.

**402 Independent Study** Fall or spring, 4 credits. Prerequisite: permission of a department faculty member.

Hours to be arranged. Staff. Individual investigation and discussion of special topics not covered in the regular course offerings, by arrangement with various members of the department. May be repeated for credit.

**[405 Original Works of Art** Fall, 4 credits. Prerequisites: at least four courses in the history of art and permission of instructor. T. W. Leavitt. Not offered 1976-77.]

**406 Introduction to Museums** Fall, 2 credits. S-U grades only. Prerequisite: permission of instructor.

M 3:35. T. W. Leavitt and staff. The history, philosophy, form, and operation of museums will be considered utilizing the resources of the Herbert F. Johnson Museum. This course is for art history majors and museum guides.

**411 Techniques and Materials: Painting** Spring, 4 credits. Prerequisite: four art history courses and permission of instructor.

W 1:25-3:20; workshop hour to be arranged. H. P. Kahn. The techniques of painting in their historical and formal contexts. Studies and laboratory exercises and

experiments as well as historical, analytical research of materials and conservation.

**412 Techniques and Materials:**

**Graphics** Spring, 4 credits. Prerequisite: four art history courses and permission of instructor. H. P. Kahn. Not offered 1976-77.]

**413 Books, Prints, and the Graphic Image**

Spring, 4 credits. Prerequisite: four art history courses and permission of instructor. F 1:25-3:20; workshop hour to be arranged. H. P. Kahn.

The history and formal evolution of letters, types, illustrations, books, and publications. Graphic exercises in workshop: calligraphy, typography, graphic processes. Theories of design and message.

**Seminar on Interpretation of Coin Finds (Society for the Humanities 414)**

**415 Seminar in Pre-Columbian Art and Archaeology** Fall, 4 credits. J. F. Scott. Not offered 1976-77.]

**421 The History of Art Criticism**

Fall, 4 credits. Limited to 15 students. Prerequisite: permission of instructor. W 2:30-4:25. J. V. Falkenheim. Topic for 1976-77: Formalism. A consideration of the ideas of selected nineteenth- and early twentieth-century theorists and critics responsible for generating a formalist approach to art, followed by an evaluation of the writings of various later twentieth-century critics who have subscribed to this method of critical analysis.

**431 Greek Sculpture** Spring, 4 credits. Prerequisite: 215, or permission of instructor. A. Ramage. Not offered 1976-77.]

**448 Mannerism and the Early Baroque in Italy** Spring, 4 credits. Prerequisite: permission of instructor. E. G. Dotson. Not offered 1976-77.]

**449 Studies in Italian Renaissance Art** Fall, 4 credits. Prerequisite: permission of instructor. A. S. Roe. Not offered 1976-77.]

**452 Studies in English Art** Fall, 4 credits. Prerequisite: permission of instructor. A. S. Roe. Not offered 1976-77.]

**456 Literature and the Arts in Sixteenth-Century France (also French 456)** Spring, 4 credits. Prerequisites: a good reading knowledge of French and permission of either instructor.

T Th 10:10-11:25. E. G. Dotson, E. P. Morris. Parallelisms and convergences of the written and visual arts in Renaissance France. Examples from Rabelais, Scève, Ronsard, Leonardo, Clouet, and Rosso; from printed books and manuscripts; royal entries and pageants; ideal, symbolic, and practical architecture; texts taking the fine arts as occasion or metaphor. Theories of the connections among the arts and of symbolic systems.

**458 Classic and Romantic Art** Spring, 4 credits. Prerequisite: permission of instructor. E. G. Dotson. Not offered 1976-77.]

**462 Art and Technology: 1850-1950** Spring, 4 credits. Limited to 30 students. Prerequisites: 260, 290, 363, or equivalents, or permission of instructor.

T Th 12:20-1:35. T. M. Brown. Approached topically, an examination of the issues of the two- and three-dimensional visual art and design within the context of a mass-technological world. Discussions will revolve around topics presented, as well as required weekly reading.

**481 Masters of Japanese Prints** Fall, 4 credits. Prerequisites: 384 and permission of instructor. M. W. Young. Not offered 1976-77.

**482 Ceramic Art of Asia** Fall, 4 credits. Prerequisite: 280, 383, 384, or permission of instructor.

Th 2:30-4:25. S. J. O'Connor. The Johnson Museum's collection of Asian ceramics will provide a principal resource for study. Lectures, reports, and discussions.

**488 Traditional Arts in Southeast Asia** Spring, 4 credits. Prerequisite: permission of instructor. S. J. O'Connor. Not offered 1976-77.]

**493 Honors Work** Fall or spring, 4 credits. S-U grades only. Intended for senior art history majors who have been admitted to the honors program.

Hours to be arranged. Staff. Basic methods of art historical research will be discussed and individual readings assigned, leading to the selection of an appropriate thesis topic.

**494 Honors Work** Fall or spring, 4 credits. Prerequisite: 493.

Hours to be arranged. Staff. The student, under faculty direction, will prepare a senior thesis.

**510 Seminar in Latin American Art** Fall, 4 credits. J. F. Scott. Not offered 1976-77.]

**531 Problems in Medieval Art and Architecture** Spring, 4 credits. Limited to 15 students. Prerequisite: permission of instructor.

T 3:35-5:30. R. G. Calkins. Topic for 1976-77: Painting in the time of John of Berry.

**564 Studies in Modern Art** Fall, 4 credits. Prerequisite: permission of instructor.

J. V. Falkenheim. Not offered 1976-77.]

**565 Problems in Modern Art and Architecture** Spring, 4 credits. Limited to 15 students. Prerequisite: permission of instructor.

M 2:30-4:25. T. M. Brown.

Topic to be announced.

**580 Problems in Asian Art** Spring, 4 credits. S. J. O'Connor. Not offered 1976-77.]

**591-592 Supervised Reading** 591, fall; 592, spring, 4 credits, but may be taken more than once in the same term. For graduate students only.

**595 Methodology Seminar** Spring, 4 credits. S-U grades only. Required of all graduate students. Prerequisite: permission of instructor. R. G. Calkins. Not offered 1976-77.]

**596 Problems of Art Criticism** Fall, 4 credits. Open to graduate students and especially qualified undergraduates. Prerequisite: permission of instructor. S. J. O'Connor. Not offered 1976-77.]

**Seminar in Classical Greek Archaeology (Classics 630)**

**Archaeology**

Students who are interested in archaeology are directed especially to History of Art 315, 415, 482, and 488. The following specialized courses treat specific excavational material and procedures and are open to students who have some background in ancient history, ancient languages, anthropology, or art history.

**423 Ceramics** Fall, 4 credits. Prerequisite: permission of instructor. A. Ramage. Not offered 1976-77.]

**424 Numismatics** Fall, 4 credits. Prerequisite: permission of instructor.

T 2:30-4:25. A. Ramage. The history and development of Greek and Roman coins; their value for art and history, their epigraphical

interest, problems of attribution. Work with actual examples. Lectures, discussions, reports.

Mathematics

C. Earle, chairman; I. Berstein, L. Billera, J. Bramble, K. Brown, S. Chase, M. Cohen, R. Dennis, E. Dror, A. Edmonds, R. Farrell, M. Fisher, W. Fuchs, S. Gelbart, S. Goldstein, L. Gross, R. Hamilton, D. Henderson, P. Kahn, H. Kesten, J. Kiefer, A. Knapp, D. Kubert, S. Lichtenbaum, G. Livesay, M. Morley, A. Nerode, G. Papanicolau, L. Payne, R. Platek, C. Queen, A. Rosenberg, O. Rothaus, A. Schatz, S. Sen, R. Shore, A. Sommese, F. Spitzer, R. Strichartz, M. Sweedler, L. Wahlbin, H. Wang, J. West, A. Zitronenbaum.

Members of the department are available to discuss with students the appropriate courses for their levels of ability and interest, and students are urged to avail themselves of this help.

Much time may be saved by a careful reading of this announcement.

Students wishing to take any of the courses numbered 300 or above are invited to confer, before registering, with the instructor concerned.

Subject matter of courses indicated by the second digit thus: 0, general; 1, 2, analysis; 3, 4, algebra; 5, 6, topology and geometry; 7, probability and statistics; 8, logic; 9, other. The level of a course is indicated by the first digit of the course number: roughly 1, 2, indicate underclass courses; 3, 4, upperclass courses; 5, 6, graduate courses.

Mid-term grades, when required, will be S or U only, except in special circumstances. In all 600-level courses, final grades will be S-U only, with the exception of 690.

Advanced Placement

Secondary school students are strongly urged to take one of the two Advanced Placement Examinations of the College Entrance Examination Board in their senior year. In addition, there will be a placement examination in mathematics offered at Cornell just before the beginning of classes in the fall which some students should take. It is most important that anyone with any knowledge of calculus read carefully the brochure, *Advanced Placement of Freshmen*.

Major Options

Questions concerning the major in mathematics should be brought to a departmental representative. The general description of the options available are listed below.

Option I

This option is appropriate for students who contemplate a Ph.D in pure mathematics or applied mathematics. Prerequisite: course 221-222. Requirements: (a) 411-412, (b) 431-432, (c) at least twelve additional credits of mathematics courses numbered 300 or above, other than 315, 370, Computer Science 621, 622 may be included in these twelve credits. (d) one course from outside mathematics with serious mathematical content and dealing with scientific matters, or Math 305.

The department strongly recommends that all prospective Option 1 majors take Physics 112 and 213 or 207-208 in their freshman year. Students should also seriously consider the offerings in differential equations, probability and statistics, and numerical analysis.

Option II

This option is appropriate for those mainly interested in the application of mathematics and who do not

contemplate an eventual Ph.D. in mathematics or applied mathematics. It will not prepare a student for work at the Ph.D. level in the theoretical side of even such applied areas as statistics and numerical analysis. Prerequisites: (a) 221–222; (b) Physics 207–208 or 112 and 213. Requirements: (a) 421, 422; (b) 431, and either 332 or 432; (c) Computer Science 211 (with Computer Science 100 as prerequisite) (d) an approved eight credit sequence in statistics, numerical analysis (in the Department of Computer Science), or differential equations; (e) at least eight additional credits of courses numbered 300 or above in mathematics, computer science, or a physical science not including Mathematics 315, 370, or Computer Science 100.

An alternate version with emphasis on computer science. Prerequisites: (a) 221–222; (b) Computer Science 100 plus one of 102, 104 or 106. Requirements: (a) 421–422 or 411 plus one additional course approved by the mathematics department; (b) 431 and either 332 or 432; (c) Computer Science 314, 410, and one of the following: 321–322 and 481, 481–482 and 321, 611–612 and 321 or 481.

Alternate version with emphasis on operations research. Prerequisites: (a) 221–222; (b) Computer Science 100 plus one of 102, 104, or 106. Requirements: (a) 421–422 or 411 plus one additional course approved by the mathematics department; (b) 431 and either 332 or 432; (c) two of OR&IE 335, OR&IE 634, OR&IE 437; (d) OR&IE 320 and Math 371; (e) OR&IE 321 or OR&IE 361. (Operations research courses are offered by the College of Engineering.)

### Option III

This option is for prospective secondary school teachers and others who wish to major in mathematics but do not intend to become professional mathematicians, such as premedical and prelaw students. It does not prepare a student for graduate work in mathematics. Candidates for student teaching must sign up with Professor A. Nerode or D. Henderson by the second term of the sophomore year. (Students planning to start their Option III major or teacher preparation program after 1976 should consult with departmental representatives. One or both may be discontinued.)

Prerequisites: (a) 222 or (a') 214–216–218 and either 331 or 332; (b) Physics 101–102, or 207–208. Mathematics requirements: (a) 311 and 315; (b) 331, if 221 has not been taken; 332; (c) 451; (d) Computer Science 100 and one of 101, 102, 104 or 106 and either (e) 452 and four additional credits of mathematics courses numbered above 300 plus Mathematics 130 and 140 and one course in education—Mathematics 370 is recommended but not required; or (e') 312 or 452, and eight additional credits of mathematics courses numbered above 300.

### The Honors Program

Honors in mathematics will be awarded on the basis of a high level of performance in departmental courses. Further requirements, if any, will be announced during the year.

### Distribution Requirement

The Group IV distribution requirement is satisfied in mathematics by any six credits, not including more than one course from 105, 107, 303. Computer Science 100 plus one of 101, 102, 104, or 106 may be used for three of these credits. The mathematics distribution requirement is also satisfied by a score of 3 on the CEEB-BC examination. However, Mathematics 109 or Orientation 115, College of Agriculture and Life Sciences, may not be used.

### General Courses

Students wanting a general introductory mathematics course are advised to take 107–108 (see description below).

**130 Practice Teaching in Mathematics** Fall or spring, 9 credits. S-U grades only. Students will not be permitted to take more than two additional courses while they are teaching.

**131 Practice Teaching in Mathematics for MAT Candidates** Fall or spring, 9 credits.

**140 Methods of Teaching Mathematics** Fall, 3 credits. Open only to students enrolled concurrently in Mathematics 130 or 131, or students who will take 130 or 131 in the spring.

A discussion of methods of teaching mathematics at the high school level.

**303 History of Mathematics** Spring, 3 credits. Prerequisite: one term of calculus. Lec, M W F 9:05. Topics in mathematics from antiquity to the present.

**401 Honors Seminar** Spring, 4 credits. Prerequisite: permission of instructor. Students will discuss selected topics under the guidance of one or more members of the staff.

**690 Supervised Reading and Research** Variable credit up to six hours each term.

### Basic Sequences

College algebra and trigonometry are taught in Mathematics 109 and also in Orientation 5 and 115, offered by the College of Agriculture and Life Science. Mathematics 109 is designed to prepare students for Mathematics 108 or 111.

There are two sequences in elementary calculus and several special purpose sequences. The two elementary calculus sequences have 111 in common, for which, however, 191 may be substituted. The upper sequence continues with 122, 221, and 222, while the standard sequence continues with 112 and the package of one-credit courses 214–215–216–218. Students who desire to take advanced courses in theoretical mathematics should take the upper sequence, which is prerequisite to most of them. A student whose performance in 112 has been exceptional may be admitted into 221. A student in the standard sequence who wants the linear algebra material of 221 may obtain it in 331.

The special purpose sequences are 105–106, 107–108, and 191–192–293–294. The latter is primarily for engineers. Note that there are honors versions of 191, 192, 293, and 294, namely, 193, 194, 295, and 296, respectively. Mathematics 107–108 is intended primarily for students in the more descriptive areas of the social sciences, and will normally be terminal. Mathematics 107 treats finite mathematics, and 108 gives an introduction to calculus; 108 may be taken without 107, and is preferable to 111 for students desiring only one semester of calculus. Mathematics 105–106 is similar to 107–108 but it presents mathematics from the point of view of the biologist.

Students who want a second semester of mathematics after Orientation 115 are advised to take 107 or 105, or, if they need a calculus course, 111. However, they cannot receive credit for both Orientation 115 and 108. Students interested in starting with two semesters of calculus should take Mathematics 111–112 or 111–122. Students who want two semesters of calculus can also follow 106 with 112 or 122; or 108 with 112 if they have done exceptionally well in 108. In exceptional circumstances they may follow 106 with 214 or 218, providing they make up some missing material on their own. Students wishing to switch between

sequences may take 105 and 111, or 107 and 111. Warning: 105–111 may not satisfy the requirements for a biology major.

Students cannot receive credit for both 105 and 107, not for both 108 and Orientation 115. Nor can they receive credit for more than one of 103, 106, 108, 111, 191, 193. Nor can they receive credit for more than one of 112, 122, 192, 194. Nor can they receive credit for both 192 and 216–218.

**103 Mathematics for Architects (also Architecture 221)** Fall, 3 credits.

Lec., T 10:10; 2 rec. to be arranged. Rudiments of calculus and introduction to vectors and matrices.

**105 Finite Mathematics for Biologists (also Engineering T & AM 105)** Fall, 3 credits.

Prerequisite: three years of high school mathematics including trigonometry.

Preliminary examinations will be held 7:30 p.m. on Oct. 7, Nov. 4, Nov. 30.

Models, analytic geometry, difference equations, elementary linear algebra, probability. Examples from biology will be used throughout the course.

**106 Calculus for Biologists (also Engineering T & AM 106)** Spring, 3 credits. Prerequisite: 105 or three years of high school mathematics, including trigonometry and analytic geometry.

Preliminary examinations will be held 7:30 p.m. on Feb. 24, March 24, April 28.

Introduction to differential and integral calculus, partial derivatives, elementary differential equations. Examples from biology will be used throughout the course.

**107 Finite Mathematics for the Biological and Social Sciences** Fall or spring, 3 credits.

Prerequisite: three years of high school mathematics.

Preliminary examinations will be held 7:30 p.m. on Oct. 7, Nov. 4, Dec. 2, Feb. 24, March 24, April 28.

Lec: fall, T Th 12:20 and 2 hours to be arranged; spring, T Th 11:15, and 2 hours to be arranged.

Functions, enumeration, permutations and combinations, probability, vectors and matrices, Markov chains.

**108 Calculus with Applications to the Biological and Social Sciences** Fall or spring, 3 credits.

Prerequisite: three years of high school mathematics including trigonometry and analytic geometry of the line and circle. Math 107 is desirable, but not mandatory.

Preliminary examinations will be held 7:30 p.m. on Oct. 7, Nov. 4, Dec. 2, Feb. 24, March 24, April 28. Lec: fall, T Th 11:15 and 2 hours to be arranged; spring, T Th 12:20 and 2 hours to be arranged.

Behavior of functions, introduction to differential and integral calculus, elementary differential equations.

**109 Precalculus Mathematics** Fall, 3 transcript credits only; cannot be used for graduation.

M W F 11:15.

This course is designed to prepare students for Mathematics 111 or 108. Topics include a review of algebra, trigonometry, logarithms, and exponentials.

**111 Calculus** Fall or spring, 3 credits.

Prerequisite: 109 or three years of high school mathematics including trigonometry.

Preliminary examinations will be held 7:30 p.m. on Sept. 23, Oct. 21, Nov. 30, Feb. 10 March 17, April 26. Lec: fall, T Th 11:15 or 12:20 or M W 12:20 and 2 hours to be arranged; Spring T Th 11:15 and 2 hours to be arranged.

Plane analytic geometry, differentiation and integration of algebraic and trigonometric functions, applications of differentiation, logarithmic, and exponential functions.

**112 Calculus** Fall or spring, 3 credits.

Prerequisites: 106, 111 with a grade of C or better, or

exceptional performance in 108. (Those who do extremely well in 111 should take 122 instead of 112.)

Preliminary examinations will be held 7:30 p.m. on Oct. 7, Nov. 2, Nov. 30, Feb. 22, March 22, April 26. Lec, fall, T Th 11:15 and 2 hours to be arranged; spring, T Th 11:15 or 12:20 or M W 12:20 and 2 hours to be arranged.

Applications of integration, techniques of integration, infinite series, multiple integrals, brief introduction to partial derivatives.

### 122 Calculus

Fall or spring, 4 credits. Prerequisite: performance at a high level in 111 or permission of the department.

Lec, fall, M W F 10:10, 11:15, or 12:20; spring, M W F 9:05 or 10:10.

Differentiation and integration of elementary transcendental functions, the techniques of integration, applications, polar coordinates, vectors in the plane, and infinite series. The approach is more theoretical than in 112.

### 191-193 Calculus for Engineers

Fall or spring, 4 credits. Prerequisite: three years of high school mathematics, including trigonometry. 193 is an honors section that includes more theoretical material than 191 and is offered in the fall only.

Preliminary examinations will be held 7:30 p.m. on Oct. 5, Nov. 2, Nov. 30, Feb. 22, March 22, April 26. Lec, 191, fall, M W F 9:05 or 11:15, and 2 hours to be arranged; 191, spring, M W F 9:05 and 2 hours to be arranged; 193, M W F 11:15 and 2 hours to be arranged.

Plane analytic geometry, differential and integral calculus and applications.

### 192-194 Calculus for Engineers

Fall or spring, 4 credits. Prerequisite: 191 or 193, 194 is an honors section that includes more theoretical material than 192. It requires the recommendation of the 191 lecturer to enter this course from 191. 194 is given the spring term only.

Preliminary examinations will be held 7:30 p.m. on Oct. 7, Nov. 4, Dec. 2, Feb. 24, March 24, April 28. Lec, 192, fall, M W F 11:15 and 2 hours to be arranged; 192, spring, M W F 9:05 or 11:15 and 2 hours to be arranged; 194, M W F 9:05 and 2 hours to be arranged.

Transcendental functions, technique of integration and multiple integrals, vector calculus, analytic geometry in space, partial differentiation, applications.

### 201 Mathematics for Social Scientists

Fall, 4 credits. An intensive course in mathematics for social scientists, especially suitable for graduate students.

M W F 11:15.

The elements of set theory, vectors and matrices, probability, and rudimentary calculus. Problems will be drawn from the social sciences.

### 214-215-216-218

Fall or spring, 1 credit each. Prerequisite: 112 or 122. These courses are taught as a unified package in the expected order

216-218-214-215 for three or four weeks each. Students may register for any subset of these courses in accordance with their interests and needs. However, 216-218 should not be taken after 192. If in doubt as to choices, they should consult with their adviser and the course instructor. All students should attend the first lecture of the semester to learn the dates for each course, the examination dates, and the structure of the whole.

Preliminary exams will be held 7:30 p.m. on Oct. 7, Nov. 4, Nov. 30, Feb. 24, March 24, April 26.

Lec, T Th 11:15, F 8, and 2 hours to be arranged.

### 214 Introduction to Differential Equations

Complex numbers and functions. Simple first and second order equations with applications.

### 215 Systems of Ordinary and Partial Differential Equations

Prerequisite: 214. Introduction to numerical methods of solution, systems of differential

equations, elementary partial differential equations, and boundary value problems. Applications.

### 216 Vector Analysis

Vectors, matrices, vector valued functions.

### 218 Partial Derivatives and Extremal Problems

Prerequisite: 216.

Partial derivatives, chain rule for functions of several variables, gradients, max-min problems in several variables, Lagrange multipliers, line integrals.

### 221 Calculus

Fall or spring, 4 credits. Prerequisite: grade of B or better in 122 or permission of instructor.

Fall, M W F 9:05 or 11:15; spring, M W F 9:05, 10:10, or 11:15.

Linear algebra and differential equations. Topics include vector algebra, linear transformations, matrices, linear differential equations.

### 222 Calculus

Fall or spring, 4 credits. Prerequisite: 221.

Fall, M W F 11:15 or 12:20; spring, M W F 9:05, 10:10, or 11:15.

Vector differential calculus, calculus of functions of several variables, multiple integrals.

### 293-295 Engineering Mathematics

Fall or spring, 4 credits. Prerequisite: 192 or 194. 295 is an honors section offered in the fall only.

Preliminary examinations will be held 7:30 p.m. on Oct. 7, Nov. 2, Nov. 30, Feb. 22, March 22, April 26. Lec, 293, fall, M W F 10:10, 12:20 and 1 hour to be arranged.

Vectors and matrices, first-order differential equations, infinite series, complex numbers, applications. Problems for programming and running on the automatic computer will be assigned, and students are expected to have a knowledge of computer programming equivalent to that taught in Engineering Engr. 105. For more details about 295 see engineering course descriptions for theoretical and applied mechanics.

### 294-296 Engineering Mathematics

Fall or spring, 294, 3 credits; 296, 4 credits. Prerequisite: 293 or 295. 296 is an honors section and it requires the consent of the instructor to enter 296 from 293. 296 is offered in the spring only.

Preliminary examinations will be held 7:30 p.m. on Oct. 5, Nov. 2, Nov. 30, Feb. 22, March 22, April 26. Lec, 294, fall, M W 12:20 and 1 hour to be arranged; Lec, 294, spring, M W 10:10 or 12:20 and 1 hour to be arranged.

Linear differential equations, quadratic forms and eigenvalues, differential vector calculus, and applications. For more details about 296 see engineering course descriptions for theoretical and applied mechanics.

## Applied Mathematics and Differential Equations

### 305 Mathematics in the Real World

Spring, 3 credits. Prerequisite: 222 or 294 or permission of instructor.

Selected uses of mathematics to solve current relevant problems. Illustration of and active student involvement in the complete applied mathematical methodology. Topics from voting situations and group decisions, the social and life sciences, and efficient and equitable allocations of goods will be included. Emphasis on discrete mathematics and deterministic models.

### 315 Higher Calculus

Spring, 4 credits. Prerequisite: 214-216-218. Intended for students who have had only three semesters of calculus. It does not prepare for 415-416 and will not meet the needs of those graduate students whose work requires really serious application of mathematical methods.

M W F 12:20.

Vector analysis. Elements of complex variables. Ordinary and partial differential equations. Fourier series. Special functions. Laplace transforms. Emphasis on applications.

### 415-416 Mathematical Methods in Physics

415, fall; 416, spring. 4 credits each. Intended for graduate students in physics or related fields who have had a strong advanced calculus course and at least two years of general physics. The course goes very quickly, covering in two semesters slightly more than 421-422-423. A knowledge of the elements of the theory of matrices and complex variables will be assumed. Undergraduates will be admitted only with permission of instructor. First term prerequisite to the second.

T W Th F 12:20

Topics designed to give a working knowledge of the principal mathematical methods used in advanced physics. A brief discussion of some basic notions: metric space, vector space, linearity, continuity, integration. Generalized functions (Schwartz distributions). Fourier series and Fourier integrals. Saddle point method. Linear operators. Differential operators and integral operators, the equations and eigenvalue problems connected with them and the special functions arising from them. Elements of group theory. The rotation group and its representations.

### 421 Applicable Mathematics

Fall or spring, 4 credits. Prerequisite: high level of performance in 222 or 294 or 214-216-218 and 331. Graduate students who need mathematics extensively in their work and who have had a solid advanced calculus course as undergraduates should take 415-416. If they have not had such an advanced calculus course, they should take 421-422-423. If their preparation is still too weak for this, they should take all or part of 221-222, followed by 421-422-423.

T W Th F 12:20.

Theorems of Stokes, Green, Gauss, etc. Sequences and infinite series. Fourier series and orthogonal functions. Laplace transforms. Ordinary differential equations.

### 422 Applicable Mathematics

Spring, 4 credits. Prerequisite: 421.

T W Th F 12:20.

Complex variables. Generalized functions. Fourier transforms. Partial differential equations.

### 423 Applicable Mathematics

Fall, 4 credits. Prerequisite: 421.

T W Th F 12:20.

Linear operators and integral equations. Calculus of variations. Application to eigenvalue problems. Green's function, and treatment of special problems of mathematical physics.

### 427 Introduction to Ordinary Differential Equations

Fall, 4 credits. Prerequisite: 222 or 294, or permission of instructor.

M W F 9:05.

Covers the basic existence, uniqueness and stability theory together with methods of solution and methods of approximation. Topics include singular points, series solutions, Sturm-Liouville theory, transform methods, approximation methods, and application to physical problems.

### 428 Introduction to Partial Differential Equations

Spring, 4 credits. Prerequisite: 222 or 294 or permission of instructor.

M W F 9:05.

Laplace, heat, and wave equations. Topics include maximum principles, existence, uniqueness, stability. Fourier series methods, approximation methods, and applications.

## Analysis

**311-312 Elementary Analysis** 311, fall; 312, spring of odd numbered years only. 4 credits each. Prerequisites: 214-216-218, 311 and a knowledge of

linear algebra as taught in 331 are required for 312. A student may not receive credit for both 311–312 and 411–412.

M W F 12:20.

A careful study of the topology of the real line. Continuous functions of one real variable. Differentiation and integration of such functions. Series and sequences. Functions of several variables. The material of 311–312 is similar to that of 411–412 below, but is taught at a more elementary level and at a slower pace.

**411–412 Introduction to Analysis** 411, fall; 412, spring. 4 credits per term. Prerequisite: 222. Students needing measure theory and Lebesgue integration for advanced probability courses should take 413–414, or arrange to audit the first few weeks of Math 521.

T Th 8:40–9:55 or M W F 10:10.

An introduction to the theory of functions of real variables, stressing rigorous logical development of the subject rather than technique of applications. Topics include metric spaces, the real number system, continuous and differentiable functions, integration, convergence and approximation theorems. Fourier series, calculus in several variables and differential forms.

**413–414 Introduction to Analysis** 413, fall; 414, spring. 4 credits each. Prerequisite: 222.

T Th 8:40–9:55.

Honors version of 411–412. Course will also cover parts of measure theory and Lebesgue integration.

**418 Introduction to the Theory of Functions of One Complex Variable** Spring. 4 credits. Prerequisite: 222 or 312.

M W F 9:05.

A rigorous introduction to complex variable theory. Intended mainly for undergraduates and for graduate students outside mathematics. Complex numbers. Differential and integral calculus for functions of a complex variable including Cauchy's theorem and the calculus of residues. Elements of conformal mapping. Elements of several complex variables.

## Algebra

**331 Linear Algebra** Fall. 4 credits. Prerequisite: one year of calculus. A student may not receive credit for both 221 and 331.

M W F 10:10.

Vectors, matrices, and linear transformations, affine and Euclidean spaces, transformation of matrices, and eigenvalues.

**332 Algebra and Number Theory** Spring. 4 credits. Prerequisite: one year of calculus. 332 will not serve as prerequisite for courses numbered 500 and above.

M W F 10:10.

Commutative rings with unity, fields, and finite groups. Motivations and examples are derived mostly from arithmetical problems on the integers or congruence classes of integers.

**431–433 Introduction to Algebra** Fall. 4 credits. Prerequisite: 221 or 331. 433 is an honors section which will be more theoretical and rigorous than 431 and will include additional material such as multilinear and exterior algebra.

431, M W F 9:05 or 10:10; 433, M W F 10:10.

An introduction to linear algebra, including the study of vector spaces, linear transformation, matrices, and systems of linear equations; quadratic forms and inner product spaces; canonical forms for various classes of matrices and linear transformations; determinants.

**432–434 Introduction to Algebra** Spring. 4 credits. Prerequisite: 221 or 331. 434 is an honors section that will be more theoretical and rigorous than 432 and will include additional material such as the structure of finitely generated modules over a

principal ideal domain with applications to canonical forms of matrices.

M W F 10:10.

An introduction to various topics in abstract algebra, including groups, rings, fields, factorization of polynomials and integers, congruences, and the structure of finitely generated abelian groups.

## Geometry and Topology

**451–452 Classical Geometries** 451, fall; 452, spring. 4 credits per term. Prerequisite: 221 or 331 or 431, which may be taken concurrently. First term prerequisite to the second.

M W 3:35–5.

Axiomatic methods in geometry. Foundations of Euclidean geometry. Non-Euclidean geometry, projective geometry, and other geometric topics.

**453–454 Introduction to Topology and Geometry** 453, fall; 454, spring. 4 credits each.

Prerequisites: 412 and 432, or permission of instructor.

M W F 12:20.

453: basic point set topology, connectedness, compactness, metric spaces, fundamental group. Application of these concepts to surfaces such as the torus, the Klein bottle, the Moebius band. 454: classical differential geometry of curves and surfaces in three-dimensional space.

## Probability and Statistics

**370 Elementary Statistics** Spring. 4 credits. Prerequisites: 112, 122 or 192; or 106 or 108 with permission of instructor. A terminal course for students who will take no further work in this area; 370 does not prepare for 472.

Preliminary examinations will be held 7:30 p.m. on Feb. 22, March 22, April 26. M W F 9:05.

Topics in probability that are essential to an understanding of statistics; introduction to the principles underlying modern statistical inference and the rationale underlying choice of statistical methods in various situations.

**471 Basic Probability** Fall. 4 credits. Prerequisite: 112. Can serve as a terminal course in basic probability but is intended primarily for those who will continue with 472.

Preliminary examinations will be held 7:30 p.m. on Oct. 5, Nov. 2, Nov. 30. M W F 11:15.

Topics covered include combinatorics, important probability laws, expectations, moments, moment generating functions, limit theorems. Emphasis is on diverse applications and on development of use in statistical applications. See also the description of 571.

**472 Statistics** Spring. 4 credits. Prerequisite: 471 and knowledge of linear algebra such as taught in 221.

Preliminary examinations will be held 7:30 p.m. on Feb. 22, March 22, April 26. M W F 11:15.

Classical and recently developed statistical procedures are discussed in a framework that emphasizes the basic principles of statistical inference and the rationale underlying the choice of these procedures in various settings. These settings include problems of estimation, hypothesis testing, large sample theory.

**473 Further Topics in Statistics** Fall. 4 credits. Prerequisite: 472 or 574. (For corresponding subject matter taught in more detail, see description of 573 and 675.)

M W F 9:05

More detailed discussion of some of the topics not covered at length in 472. Design and analysis of experiments. Multivariate analysis. Nonparametric inference; robustness. Sequential analysis.

## Mathematical Logic

**381 Elementary Mathematical Logic** Spring. 4 credits. Prerequisite 122.

M W F 11:15.

Propositional and predicate logic. Completeness and incompleteness theorems. Set theory.

## Graduate Courses

Students interested in taking graduate courses in mathematics should consult the department for further course details, times, and possible changes in courses as described below.

**511–512 Real and Complex Analysis** First term: set-theoretic preliminaries, abstract integration, Borel measures, Lebesgue measures,  $L^p$  spaces, Hilbert spaces, Banach spaces, product spaces, differentiation. Second term: Fourier transforms, Complex variables, harmonic functions, Schwarz lemma, approximation by rational functions.

**519–520 Partial Differential Equations** Classification of partial differential equations. Questions of existence, uniqueness, and continuity of the solutions of typical boundary-value problems. Equations of Laplace and Poisson, principles of maximum and mean; wave equation, heat equation.

**521 Elementary Functional Analysis** Elementary set theory and topology, Banach and Hilbert spaces, measure and integration. Graduate students in mathematics should take 613 for functional analysis.

**522 Applied Functional Analysis** Spectral theorem for bounded operators, spectral theory for unbounded operators in Hilbert space, compact operators, distributions. Applications.

**531–532 Algebra** First term: finite groups, field extensions, Galois theory, rings and algebras, tensor algebra. Second term: Wedderburn structure theorem, Brauer group, group cohomology, Ext, Dedekind domain, primary decomposition, Hilbert basis theorem, local rings. Additional topics selected by instructor.

**537 Elementary Number Theory** Prerequisite: 432. Advanced undergraduates are encouraged to attend.

## 549–550 Lie Groups and Differential Geometry

**551 Introductory Algebraic Topology** Fundamental group and covering spaces. Homology and cohomology theories for complexes and spaces.

**552 Differentiable Manifolds** Manifolds and differentiable structures. Tangent, cotangent, and tensor bundles; Exterior calculus. Riemannian structures. Local and global theory of differential equations. Integration on manifolds.

**561 Geometric Topology** Topics from general topology. Introduction to geometric properties of manifolds.

**571–572 Probability Theory** Properties and examples of probability spaces. Sample space, random variables, and distribution functions. Expectation and moments. Independence, Borel-Cantelli lemma, zero-one law. Convergence of random variables, probability measures and characteristic functions. Law of large numbers. Selected limit theorems for sums of independent random variables. Markov chains, recurrent events. Ergodic and renewal theorems. Martingale theory. Brownian motion and processes with independent increments.

**571–574 Probability and Statistics** First term: Same as first term of 571–572. Second term: Topics

include an introduction to the theory of point estimation, consistency, efficiency, sufficiency, and the method of maximum likelihood; the classical tests of hypotheses and their power; the theory of confidence intervals; the basic concepts of statistical decision theory; the fundamentals of sequential analysis. Intended to furnish a rigorous introduction to mathematical statistics, the course is prerequisite to all advanced courses in statistics.

### 573 Experimental Design, Multivariate

**Analysis** Rationale for selection of experimental designs, and algorithms for constructing optimum designs. Optimum properties and distribution theory for classical analysis of variance procedures and their simplest multivariate analogues.

**581 Logic** Basic topics in mathematical logic including: propositional and predicate calculus; formal number theory and recursive functions; completeness and incompleteness theorems.

### 611-612 Seminar in Analysis

**613 Functional Analysis** Topological vector spaces, Banach and Hilbert spaces, Banach algebras. Additional topics to be selected by instructor.

### 615 Fourier Analysis

### 623 Several Complex Variables

### 627-628 Seminar in Partial Differential Equations

### 631-632 Seminar in Algebra

### 635 Theory of Rings

**637 Algebraic Number Theory** Summary of algebraic foundations followed by a discussion of some classical problems: class numbers, primes in arithmetic progressions, binary quadratic forms and genera.

### 640 Homological Algebra

### 651-652 Seminar in Topology

**653-654 Algebraic Topology** Duality theory in manifolds, applications, cohomology operations, spectral sequences, homotopy theory, general cohomology theories, categories and functors.

**657-658 Advanced Topology** Selection of advanced topics from modern algebraic, differential, and geometric topology. Course content varies from year to year.

### 667 Algebraic Geometry

### 661-662 Seminar in Geometry

### 671-672 Seminar in Probability and Statistics

**675-676 Statistical Decision Theory** General development of statistical decision theory, with application to classical estimation and hypothesis testing as well as to multiple decision problems. Admissibility, complete classes, characterization of Bayes procedures. Invariance. Polya families and other special settings.

### 677-678 Stochastic Processes

### 681-682 Seminar in Logic

**684 Recursion Theory** Theory of effectively computable functions. Classification of recursively enumerable sets. Degrees of recursive unsolvability. Applications to logic. Hierarchies. Recursive functions of ordinals and higher type objects. Generalized recursion theory.

**687 Set Theory** Models of set theory. Theorems of Gödel and Cohen, recent independence results.

### 690 Supervised Reading and Research

## Modern Languages, Literatures, and Linguistics

**The Department of Modern Languages and Linguistics** (G. B. Kelley, chairman) offers courses in linguistics, and elementary, intermediate, and advanced language courses although literature departments also offer some language courses. For course listings, see the separate language headings in this section.

For fulfillment of the language requirement for graduation and for attainment of qualification see p. 45. S-U options may be chosen for all courses offered by the department except for German 101-102 and Burmese, Thai, and Vietnamese.

**The Department of German Literature** (S. L. Gilman, chairman) offers courses in Germanic literatures (listed under German below).

**The Department of Romance Studies** (P. E. Lewis, chairman) offers courses in French literature, Italian literature, and Spanish literature (listed under French, Italian, and Spanish below). In addition, the department's program seeks to encourage study of the interactions of the Romance literatures among themselves and with other literatures, both in its course offerings and in opportunities for independent study. Each term, one course will be offered in English which emphasizes comparative and methodological questions (for 1976-77 see Romance Studies 381-382, p. 96).

**The Department of Russian Literature** (P. J. Carden, chairwoman) offers courses in Russian literature (listed under Russian below).

### Courses Listed Elsewhere

Courses in Swahili are offered by the Africana Studies and Research Center (see p. 118). Courses in Greek and Latin are offered by the Department of Classics (see p. 60). Courses in Akkadian, Arabic, Aramaic, and Hebrew are offered by the Department of Semitic Languages in Literatures (see p. 111).

### Teacher Preparation Programs

Cornell offers programs in French, German, Russian, and Spanish. These programs are open to undergraduates (leading to a provisional certification, valid for five years) and to graduate M.A.T. students (leading to permanent certification). Interested undergraduates should consult Professor J. Bereaud, Romance studies, during their sophomore year, to inquire about the continuation and structure of this program after 1977.

### Course Placement

See the brochure *Advanced Placement of Freshmen*.

### Description of Elementary and Intermediate Language Courses

**101-102 Language Courses** These are semi-intensive six-credit courses which give a thorough grounding in the language—listening, speaking, reading, and writing. They are conducted in small groups with opportunity for contact with native speakers of the language and laboratory work. These courses are offered by the Department of

Modern Languages and Linguistics in a wide variety of languages (see listings below).

**131-132-133-134 Language Courses** The aim of these three-credit courses is primarily to develop skill in reading, although some attention will be devoted to the spoken language, especially to listening comprehension. These courses are offered by the Department of Modern Languages and Linguistics in a variety of languages (see listings below). They are not normally taken by those who wish to pursue further language and literature studies on the 200 level and above.

**111-112 (Spanish only)** Introductory, all-skills language courses, offered by Romance studies, with emphasis on the study of the language in its cultural context. Students will be encouraged to read texts of literary or humanistic value as early as possible. Students who have completed 111 or 101 or who qualify for 102 are eligible for 112. (See also Spanish 101-102 and 131-132).

**203-204 Intermediate Language Courses** These courses consist of guided conversation, composition, reading, pronunciation, and grammar review, with special attention to the development of accurate and idiomatic expression in the language. (Please note that students placed in the 200 level, also have the option of taking courses in introductory literature; see separate listings under 200, 201, and 202 for descriptions of these courses, any of which may be taken concurrently with the 203-204 language courses described above. The introductory literature courses are offered by the respective literature departments and the 203-204 language courses by the Department of Modern Languages and Linguistics.)

### Burmese

R. B. Jones

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term. Prerequisite for 102 is 101 or equivalent.

Lec, T Th 10:10; drill, M-F 11:15.  
For course description see above.

**201-202 Burmese Reading** 201, fall; 202, spring. 3 credits per term. Prerequisites: for 201, qualification in Burmese; for 202, Burmese 201.

**203-204 Composition and Conversation** 203, fall; 204, spring. 3 credits per term. Prerequisites: for 203, qualification in Burmese; for 204, Burmese 203.

**301-302 Advanced Burmese Reading** 301, fall; 302, spring. 4 credits per term. Prerequisites: for 301, Burmese 202 or permission of instructor; for 302, Burmese 301 or permission of instructor.

Hours to be arranged.  
Selected readings in Burmese writings in various fields.

### Cambodian

F. E. Huffman

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term. Prerequisite for 102 is 101 or equivalent.

Lec, T Th 9:05; drill, M-F 8.  
For course description see above.

**201-202 Cambodian Reading** 201, fall; 202, spring. 3 credits per term. Prerequisites: for 201, qualification in Cambodian; for 202, Cambodian 201.

**203-204 Composition and Conversation** 203, fall; 204, spring. 3 credits per term. Prerequisites: for 203, qualification in Cambodian; for 204, Cambodian 203.

**301-302 Advanced Cambodian** 301, fall; 302, spring. 4 credits per term. Prerequisites: for 301, Cambodian 201-202 or the equivalent; for 302, Cambodian 301.

**401-402 Directed Individual Study** 401, fall; 402, spring. For advanced students. 4 credits per term. Prerequisite: permission of instructor.

**404 Structure of Cambodian** Spring only. 4 credits. Prerequisite: Ling 101-102 or the equivalent.

### Cebuano (Bisayan)

J. U. Wolff

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term. Prerequisite for 102 is 101 or equivalent. Offered according to demand. For course description see p. 87.

### Chinese

N. C. Bodman, S. L. Fessler, J. McCoy, T. L. Mei, P. S. Ni, P. Wang, K. M. Wong  
For a major involving Chinese studies see Asian Studies.

#### Languages and Linguistics

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term. Prerequisite for 102 is 101 or equivalent.  
Lec, M W F 9:05; drill, M-F 8.  
For description see p. 87.

**[111-112 Cantonese Basic Course** 111, fall; 112, spring. 6 credits per term. Prerequisite: permission of instructor. J. McCoy. Not offered in 1976-77.]

**201-202 Intermediate Chinese I** 201, fall; 202, spring. 4 credits per term. Prerequisite: qualification in Chinese.  
M-F 9:05.

**203-204 Chinese Conversation** 203, fall; 204, spring. 1 credit a term. S-U grades only. Prerequisite: Chin 101-102. Two class hours. May be repeated for credit. For course description see p. 87.

**211-212 Intermediate Cantonese** 211, fall; 212, spring. 4 credits per term. Prerequisite: Cantonese 112 or permission of instructor.  
J. McCoy.

**213-214 Introduction to Classical Chinese** 213, fall; 214, spring. 3 credits per term. Prerequisite: qualification in Chinese or permission of instructor. This course may be taken concurrently with Chinese 101-102, 201-202, or 301-302.  
T. L. Mei, K. M. Wong.

**301 Intermediate Chinese II** Fall. 4 credits. Prerequisite: Chin 202 or equivalent.  
M W F 10:10.  
Readings and drill in modern expository Chinese.

**302 Intermediate Chinese III** Spring. 4 credits. Prerequisite: Chin 301.  
M W F 10:10.  
Readings in Modern Chinese with social science and humanities content.

**303-304 Chinese Conversation—Intermediate** 303, fall; 304, spring. 1 credit per term. S-U grades only. Prerequisite: Chinese 201-202. May be repeated for credit.  
Guided conversation and oral composition and translation. Corrective pronunciation drill.

**[401-402 History of the Chinese Language** 401, fall; 402, spring. 4 credits per term. Prerequisite: permission of instructor. N. C. Bodman. Not offered in 1976-77.]

**[403 Linguistic Structure of Chinese: Phonology and Morphology** Fall term on student demand. 4 credits. Prerequisite: permission of instructor. N. C. Bodman. Not offered in 1976-77.]

**404 Linguistic Structure of Chinese: Syntax** Spring term on student demand. 4 credits. Prerequisite: Chin 403.  
T 2:30-4:25. J. McCoy.

**[405 Chinese Dialects** Fall term on student demand. 4 credits. Prerequisite: permission of instructor. N. C. Bodman. Not offered in 1976-77.]

**607 Chinese Dialect Seminar** Fall or spring on student demand. 4 credits. Prerequisite: Chin 405 and permission of instructor.  
N. C. Bodman, J. McCoy.  
Analysis and/or field techniques in a dialect area.

#### Sino-Tibetan Linguistics (Linguistics 662)

#### FALCON

**161-162 Intensive Mandarin Course** 161, fall (paralleled to first 16 credits of instruction in regular program); 162, spring (parallel to second 16 credits of instruction in regular program). Prerequisite: permission of instructor.  
J. McCoy and staff.

#### Literature

**314 Chinese Philosophical Texts** Spring. 4 credits. Prerequisite: Chin 214.  
T. L. Mei.

**320 T'ang and Sung Poetry** Fall. 4 credits. Prerequisite: permission of instructor.  
T. L. Mei.

**411-412 Readings in Modern Chinese Literature** 411, fall; 412, spring. 4 credits per term. Prerequisite: Chin 302.

**413 Classical Chinese Prose** Fall. 4 credits. Prerequisite: Chin 214.  
Staff.

**416 Pre-T'ang Poetry** Spring. 4 credits. Prerequisite: permission of instructor.  
T. L. Mei.

**[418-419 Chinese Poetic Drama** 418, spring; 419, fall. 4 credits per term. Prerequisite: permission of instructor. K. M. Wong. Not offered 1976-77.]

**420 Traditional Fiction** Spring. 4 credits. Prerequisite: permission of instructor.  
K. M. Wong.

**421-422 Directed Study** 421, fall; 422, spring. 2-4 credits per term. Prerequisite: permission of instructor.  
Staff.

**[423 Readings in Shorter Works of Fiction** Fall. 4 credits. Prerequisite: permission of instructor. K. M. Wong. Not offered in 1976-77.]

**424 Readings in Literary Criticism** Spring. 4 credits. Prerequisite: permission of instructor.  
J. McCoy.

For complete descriptions of courses numbered 600 or above consult the graduate faculty representative.

**430 Readings in Folk Literature** Fall or spring on student demand. 4 credits. Prerequisite: permission of instructor.  
J. McCoy.

**603 Seminar in Chinese Poetry and Poetics** Fall. 4 credits. Prerequisite: permission of instructor.  
T. L. Mei.

**605 Seminar in Chinese Fiction** Fall. 4 credits. Prerequisite: permission of instructor.  
K. M. Wong.

**[609 Seminar in Chinese Folk Literature** Either term on student demand. 4 credits. Prerequisite: permission of instructor. Not offered 1976-77.]

**621-622 Advanced Directed Reading** 621, fall; 622, spring. Credits arranged. Prerequisite: permission of instructor.  
J. McCoy, T. L. Mei, K. M. Wong.

See also **Govt 654 Culture and Mass Line in China**

### Czech

**[131-132 Elementary Course** 131, fall; 132, spring. 3 credits per term. First term or equivalent is prerequisite to the second. L. H. Babby. Not offered in 1976-77.]

**[133-134 Elementary Course II** 133, fall; 134, spring. 3 credits per term. First term or equivalent is prerequisite to the second. L. H. Babby. Not offered in 1976-77.]

### Dutch

F. C. van Coetssem

**131-132 Elementary Reading Course I** 131, fall; 132, spring. 3 credits per term. Prerequisite: permission of instructor.  
Hours to be arranged.  
For course description see p. 87.

**133-134 Elementary Reading Course II** 133, fall; 134, spring. 3 credits per term. Prerequisite: Dutch 132 or permission of instructor.  
Hours to be arranged.  
For course description see p. 87.

#### Seminar in Dutch Linguistics (German 740)

### English as a Second Language

M. A. Martin

The following courses are offered by the Department of Modern Languages and Linguistics. Foreign students should consult a member of the department (323-B Morrill Hall) to arrange for placement in courses. All students must register for credit.

**102 English as a Second Language** Fall. 6 credits. Prerequisite: placement by the instructor.  
M-F 9:05.

**103 English as a Second Language** Spring. 3 credits. Prerequisite: Eng 102 or placement by the instructor.  
M W F 2:30.  
Designed for those who have completed English 102 and who require or desire further practice. Emphasis is on developing control of written as well as spoken language.

**211-212 English as a Second Language** 211, fall; 212, spring. 3 credits a term. Prerequisite: placement by the instructor.  
M W F 11:15 or 2:30.

**213 English for Non-Native Speakers** Spring. 3 credits. Prerequisite: Eng 212 or placement by the instructor.  
T Th 1:25.  
Designed for those whose writing fluency is sufficient for them to carry on regular academic work, but who feel the need for refining and developing their ability to express themselves clearly and effectively. As much as possible, individual attention will be given to students in two class hours and a weekly interview.

## French

J. Béreaud, A. M. Colby, I. Daly,  
M. Ekman, N. Furman, D. I. Grossvogel, J. Harari,  
R. Klein, P. Lewis, S. A. Littauer, M. Marion,  
E. P. Morris, J. S. Noblitt, A. Seznec, L. R. Waugh.

### French Major

The French major is designed to give students proficiency in the oral and written language, to acquaint them with a fair portion of the masterworks of French literature, and to develop skills in literary and linguistic analysis.

Students wishing to major in French should consult a member of the French faculty with whom they will work out a plan of studies. The previous training and interests of students will be taken into account in order to devise a coherent program. They will be encouraged to take courses in related subjects such as anthropology, music, history, art history, philosophy, linguistics, Classics, English, comparative literature, and other foreign languages and literatures.

Interested students are encouraged to seek faculty advice about the major as early as possible. For admission to a major in French, students should normally have completed French 201, 202 and 211-212 or 203-204, or their equivalents, and should be accepted by the director of the undergraduate studies, J. Béreaud. Students specifically interested in French linguistics should consult with L. Waugh in the Department of Modern Languages and Linguistics.

To fulfill the major requirements, students are expected to complete successfully twenty-four credits of French courses at the 300 level or higher. Students seeking teacher certification may substitute one term of French 401-402 or 407-408 for four credits of the twenty-four required. One or more courses offered by the Department of Comparative Literature may be counted toward the required twenty-four credits if students obtain prior approval of their major advisers. Students majoring in French will be expected also to develop competence in the language. The competence is demonstrated by the successful completion of French 312 or by the passing of a special examination to be taken no later than the end of the junior year. French majors may elect to pursue a concentration of courses in language and linguistics, dividing their twenty-four additional credits of 300- and 400-level courses equally between literature and linguistics, in which case they may choose a major adviser from the Department of Modern Languages and Linguistics. For any question concerning placement in the language courses within the Department of Romance Studies, please consult J. Béreaud, who will arrange a placement test whenever necessary.

French majors may study in France during their junior year under any of several study-abroad plans which are recognized by the Departments of Romance Studies or Modern Languages and Linguistics and which allow the transfer of credit. The Department of Romance Studies has information on such plans.

### The Honors Program

The purpose of the honors program is to encourage well-qualified students to do independent work in French, outside the structure of courses. The preparation of the senior honors essay, in particular, spread out over three terms, provides a unique learning opportunity, since it allows for wide reading, careful outlining, and extensive rewriting to a degree not practically possible in the case of course papers. At each stage of their work the students will have regular weekly meetings with faculty tutors.

No special seminars or courses are required of honors students. The junior tutorial (ordinarily, two terms; exceptionally, one) will be devoted to intensive study of selected problems or authors, and to the

choice of a topic for the honors essay; the Senior tutorial, to the writing of that essay. Honors students may be released from one or two courses in either the junior or senior year to have adequate time for honors work (credit is obtained by enrolling in French 419-420). They will take an informal oral examination at the end of the senior year.

Honors students are selected on the basis of their work in French language and literature courses in the freshman and sophomore years. Students interested should consult E. Morris for details, no later than the spring term of the sophomore year, and earlier if possible. Honors in French linguistics will be supervised by L. Waugh.

### Teacher Preparation Program

Interested students see p. 87.

### Distribution Requirement

The distribution requirement in the humanities in French is satisfied by French 201 and 202, 221, 222, or any 300-level literature course.

Of the courses listed below, those dealing with literature, together with language courses 200, 211-212, and 311-312, are staffed and administered by the Department of Romance Studies, and inquiries in regard to them should be addressed to that department, 278 Goldwin Smith Hall. The courses dealing with linguistics and the other language courses are offered by the Department of Modern Languages and Linguistics, 203 Morrill Hall.

### Languages and Linguistics

**101-102 Basic Course (Conversation and Reading)** 101, fall; 102, spring. 6 credits per term. Assumes no knowledge of French. Students who have previously studied French should consult p. 00 before registering for this course. Prerequisite for 102 is 101 or equivalent.

Lec, T Th 10:10, 1:25; drill, M-F 8, 9:05, 10:10, 11:15, 12:20, 1:25.

For course description see p. 87.

**131-132 Elementary Reading Course I** 131, fall; 132, spring. 3 credits per term. Assumes no knowledge of French; students who have previously studied French should consult p. 00 before registering for this course. 131 or equivalent is prerequisite for 132.

M W F 9:05, 10:10, 11:15, 12:20, 1:25, 2:30.

For course description see p. 87.

**133-134 Elementary Reading Course II** 133, fall; 134, spring. 3 credits per term. French 132 or equivalent is prerequisite for 133; 133 or equivalent is prerequisite for 134.

M W F 9:05, 10:10, 11:15, 1:25, 2:30.

For course description see p. 87.

**200 Intermediate Course** Fall or spring. 3 credits. Prerequisite: qualification in French. (For definition of qualification see p. 00; maximum allowable CEEB score 629.) Offered by Department of Romance Studies.

Fall: M W F 9:05, 10:10, 11:15, 12:20, 1:25, or T Th 8:40-9:55; spring: M W F 9:05, 10:10, 11:15, 12:20, or T Th 8:40-9:55. Staff.

Extended readings and discussions of modern texts selected for their cultural and humanistic value. A brief review of grammar is included.

### 203 Intermediate Composition and Conversation

Fall or spring. 3 credits. Prerequisite: qualification in French. (For definition of qualification see p. 45.)

Fall: lec, W 11:15, T 10:10 or T 1:25; drill, M W F 9:05, 10:10, 11:15, 12:20, 1:25, 2:30. Spring: lec, W 11:15 or T 1:25; drill, M W F 9:05, 10:10, 12:20, 1:25.

For course description see p. 87.

### 204 Intermediate Composition and Conversation

Spring. 3 credits. Prerequisite: Fr 203 or equivalent.

Lec, W 1:25, T 10:10, or T 2:30; drill, M W F 8, 9:05, 10:10, 11:15, 12:20, 1:25.

Evening prelims. For course description see p. 87.

### 211-212 Intermediate French

211, fall; 212, spring. 3 credits per term. Prerequisite: qualification in French. (For definition of qualification see p. 45.) Offered by Department of Romance Studies.

M W F 11:15 or T Th 10:10-11:25. N. Furman and staff.

Review of French grammar and study of the language through the critical reading of texts on French culture and literature. Students will write short essays in French. In addition, there will be one hour of conversation per week in small groups.

### 311-312 Advanced Composition and Conversation

311, fall; 312, spring. 4 credits per term. Prerequisite: Fr 212 or 204, or placement by special examination. (Offered by Department of Romance Studies.)

Fall: M W F 11:15 or T Th 10:10; spring: M W F 11:15. Fall, J. Béreaud and staff; spring, N. Furman.

Reading and analysis of selected contemporary texts. Detailed study of present-day syntax. Weekly translations or essays in French. One hour of conversation each week in small groups.

### 401-402 History of the French Language

401, fall; 402, spring. 4 credits per term. Prerequisites: qualification in French and Ling 101.

M W F 2:30 Staff

### 407 French for Teachers

Fall. 4 credits.

Prerequisite: qualification in French.

M W F 3:35. J. S. Noblitt. Survey of the current teaching methods, preparation of teaching materials, and selection and use of textbooks and realia. Further study of structure of French as needed for professional preparation.

### 408 Linguistic Structure of French

Spring. 4 credits. Prerequisites: qualification in French and Ling 101, or permission of instructor.

M W F 3:35. L. R. Waugh.

A descriptive analysis of present-day French, with emphasis on its phonetics, phonemics, morphology, and syntax.

### 410 Semantic Structure of French

Fall or spring, alternate years. 4 credits. Prerequisite: permission of instructor. Open to undergraduate and graduate students. To be given fall 1976.

Hours to be arranged. L. R. Waugh.

### 450 Practice Teaching

Fall or spring. 6 credits. Prerequisite: 408 (the methods course, Fr 407, may be taken concurrently with practice teaching). Open only to students enrolled in a teacher preparation program.

Hours to be arranged.

Students will observe, and then participate in teaching classes in the secondary school system. They will also become acquainted with a language laboratory.

For complete description of the courses numbered 600 or above, consult the graduate facilities representative.

### [601 Gallo-Romance Dialectology

Fall. 4 credits. Prerequisite: permission of instructor. Offered in alternate years. Not offered 1976-77.]

### 602 Linguistic Structures of Old and Middle French

Spring. 4 credits. Prerequisite: Fr 408 or permission of instructor.

M W F 10:10. J. S. Noblitt.

### [604 Contemporary Theories of French Grammar

Fall or spring. 4 credits. Prerequisite:

permission of instructor. L. R. Waugh. Not offered in 1976-77.]

**The Comparative Study of the Romance Languages (Romance Linguistics 321-322, 323-324, 620, 621, 622.)**

**700 Seminar in French Linguistics** According to demand. 4 credits.  
Hours to be arranged.

**Literature**

**201 Introduction to French Literature: The Modern Tradition** Fall or spring. 3 credits. Prerequisite: a score of 650 on the written portion of the CEEB exam (students with scores in the 560-649 range, see French 221). French 201 serves as prerequisite for all 300-level courses in French literature and is required of all majors.

Fall: M W F 9:05, 10:10, 11:15, 12:20, 1:25 or T Th 8:40-9:55 and 10:10-11:25; spring: M W F 11:15 or T Th 10:10-11:25. R. Klein and staff.

Introduces the student to the major genres (poetry, drama, and the novel) in the late nineteenth and early twentieth centuries, and treats the principal themes, techniques, and interpretive dilemmas encountered in modern French literature. Authors such as Baudelaire, Mallarmé, Proust, Sartre, Beckett, and Genet will be read.

**202 Studies in French Literature** Fall or spring. 3 credits. Prerequisite: for majors, Fr 201; for nonmajors, a score of 650 on the written portion of the CEEB exam (students with scores in the 560-649 range, see French 221). Required of all majors but not limited to them.

Fall: T Th 10:10-11:25; spring: M W F 10:10, 11:15, or T Th 10:10-11:25. J. Harari and staff.

Study of the classic literature of seventeenth-century France, and its immediate forebears (Montaigne) and successors. Authors such as Montaigne, Corneille, Racine, Molière, Voltaire, and Rousseau will be read.

**221 Readings in Modern Literature** Fall or spring. 3 credits. Prerequisite: qualification in French. (For definition of qualification see p. 45.) Maximum allowable CEEB score: 649.

Fall: M W F 12:20; spring: M W F 10:10.

J. Béreaud and staff.

Discussion of representative texts of the twentieth century in the context of current intellectual and social issues. Readings will include such writers as Apollinaire, Gide, Sartre, Ionesco, Genet, and Natalie Sarraute.

[222 French Civilization Not offered 1976-77.]

**308 Body and Mind in French**

**Love-Poetry** Spring. 4 credits.

W F 10:10; 1 additional hour to be arranged.  
E. Morris.

There are at all periods French poets who seek to preserve in their erotic pieces something of the offhandedness, the ease with language and feelings, and the musicality of popular song, and sometimes its obscenity as well: Marot, Verlaine, and Apollinaire, for example. Others, like Scève, Mallarmé, and Valéry, drawing on a learned tradition, tend to view the sexual encounter as a threat to selfhood and art. Repulsions and interpenetrations of the two currents define a literary field which this course (conducted in French) will attempt to survey, with the help of theorists like Plato, Freud, and Merleau-Ponty.

**309 Crime and the Nature of Fiction** Fall. 4 credits.

M W F 11:15. D. Grossvogel.

Crime as the central concern in "serious" and "escapist" literatures. Guilt and cleansing, exploration of external and internal mystery, deciphering the clues and the text, etc. Proposed readings: Sophocles, Poe, Kafka, Robbe-Grillet, Pirandello, Christie, etc.

**361 French Tragedy from Hardy to Racine** Fall. 4 credits.

T Th 10:10-11:25. A. Seznec.

Course will deal with dramatic theory and practice of the sixteenth and seventeenth centuries. Readings will include Mairet, Tristan, Rotrou, and Corneille.

**375 The Eighteenth-Century Novel** Fall. 4 credits.

M 1:25-3:20. J. Harari.

Evolution and narrative technique of the eighteenth-century novel in its philosophical and social context. Montesquieu, Marivaux, Diderot, Voltaire, Rousseau, Crébillon, and Laclos. In French.

**388 Mallarmé, Rimbaud, Valéry, Claudel** Spring. 4 credits.

T Th 1-2:15. R. Klein.

The course will consist of close readings of selected poems with the general aim of determining a field of influence in which Valéry and Claudel may be read in the light of their most powerful, immediate poetic predecessors. The course will attempt to specify in theory and in practice the conditions and the limitations of an incipient literary history.

**389 French Romanticism** Fall. 4 credits.

T Th 1:25-3:20. N. Furman.

History and expression of French romanticism in its poetry, theater, and novel. Among the authors studied will be Lamartine, Vigny, Hugo, Balzac. In French.

**400 Don Juan: Rank and Other Files** Spring. 4 credits.

W 1:25-3:20. D. Grossvogel.

The interpretations in literature and psychology of the Don Juan myth. Principal readings: Tirso, Molière, Byron, Shaw, Rank.

**419-420 Special Topics in French Literature**

419, fall; 420, spring. 2-4 credits per term.

Prerequisite: permission of instructor.

Staff.

Guided independent study of specific topics.

**429-430 Honors Work in French** May be taken without credit or for four credits with consent of the adviser. Open to juniors and seniors. See the director of the honors program, E. Morris.

**447 Medieval Literature** Fall. 4 credits.

Prerequisite: Fr 201-202 or permission of instructor.

M W F 9:05. A. Colby.

The course will deal with the epic and the theater. Facility in reading Old French and appreciation of these two major genres are the primary goals of this course.

**456 Literature and the Arts in Sixteenth-Century France (also History of Art 456)** Spring. 4 credits.

Prerequisite: a good reading knowledge of French and permission of either instructor.

T Th 10:10-11:25. E. Dotson, E. Morris.

Parallelisms and convergences of the written and visual arts in Renaissance France. Examples from Rabelais, Scève, Ronsard, Leonardo, Clouet, and Rosso; from printed books and manuscripts; royal entries and pageants; ideal, symbolic, and practical architecture; texts taking the fine arts as occasion or metaphor. Theories of the connections among the arts, and of symbolic systems.

**457 Rabelais** Fall. 4 credits.

W 2:30-4:25. E. Morris.

**462 Racine** Spring. 4 credits.

T Th 2:30-3:45. A. Seznec.

An intensive reading of the tragedies. Special sessions will be devoted to major contemporary critical perspectives.

**486 Emile Zola** Spring. 4 credits.

M 1:25-3:20. N. Furman.

An in-depth study of representative novels of Emile

Zola. Special attention will be given to the corpus of criticism surrounding these novels.

**493 Modern French Prose Fiction Texts** Fall. 4 credits.

Th 2:30-4:25. R. Klein.

In this course we will read books by four major French writers: Genet, Bataille, Blanchot, and Klossowski. The most general framework in which they will be considered brackets the question of negative theology: Is nothing God? The texts trap that question in ways which immensely complicate the task of asking it.

**639-640 Special Topics in French Literature**

639, fall; 640, spring. 4 credits per term. To be taken by all new graduate students.

Staff.

**649 Introduction to French Philology** Fall. 4 credits

F 2:30-4:25. A. Colby.

A study of the phonological, morphological, syntactical, and etymological developments that most frequently create problems for the student of literature.

**Problems of Interpretation in the Human Sciences (Romance Studies 381-382)**

**Germanic Studies**

E. Augsberger, D. H. Bansberg, A. J. Berger, V. T. Bjarnar, E. A. Blackall, D. Connor, H. Deinert, S. L. Gilman, A. B. Groos, Jr., R. L. Jones, I. Kovary, H. L. Kufner, G. Valk, F. C. van Coetsem.

**German Major**

Students majoring in German are encouraged to design their program in a manner that will allow for diversity in their course of study. It should enable them to become acquainted with an adequate selection of major works, authors, and movements of German literature and to develop their skill in literary analysis. Students majoring in German will normally proceed through German 201, 202, 203, 204. However, if their previous training qualifies them for immediate enrollment in 300- and 400-level courses, every effort will be made to permit them to do so. For details, students may consult the major advisers, D. H. Bansberg in the Department of German Literature, or R. L. Jones in the Department of Modern Languages and Linguistics. Students majoring in German are expected to complete successfully a minimum of six 300- and 400-level courses in addition to German 303-304 (of the 300-level courses listed below, those bracketed will be offered the following year). These courses should be a representative selection of subjects in German literature and/or Germanic linguistics. The attention of students majoring in German is called to the courses offered by the Department of Comparative Literature, many of which complement the course offerings in German.

Students majoring in German are expected to become competent in the German language. This competence is normally demonstrated by the successful completion of German 304. Placement of German majors who have done no work in German at Cornell will be determined by the level of preparation they have obtained elsewhere. For information please consult the major advisers, D. H. Bansberg or R. L. Jones. All German majors, particularly those who have had no German prior to coming to Cornell, are encouraged to spend at least part of their junior year abroad. Students have the opportunity to enroll, for credit, in a Cornell-sponsored Summer Language Program in Germany. Information is available upon request at the departmental offices.

**The German Area Studies Major**

The major in German area studies consists of a set number of courses in German language to which is

added a set number of courses in German area studies, presently taught in various departments of the University. The major in German area studies will be required to take language courses in the Department of Modern Languages and Linguistics through the 300 level, and will be required to take at least four courses above the 200 level in another area. It is strongly suggested that majors in German area studies also incorporate the basic German History Course (357-358) in their prospective program. The Department of German Literature will offer a tutorial for German area studies students to enable them to read and discuss their area of specialization in German. The major adviser will aid German area studies majors in the selection of the program. Each major will also have a minor area adviser who will aid in the area of further specialization. For details, students should consult the major adviser, D. H. Bansberg, in the Department of German Literature.

### The Honors Program

The honors program in German is open to superior students who wish to work independently in an area of their own choice. Students are free to select any member of the Field of Germanic Studies to assist them in designing their honors program, to supervise their work, and to help them select a suitable topic for an honors essay. The independent study courses 451, 452 may form part of the program.

### Teacher Preparation Program

Interested students see p. 87.

### Distribution Requirement

The distribution requirement in the humanities is satisfied in German by any two German literature courses at the 200 level and above.

### Freshman Seminar Requirement

The following courses will satisfy the Freshman Seminar requirement: German 100 and 109.

### Languages and Linguistics

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term. Students who have previously studied German should consult p. 00 before registering for this course. Prerequisite for 102 is 101 or equivalent.

Lec. M W 10:10; drill, M-F 8, 9:05, 11:15, 12:20.  
H. L. Kufner and staff.

For course description see p. 87.

**131-132 Elementary Reading Course** 131, fall; 132, spring. 3 credits per term. Students who have previously studied German should consult p. 00 before registering for this course. Prerequisite for 132 is 131 or equivalent.

Lec. T 11:15, 2:30, drill, M W F 8, 9:05, 10:10, 11:15, 12:20, 1:25, 2:30 or T Th 10:10-11:25.  
R. L. Jones and staff.

For course description see p. 87.

**133-134 Elementary Reading Course II** 133, fall; 134, spring. 3 credits per term. Prerequisite for 133 is 132 or equivalent; prerequisite for 134 is 133 or equivalent.

M W F 10:10, 2:30 or T Th 10:10-11:25. I. Kovary.  
For course description see p. 87.

**203 Intermediate Composition and Conversation** Fall. 3 credits. Prerequisite: qualification in German. (For definition of qualification see p. 00)

M W F 9:05, 10:10, 11:15, 1:25. E. Augsberger, G. Valk.

For course description see p. 87.

**204 Intermediate Composition and Conversation** Spring only. 3 credits. Prerequisite: Ger 203 or

consent of instructor.

M W F 9:05 or 10:10. E. Augsberger, G. Valk.

For course description see p. 87.

**303-304 Advanced Composition and Conversation** 303, fall; 304, spring. 4 credits per term. Prerequisites: for Ger 303, Ger 204 or equivalent; for 304, 303 or equivalent.

M W F 1:25. E. Augsberger.

Emphasis is placed on increasing the student's oral and written command of German. Detailed study of present-day syntax and different levels of style.

**401 Introduction to Germanic Linguistics** Fall. 4 credits. Prerequisite: Ling 101. Offered in alternate years.

**402 History of the German Language** Spring. 4 credits. Prerequisite: Ger 204 and Ling 101 or permission of instructor. Offered in alternate years.

M W 1:25. R. L. Jones.

**407 German for Teachers** Fall. 4 credits.

M W F 11:15. H. L. Kufner.

Survey of the current teaching methods, preparation of teaching materials, selection and use of textbooks and realia. Further study of structure of German as needed for professional preparation. Required of students seeking certification by New York State.

**408 Linguistic Structure of German** Spring. 4 credits. Prerequisites: Ger 204 and Ling 101, or permission of instructor.

M W F 11:15. R. L. Jones.

For complete descriptions of courses numbered 600 or above, consult the appropriate instructor.

**602 Gothic** Fall only. 4 credits. Offered in alternate years. Prerequisite: Ling 101.

**603-604 Old Saxon, Old High German, Old Low Franconian, Old Frisian** 603, fall; 604, spring. 4 credits per term. Offered in alternate years. Prerequisite: Ling 102.

M W F 3:35.

**609-610 Old Norse** 609, fall; 610, spring. 4 credits per term.

Hours to be arranged. V. Bjarnar.

**710 Seminar in Germanic Linguistics** Fall or spring, subject to the needs of students and to the limitations of staff time. 4 credits.

Hours to be arranged. Staff.

**720 Seminar in Comparative Germanic Linguistics** Fall or spring, subject to the needs of students and to the limitations of staff time. 4 credits.

Hours to be arranged. Staff.

**721-722 Computer Methods in Germanic Studies** 721, fall; 722, spring. Subject to the needs of students and to the limitations of staff time. 4 credits per term.

Hours to be arranged. R. L. Jones.

**730 Seminar in German Linguistics** Fall or spring, subject to the needs of students and to the limitations of staff time. 4 credits.

Hours to be arranged. R. L. Jones.

**740 Seminar in Dutch Linguistics** Fall or spring, subject to the needs of students and to the limitations of staff time. 4 credits.

Hours to be arranged. F. C. van Coetsen.

Selected topics including the history, structure, and dialects of modern Dutch.

### Literature

#### Freshman Seminars

**German 100 Writing About Literature** Fall or spring. 4 credits.

T Th 12:20-1:35, M W F 12:20, T Th 8:30-10.

D. Connor and staff.

As the title suggests, the major emphasis in this course is on writing. Weekly writing assignments will include imitations of various authors, styles, and forms of literature, as well as more traditional literary analysis. The readings will consist of English translations of German plays, novels, short stories, fairy tales, and poems.

**109 Folk Tale and Folk Poetry** Fall or spring. 3 credits.

M W F 12:20, T Th 8:30-10. A. Berger and staff.

The course will discuss folktales (Grimm, Hans Christian Andersen, etc.), ballads (Scottish, Danish, Faroese, German) as well as popular literary forms (myths, ballads, and legends). Readings will be in English with supplemental readings from critics such as J. R. R. Tolkien and C. Levi-Strauss.

### German Literature

**201 Problems in the Analysis of Drama** Fall. 3 or 4 credits. For details, consult instructor.

Prerequisite: qualification in German. (For definition of qualification see p. 45.) One section to be taught in German; for specifics, please consult D. H. Bansberg.

M W F 12:20, T Th 3:35. D. H. Bansberg and staff. Self-confrontation and social conflict in the plays of six major Austrian, Swiss, and German dramatists: Dürrenmatt, Brecht, Büchner, Hofmannsthal, Goethe, and Schiller. The texts will be used to help students to develop an analytic approach to drama and to enable them to improve their reading knowledge of German.

**202 Problems in the Analysis of Prose** Spring. 3 or 4 credits. For details, consult instructor.

Prerequisite: qualification in German. (For definition of qualification see p. 45.) One section to be taught in German; for specifics, please consult D. H. Bansberg.

M W F 12:20, T Th 3:35. D. H. Bansberg and staff.

The complexities of inner and outer reality as expressed in selected prose works of Kafka, Mann, Kleist, Grass, Brentano, Tieck, and Hofmannsthal. These texts will be used to develop a critical method for the reading of modern narrative literature.

**211 Intensive Workshop in Germanic Studies for Freshmen I** Fall. 6 credits. Intended for entering freshmen with extensive training in the German language (a score of 680 or higher on the placement examination). Not intended as a survey, but rather as a rigorous seminar designed to familiarize the student with literary forms and the tools of critical analysis. To be conducted in German.

T 2:30-4 and W 2:30-3:30 and Th 2:30-4.  
H. Deinert.

The course will provide an intensive introduction to the study of German literature through the discussion of exemplary prose works, dramas, and poems from the eighteenth century to the present. In addition, the course will introduce the student to German history and civilization through complementary outside reading.

**312 Intensive Workshop in Germanic Studies for Freshmen II** Spring. 4 credits. To be conducted in German.

T Th 2:30-4. H. Deinert.

Designed as a sequel to 211. Emphasis on modern German literature since 1900 (Thomas Mann, Hesse, Kafka, Grass, Handke, Hauptmann, Brecht, Dürrenmatt, Weiss, Rilke, Trakl, Benn, Celan). Supplementary reading from philosophy (Schopenhauer, Nietzsche, Heidegger); psychology (Freud, Adler, Jung); sociology, and political theory.

[354 Schiller Not offered 1976-77.]

**355 The Age of Goethe** Fall. 4 credits.

Prerequisite: Ger 201, 202, or permission of instructor.

T Th 12:20. D. H. Bansberg.

A survey of German literature and thought from the end of the eighteenth century through the beginning of the nineteenth century.

**356 Major Works of Goethe** Spring, 4 credits.

Prerequisite: Ger 201, 202, or permission of instructor.

M W F 10:10. E. A. Blackall.

The selection of works may vary from year to year. In 1977 we will read and discuss *Iphigenie auf Tauris*, *Torquato Tasso*, *Hermann und Dorothea*, *Die Wahlverwandtschaften*, and some of the longer poems.

**357 Romanticism** Spring, 4 credits. Prerequisite:

Ger 201, 202, or permission of instructor.

Hours to be arranged. Staff.

**359 Nineteenth-Century Drama** Fall, 4 credits.

Prerequisite: Ger 201, 202, or permission of instructor. One lecture and two discussion sessions weekly. The discussion sessions will analyze individual plays illustrative of the lecture topics.

M W F 11:15. E. A. Blackall.

The lectures will deal with general aspects of dramatic literature in the century such as: Romantic theory of drama, the psychological drama of Kleist, panoramic drama and Büchner, Viennese comedy, the philosophical drama of Hebbel, baroque tradition in Grillparzer and Hofmannsthal, Wagner's music-drama, and the social drama of Naturalism.

**[361 Modern German Literature I: Contemporary German Prose** Not offered 1976-77.]**[363 Modern German Literature III: Nineteenth- and Twentieth-Century German Poetry** Not offered 1976-77.]**Courses in English Translation****[314 Nietzsche, the Man and the Artist** Not offered 1976-77.]**350 Yiddish Literature in English Translation** Spring, 4 credits.

T TH 12:20-1:35. S. L. Gilman.

An introduction to the literary tradition of Eastern European Jewry. Lectures will cover the historical and sociological contexts of Yiddish literature from the Middle Ages to the present. Readings will concentrate in the tradition of the Yiddish novel during the nineteenth and twentieth centuries. (Mendele, Sholem Aleichem, Peretz, Asch, I. J. Singer, I. B. Singer.)

**362 Twentieth-Century German Drama in English Translation** Spring, 4 credits.

T TH 12:20-1:35. D. H. Bansberg.

An introduction to the avant-garde German theater with readings of dramas and dramatic theory in English.

**413 Topics in German Literature I: The Modern German Novel in English Translation** Fall, 2-4 credits. (For details on variable credit, consult the instructor.)

T Th 12:20. H. Deinert.

The spirit of the first half of the century as reflected in prose works by a variety of major authors. Emphasis on Hesse (*Siddharta*, *Demian*, *Steppenwolf*, *Narcissus and Goldmund*); Kafka (*Amerika*, *The Trial*, the short stories); Rilke (*Malte Laurids Brigge*); Thomas Mann (*Tonio Kröger*, *Tristan*, *Death in Venice*). Supplementary reading from authors like Dostoevsky, Hamsun, Alain-Fournier, and others.

**[414 The Modern Scandinavian Novel** Not offered in 1976-77.]**Advanced Courses****405 Introduction to Medieval German Literature** Fall, 4 credits. Intended for students with no previous knowledge of Middle High German.

M W F 10:10. A. B. Groos.

The course will provide a survey of the court epic, the heroic epic, and Minnesang. Emphasis will be placed on a thorough understanding of the Middle High German language.

**[406 Introduction to Medieval German Literature II** Not offered 1976-77.]**[416 Don Juan and Faust** Not offered 1976-77.]**[417-418 The Great Moments of German Literature** Not offered 1976-77.]**[421 Germanic Mythology** Not offered 1976-77.]**451-452 Independent Study** 451, fall; 452, spring. Variable credit, 1-4 hours per term.

Hours to be arranged. Staff.  
Extensive reading of texts in addition to regular course work, under the direction of a member of the department.

**The Novella in World Literature (Comparative Literature 414)****Myth and Literature (Comparative Literature 476)****Fiction and the Irrational (Comparative Literature 479)****Topics in Modern Literature: From Formalism to Structuralism (Comparative Literature 698)****Topics in Modern Literature: Hermeneutics (Comparative Literature 699)**

For complete descriptions of courses numbered 600 or above, consult the appropriate instructor.

**Seminars****[611 Seminar in Old Norse Literature** Not offered 1976-77.]**612 Seminar in Old Norse Literature II: (Topic to be announced).** Spring, 4 credits. Prerequisite: Ger 610 or permission of the instructor.  
Hours to be arranged. A. J. Berger.**[623 Seminar in Middle High German Literature I** Not offered 1976-77.]**[624 Seminar in Middle High German Literature II** Not offered 1976-77.]**625 The Northern Renaissance and Reformation** Fall, 4 credits.  
W 1:25-3:25. S. L. Gilman.**[627 Aspects of Baroque Literature** Not offered 1976-77.]**German 629 German Literature, 1700 to 1770** Spring, 4 credits.  
M 3:35. E. A. Blackall.**[631 From Wilhelm Meister to Buddenbrooks** Not offered 1976-77.]**632 Goethe's Poetry** Fall, 4 credits.  
Th 1:25. E. A. Blackall.**633 Romanticism** Spring, 4 credits.  
Hours to be arranged. Staff.**638 Twentieth-Century German Literature: Bertolt Brecht** Spring, 4 credits.  
T 1:25. H. Deinert.**[639 Contemporary Lyrical Poetry** Not offered 1976-77.]**650 Graduate Seminar in Medieval Literature (also English 710)** Fall, 4 credits.

Hours to be arranged. A. B. Groos.

**699 Colloquium on the Teaching of Literature** Fall or spring. Variable credit, 1-4 hours per term. Open to teaching assistants in the Department of German Literature. Composed of all faculty members and assistants teaching undergraduate courses.

Hours to be arranged. Staff.

**753-754 Tutorial in German Literature** 753, fall; 754, spring. Variable credit, 1-4 hours per term. Open only with permission of instructor.

Hours to be arranged. Staff.

Tutorials for 1976-77:

**753 Tutorial in Middle High German Literature** Fall, 4 credits. Topic to be announced.  
Hours to be arranged. A. B. Groos.**754 Tutorial: The Literature of the East German Democratic Republic** Spring, 4 credits.  
Hours to be arranged. S. L. Gilman.**Modern Greek**

See listings under Classics.

**Hindi-Urdu**

J. W. Gair, G. B. Kelley

**101-102 Hindi-Urdu Basic Course** 101, fall; 102, spring. 6 credits per term. Prerequisite for 102 is 101 or equivalent.

Hours to be arranged.

For course description see p. 87.

**201-202 Hindi Reading** 201, fall; 202, spring. 3 credits per term. Prerequisites: for 201, qualification in Hindi; for 202, Hindi 201 or permission of instructor.  
Hours to be arranged.**203-204 Composition and Conversation** 203, fall; 204, spring. 3 credits per term. Prerequisites: for 203, qualification in Hindi; for 204, Hindi 203 or permission of instructor.

Hours to be arranged.

For course description see p. 87.

**301-302 Readings in Hindi Literature** 301, fall; 302, spring. 4 credits per term. Prerequisites: for 301, Hindi 202; for 302, Hindi 301 or equivalent.  
Hours to be arranged.**303-304 Advanced Composition and Conversation** 303, fall; 304, spring. 4 credits per term. Prerequisites: for 303, Hindi 204 or equivalent; for 304, 303 or equivalent.  
Hours to be arranged.**305-306 Advanced Hindi Readings** 305, fall; 306, spring. 4 credits per term. Prerequisites: for 305, Hindi 202 or equivalent; for 306, Hindi 305 or equivalent.

Hours to be arranged.

Intended for those who wish to do readings in history, government, economics, etc., instead of literature.

**401 History of Hindi** Fall or spring. 4 credits. Prerequisite: Hindi 101-102 or equivalent, or Ling 102.

Hours to be arranged.

For complete descriptions of courses numbered 600 and above, consult the graduate faculty representative.

**700 Seminar in Hindi Linguistics** Fall or spring. 3 credits. Prerequisite: permission of instructor.  
Hours to be arranged. J. W. Gair, G. B. Kelly.

## Indonesian

J. M. Echols, J. U. Wolff

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term. Prerequisite for 102 is Indo 101. M-F 8, plus 2 more hours to be arranged. For course description see p. 87.

**201-202 Indonesian Reading** 201, fall; 202, spring. 3 credits per term. Prerequisites: for 201, qualification in Indonesian; for 202, Indo 201, or permission of instructor. Hours to be arranged.

**203-204 Composition and Conversation** 203, fall; 204, spring. 3 credits per term. Prerequisites: for 203, qualification in Indonesian; for 204, Indo 203 or permission of instructor. Hours to be arranged. For course description see p. 87.

**300 Linguistic Structure of Indonesian** Fall or spring. 4 credits. Prerequisites: Indo 101-102 or the equivalent, and Ling 101. Hours to be arranged. J. U. Wolff.

**301-302 Readings in Indonesian and Malay** 301, fall; 302, spring. 4 credits per term. Prerequisites: for 301, Indo 201-202 or the equivalent; for 302, Indo 301. Hours to be arranged.

**303-304 Advanced Indonesian Conversation and Composition** 303, fall; 304, spring. 4 credits per term. Prerequisites: for 303, Indo 204; for 304, Indo 303 or equivalent. Hours to be arranged.

**401-402 Advanced Readings in Indonesian and Malay Literature** 401, fall; 402, spring. 4 credits per term. Prerequisites: for 401, Indo 302 or equivalent; for 402, Indo 401 or equivalent. Hours to be arranged.

**Malayo-Polynesian Linguistics (Linguistics 655-656)**

## Irish

See **Linguistics 623, 624, 627**

## Italian

A. Grossvogel, G. Mazzotta

## Italian Major

Students who wish to major in Italian should choose a faculty member to serve as major adviser; the general plan and the details of the student's course of studies will be worked out in consultation. Italian majors are encouraged to take courses in related subjects such as history, art history, music, philosophy, anthropology, Classics, linguistics, and other modern languages and literatures. While, theoretically, a Cornell major occupies only the junior and senior years, as a matter of practical fact it is wise for the student to seek faculty advice on the major as early as possible.

Students who elect to major in Italian ordinarily should have completed Italian Literature 201-202 and Italian Language 203-204 by the end of their sophomore year. Exemptions can be made on the basis of an examination. Students majoring in Italian are expected to become conversant with a fair portion of the masterworks of Italian literature, to acquaint themselves with the outlines of Italian literary history, and to develop some skill in literary analysis. To this end students will be expected to complete successfully twenty-four credits of Italian Literature courses at the 300 level or higher, with papers to be written in Italian or English. One or more courses

offered by the Department of Comparative Literature may be counted toward the required twenty-four credits if students obtain the prior approval of their major adviser.

Students majoring in Italian also will be expected to acquire competence in the handling of the language. That competence may be demonstrated by the successful completion of Italian 304 or by passing an oral and written examination to be arranged with the adviser.

Italian majors may study in Italy, generally during their junior year, under any one of those study-abroad plans, organized by American universities, that allow the transfer of grades and credit, such as the Syracuse Semester in Italy in Florence.

## Distribution Requirement

The distribution requirement in the humanities is satisfied in Italian by Italian 201-202.

Courses dealing with literature are staffed and administered by the Department of Romance Studies, and inquiries in regard to them ought to be addressed to that department, 278 Goldwin Smith Hall.

The courses dealing with language and linguistics are offered and administered by the Department of Modern Languages and Linguistics, 203 Morrill Hall.

## Languages and Linguistics

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term. Prerequisite for 102 is Ital 101 or equivalent. Lec, T Th 10:10. Drill, M-F 8, or 12:20. For course description see p. 87.

**131-132 Elementary Reading Course** 131, fall; 132, spring. 3 credits per term. Prerequisite for 132 is Ital 131 or equivalent. M W F 2:30. For course description see p. 87.

**203-204 Composition and Conversation** 203, fall; 204, spring. 3 credits per term. Prerequisites: for 203, qualification in Italian; for 204, Ital 203 or equivalent. M W F 9:05. For course description see p. 87.

**[300 Advanced Composition and Conversation** According to demand. 2-4 credits. Prerequisite: Ital 204. Not offered 1976-77.]

**[402 History of Italian Language** Fall. 4 credits. Offered in alternate years. Prerequisites: qualification in Italian and Ling 101 or permission of instructor. Not offered 1976-77.]

**[403 Structure of Italian** Spring. 4 credits. Offered in alternate years. Prerequisites: qualification in Italian and Ling 101 or permission of instructor. Not offered in 1976-77.]

**[432 Italian Dialectology** Spring. 4 credits. Offered in alternate years. Not offered 1976-77.]

For complete descriptions of courses numbered 700 and above, consult the graduate faculty representative.

**[700 Seminar in Italian Linguistics** Offered according to demand. 4 credits. Not offered in 1976-77.]

## Literature

**105 Freshman Seminar: Strong Towers and Wicked Gardens** Fall. 3 credits. M W F 11:15. A. Grossvogel.

Two ancient literary *topoi*, their survival and coexistence in modern narrative. Readings will include works by such writers as Beckford, Nerval,

Stendhal, Proust, Mann, Kafka, Lampedusa, Buzzati, Calvino, Gadda Landolfi, Volponi.

**201-202 Introduction to Italian Literature** 201, fall; 202, spring. 3 credits per term. Prerequisite: qualification in Italian. (For definition of qualification see p. 45.)

T Th 12:20-1:35. Staff. Classes will be conducted in Italian.

**[327-328 Dante: La Divina Commedia** Not offered 1976-77.]

**[334 Dante in Translation** Not offered 1976-77.]

**335 Boccaccio** Fall. 4 credits.

T Th 10:10-11:25. G. Mazzotta. Critical investigation, by focusing on the *Decameron*, *Filistrato*, and *Teseida*, of some crucial topics such as nature, love, typology, mimesis, etc., within their appropriate medieval background. In English.

**381 Svevo and Pirandello** Fall. 4 credits.

M W F 2:30. A. Grossvogel. An examination of the narrative and dramatic productions of the two authors and of their relationship as contemporaries.

**398 From the "Ermetici" to the "Novissimi"** Spring. 4 credits. Prerequisite: reading knowledge of Italian.

T Th 10:10-11:25. A. Grossvogel. An introduction to contemporary Italian poetry. Readings from the poetry of Ungaretti, Quasimodo, and Montale to that of Giuliani, Cignetti, and Zanzotto. Particular emphasis will be given to the works of Montale.

**419-420 Special Topics in Italian Literature** 419, fall; 420, spring. 2-4 credits per term. Prerequisite: permission of the instructor. Staff.

Guided independent study of specific topics.

**437 Petrarch** Fall. 4 credits.

T 2:30-4:25. G. Mazzotta. The course, to be conducted as a seminar, will focus on the *Canzoniere* and will explore a series of problems proper to the lyric (self, language of the will, music, etc.). In English.

**447 The Italian Renaissance Epic** Fall. 4 credits.

Th 2:30-4:25. G. Mazzotta. The main emphasis will fall on Ariosto and Tasso in the context of Renaissance rhetoric and thought. In English.

**486 Alessandro Manzoni and the Nineteenth-Century Historical Novel** Spring. 4 credits. Th 2:30-4:25. A. Grossvogel.

## Japanese

K. Brazell, E. H. Jordan, J. McCoy, B. D. Nee.

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term. Prerequisite for 102 is Jap 101 or equivalent.

Lec, M W F 10:10; drill, M-F 9:05, 12:20. For course description see p. 87.

## 121-122 Accelerated Introductory

**Japanese** 121, fall; 122, spring. 5 credits per term. Prerequisites: for 121, permission of instructors; for 122, Jap 121.

M-F 12:20. Accelerated training in listening, speaking, reading, and writing for students who have already acquired a limited facility in Japanese through residence in Japan or brief formal study, but who require additional training to qualify for admission to second-year Japanese courses.

**201-202 Intermediate Japanese I** 201, fall; 202, spring. 4 credits per term. Prerequisites: for 201, Jap

102 or equivalent; for 202, Jap 201 or equivalent.  
M-F 10:10.

**203-204 Japanese Conversation** 203, fall; 204, spring. 2 credits per term. Prerequisites: for 203, Jap 102 or equivalent; for 204, Jap 203 or equivalent.  
M W F 12:20.

For course description see p. 87.

**301-302 Intermediate Japanese II** 301, fall; 302, spring. 4 credits per term. Prerequisites: for 301, Jap 202 or equivalent; for 302, Jap 301 or equivalent.  
M W F 10:10. E. H. Jorden.

Reading of selected modern texts with emphasis on expository style.

**303-304 Japanese Conversation—Intermediate** 303, fall; 304, spring. 2 credits per term. Prerequisites: for 303, Jap 204 or equivalent; for 304, Jap 303 or equivalent.  
Hours to be arranged. E. H. Jorden.

**305-306 Introduction to Literary Japanese** 305, fall; 306, spring. 4 credits per term. Prerequisites: for 305, Jap 202 or equivalent; for 306, Jap 305 or equivalent.  
Hours to be arranged.

**401-402 Advanced Japanese** 401, fall; 402, spring. 4 credits per term. Prerequisites: for 401, Jap 302 or equivalent; for 402, Jap 401 or equivalent.  
Hours to be arranged.

**404 Linguistic Structure of Japanese** Spring. 4 credits. Prerequisites: Jap 102 or permission of instructor, and Ling 101.  
Hours to be arranged. E. H. Jorden, J. McCoy.

**405-406 Intermediate Literary Japanese** 405, fall; 406, spring. 4 credits per term. Prerequisites: for 405, Jap 402 or equivalent; for 406, Jap 405 or equivalent.  
Hours to be arranged.

**421-422 Directed Readings** 421, fall; 422, spring. Credit to be arranged. Prerequisites: for 421, Jap 402 or equivalent; for 422, Jap 421 or equivalent. Topics will be selected on the basis of student needs.  
Hours to be arranged.

**432 Introduction to Japanese Reading for Students of Chinese** Spring. 4 credits. Prerequisite: Jap 101 or equivalent.  
Hours to be arranged. E. H. Jorden, J. McCoy.

## FALCON

**161-162 Intensive Course** 161, fall; 162 spring. 16 credits per term. Prerequisite: permission of instructor.  
Six hours a day, M-F. E. H. Jorden and staff.

## Javanese

J. M. Echols, J. U. Wolff

**131-132 Elementary Course** 131, fall; 132, spring. 3 credits per term. Prerequisites: for 131, qualification in Indonesian; for 132, Javanese 131 or equivalent.  
Hours to be arranged.

**133-134 Intermediate Course** 133, fall; 134, spring. 3 credits per term. Prerequisites: for 133, Javanese 132 or equivalent; for 134, Javanese 133 or equivalent.  
Hours to be arranged.

**Old Javanese (see Linguistics 651-652)**

## Linguistics

L. H. Babby, N. C. Bodman, J. S. Bowers, E. W. Browne, J. M. Echols, J. W. Gair, J. E. Grimes, R. A.

Hall, Jr., C. F. Hockett, F. E. Huffman, R. B. Jones, Jr., R. L. Jones, E. H. Jorden, G. B. Kelley, L. D. King, H. L. Kufner, R. L. Leed, S. McConnell-Ginet, J. McCoy, G. M. Messing, J. S. Noblitt, D. F. Solá, M. Suárez, F. C. van Coetsem, J. F. Vigorita, L. R. Waugh, J. U. Wolff.

## Linguistics Major

The major in linguistics has three prerequisites: (1) Linguistics 101-102; (2) qualification in two languages, one from the familiar European group (Latin, Greek, French, Italian, Portuguese, Spanish, German, Russian) and one from the other languages offered at Cornell, with six credits beyond qualification in one or the other of these two; (3) a two-semester sequence in a related discipline (e.g. the literature of the language in which six credits beyond qualification was offered as a prerequisite, anthropology, computer science, mathematics, philosophy, psychology, or sociology). Completion of the major requires: (1) Linguistics 303, 304, 311; (2) a course in historical linguistics, either a course in historical method such as Linguistics 404 or the history of a specific language or family; (3) a minimum of eight additional credits in linguistics chosen in consultation with the adviser. Prospective majors should see J. W. Gair.

## The Honors Program

Applications for honors should be made during the junior year. Candidates for admission must have a 3.0 average overall and should have a 3.2 average in linguistics courses.

In addition to the regular requirements of the major, the candidate for honors will complete an honors thesis and take a final oral examination in defense of it. The thesis is usually written during the senior year, but may be begun in the second term of the junior year when the student's program so warrants. The oral examination will be conducted by the honors committee consisting of the thesis adviser and at least one other faculty member in linguistics. Members of other departments may serve as additional members if the topic makes this advisable. Linguistics 493 and/or 494 may be taken in conjunction with thesis research and writing, but are not required.

## Distribution Requirement

Linguistics 101-102, or the combination Linguistics 101 and any other course for which Linguistics 101 is a prerequisite, satisfies the distribution requirement in the social sciences.

**101-102 Introduction to the Scientific Study of Language** 101, fall or spring; 102 spring only. 3 credits per term. First term is a prerequisite to the second.  
101 lec: fall, M W F 9:05, 10:10, 11:15; spring, M W F 9:05, 10:10, 11:15.  
Staff.

An introductory survey course designed to acquaint the student with the nature of human language and with its systematic study.

**201-202 Phonetics** 201, fall; 202, spring. 3 credits per term. 201 prerequisite for 202.  
T Th 10:10-11:25.  
Practical, experimental, and theoretical aspects of articulatory and acoustic phonetics.

**203 Multilingual Societies and Cultural Policy** Spring. 4 credits.  
T Th 2:30-4. D. F. Solá.  
An interdisciplinary course on the linguistic, cultural, and political components of cultural policy in multilingual and multicultural societies.

**244 Sex Roles and Linguistic Behavior (also Women's Studies 244)** Spring. 4 credits. Prerequisite: Ling 101, Psych 215, or permission of instructor.

M W F 1:25. S. McConnell-Ginet.  
Types of linguistic phenomena in which sex (or conversational participants or of referent) is a relevant variable will be surveyed; situations in different speech communities will be contrasted. Workshop sessions will include analysis to increase understanding of English male/female speech differences. Possible origins and implications of sex-differentiated linguistic behavior also will be considered.

**303 Phonology** Fall. 4 credits. Prerequisite: Ling 101.  
T Th 2:30-3:45. L. R. Waugh.  
A general survey of neo-Bloomfieldian and Jakobsonian phonology.

**304 Morphology** Spring. 4 credits. Prerequisite: Ling 303 or permission of instructor.  
T Th 2:30-3:45. L. R. Waugh.  
A general survey of generative phonology and neo-Bloomfieldian, Jakobsonian, and generative morphology.

**306 Syntax** Fall. 4 credits. Prerequisite: Ling 102 or permission of instructor.  
M W F 10:10. R. A. Hall, Jr.

**[308 Dialectology** Spring. 4 credits. Offered in alternate years. Not offered in 1976-77.]

**311-312 The Structure of English** 311, fall; 312, spring. 4 credits per term. Prerequisites: for 311, Ling 102 or permission of instructor; for 312, 311 or permission of instructor.  
M W F 11:15. Staff.

The first term is devoted to a study of the structure of English from the point of view of modern transformational analysis. Emphasis is on enabling students to develop the skills of analysis, though current works on English grammar are also examined. The second term is devoted to approaches to the semantic interpretation of English sentences.

**[318 Style and Language** Spring only. 4 credits. Prerequisite: Ling 101 or permission of instructor. G. M. Messing. Not offered 1976-77.]

**325 Teaching English as a Foreign Language** Spring. 4 credits. Prerequisites: Ling 102, 311, or equivalent, or permission of instructor.  
T Th 2:30-3:45. Staff.

**[341 India as a Linguistic Area** Fall. 4 credits. Offered in alternate years. Prerequisite: Ling 102. J. W. Gair or G. B. Kelley. Not offered 1976-77.]

**400 Analytic Techniques** Fall. 4 credits. Prerequisite: permission of instructor.  
Hours to be arranged. C. F. Hockett.

**[401 Linguistic Structures** Fall. 4 credits. Prerequisite: 304. Offered in alternate years. J. W. Gair. Not offered 1976-77.]

**402 Contrastive Analysis** Spring. 4 credits. Prerequisite: permission of instructor.  
Hours to be arranged. C. F. Hockett.

**403 Applied Linguistics and Second-Language Acquisition** Spring. 4 credits. Prerequisite: structure of a language at 400 level.  
T Th 2:30-3:45. J. S. Noblitt.

**404 Comparative Methodology** Fall. 4 credits. Prerequisite: Ling 303.  
M W F 10:10. R. B. Jones.

Practice in the reconstruction of proto-languages with discussion of problems and methods.

**405-406 Sociolinguistics** 405, fall; 406, spring. 4 credits per term. First term is prerequisite to the second, or permission of instructor.  
T Th 1:25. G. B. Kelley.

**410 Historical Linguistics: Methods and Approaches**

Spring, 4 credits. Prerequisite: Ling 102 or permission of instructor.

Hours to be arranged. F. C. van Coetsem. General introduction to historical linguistics including methods and approaches, issues and applications.

**411-412 Transformational Grammar: Syntax and Semantics**

411, fall; 412, spring. 4 credits per term. Prerequisite: Ling 102; first term is prerequisite to the second.

T Th 10:10-11:25.

Fall: Introduction to the theory of syntax within a generative-transformational framework. Spring: advanced course on syntax and the relation of syntax to semantics.

**[413-414 Generative Phonology**

413, fall; 414, spring. 4 credits per term. Given in alternate years. Prerequisites: for 413, Ling 102; for 414, Ling 413. Hours to be arranged. J. S. Bowers. Not offered 1976-77.]

**[440 Dravidian Structures**

Either term according to demand. 4 credits. Prerequisite: Ling 102. G. B. Kelley. Not offered 1976-77.]

**[442 Indo-Aryan Structures**

Either term according to demand. 4 credits. Prerequisite: Ling 102. J. W. Gair. Not offered 1976-77.]

**493 Honors Thesis Research**

Fall. 4 credits. Staff. May be taken before or after Ling 494 or may be taken independently.

**494 Honors Thesis Research**

Spring. 4 credits. Staff. May be taken as a continuation of or before Ling 493.

For complete information on courses numbered 600 or above, consult the appropriate instructor.

**600 Field Methods**

Fall or spring. 4 credits. Prerequisites: Ling. 101 or 201. Hours to be arranged. F. E. Huffman.

**[601 Literature, Language, and Culture**

Spring. 4 credits. Offered in alternate years. Not offered in 1976-77.]

**602 Pidgin and Creole Languages**

Spring. 4 credits. Prerequisite: Ling 102. Hours to be arranged. R. A. Hall, Jr.

**603 History of Linguistics**

Fall. 4 credits. M W F 9:05. R. A. Hall, Jr.

**605-606 Linguistic Data Processing**

605, fall; 606, spring. 2 credits per term. Prerequisites: for 605, Ling 102 and permission of instructor; for 606, Ling 605.

Hours to be arranged. R. L. Jones.

**[607 Schools of Linguistics**

Spring. 4 credits. Prerequisites: Ling 102 and permission of instructor. J. E. Grimes. Not offered 1976-77.]

**[608 Discourse Analysis**

Spring. 4 credits. Prerequisite: permission of instructor. J. E. Grimes. Not offered 1976-77.]

**[610 Topics in Transformational Grammar**

Fall or spring. 3 credits. Prerequisite: permission of instructor. J. S. Bowers. Not offered in 1976-77.]

**623-624 Old Irish**

623, fall; 624, spring. 4 credits per term. Offered in alternate years. Prerequisite for 624 is 623 or permission of instructor.

Hours to be arranged. J. F. Vigorita.

**[625-626 Middle Welsh**

625, fall; 626, spring. 4 credits per term. Offered in alternate years.

Prerequisite for 626 is 625. J. F. Vigorita. Not offered 1976-77.]

Either Old Irish or Middle Welsh will be offered according to demand.

**627 Advanced Old Irish**

Fall or spring. 2-4 credits. May be repeated for credit. Prerequisite: Ling 624 or permission of instructor.

Hours to be arranged. J. F. Vigorita.

**628 Comparative Celtic Grammar**

Spring. 4 credits. Prerequisite: one Celtic language or permission of instructor.

Hours to be arranged. J. F. Vigorita.

**[629 Advanced Middle Welsh**

Either term. 2-4 credits. May be repeated for credit. Prerequisite: Ling 626. J. F. Vigorita. Not offered 1976-77.]

**631-632 Comparative Indo-European Linguistics**

631, fall; 632, spring. 4 credits per term. Prerequisites: for 631, permission of instructor; for 632, 631 or permission of instructor.

W F 12:20. G. M. Messing.

**[640 Elementary Pali**

Either term according to demand. 3 credits. J. W. Gair. Not offered 1976-77.]

**641-642 Elementary Sanskrit**

641, fall; 642, spring. 3 credits per term. First term is prerequisite to the second.

Hours to be arranged. J. F. Vigorita.

**[644 Comparative Indo-Aryan**

Spring. 4 credits. Prerequisites: Ling 102 and a basic course in Indo-Aryan language, or permission of instructor.

J. W. Gair. Not offered 1976-77.]

**[646 Comparative Dravidian**

Spring. 4 credits. Prerequisites: Ling 102 and a basic course in a Dravidian language, or permission of instructor.

G. B. Kelley. Not offered 1976-77.]

**651-652 Old Javanese**

651, fall; 652, spring. 4 credits per term.

Hours to be arranged. J. M. Echols.

**653-654 Seminar in Southeast Asian Linguistics**

653, fall; 654, spring. 4 credits per term. Prerequisites: Ling 303 or permission of instructor; first term is prerequisite to the second.

Hours to be arranged. R. B. Jones, Jr.

**655-656 Malayo-Polynesian Linguistics**

655, fall; 656, spring. 4 credits per term. Prerequisites: Ling 102 and permission of instructor; first term is prerequisite to the second.

Hours to be arranged. J. U. Wolff.

**[657 Seminar in Mon-Khmer Linguistics**

Fall. 4 credits. Prerequisites: Ling 102 and permission of instructor. F. E. Huffman. Not offered 1976-77.]

**[662 Sino-Tibetan Linguistics**

Spring term on student demand. 4 credits. Prerequisites: Ling 102 or Chin 401-402, and permission of instructor.

N. C. Bodman. Not offered 1976-77.]

**671-672 Comparative Slavic Linguistics**

671, fall; 672, spring. 4 credits per term. Offered in alternate years. Prerequisite: permission of instructor.

First term is a prerequisite of the second.

Hours to be arranged. E. W. Browne.

**700 Seminar**

Fall or spring. Credit to be arranged. Prerequisite: permission of instructor.

Hours to be arranged. Staff.

**701-702 Directed Research**

**751 Thai Dialectology**

Fall. 4 credits. Prerequisites: Ling 303 and permission of instructor. Hours to be arranged. R. B. Jones, Jr.

**752 Comparative Thai**

Spring. 4 credits. Prerequisites: Ling 404 or equivalent and permission of instructor.

Hours to be arranged. R. B. Jones, Jr.

**753 Tibeto-Burman Linguistics**

Fall. 4 credits. Prerequisites: Ling 404 or equivalent and permission of instructor.

Hours to be arranged. R. B. Jones, Jr.

**Pali**

See **Linguistics 640**

**Polish**

**131-132 Elementary Course** 131, fall; 132, spring. 3 credits per term. First term or equivalent, is a prerequisite to the second.

Hours to be arranged. E. W. Browne. For course description see p. 87.

**[133-134 Elementary Course II**

133, fall; 134, spring. 3 credits per term. First term or equivalent is a prerequisite to the second. E. W. Browne. Not offered in 1976-77.]

**Portuguese**

L. D. King

**101-102 Basic Course**

101, fall; 102, spring. 6 credits per term. Prerequisite for 102 is Port 101 or equivalent.

Lec. T Th 12:20; drill, M-F 1:25.

For course description see p. 87.

**131-132 Elementary Course**

131, fall; 132, spring. 3 credits per term. Prerequisites: qualification in Spanish and permission of instructor; first term is a prerequisite to the second.

Lec. T 12:20; drill, M W F 11:15. Staff.

A basic course designed for students who have a strong background in Spanish or another Romance language.

**203-204 Intermediate Composition and Conversation**

203, fall; 204, spring. 3 credits per term. Prerequisites: for 203, qualification in Portuguese; for 204, Port 203 or permission of instructor.

M W F 10:10. Staff.

For course description see p. 87.

**[303-304 Advanced Composition and Conversation**

303, fall; 304, spring. 4 credits per term. Offered in alternate years. Prerequisites: for 303, Port 204 or equivalent; for 304, Port 303 or equivalent. Staff. Not offered in 1976-77.]

**305-306 Advanced Readings**

305, fall; 306, spring. 4 credits per term. Offered in alternate years. Prerequisites: for 305, Port 304 or equivalent; for 306, Port 305 or equivalent.

T Th 10:10. Staff.

**Quechua**

D. F. Solá

**131-132 Elementary Course**

131, fall; 132, spring. 3 credits per term. Prerequisite: qualification in Spanish.

M W 11:15, plus required lab hours.

For course description see p. 87. A beginning conversation course in the Cuzco dialect of Quechua.

**133-134 Intermediate Course**

133, fall; 134, spring. 3 credits per term. Prerequisites: for 133, Quechua 131-132 or equivalent; for 134 is Quechua 133 or equivalent.

Hours to be arranged.

An intermediate conversation and reading course. Study of the Huarochiri manuscript.

**700 Seminar in Quechua Linguistics** Fall or spring. Credit to be arranged. Prerequisite: permission of instructor.  
Hours to be arranged.

## Romance Linguistics

**321-322 History of the Romance Languages** 321, fall; 322, spring. 4 credits per term. Offered in alternate years. First term is prerequisite to the second.  
Hours to be arranged. Staff.

**323-324 Comparative Romance Linguistics** 323, fall; 324, spring. 4 credits per term. Offered in alternate years. First term is prerequisite to the second.  
Hours to be arranged.

**[620 Areal Topics in Romance Linguistics** Fall or spring. 4 credits. May be repeated for credit. Not offered 1976-77.]

**[621 Problems and Methods in Romance Linguistics** Fall. 4 credits. Offered every third year. Not offered 1976-77.]

**[622 Romance Dialectology** Spring. 4 credits. Offered every third year. Not offered 1976-77.]

## Romance Studies

**381-382 Problems of Interpretation in the Human Sciences** 381, fall; 382, spring. 4 credits per term.  
T Th 2:30-3:35. J. Harari.

The aim of this course is to begin to formulate a critical vocabulary (concepts, methods, and strategies grouped under the names structuralism, poststructuralism, etc.) in order to evaluate alternative theories and approaches to texts. Readings in Saussure, Barthes, Derrida, De Man, Girard, Lévi-Strauss, Foucault, and Said. In English; reading knowledge of French suggested.

## Romanian

**[131-132 Elementary Course** 131, fall; 132, spring. 3 credits per term. First term or equivalent is prerequisite to the second. Hours to be arranged. Staff. Not offered 1976-77.]

**[133-134 Elementary Course II** 133, fall; 134, spring. 3 credits per term. First term or equivalent is prerequisite to the second. Hours to be arranged. Staff. Not offered 1976-77.]

## Russian

L. H. Babby, E. W. Browne, P. J. Carden, G. Gibian, A. Glasse, R. L. Leed, S. Lottridge, V. Ripp.

### Russian Major

Russian majors study Russian language, literature, and linguistics with emphasis placed in accordance with their specific interests. It is desirable, although not necessary, for prospective majors to complete Russian 101-102, 201-202, 303-304 as freshmen and sophomores since these courses are prerequisites to most of the junior and senior courses which count toward the major. Students may be admitted to the major upon satisfactory completion of Russian 102 or the equivalent.

Students who elect to major in Russian should consult with both P. J. Carden and R. L. Leed as soon as possible.

For a major in Russian, students will be required to complete: (1) Russian 301-302 or 303-304 or the equivalent; (2) eighteen credits from 300- and 400-

level literature and linguistics courses of which twelve credits must be in literature in the original.

Prospective teachers of Russian in secondary schools should take Linguistics 101 in the freshman or sophomore year, followed by Russian 403 and 407.

## The Honors Program

Students taking honors in Russian undertake individual reading and research, write an honors essay, and take a comprehensive examination at the end of the senior year.

### Major in Russian and Soviet Studies

Interested students see p. 124.

### Teacher Preparation Program

Interested students see p. 87.

### Distribution Requirement

The distribution requirement in the humanities is satisfied in Russian by any two Russian literature courses at the 200 level and above.

### Languages and Linguistics

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term. Students who have previously studied Russian should consult p. 00 before registering. Prerequisite for 102 is Russian 101 or equivalent.

Lec, M W 2:30 or T Th 11:15; drill, M-F 8, 9:05, 12:20.

For course description see p. 87.

**131-132 Elementary Reading Course I** 131, fall; 132, spring. 3 credits per term. Students who have previously studied Russian should consult p. 00 before registering. 131 or equivalent prerequisite for 132.

Lec, T 3:35; drill, M W F 11:15, 3:35.

For course description see p. 87.

**133-134 Elementary Reading Course II** 133, fall; 134, spring. 3 credits per term. 132 or equivalent prerequisite for 133; 133 or equivalent prerequisite for 134.

M W F 1:25.

For course description see p. 87.

**203-204 Composition and Conversation** 203, fall; 204, spring. 3 credits per term. Prerequisite: qualification in Russian. (For definition of qualification see p. 00.) First term or equivalent is prerequisite to the second.

Lec, T 2:30; drill M W F 11:15, 1:25, or 3:35.

R. L. Leed and staff.

For course description see p. 87.

**301-302 Advanced Russian Morphology and Syntax** 301, fall; 302, spring. 4 credits per term. Prerequisite: Rus 204 or equivalent; first term is prerequisite to the second.

Hours to be arranged. L. H. Babby.

This is a practical language course in which emphasis is placed on those areas of Russian that are particularly hard for English speakers: aspect, gerunds, participles, -SJA verbs, sequence of tense, etc.

**303-304 Advanced Composition and Conversation** 303, fall; 304, spring. 4 credits per term. Prerequisites: for 303, Rus 204 or equivalent; for 304, Rus 303 or equivalent.

T Th 10:10-11:40. Staff.

**305-306 Directed Individual Study** 305, fall; 306, spring. 2 credits per term. Prerequisite: Russian 303-304 or equivalent; first term is prerequisite to the second.

Hours to be arranged. Staff.

This is a practical language course on an advanced level and is designed to improve oral control of colloquial Russian.

**401-402 History of the Russian Language** 401, fall; 402, spring. 4 credits per term. Offered in alternate years. Prerequisite for 401 is qualification in Russian and Ling 101; first term or equivalent is prerequisite to the second.

E. W. Browne.

**[403-404 Linguistic Structure of Russian** 403, fall; 404, spring. 4 credits per term. Offered in alternate years. Prerequisite: qualification in Russian; Ling 101-102 recommended; first term or equivalent is prerequisite to the second. L. H. Babby. Not offered 1976-77.]

**407 Russian for Teachers** Fall term in alternate years. 4 credits. Prerequisites: qualification in Russian, Ling 101, and Rus 403 (or concurrent registration).

Hours to be arranged. R. L. Leed.

**450 Practice Teaching** Fall or spring. 6 credits. Prerequisite: Rus 403. The methods course, Russian 407 may be taken concurrently with practice teaching. Open only to students enrolled in a teacher preparation program.

Students will observe and then participate in teaching classes in the secondary school system. They will also become acquainted with a language laboratory.

**[601 Old Church Slavic** Fall. 4 credits. This course is prerequisite to 602. Not offered 1976-77.]

**[602 Old Russian** Spring. 4 credits. Prerequisite: 601. Not offered 1976-77.]

## Comparative Slavic Linguistics (Linguistics 671-672)

**700 Seminar in Slavic Linguistics** According to demand. Variable credit.  
Staff.

## Literature

**103 Freshman Seminar: Russian Literature** Fall or spring. 3 credits.

**[107 Freshman Seminar: Two years in Russia—1946 and 1929** Spring. 3 credits. Open only to freshmen who are concurrently enrolled in or have taken a Russian language course at any level. Intended for students who plan an early concentration in Russian. G. Gibian. Not offered 1976-77.]

**201-202 Readings in Russian Literature** 201, fall; 202, spring. 3 credits per term. Prerequisite: qualification in Russian; open to first-year students.  
M W F 10:10. Fall, S. Lottridge; spring, V. Ripp.  
Completion of this series is the prerequisite for all 300- and 400-level literature courses where the reading is done in Russian. Close reading of selected texts, with attention to their stylistic features and their significance in Russian literary history.

**207 Russian Literature** Fall. 3 credits. Enrollment limited to 60.

T Th 1:25-2:05. P. Carden.

An introduction to the major Russian prose writers of the first half of the nineteenth century. The class is conducted as a discussion. Works by Pushkin, Lermontov, Gogol, Turgenev, and Goncharov will be read in English translation.

**208 Russian Literature** Spring. 3 credits. Enrollment limited to 60; students who have taken 207 have priority in registering for 208.

T Th 1:25-2:05. P. Carden.

An introduction to major Russian prose writers of the

second half of the nineteenth century and the beginning of the twentieth century. The course may be taken separately, but the themes and goals of the discussion are a continuation of Russian 207. Works by Dostoevsky, Tolstoy, Chekhov, Babel, and Pasternak are read in English translation.

**[210 Images of Women in Russian Literature]** Fall. 3 credits. Not offered 1976-77.]

**[314 Intellectual Background of Russian Literature, 1750-1860]** Spring. 4 credits. Conducted in Russian. A. Glasse. Not offered 1976-77.]

**331 Russian Poetry** Fall. 4 credits. Prerequisite: Rus 202 or the equivalent and permission of instructor. A survey of Russian poetry with primary emphasis on analysis of the individual poems by major poets. This course counts toward the fulfillment of twelve credits of literature in the original.

**332 Russian Theatre and Drama** Fall. 4 credits. Conducted in English. M W F 10:10. A. Glasse. A survey of Russian theatre and drama from the beginning to the present time, in translation.

**[335 Gogol]** Spring. 4 credits. S. Lottridge. Not offered 1976-77.]

**[336 Society and Literature]** Fall. 4 credits. V. Ripp. Not offered 1976-77.]

**[367 The Russian Novel in Translation]** Fall. 4 credits. G. Gibian. Not offered 1976-77.]

**368 Soviet Literature in Translation** Spring. 4 credits. M W F 12:20. S. Lottridge. Introduction to selected works of Russian literature, mainly from one Soviet period, examined primarily as works of art, with some attention to their social historical importance.

**369 Dostoevsky** Spring. 4 credits. T Th 2:30-3:50. V. Ripp. Reading of Dostoevsky's major works from *Poor Folk* to *The Brothers Karamazov*. Consideration of such problems as Dostoevsky's conception of good and evil, structure of his novels, and his importance for modern European literature. Reading in translation, but graduate students do a portion of reading in Russian.

**370 Revolution and the Individual in Russian Literature—Nineteenth and Twentieth Centuries** Fall. 4 credits. T Th 10:10 and one hour to be arranged. G. Gibian. Two main lines of Russian literary portrayal of the choices between individual regeneration and social reform. Thirst for collectivism. Problems of individualism; alienation; searches for a cohesive community. Psychology and nationalism in Russian literature. Readings in Dostoevsky, Tolstoy, Mayakovsky, Pasternak, Solzhenitsyn, and others.

**[380 Solzhenitsyn and Siniavsky]** Fall. Variable credit. G. Gibian. Not offered in 1976-77.]

**393 Honors Essay Tutorial** Fall or spring. 4 credits.

**431 Russian Prose Fiction** Fall. 4 credits. Prerequisites: Rus 202 or equivalent and permission of instructor. T Th 2:30 and 1 hour to be arranged. G. Gibian.

**432 Pushkin** Spring. 4 credits. Prerequisites: Rus 202 or equivalent and permission of instructor. M W 2:30 and 1 hour to be arranged. S. Lottridge.

**492 Supervised Reading in Russian Literature** Fall or spring. Variable credit. By initiation of the department.

**[499 Origins of the Avant-Garde (also Comparative Literature 499)]** Spring. 4 credits. P. Carden. Not offered 1976-77.]

**611 Supervised Reading and Research** Fall or spring. Credit to be arranged. Prerequisite: permission of the department.

**[617 Russian Stylistics]** Fall. 4 credits. Conducted in Russian. A. Glasse. Not offered 1976-77.]

**[618 Russian Stylistics]** Spring. 4 credits. S-U grades only. Conducted in Russian. A. Glasse. Not offered 1976-77.]

**[620 Studies in Russian Poetry]** Spring. 4 credits. Not offered 1976-77.]

**[621 Russian Literature from the Beginnings to 1700]** Fall. 4 credits. P. Carden. Not offered 1976-77.]

**[622 Eighteenth-Century Literature]** Fall. 4 credits. Conducted in Russian. A. Glasse. Not offered 1976-77.]

**623 Early Nineteenth-Century Literature** Fall. 4 credits. Prerequisite: Rus 622 or permission of instructor. Conducted in Russian. M W F 12:20. A. Glasse.

A study of the Alexandrine period through the works of the most influential poets, dramatists, and prose writers. Analyses of such authors as: Zhukovskii, Batiushkov, Griboedov, "pushkinskaia pleiada," and "decembrist" poets. All reading in Russian.

**624 Russian Romanticism** Spring. 4 credits. M W F 11:15. A. Glasse.

**[628 Topics in Soviet Literature]** Fall. 4 credits. Not offered 1976-77.]

**671 Seminar in Nineteenth-Century Russian Literature** Fall. 4 credits. Th 3:25-5:40. S. Lottridge.

**672 Seminar in Twentieth-Century Russian Literature** Spring. 4 credits. Th 3:35-5:45. P. Carden. Topic: Modernism in Russian prose.

**701 Introduction to Graduate Study** Fall. 4 credits. S-U grades only. G. Gibian and staff. Required of all first-year graduate students majoring in Russian literature. Bibliography, methods of literary analysis, stylistics, topics in scholarship.

## Sanskrit

See **Linguistics 641-642**

## Serbo-Croatian

**131-132 Elementary Course** 131, fall; 132, spring. 3 credits per term. First term or equivalent is prerequisite to the second. Hours to be arranged. E. W. Browne. For course description see p. 87.

**133-134 Elementary Course II** 133, fall; 134, spring. 3 credits per term. First term or equivalent is prerequisite to the second. Hours to be arranged. E. W. Browne. For course description see p. 87.

## Sinhala (Sinhalese)

**J. W. Gair**

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term. First term or equivalent is prerequisite to the second. Hours to be arranged. For course description see p. 87.

**201-202 Sinhala Reading** 201, fall; 202, spring. 3 credits per term. Prerequisites: for 201, qualification in Sinhala; for 202, Sinhala 201 or equivalent. Hours to be arranged.

**203-204 Composition and Conversation** 203, fall; 204, spring. 3 credits per term. Prerequisites: for 203, Sinhala 202 or permission of instructor; for 204, is Sinhala 203 or equivalent. Hours to be arranged. For course description see p. 87.

See also **Linguistics 341, 442, 631, 640, 641, 644.**

## Spanish

C. M. Arroyo, U. J. DeWinter, R. O. González, L. Kerr, L. D. King, J. W. Kronik, D. F. Solá, M. Suñer, M. Van Antwerp.

### Spanish Major

The Spanish major is designed to give students proficiency in the oral and written language; to acquaint them with Hispanic culture, and to develop their skill in literary and linguistic analysis. Satisfactory completion of the major should enable students to meet language and literature requirements for a provisional teaching certificate, to continue with graduate work in Spanish, or to satisfy standards for acceptance into the training programs of the government, social agencies, or business concerns.

Students who elect a major in Spanish will work out a plan of studies in consultation with their major adviser or the director of undergraduate studies. Previous training and interests will be taken into account. They are encouraged to take related courses in fields such as history, philosophy, anthropology, linguistics, art, music, Classics, English, comparative literature, and other foreign languages and literatures. Interested students are encouraged to seek faculty advice about the major as early as possible. (Students interested in Spanish linguistics should consult with M. Suñer in the Department of Modern Languages and Linguistics.) The students' program of courses will be determined on the basis of their vocational goals. Students are free to combine a Spanish major with a concentration of courses in linguistics (in which case they may choose an adviser from the Department of Modern Languages and Linguistics), comparative literature, or sociology and anthropology, or with premedical or prelaw programs.

Spanish 201 and 204 or their equivalent are prerequisite to entering the major in Spanish. A typical Spanish major not split with another discipline would normally comprise: 1) two courses in the 315-316-317 series; 2) 303-304 or their equivalent (study abroad may be substituted); 3) twenty-four additional credits in Hispanic literature; and 4) 408.

Spanish majors are encouraged to spend all or part of their junior year in a Spanish-speaking country on one of the study-abroad programs organized by American universities that allow the transfer of grades and credits.

The J. G. White Prizes and Scholarships are available annually to students who achieve excellence in Spanish.

For acceptance into the major students must have approval of the chairperson of the Department of Romances Studies and of that Department's director of undergraduate studies in Spanish, M. Van Antwerp.

### The Honors Program

The honors program in Spanish is open to superior

students who wish to undertake guided independent reading and research in an area of their choice. Students in the senior year select a member of the Spanish faculty who will supervise their work and direct the writing of the honors essay.

#### Teacher Preparation Program

Interested students see p. 87.

#### Distribution Requirement

The distribution requirement in the humanities is satisfied in Spanish by any two of the following courses: Spanish 201, 315, 316, 317, or any 300-level literature course.

Of the courses listed below, those dealing with literature, as well as Spanish 111–112, are staffed and administered by the Department of Romance Studies, and inquiries regarding them should be addressed to that department, 278 Goldwin Smith Hall.

The courses dealing with language and linguistics (except 111–112) are offered by the Department of Modern Languages and Linguistics, and are administered by that department, 203 Morrill Hall.

#### Languages and Linguistics

**101–102 Basic Course** 101, fall; 102, spring. 6 credits per term. Students who have previously studied Spanish should consult p. 00 before registering for this course. Prerequisite for 102 is Span 101 or equivalent.

Fall; lec, M W 1:25, 2:30; drill M-F 8, 9:05, 10:10, 11:15, 12:20–1:25, 2:30. Spring; lec, M W 12:20, 1:25; drill, M-F 8, 9:05, 10:10, 11:15, 12:20. For course description see p. 87.

**111–112 Basic Course** 111, fall; 112, spring. 4 credits per term. Prerequisite: permission of instructor.

M W F 9:05 or 1:25. M. Van Antwerp and staff. For course description see p. 87.

**131–132 Elementary Reading Course I** 131, fall; 132, spring. 3 credits per term. Students who have previously studied Spanish should consult p. 00 before registering for this course. Prerequisite for 132 is Span 131 or equivalent.

M W F 9:05, 12:20, or 1:25. For course description see p. 87.

**133–134 Elementary Reading Course II** 133, fall; 134, spring. 3 credits per term. Prerequisites: for 133 Span 132 or equivalent; for 134, is Span 133 or equivalent.

Fall; M W F 11:15, 12:20, 1:25, or 2:30. Spring; M W F 12:20 or 1:25.

For course description see p. 87.

**203 Intermediate Composition and Conversation** Fall or spring. 3 credits. Prerequisite: qualification in Spanish. (For definition of qualification see p. 00.) Evening examinations.

Fall; M W F 8, 9:05, 10:10, 11:15, 12:20, or 1:25; spring; M W F 9:05, 10:10, 12:20, or 1:25.

**204 Intermediate Composition and Conversation** Spring. 3 credits. Prerequisite: Span 203 or equivalent.

M W F 9:05, 11:15, or 12:20. For course description see p. 87.

**303–304 Advanced Composition and Conversation** 303, fall; 304, spring. 4 credits per term. Prerequisites: for 303, Span 204 or equivalent; for 304, Span 303 or equivalent.

M W F 10:10. The study of fundamental aspects of style in standard spoken and written Spanish.

**305–306 Spanish for Bilinguals** 305, fall; 306, spring. 4 credits per term.

M W F 1:25. Advanced composition and conversation for Spanish-English bilinguals.

**[401–402 History of the Spanish Language** 401, fall; 402, spring. 4 credits per term. Offered in alternate years; not offered 1976–77. Prerequisites: qualification in Spanish and Ling 101 or permission of instructor.]

**407 Spanish for Teachers** Fall. 4 credits. Prerequisites: qualification in Spanish and Ling 101 or permission of instructor.

M W F 2:30. A course in methodology and applied linguistics for prospective teachers of the Spanish language.

**408 The Grammatical Structure of Spanish** Spring. 4 credits. Prerequisites: qualification in Spanish and Ling 101 or permission of instructor.

M W F 2:30. Descriptive analysis of the morphological and syntactical structure of present-day standard Spanish. A survey of current attitudes, methods, materials, and techniques. Required for provisional New York State teacher certification.

**450 Practice Teaching** Fall or spring. 6 credits. Prerequisite: Span 408 (the methods course, Span 407 may be taken concurrently with practice teaching). Open only to students enrolled in a teacher preparation program.

Students will observe and then participate in teaching classes in the secondary school system. They will also become acquainted with a language laboratory.

For complete descriptions of courses numbered 600 or above, consult the graduate faculty representative.

**601 Hispanic Dialectology** Fall or spring. 4 credits. Offered according to demand.

Hours to be arranged.

**602 Linguistic Structures of Ibero-Romance** Fall or spring. 4 credits. Offered according to demand.

Hours to be arranged.

**603 Contemporary Theories of Spanish Phonology** Fall or spring. 4 credits. Offered according to demand.

Hours to be arranged.

**604 Contemporary Theories of Spanish Grammar** Fall or spring. 4 credits. Offered according to demand.

Hours to be arranged.

**The Comparative Study of the Romance Languages (Romance Linguistics 321–322, 323–324, 620, 621, 622)**

**700 Seminar in Ibero-Romance Linguistics** According to demand. Variable credit. Hours to be arranged.

#### Literature

**201 Introduction to Hispanic Literature** Fall or spring. 3 credits. Prerequisite: qualification in Spanish or permission of instructor. (For definition of qualification see p. 45.)

Fall; M W F 9:05, 12:20, 1:25, or T Th 10:10–11:25; spring; M W F 12:20, 1:25, or T Th 12:20–1:35.

L. Kerr and staff. An intermediate reading course in which texts from Spain and Spanish America are read and analyzed. The course is designed to increase reading and speaking facility in Spanish and to develop critical and analytical skills in the appreciation of literary texts. Conducted mainly in Spanish. (The literature course that normally follows 201 is 315 or 316 or 317.)

**313 Spanish Civilization** Fall. 4 credits.

Prerequisite: Span 201 or four years of entrance Spanish, or permission of instructor.

M W F 11:15. M. Van Antwerp. A study of the major periods of Spanish political and intellectual history, with focus also on Spanish art. Readings in both Spanish and English. Conducted in Spanish.

**315 Readings in Golden Age Spanish Literature** Spring. 4 credits. Prerequisite: Span 201 or four years of entrance Spanish, or permission of instructor. (This course is not prerequisite to 316 or 317.)

M W F 9:05. R. González. A study of the concepts of Renaissance, mysticism, and baroque as they are reflected in representative Spanish works of the sixteenth and seventeenth centuries.

**316 Readings in Modern Spanish Literature** Fall. 4 credits. Prerequisite: Span 201 or four years of entrance Spanish or permission of instructor.

T Th 10:10–11:25. J. Kronik. Reading and discussion of representative texts from Spain from romanticism to the present: Zorrilla, Galdós, Unamuno, García Lorca, Cela, and others.

**317 Readings in Modern Spanish-American Literature** Spring. 4 credits. Prerequisite: Span 201 or four years of entrance Spanish, or permission of instructor.

T Th 10:10–11:25. L. Kerr. Reading and discussion of representative texts of the nineteenth and twentieth centuries from Spanish America: Darío, Neruda, Borges, Paz, Cortázar, García Márquez, and others.

Note: The prerequisite for the following courses, unless otherwise indicated, is Spanish 315 or 316 or 317 or permission of instructor.

**[329 Spanish-American Literature to "Modernismo"** Not offered 1976–77.]

**[332 Twentieth-Century Spanish-American Drama** Not offered 1976–77.]

**334 The Spanish American Short Story: The "Genre Fantastique"** Fall. 4 credits. Prerequisite: Span 315, 316 or 317 or permission of instructor.

T Th 1–2:15. L. Kerr. Theoretical readings and discussion of the fantastic and the short narrative form will lead to an intensive analysis of the works of Jorge Luis Borges and Julio Cortázar: an examination of these texts both as part of the development of the *genre fantastique* and the Spanish American  *cuento* tradition.

**362 Drama of the Spanish Golden Age** Spring. 4 credits.

M W F 11:15. M. Van Antwerp. A study of the major plays and theatrical trends of the sixteenth and seventeenth centuries, with emphasis on the works of Lope de Vega, Tirso de Molina, and Calderón de la Barca.

**[367 Poetry of the Spanish Golden Age** Not offered 1976–77.]

**[385 The Nineteenth-Century Spanish Novel** Not offered 1976–77.]

**389 Form and Formlessness in the Novel of the Generation of 1898** Fall. 4 credits.

T Th 2:30–3:45. J. Kronik. The prose fiction of Unamuno, Baroja, Azorín, Valle-Inclán. Analysis of representative works and discussion of problems such as the struggle against traditional genre limitations, the search for new novelistic forms, the formal demands of a new ideology, art as game. Readings in novelistic theory.

**[391 The Post-Civil War Drama in Spain** Not offered 1976–77.]

[396 **The Post-Civil War Novel in Spain** Not offered 1976-77.]

[398 **Modern Poetry** Not offered 1976-77.]

**399 Literature and Religion (also Comparative Literature 329)** Spring. 4 credits.  
T Th 10:10-11:25. C. M-Arroyo.

Three sections: (1) basic themes: religion and the epic (commitment and collective faith), religion and tragedy, religion and the psychological novel (freedom, determinism), literature and love (erotic, Christian, Neoplatonic); (2) basic sentiments (aestheticism, mysticism, nihilism, and the tragic sense of life); (3) the common roots of philosophy, art, and religion. Readings and class discussion in English.

**419-420 Special Topics in Hispanic Literature** 419, fall; 420, spring. 4 credits per term. Prerequisite: permission of instructor.  
Staff.

Guided independent study of specific topics. For undergraduates interested in special problems not covered in courses.

**429-430 Honors Work in Hispanic Literature** 429, fall; 430, spring. 4 credits per term. Prerequisite: senior standing and permission of instructor.  
Staff.

**434 Latin American Writing of Self-Awareness** Spring. 4 credits.  
M W 12:20-1:35. R. González.

A (de) constructive reading of the major texts of Latin American self-awareness, and their literary, political, and philosophical repercussions. The texts that will be read are: Sarmiento's *Facundo*, Martí's "Nuestra América," Rodó's *Ariel*, Reyes' *La última Tule*, Vasconcelos' *La raza cósmica*, Henríquez Ureña's *Las corrientes literarias en la América hispánica*, Paz' *El laberinto de la soledad* and Fernández Retamar's *Calibán*. Conducted in Spanish.

**435 The Modern Spanish American Novel** Spring. 4 credits.  
T Th 1-2:15. L. Kerr.

A study of the Spanish American novel from *Los de abajo* to texts of the 1970s, including works by Asturias, Cabrera Infante, Cortázar, García Márquez, and Puig. Readings and discussion of literary and theoretical texts to be directed towards an in-depth analysis of the linguistic and structural problems presented by these novels.

[436 **Contemporary Spanish-American Prose Fiction** Not offered 1976-77.]

**440 Medieval Literature** Spring. 4 credits.  
T Th 2:30-3:45. C. M-Arroyo.

From *El Mio Cid* to *La Celestina*: a double approach: linguistic and ideological. Conducted in Spanish.

**455 The Picaresque Novel (also Comparative Literature 463)** Fall. 4 credits. Prerequisite: permission of instructor.

W 3:35-5:30. R. González.  
A detailed study of the picaresque novel in Europe from its Spanish models in the sixteenth century to Lesage and Fielding. Readings will include *Lazarillo de Tormes*, Mateo Alemán's *Guzmán de Alfarache*, Quevedo's *Buscón*, and Grimmelshausen's *Simplicissimus*. Discussion devoted to critical controversies about the picaresque, the concept of realism, the development of the novel, the feminine picaresque, and early manifestations of the picaresque in Latin America. Readings in English and in the original. Class conducted in English.

**635 Graduate Seminar in Spanish-American Literature: Carpentier** Fall. 4 credits.  
F 2:30-4:25. R. González.

A detailed study of Carpentier's literary production in the context of Spanish-American, North American,

and European letters of the last forty years. Conducted in Spanish.

**639-640 Special Topics in Hispanic Literature** 639, fall; 640, spring. 4 credits. To be taken by all new graduate students.  
Staff.

## Swedish

J. M. Echols

**131-132 Elementary Reading Course** 131, fall; 132, spring. 3 credits per term; first term is prerequisite to the second.  
M 1:25; Th 2:30-4.  
For course description see p. 87.

## Tagalog

J. U. Wolff

**101-102 Basic Course** 101, fall; 102, spring. According to demand. 6 credits per term. Prerequisite: permission of instructor; first term or equivalent is prerequisite to the second.  
Hours to be arranged.  
For course description see p. 87.

**201-202 Tagalog Reading** 201, fall; 202, spring. 3 credits per term. Prerequisite for 201 is Tagalog 102 or equivalent; first term or equivalent is prerequisite to the second.  
Hours to be arranged.

**300 Linguistic Structure of Tagalog** Fall or spring. 4 credits. Prerequisite: Ling 101  
Hours to be arranged. J. U. Wolff.

## Tamil

J. W. Gair

[101-102 **Basic Course** According to demand. 101, fall; 102, spring. 6 credits per term; first term or equivalent is prerequisite to the second. Not offered 1976-77.]

## Telugu

G. B. Kelley

[101-102 **Basic Course** 101, fall; 102, spring. 6 credits per term. First term or equivalent is prerequisite to the second. Not offered 1976-77.]

[201-202 **Telugu Reading** 201, fall; 202, spring. 3 credits per term. Prerequisite: qualification in Telugu; first term or equivalent is prerequisite to the second. Not offered 1976-77.]

See also **Linguistics 341, 440, 646.**

## Thai

R. B. Jones, Jr., R. Mendiones

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term; first term or equivalent is prerequisite to the second.  
Lec. T Th 10:10; drill, M-F 9:05.  
For course description see p. 87.

**201-202 Thai Reading** 201, fall; 202, spring. 3 credits per term. Prerequisites: for 201, qualification in Thai; for 202, Thai 201 or equivalent.  
M W F 11:15.

**203-204 Composition and Conversation** 203, fall; 204, spring. 3 credits per term. Prerequisites: for 203, qualification in Thai; for 204, Thai 203.  
Hours to be arranged.  
For course description see p. 87.

**301-302 Advanced Thai** 301, fall; 302, spring. 4 credits per term. Prerequisite: Thai 201-202 or equivalent.  
M W F 1:25.  
Selected readings in Thai writings in various fields.

**303-304 Thai Literature** 303, fall; 304, spring. 4 credits per term. Prerequisite: Thai 301-302 or the equivalent.  
Hours to be arranged.  
Reading of some of the significant novels, short stories, and letters written since 1850.

**401-402 Directed Individual Study** 401, fall; 402, spring. 4 credits per term. For advanced students. Prerequisite: permission of instructor.  
Hours to be arranged.

## Ukrainian

[131-132 **Elementary Course** 131, fall; 132, spring. 3 credits per term; first term is a prerequisite to the second or equivalent. E. W. Browne. Not offered 1976-77.]

[133-134 **Elementary Course II** 133, fall; 134, spring. 3 credits per term; first term is a prerequisite to the second or equivalent. E. W. Browne. Not offered 1976-77.]

## Vietnamese

F. E. Huffman

**101-102 Basic Course** 101, fall; 102, spring. 6 credits per term. First term or equivalent is prerequisite to the second.  
Lec. T Th 10:10; drill, M-F 9:05.  
For course description see p. 87.

**201-202 Vietnamese Reading** 201, fall; 202, spring. 3 credits per term. Prerequisites: for 201, qualification in Vietnamese; for 202, Viet 201.  
Hours to be arranged.

**203-204 Composition and Conversation** 203, fall; 204, spring. 3 credits per term. Prerequisites: for 203, qualification in Vietnamese; for 204, Viet 203.  
Hours to be arranged.  
For course description see p. 87.

**301-302 Advanced Vietnamese** 301, fall; 302, spring. 4 credits per term. Prerequisite: Viet 201-202 or the equivalent.  
Hours to be arranged.

**303-304 Vietnamese Literature** 303, fall; 304, spring. 4 credits per term. Prerequisite: Viet 301-302 or equivalent.  
Hours to be arranged.  
Reading of selections from contemporary literature.

**401-402 Directed Individual Study** 401, fall; 402, spring. 4 credits per term. Prerequisite: permission of instructor. For advanced students.  
Hours to be arranged.

## Welsh

See **Linguistics 625-626, 629.**

## Music

J. T. H. Hsu, acting chairman; W. W. Austin, M. Bilson, K. Husa, M. Keller, S. Monosoff, E. Murray, R. M. Palmer, D. R. M. Paterson, D. M. Randel, T. A. Sokol, M. W. Stith, B. Troxell, J. Webster, N. A. Zaslav.

There are two options available to the student planning to major in music. At the core of both

options is a program which carries the study of music to an advanced level through the deliberate integration of performance, music theory, and music history. This core program sets standards which the Department of Music believes all serious students of music must meet, regardless of the role that music may ultimately play in their lives. Option I is designed to allow the student greater opportunity to elect courses in fields other than music. Option II is designed for the student interested in a more specialized program with a view toward graduate study and a career in music.

**Option I** presupposes some musical background and the satisfactory completion of Music 151–152 by the end of the sophomore year. Students must take a piano examination before admission to the major and will be expected to remedy through further study any deficiencies that may be revealed.

The requirements for the Bachelor of Arts degree with a major in music under Option I include four semester courses in music theory (251–252 and 351–352), three semester courses in music history (381–382 plus one other numbered 300 or above), and four semesters of participation in a musical organization or ensemble.

**Option II** presupposes considerable musical studies before entering and the satisfactory completion of Music 251–252, normally by the end of the sophomore year. Students must take a piano examination before admission to the major and will be expected to remedy through further study any deficiencies that may be revealed.

The requirements for the Bachelor of Arts degree with a major in music under Option II include three semester courses in music theory (351–352 and 451 or 453), three semester courses in music history (381–382 plus one other numbered 300 or above), and two semesters of participation in a musical organization.

In addition, the student majoring in music under Option II will concentrate in one of the following areas:

*A. Theory and Composition.* The student concentrating in theory and composition will elect, during the junior and senior years, four additional semester courses in this area plus Music 462 or 463. These courses may include Music 401–402.

*B. Music History.* The student concentrating in music history will elect, during the junior and senior years, four additional semester courses in this area plus Music 462 or 463. These courses may include Music 401–402. Two of the four may be drawn from the offerings of other departments.

*C. Performance.* The student who has shown exceptional promise as a performer during the freshman and sophomore years, as demonstrated in part by a solo recital, may concentrate in performance by electing, during the junior and senior years, four semesters of private instruction in his or her major instrument plus two semesters of chamber music.

Students contemplating a program in music under either option should arrange for placement examinations and auditions during the orientation period of the freshman year, or earlier if possible. Before entering the major, each student should choose an adviser from among the department's faculty members.

## The Honors Program

The honors program in music is intended to provide a special distinction to the department's ablest undergraduate majors. To become a candidate for honors in music a student must be invited by the faculty at the beginning of the second semester of the junior year. As soon as possible thereafter, the student will form a committee of three faculty members to guide and evaluate the honors work. In

the senior year the candidate will enroll in Music 401–402 with the chairperson of the honors committee as instructor. Candidates will be encouraged to formulate programs that will allow them to demonstrate their total musical ability. The level of honors conferred will be based on the whole range of the independent work in this program of which a major part will culminate in an honors thesis, composition, or recital, to be presented not later than April 1, and a comprehensive examination to be held not later than May 1.

## Distribution Requirement

The distribution requirement in the expressive arts is satisfied in music with any six credits in Music. A maximum of three credits in courses from Music 331 through 338 and 441 through 444 may be used to satisfy this requirement.

## Facilities

A large collection of recorded music and scores is housed in the Department of Music, where listening facilities are provided in the Music Library. These facilities may be used by any member of the student body at hours to be announced each term.

Choral and instrumental ensembles are trained and directed by members of the departmental staff each term, and all students who are interested are invited to join one or more of these groups. These ensembles included the Sage Chapel Choir, the Cornell Chorus, the Cornell University Glee Club, the bands (marching band, wind ensemble, symphonic band, brass ensembles), the Cornell Symphony Orchestra, the Cornell Chamber Orchestra, and chamber music groups. For rehearsal hours and conditions for academic credit, see Music 331 through 338 and 441 through 444. Announcements of tryouts for all organizations will be made at the beginning of the fall term.

## Music Theory

**141–142 Rudiments of Music Theory** 141, fall; 142, spring. 3 credits per term. May not be counted toward the requirements for the major in music. Some familiarity with music is desirable but not necessary. 141 with grade of B- or better is prerequisite to 142.

M W 9:05; disc, hours to be arranged. J. Webster. An elementary, self-contained introduction to music theory, emphasizing fundamental musical techniques, theoretical concepts, and their application. Music 141: ear training; notation, pitch, meter; intervals, scales, triads; basic concepts of tonality; extensive listening to music in various styles; intensive listening and analysis of representative works of Bach, Mozart, and Debussy. Music 142: a technical continuation, including a systematic introduction to counterpoint. Composition of short pieces in the style of J. S. Bach four-part chorales or short keyboard works of the eighteenth and nineteenth centuries.

**151–152 Elementary Theory** 151, fall; 152, spring. 4 credits per term. First term or its equivalent prerequisite to the second. Students intending to major in music under Option II should enroll in Music 151–152 during their freshman year. A knowledge of the rudiments of music and some ability to perform are required for admission. Registration for this course is provisional, depending upon the demonstration of adequate background and ability in proficiency tests given on the first two days of the term.

M W F 9:05, Th 2:30–4:25. D. R. M. Paterson. Designed for students expecting to major in music and other qualified students. An integrated theory course required for admission to the music major. Detailed study of the fundamental elements of tonal music: rhythm, scales, intervals, triads; melodic movement, two-part counterpoint, harmonic progression in the chorale style of J. S. Bach; and

introduction to analysis of small forms. Drill in aural discrimination, sight singing, keyboard harmony, and elementary figured bass; rhythmic, melodic, and harmonic dictation; and score reading.

**251–252 Intermediate Theory** 251, fall; 252, spring. 4 credits per term. Prerequisite: a grade of C or better in 152 or the equivalent. First term prerequisite to the second.

M W F 10:10, Th 1:25–3. J. T. H. Hsu. Continuation of study and writing in the chorale style of J. S. Bach, concentrating on seventh chords; also study of secondary dominants, modulation, augmented sixth chords, and the Neapolitan. Introduction to writing small forms using piano textures, combined with analysis of larger forms and sonatas. Analysis and writing of two- and three-voice chorale preludes. Ear training, keyboard harmony, and score reading.

**351–352 Advanced Theory** 351, fall. 352, spring. 4 credits per term. Prerequisite: a grade of C or better in 252 or the equivalent. First term prerequisite to the second.

M W F 9:05. E. Murray. 351: inventions, chromatic harmony, analysis of larger forms and nineteenth-century music, ear training, score reading, and advanced keyboard studies including figured bass. 352: introduction to some techniques of composers from 1900 to 1950, including expanded tonal resources, atonality, and new approaches to form and rhythm. Analysis of representative smaller works by Bartók, Hindemith, Schoenberg, Stravinsky, Webern, and some American composers. Writing assignments in various styles.

**451 Modal Counterpoint and Analysis** Spring. 4 credits. Prerequisite: 352 or the equivalent with a grade of C or better.

T 10:10–12:05; 1 additional hour to be arranged. R. M. Palmer.

Contrapuntal techniques of the sixteenth century, including the analysis of works by Palestrina and his contemporaries.

**[453 Fugue** Spring. 4 credits. Prerequisite: a grade of C or better in 352 or the equivalent. R. M. Palmer. Not offered 1976–77.]

**456 Orchestration** Spring. 4 credits. Prerequisite: 352 or the equivalent.

W 10:10–12:05. K. Husa. A study of the instruments of the orchestra and their representative works from 1700 to the present. Scoring for various instrumental groups including large orchestra. Students will occasionally attend rehearsals of the Cornell musical organizations and ensembles.

**457 Analysis and Composition (Proseminar)** Fall. 4 credits. Prerequisite: 352 or its equivalent.

W 2:30–4:25. K. Husa. A development of the techniques for analyzing structure and function in twentieth-century music. New methods of tonal analysis will be employed, and atonal and serial music will be studied in the wider context of twentieth-century tonality. Compositional projects will concentrate on the acquisition of fundamental techniques and the assimilation of new materials. Students may concentrate on either analysis or composition.

**[460 Electronic Music Composition** Fall. 3 credits. Enrollment limited to 10. Prerequisite: 252 and permission of instructor. M. W. Stith and staff. Not offered 1976–77.]

**[462 Orchestral Conducting** Spring. 2 credits. Prerequisite: 352. K. Husa. Not offered 1976–77.]

**[463 Choral Conducting** Spring. 2 credits. Prerequisite: 252 or the equivalent. T. A. Sokol. Not offered 1976–77.]

**[464 Choral Style** Spring. 2 credits. Prerequisite: 352 or the equivalent. T. A. Sokol. Not offered 1976-77.]

## Music History

**[101 Introduction to Music** Fall. 3 credits. D. M. Randel and staff. Not offered 1976-77.]

**213 The Art of Music** Fall. 3 credits. T Th 11:15; disc, hours to be arranged. W. W. Austin and assistants.

A survey designed to speed up the continuing development of various independent tastes. Topics such as melody, rhythm, chords, and forms are explored in relation to many musical styles—popular, folk, jazz, church music, and concert music, especially that for piano. Students choose individually the styles they study most, familiar or unfamiliar, but all learn enough of the many styles to trace historical continuities amid the contrasts.

**[214 Opera** Spring. 3 credits. N. A. Zaslav. Not offered 1976-77.]

**218 Chopin, Chaikovsky, Musorgsky** Spring. 3 credits.

T Th 11:15; disc, hours to be arranged. W. W. Austin, G. Gibian, and staff.

Chief works of the three composers, including symphonies, concertos, and operas, are studied through phonograph records. Piano music and chamber music are presented in live performance. The biographical, social, and intellectual contexts of the music are considered in relation to concerns of the present. Students' essays may deal with such concerns more than any technical aspect of the music, though techniques are not neglected.

**219 Chopin, Chaikovsky, Musorgsky** Spring. 1 credit. Seminar for students capable of reading in Russian. Open only to students concurrently enrolled in Music 218.

**[315 Brahms, Wagner, and the End of an Era** Fall. 4 credits. Prerequisite: any course in music or permission of instructor. D. M. Randel. Not offered 1976-77.]

**[316 Music and Poetry in France: Late Middle Ages and Renaissance** Spring. 4 credits. Prerequisite: permission of either instructor. Of most interest to students who have done some work in music or French literature. A good reading knowledge of French required. D. M. Randel, E. P. Morris, and guest lecturers. Not offered 1976-77.]

**[318 Baroque Instrumental Music** Spring. 4 credits. Prerequisite: any course in music or permission of instructor. N. A. Zaslav. Not offered 1976-77.]

**381 Monteverdi to Mozart** Fall. 4 credits. Prerequisite: 152 or permission of instructor. T 11:15, Th 11:15-1:10.

The history of music from the emergence of baroque style around 1600 through the classical period at the end of the eighteenth century. Emphasis on works of Monteverdi, Schütz, Purcell, J. S. Bach, Handel, Haydn, and Mozart.

**382 Beethoven to Debussy** Spring. 4 credits. Prerequisite: 151 or permission of instructor. T 11:15, Th 11:15-1:05.

The history of musical styles from Beethoven's time through the beginning of the twentieth century. Emphasis on works of Beethoven, Schubert, Schumann, Chopin, Verdi, Wagner, Brahms, Mahler, and Debussy.

**385 Schoenberg, Bartók and Stravinsky** Fall. 3 credits. Prerequisite: ability to play (on any instrument) a piece from Bartók's *Mikrokosmos*, vol. 1. M W 11:15. W. W. Austin.

A survey of the three composers' works, of their interactions with each other, and of their connections with some of the literary, artistic, political, and religious concerns of their time.

**[387 Mozart, His Life, Works, and Times (also German 387)** Fall. 4 credits. N. A. Zaslav, S. L. Gilman. Not offered 1976-77.]

**[481 Music in Western Europe to Josquin** Fall. 4 credits. Prerequisite: permission of instructor. Not offered 1976-77.]

**[482 Josquin to Monteverdi** Fall. 4 credits. Prerequisite: 382 or permission of instructor. Not offered 1976-77.]

## Independent Study

**301-302 Independent Study in Music** 301, fall; 302, spring. 4 credits per term. Limited to juniors and seniors who are majoring in music. Department approval required. Staff.

## The Honors Program

**401-402 Honors in Music** 401, fall; 402, spring. 4 credits per term. Open only to honors candidates in their senior year. Staff.

## Musical Performance

**321-322 Individual Instruction in Voice, Organ, Piano, String, Woodwind, and Brass Instruments** 321, fall; 322, spring. 2 credits per term. Undergraduate credit only. 321 is not prerequisite to 322. Admission by audition only; students may not preregister. Basic fee for one half-hour lesson weekly during one term (carrying no credit), \$60. Fees for a practice schedule of six hours weekly during one term: \$30 for the use of a pipe organ; \$15 for a practice room with piano; \$5 for a practice room without piano. For credit: one-hour lesson weekly (or two half-hours) and a double practice schedule earn two credits per term, provided that the student has earned, or is earning, at least three credits in courses in music history or music theory for every four credits in Music 321-322. The basic fees involved are then multiplied by one and one-half (lesson fee \$90; practice fee \$45, \$22.50, and \$7.50). All fees are nonrefundable once classes begin, even if registration is subsequently canceled by the student. A student may register for this course in successive years. The Department of Music offers a limited number of scholarships for lesson fees. For information inquire at the Department of Music office.

**391-392 Advanced Individual Instruction** 391, fall; 392, spring. 4 credits per term. Open only to juniors and seniors who are majoring under Option II with concentration in performance. 391 is not prerequisite to 392.

## Musical Organizations and Ensembles

Students may participate in musical organizations and ensembles throughout the year and obtain one credit per term. Consent of the instructor is required, and admission is by audition only, except in the Sage Chapel Choir. Registration is permitted in two of these courses simultaneously, and students may register in successive years, but no student may earn more than six credits in these courses. Membership in these and other musical organizations is also open to students without credit, if desired.

**331-332 Sage Chapel Choir** No audition for admission, M 7-8:30 p.m., Th 7-8:30 p.m., Sunday 9:30 a.m..

**333-334 Cornell Chorus** T 7:15-9 p.m., Sunday

2:15-3:45 or 7:15-9 p.m. Permission of the instructor is required. T. A. Sokol.

**335-336 Cornell Orchestra** Rehearsals for the Cornell Symphony Orchestra: full orchestra, W 7:30-10 p.m.; sectional rehearsals, alternate T or Th 7:30-10 p.m. Rehearsals for the Cornell Chamber Orchestra, M 7:30-10 p.m. (Limited to more experienced players.) E. Murray.

**337-338 University Bands** Marching band during football season: T 7:15-9:15 p.m., Th 4:30-5:45, F 4:30-5:45, S 11:00. Symphonic band during spring and fall terms: T 4:30-5:45, Th 7:15-9:15 p.m. Wind ensemble, spring term only: M 7:15-9:15 p.m., Th 4:30-5:45. M. W. Stith.

**339 Ear Training and Sight Singing** Fall. open only to students who are participating in a University musical ensemble. Prerequisite: permission of instructor.

T 3:35. T. A. Sokol. A practical course designed to improve the student's conception of melody and rhythm and to help sight-reading ability. Progressive class exercises in intervals, rhythms, melodies, and counterpoints.

**441-442 Chamber Music Ensembles** Permission of instructor required.

S. Monosoff, J. T. H. Hsu. Study and performance of chamber music literature; string and wind groups, piano trios and quartets, trio sonatas, etc. Emphasis on musical problems, with some practice in sight reading.

**443-444 Chamber Singers** Permission of instructor required.

F 4:30-6. T. A. Sokol. Study and performance of selected vocal chamber music.

## Graduate Courses and Seminars

**[616 Music and Poetry in France: Late Middle Ages and Renaissance** Spring. 4 credits. D.M. Randel, E. P. Morris. Not offered 1976-77.]

**[651 Twentieth-Century Classics, European and American** Spring. 4 credits. R. M. Palmer. Not offered 1976-77.]

**652 Rhythms** Spring. 4 credits. M 2:30-4:25.

Comparative studies of rhythmic schemes and performances in various styles. Open, with the instructor's consent, to students in languages, psychology, philosophy, dance, anthropology, etc., as well as in music.

**653 Analysis of Structure and Function in Tonal Music** Spring. 4 credits. Qualified upperclass students may enroll with permission of instructor.

**[655 Seminar in Analytic Techniques for Twentieth-Century Music** Fall. 4 credits. Not offered 1976-77.]

**658 Composition** Spring. 4 credits. W 2:30-4:25. R. M. Palmer.

**659-660 Seminar in Composition** 659, fall; 660, spring. 4 credits. T 2:30-4:25. K. Husa.

**681 Introduction to Bibliography and Research** Fall. 4 credits. Prerequisites: a reading knowledge of French and German, and an elementary knowledge of music theory and general music history. M 1:25-4:25. M. A. Keller.

**[684 Seminar in Renaissance Music** Spring. 4 credits. N. A. Zaslav. Not offered 1976-77.]

**685 Schoenberg, Bartók, and Stravinsky** Fall.

5 credits. Prerequisites: ability to play Stravinsky's *Pieces for the Five Fingers*, and a reading knowledge of one relevant foreign language—French, German, Russian, or Hungarian.  
M W F 11:15. W. W. Austin.

**686 Beethoven** Spring. 4 credits.  
Th 1:25–4:25. J. Webster.

**[687 Mozart, His Life, Works, and Times (also German 757)]** Fall. 4 credits. N. A. Zaslav, S. L. Gilman. Not offered 1976–77.]

**[688 Music of the Grand Siècle** Spring. 4 credits. N. A. Zaslav. Not offered 1976–77.]

**[689 Haydn** Fall. 4 credits. Prerequisites: 653 or the equivalent, and a reading knowledge of German. J. Webster. Not offered 1976–77.]

**[690 Ballad Opera** Spring. 4 credits. N. A. Zaslav. Not offered 1976–77.]

**[783–784 Seminar in Medieval Music** 783, fall; 784, spring. 4 credits. D. M. Randel. Not offered 1976–77.]

**785 History of Music Theory** Fall. 4 credits. Prerequisites: a reading knowledge of French or German.  
Th 1:25–4:25. J. Webster.

**[787–788 Debussy to Boulez** 787, fall; 788, spring. 4 credits. W. W. Austin. Not offered 1976–77.]

**[789–790 Liturgical Chant in the West** 789, fall; 790, spring. 4 credits. D. M. Randel. Not offered 1976–77.]

## Philosophy

S. Shoemaker, chairman; M. Black, R. N. Boyd, O. Chateaubriand, G. Fine, C. A. Ginet, T. H. Irwin, N. Kretzmann, D. B. Lyons, N. A. Malcolm, R. W. Miller, R. C. Stalnaker, N. L. Sturgeon, A. W. Wood.

Students expecting to major in philosophy should begin their study of it in their freshman or sophomore year. Admission to the major is granted by the chairman of the department on the basis of a student's work during the first two years.

Eight philosophy courses are required for the major. They must include at least one course in ancient philosophy, at least one other course in the history of philosophy, and a minimum of three courses numbered above 300, at least one of which must be numbered above 400 (with the exception of 490). Philosophy 231, while not required, is especially recommended for majors or prospective majors.

Philosophy majors must also complete at least eight credits of course work in related subjects approved by their major advisers.

Occasionally, majors may serve as teaching or research aides, working with faculty members familiar with their work.

### The Honors Program

A candidate for honors in philosophy must be a philosophy major with a B- or better for all work in the College of Arts and Sciences and an average of B or better for all work in philosophy. In either or both terms of the senior year a candidate for honors enrolls in Philosophy 490 and undertakes research leading to the writing of an honors essay by the end of the final term. Prospective candidates should apply to the Department of Philosophy.

### Distribution Requirements

The distribution requirement in the humanities is

satisfied in philosophy by completing any two courses in philosophy, with the following exceptions: (a) Philosophy 100 if used in satisfying the Freshman Seminar requirement; (b) a combination of two courses in formal logic, such as 231, 431, 432, and 436.

## Introductory Courses

**100 Freshman Seminar in Philosophy** Fall or spring. 3 credits. Open only to freshmen who have not taken 101. Independent sections; limited to 20 students per section.

Fall: M W F 11:15, instructor to be announced; M W F 1:25, instructor to be announced; M W F 2:30, R. N. Boyd; T Th 12:20–1:35, O. Chateaubriand; T Th 10:10–11:25, S. Shoemaker, C. Ginet, instructor to be announced. Spring: M W F 1:25, instructor to be announced; M W F 2:30, instructor to be announced; T Th 10:10–11:25, D. Lyons, N. Malcolm; T Th 2:30–3:45, G. Fine.

**101 Philosophical Classics** Fall or spring. 3 credits. Open only to students who have not taken 100.

Fall: M W F 9:05, N. Kretzmann; Spring: M W F 10:10, N. Sturgeon.

An introduction to philosophy based on readings in recognized philosophical classics and recent commentary, organized according to the principal fields of philosophy.

**131 Logic: Evidence and Argument** Fall. 3 credits. Open only to students who have not taken 231.

M W F 10:10, R. Boyd.  
A course designed to develop skills at analyzing and evaluating reasoning, argumentation, and evidence in the sciences, religion, ethics, the law, politics, and philosophy.

## Courses Primarily for Undergraduates

All 200- and 300-level courses in philosophy are designed primarily for undergraduates and are open to sophomores, juniors, and seniors except as noted in the course descriptions. The 200-level courses generally have no prerequisites. Some 300-level courses have prerequisites which instructors may waive in individual cases. (Graduate students may enroll in 300-level courses only with permission of the instructor.)

**201 Philosophical Problems** Fall. 4 credits.  
M W F 11:15, N. Malcolm.  
Topic for 1976–77: Mind, brain, behavior.

**[210 Ancient Thought** Not offered 1976–77.]

**211 Ancient Philosophy** Fall. 4 credits.  
T Th 12:20–1:35, G. Fine.  
A study of major themes in ancient thought, particularly that of Plato and Aristotle.

**212 Modern Philosophy** Spring. 4 credits. Open also to freshmen who have taken 100 or 101.  
T Th 12:20–1:35, G. Fine.  
A survey of the history of European philosophy in the seventeenth and eighteenth centuries.

**[213 Existentialism and Literature (also Comparative Literature 213)]** Not offered 1976–77.]

**231 Formal Logic** Spring. 4 credits. Also open to freshmen.  
M W F 10:10, C. Ginet.  
The analysis and evaluation of deductive reasoning in terms of formalized language (the sentential calculus and the first-order predicate calculus with identity).

**241 Ethics** Fall. 4 credits.  
T Th 10:10–11:25, N. Sturgeon.  
An introduction to the philosophical study of moral problems and to ethical theories.

**242 Social and Political Philosophy** Spring. 4 credits.  
M W F 2:30, R. Miller.  
A historical survey of philosophical thinking about the nature and norms of human society.

**243 Aesthetics** Spring. 4 credits.  
T Th 2:30–3:45, R. Miller.  
An introduction to philosophical problems concerning the nature of art, aesthetic value, and critical reasoning. Typical subjects include classic attempts to define the nature of genuine art, the objectivity of aesthetic judgment, the relation between the value of a work of art and the truth of the ideas it embodies.

**[244 Philosophy in Literature** Not offered 1976–77.]

**261 Knowledge and Reality** Spring. 4 credits. Also open to freshmen who have taken 100 or 101.  
T Th 10:10–11:25, R. Stalnaker.  
An introduction to philosophical problems concerning the nature of knowledge, of certainty and belief, and of cause, truth, substance, identity, essence, and abstract entities.

**262 Philosophy of Mind** Spring. 4 credits.  
M W F 9:05, S. Shoemaker.  
An introduction to philosophical problems concerned with the mind-body problem, knowledge of other minds, the nature of self-consciousness and self-awareness, personal identity, and freedom of the will.

**263 Religion and Reason** Fall. 4 credits.  
M W F 9:05, E. Stump.  
A survey of topics related to the rational understanding and assessment of theism in the Western tradition.

**[301, 302 Majors Seminar** Not offered 1976–77.]

**[309 Plato** Not offered 1976–77.]

**310 Aristotle (also Society for the Humanities 429)** Spring. 4 credits.  
M 1:25–3:10, T. Irwin.  
Topic for 1976–77: Aristotle on nature, man, and society. Readings from the biological, ethical, and political works.

**311 Modern Rationalism** Fall. 4 credits.  
Prerequisite: at least one course in philosophy.  
M W F 9:05, N. Malcolm.  
Topic for 1976–77: Descartes.

**312 Modern Empiricism** Spring. 4 credits. Open to students who have had at least one course in philosophy.  
M W F 11:15, S. Shoemaker.  
A study of the philosophies of the major British empiricists, in particular Locke, Berkeley, and Hume.

**313 Medieval Philosophy** Spring. 4 credits.  
M W F 10:10, N. Kretzmann.  
A study of selected classic works in medieval philosophy.

**[314 Topics in Ancient Philosophy** Not offered 1976–77.]

**315 Special Topics in the History of Philosophy** Fall. 4 credits. Prerequisite: at least one course in philosophy.  
M W F 2:30, N. Kretzmann.  
Topic for 1976–77: Philosophy and physics in antiquity and the Middle Ages.

**[316 Kant** Fall. 4 credits. Not offered 1976–77.]

**[317 Hegel** Not offered 1976–77.]

**318 Twentieth-Century Philosophy** Spring. 4 credits. Open to students who have had at least one course in philosophy.

T Th 2:30-3:45. O. Chateaubriand.  
Topic for 1976-77: to be announced.

**319 Philosophy of Marx** Fall. 4 credits. Open to students who have had at least one course in philosophy.

M W F 1:25. R. Miller.

An investigation of the philosophical aspects of Marx's social and economic theory and his critique of the capitalist mode of production. Readings will include selections from *Capital* as well as from Marx's earlier writings.

**322 Semantics** Fall. 4 credits. Open to students who have had at least one course in philosophy.

M W F 11:15. R. Stalnaker.

A survey of the philosophy of language and symbolism including discussion of the nature of communication, speech acts, and theories of meaning.

**341 Ethical Theory** Spring. 4 credits.

M W F 1:25. N. Sturgeon.

Topic for 1976-77: to be announced.

**342 Law, Society, and Morality** Fall. 4 credits.

Open to students who have had at least one course in philosophy.

M W F 2:30. D. Lyons.

Topics include: coercion and the nature of law; problems of legal punishment; limitations on liberty; justice and the general welfare.

**361 Metaphysics and Epistemology** Spring. 4 credits.

T Th 10:10-11:25. C. Ginet.

Topic for 1976-77: Knowledge, perception, and memory.

**363 Topics in the Philosophy of Religion** Spring. 4 credits.

M W F 9:05. E. Stump.

Topic for 1976-77: Renaissance and modern writers.

**381 Philosophy of Science** Fall. 4 credits. Open to students who have had at least one course in philosophy.

M W F 11:15. R. Boyd.

An examination of certain topics that arise in attempting to understand the historical development and the logical setting of science; theories and observation, explanation, and the testing of hypotheses.

**382 Philosophy and Psychology** Spring. 4 credits.

M W F 2:30. R. Boyd.

Philosophy of psychology as a special case in the philosophy of science: problems of measurement, theory construction, experimental design, and the relation of psychology to other sciences.

**383 Philosophy of Choice and Decision** Fall. 4 credits. Open to students who have had at least one course in philosophy or at least one course related to the subject matter of the course.

T Th 2:30-3:45. M. Black.

Topic for 1976-77: Rationality.

**[386 Philosophical Problems in the History of Biology** Not offered 1976-77.]

**[387 Philosophy of Mathematics** Not offered 1976-77.]

**[388 Social Theory** Not offered 1976-77.]

**[389 Philosophy of History** Not offered 1976-77.]

**390 Informal Study** Fall or spring. Credit to be arranged. To be taken only in exceptional circumstances and by arrangement made by the student with his or her adviser and the faculty member who has agreed to direct the study.  
Staff.

## Advanced Courses and Seminars

All 400-level courses in philosophy are designed primarily for advanced undergraduates, philosophy majors, and graduate students. All 600-level courses in philosophy are seminars designed primarily for graduate students. The 400- and 600-level courses are open to others only by permission of the instructor as indicated in the course description.

**[412 Medieval Philosophy** Not offered 1976-77.]

**[413 Plato and Aristotle** Not offered 1976-77.]

**431 Deductive Logic** Spring. 4 credits.

Prerequisite: 231 or the equivalent.

T Th 12:20-1:35. O. Chateaubriand.

The first-order predicate calculus: proof theory and model theory; the completeness theorem. Theories and definitions. Axiomatic set theory: sets, functions, relations, cardinals, ordinals, the recursion theorem.

**[432 Deductive Logic** Not offered 1976-77.]

**[433 Philosophy of Logic** Not offered 1976-77.]

**[435 Inductive Logic** Not offered 1976-77.]

**436 Intensional Logic** Fall. 4 credits. Prerequisite: 231 or the equivalent.

M W F 1:25. R. Stalnaker.

Topics chosen from intensional logic, pragmatics, modal logic, tense logic, deontic logic, intuitionistic logic, description theory, and others.

**[437 Problems in the Philosophy of Language** Not offered 1976-77.]

**441 Contemporary Ethical Theory** Spring.

4 credits. Open to graduate students and undergraduates who have had at least two courses in philosophy.

T Th 2:30-3:45. D. Lyons.

Topic for 1976-77: to be announced.

**442 Problems in Ethics and the Philosophy of Mind (also Society for the Humanities 428)** Fall. 4 credits.

M 3:35-5:20. T. Irwin.

Topic for 1976-77: Idealism in ethics and politics.

**461 Metaphysics** Fall. 4 credits. Open to graduate students and to undergraduates who have had at least two courses in philosophy.

T Th 12:20-1:35. C. Ginet.

Topic for 1976-77: Free will.

**462 Theory of Knowledge** Fall. 4 credits. Open to graduate students and to undergraduates who have had at least two courses in philosophy.

T Th 10:10-11:25. S. Shoemaker.

Topic for 1976-77: to be announced.

**[481 Problems in the Philosophy of Science** Not offered 1976-77.]

**490 Special Studies in Philosophy** Fall or spring. 4 credits. Open only to honors students in their senior year.  
Staff.

**611 Ancient Philosophy** Fall. 4 credits.

T 3:45-5:40. G. Fine.

Topic for 1976-77: to be announced.

**612 Medieval Philosophy** Spring. 4 credits.

Th 3:45-5:40. N. Kretzmann.

Topic for 1976-77: to be announced.

**[613 Modern Philosophers** Not offered 1976-77.]

**[619 History of Philosophy** Not offered 1976-77.]

**[631 Logic** Not offered 1976-77.]

**[632 Semantics** Not offered 1976-77.]

**[633 Philosophy of Language** Not offered 1976-77.]

**641 Ethics and Value Theory** Fall. 4 credits.

Th 3:45-5:40. N. Sturgeon.

Topic for 1976-77: to be announced.

**[661 Theory of Knowledge** Not offered 1976-77.]

**662 Philosophy of Mind.** Spring. 4 credits.

T 3:45-5:40. N. Malcolm.

Topic for 1976-77: Wittgenstein's *Zettel*.

**664 Metaphysics** Fall. 4 credits.

W 3:45-5:40. O. Chateaubriand.

Topic for 1976-77: to be announced.

**[665 Metaphysics** Not offered 1976-77.]

**681 Philosophy of Science** Spring. 4 credits.

M 3:45-5:40. R. Boyd.

Topic for 1976-77: to be announced.

**682 Philosophy of the Social Sciences** Spring. 4 credits.

W 3:45-5:40. R. Miller.

Topic for 1976-77: to be announced.

**700 Informal Study** Fall or spring. Credit to be arranged. To be taken by graduate students only in exceptional circumstances and by arrangement made by the student with his or her Special Committee and the faculty member who has agreed to direct the study.  
Staff.

## Related Courses in Other Departments

**Chinese Philosophical Literature (Asian Studies 371)**

**Biomedical Ethics (Bio Sci 205/Philosophy 245)**

**Environmental Ethics (Bio Sci 206/Philosophy 246)**

**Elementary Mathematical Logic (Mathematics 381)**

**[Greek Philosophy (Classics 224-225)** Not offered 1976-77.]

**Introduction to History of Religions (Asian Studies 203)**

**Kierkegaard and Nietzsche (Comparative Literature 698)**

**Seminar in Jewish and Islamic Philosophy (Semitics 243)**

**Seminar on Leibniz and Modern Linguistic Theory [Society for the Humanities 420 (fall); 421 (spring)]**

## Physics

R. M. Littauer, chairman; V. Ambegaokar, N. W. Ashcroft, K. Berkelman, H. A. Bethe (emeritus), R. Bowers, G. C. Brown, D. G. Cassel, G. V. Chester, R. M. Cotts, J. W. DeWire, M. E. Fisher, D. B. Fitchen, B. Gittelman, K. Gottfried, K. Greisen, L. N. Hand, D. L. Hartill, P. L. Hartman, D. F. Holcomb, T. Kinoshita, J. B. Kogut, J. A. Krumhansl, D. M. Lee, H. Mahr, B. W. Maxfield, B. D. McDaniel, N. D. Mermin, N. B. Mistry, H. F. Newhall, M. E. Nordberg, J. Orear, R. O. Pohl, J. D. Reppy, R. C. Richardson, E. E. Salpeter, J. C. Scott, R. H. Siemann, A. J. Sievers, R. H. Silsbee, A. Silverman, P. C. Stein, R. M. Talman, S. A. Teukolsky, M. Tigner, D. H. White, J. W. Wilkins, K. G. Wilson, W. M. Woodward, T. M. Yan, D. R. Yennie.

Three introductory physics sequences are open to

freshmen: 101-102, 112-213-214-315, and 207-208. In addition, there is a cluster of general-education courses 201 through 205. Advanced placement and credit are offered as outlined in the leaflet, *Advanced Placement of Freshmen*, or consult Professor R. Cotts, 522 Clark Hall. Physics 101-102 (noncalculus) has a prerequisite of three years of college-preparatory math. Both 112 and 207 require calculus (e.g., Math 191 or 111), and additional math is required for subsequent courses in sequence. 101-102 or 207-208 may be taken as terminal physics courses. The three- or four- term sequence 112-213-214 (-315) is recommended for physics majors and engineers.

For those wishing to pursue some physics beyond the introductory level, several courses may be appropriate: 205 Energy, 330 Modern Experimental Optics, 360 Introductory Electronics. Transfer students requesting credit for physics courses taken at another college should consult the department office.

### Physics Major

Various options permit the student to concentrate heavily on physics, or to take less physics and pursue an accompanying constellation of courses in a related area. Those desiring a physics concentration as preparation for professional or graduate work should complete 112-213-214 or 112-217-218 (and preferably 315) by the end of the sophomore year. A basic preparation for a less intensive physics program may include 112-213-214 or 207-208. In either case, it is necessary to complete a concurrent sequence of mathematics courses: Math 191-192-293-294 or 193-194-295-296 are normally recommended, except for students especially interested in continuing the study of pure mathematics, for whom Math 111-122-221-222 (or equivalent) may be preferred.

Prospective majors are urged to make an early appointment at the physics office for advice in planning their programs. Acceptance into the major is normally granted after completion of a year of physics and math at a satisfactory level; the student should propose a tentative plan for completing his graduation requirements as well as those for the major. The plan may change from time to time, but it must be approved by the major adviser. The major requirements have two components—a core and a concentration.

### Core

(a) 112-213-214 (or 112-217-218) or 207-208; (b) an intermediate physics course in each of four areas: mechanics 431 or 318; electricity and magnetism 432 or 325; modern physics (315 or 443); and laboratory physics (310, 360, or 410). Math courses prerequisite for the physics courses are also necessary. The choice of core is influenced by the intended concentration. For a concentration in physics, 112-213-214 (or 112-217-218), 318, 325, 315 or 443, and 310 or 410 is appropriate, while for concentrations outside physics part (b) of the core might consist of 315, 431, 432, and 410.

### Concentration

This component reflects the student's interest in some area related to physics; the array of courses must have internal coherence. The concentration must include at least fifteen credits, unless otherwise stated, with at least eight credits at the junior-senior level (above 300). Examples of concentrations: physics; mathematics; biology; chemistry; astrophysics; natural sciences; engineering; computer science; science, technology, and society; environmental studies; intellectual history; history and philosophy of science; city planning and urban development; business and economics.

The concentration in physics is recommended as preparation for professional or graduate work in physics or a closely related discipline. Twelve credits from physics courses above 300, in addition to those selected for part (b) of the core, are required; the program must include 410. Also, the following are strongly advised: 443; Math 421, 422, and 423; and at least one from 341, 444, 454, Applied and Engineering Physics A&E 401, Astronomy 431-432, Geological sciences 485-486. Students with a concentration in physics who wish to emphasize preparation for astronomy or astrophysics should consult the astronomy section of this Announcement.

A combined biology-chemistry concentration is recommended for premedical students or those who wish to prepare for work in biophysics. The concentration in natural science is particularly appropriate for teacher preparation.

### Foreign Language Requirement

Students interested in eventual graduate work in physics are advised to meet this requirement with French, German, or Russian.

### The Honors Program

A student may be granted honors in physics upon the recommendation of the Physics Advisers Committee of the physics faculty.

### Distribution Requirement

The requirement in physical sciences is met by any two sequential courses such as 101-102 or 207-208, or by any two general-education courses from the group presently comprising 201, 202, 203, and 205. "Crossovers" between sequences are permitted if prerequisites are satisfied; however, such crossovers (or the use of a truncated sequence such as 112-213) should be regarded as accidents in the evolution of a student's schedule, not as sound planning.

### Prerequisites

Prerequisites are specified in the following course descriptions to illustrate the materials that students should have mastered. Students who wish to plan programs different from those suggested by the prerequisite ordering are urged to discuss their preparation and background with a physics adviser or with the instructors in the courses. In many cases an appropriate individual program can be worked out without exact adherence to the stated prerequisites.

### Courses

**101-102 General Physics** 101, fall, except by special permission; 102, spring. (101-102 usually is offered also in the Summer Session.) 4 credits per term. Prerequisites: three years of high school mathematics, including some trigonometry. Course 101 (or 112 or 207) is prerequisite to 102. Includes more modern physics and less mathematical analysis than 207-208 or 112-213-214, but more mathematics than courses in the group 200 to 206. Students planning to major in a physical science should elect 207-208 or 112-213-214. A self-paced, mastery-oriented audiotutorial format; students work in a learning center at hours of their own choice. Repeated tests on each unit are given until mastery is demonstrated. One large group meeting on September 7.

T 10:00 or 12:20. G. C. Brown and Staff.

Basic principles treated quantitatively but without calculus. Major topics for 101: particle structure of matter; kinematics; forces and fields (including electric fields); momentum, angular momentum, energy (including nuclear energy); relativity; sound waves. For 102: electricity and magnetism; optics;

thermal physics; quantum physics. Laboratory emphasizes instrumentation, measurement, and interpretation of data. Text: *Physics for College Students—with Applications to the Life Sciences* by Tilly and Thumm.

**112 Physics I: Mechanics and Heat** Fall or spring. (Usually also offered during the Summer Session.) 4 credits. Primarily for students of engineering and for prospective physics majors. Prerequisite: coregistration in Math 192 (or 194 or 112), or substantial previous contact with introductory calculus, combined with coregistration in Math 191 (or 193 or 111). Evening exams will be scheduled.

Lec. M W 10:10 or 12:20; 2 rec per week; one 2-hr. lab alternate weeks. Fall, K. Berkelman; spring, R. H. Siemann.

Mechanics of particles: kinematics, dynamics, special relativity, conservation laws, central force fields, periodic motion. Mechanics of many-particle systems: center of mass, rotational mechanics of a rigid body, static equilibrium. Introduction to thermodynamics. At the level of *Fundamentals of Physics* (Revised Printing, 1974) by Halliday and Resnick.

**201 Great Ideas of Physics** Fall. 3 credits.

Intended for nonscientists; does not serve as a prerequisite to further science courses. Assumes no scientific background, but may use some high school mathematics.

Lec. M W F 2:30; 1 disc. P. C. Stein.

Students will investigate the basic concepts involved in some of the milestones in the evolution of physics. Topics will be selected from Newtonian mechanics; special relativity; gravitation; the difference between left and right; entropy and the "heat death" of the universe; the nature of light; quantum theory and the indeterminacy principle.

**202 Physics in the World Around Us** Spring.

3 credits. Intended for nonscientists; does not serve as a prerequisite to further science courses. Assumes no scientific background, but may use some high school mathematics.

Lec. M W F 2:30; 1 disc. G. V. Chester.

This course will show how the principles of physics explain many of the most striking phenomena we see in the world around us. Typical phenomena which may be included are weather and storms, tides, the flight of birds and airplanes, the color of the sky and sea, and the formation of crystals. Some everyday phenomena that are as yet unexplained may be included for discussion. The level of the course will be that of a typical article in the *Scientific American*.

**203 The Physics of Space Exploration** Spring.

3 credits. Intended for nonscientists; does not serve as a prerequisite to further science courses.

Assumes no scientific background, but may use some high school mathematics.

Lec. M W F 2:30; E. E. Salpeter.

Will show how the principles of physics (plus simple mathematics) are applied to gain knowledge about planets and stars. The physics behind space probes (and their limitations) will be discussed. Interpretation of data from space probes and from earthbound observations will be described. The level of the course will be that of a typical article in *Scientific American*.

**204 Physics of Musical Sound** Fall. 3 credits.

Intended for nonscientists; does not serve as a prerequisite to further science courses. Assumes no scientific background, but will use some high school algebra.

Lec. M W F 2:30. R. H. Silsbee.

The basic physical characterization of sound in terms of pitch, intensity, and tone quality will be developed, as well as the important concepts necessary to understand many features of the production, propagation, and perception of sound. Among the specific problems that will be discussed are mechanisms of tone production in musical

instruments, speculations as to the basis of consonance and dissonance, the structure of musical scales, architectural acoustics, the production of multiphonics on monophonic instruments, and the principles of electronic synthesis of musical sound.

**205 Energy** Spring. 3 credits. Prerequisites: one term of college-level physics or chemistry and one term of college-level mathematics, or permission of instructor.

Lec, M W F 2:30. D. F. Holcomb.  
Energy sources and conversion processes will be studied from two perspectives: the basic physics of energy and its conversion from one form to another, and the use of energy by man. Topics will include gravitational and mechanical energy, electromagnetic energy, thermal processes, the laws of thermodynamics, chemical and nuclear reactions, radioactivity, solar energy, and the behavior of exponential processes. Study of the history of man's use of energy and future prospects for energy sources for the earth will be based upon quantitative examination of relevant conversion processes. At the level of *My Father's Watch*, by Holcomb and Morrison, and *Energy and Power*, a Scientific American book.

**207-208 Fundamentals of Physics** 207, fall; 208, spring. 4 credits per term. Prerequisites for 207: high school physics; coregistration in Math 192 or 112, or substantial previous contact with introductory calculus, combined with coregistration in Math 191 or 111. Prerequisites for 208: 207 (or 112 or 101), and at least coregistration in Math 192 or 112. Physics 207-208 is intended as the first college physics course for students majoring in a physical science, mathematics, or an analytically oriented biological science. Evening examinations will be scheduled.

Lec, M W 9:05 or 11:15; 2 rec per week; one 3-hr lab alternate weeks. H. F. Newhall.  
Core-plus-branch plan. The first nine weeks of each semester are devoted to core material (lec/disc/lab format): 207, particle mechanics and waves; 208, electromagnetic fields and circuits. For the last five weeks each term, each student selects one branch topic and the work on this topic is done on an unstructured, self-paced basis. Possible branches: 207, thermodynamics, acoustics and the physics of music, special relativity, gravitation; 208, optics, introduction to quantum mechanics, nuclear physics, electronics. Core at the level of *Elementary Classical Physics*, 2nd ed., by Weidner and Sells.

**213 Physics II: Electricity and Magnetism** Fall or spring. (Usually offered also during the Summer Session.) 4 credits. Primarily for students of engineering and for prospective physics majors. Prerequisites: 112 and coregistration in the continuation of the mathematics sequence required for 112. Evening exams will be scheduled.

Lec, T Th 9:05 or 11:15; 2 rec per week; one 3-hr lab alternate weeks, and open evening labs optional. Fall, R. A. Buhrman.

Electrostatics, behavior of matter in electric fields, magnetic fields, Faraday's Law, electromagnetic oscillations and waves, magnetism. At the level of *Fundamentals of Physics* (Revised Printing, 1974) by Halliday and Resnick. Lab work supplements the written and oral work; electrical measurements, dc and ac circuits, resonance phenomena, physical electronics, electrical conduction, selected properties of electric and magnetic fields.

**214 Physics III: Optics, Waves, and Particles** Fall or spring. (Usually offered also during the Summer Session.) 4 credits. Primarily for students of engineering and for prospective physics majors. Prerequisites: 213 and coregistration in the continuation of the math sequence required for 112. (310 may be taken, by consent of the instructor, in place of the 214 lab; credit for 214 is then 3 credits.) Evening exams will be scheduled.

Lec, T Th 9:05 or 11:15; 2 rec per week; one 3-hr lab alternate weeks. Fall, J. C. Scott.  
Wave phenomena; electromagnetic waves; physical

optics; quantum effects, matter waves; uncertainty principle; introduction to wave mechanics, elementary applications. At the level of *Fundamentals of Waves, Optics, and Modern Physics* by Young.

**217 Physics II: Electricity and Magnetism** Fall or spring. 4 credits. A more rigorous version of Physics 213 for students who have done very well in 112 and desire a more analytic treatment than that of 213. Acceptance into the course will be determined by the instructor. Students should seek the approval of their adviser before registering. Prospective physics majors are encouraged to select 217. Students are required to do the laboratory work offered in 213 in order to obtain credit for 217. Evening exams may be scheduled.

Lec, T Th S 11:15; lab, as for 213. Fall, R. M. Cotts; spring, L. N. Hand.  
Fundamentals of electricity and magnetism, including the use of vector calculus. At the level of *Electricity and Magnetism* by Purcell (Vol. II, Berkeley Physics Series).

**218 Physics III: Optics, Waves, and Particles** Fall or spring. 4 credits. A special section of 214. Conditions governing enrollment are similar to those of 217. Students are required to do the lab work offered in 214 or to enroll concurrently in 310 (in which case credit for 218 is reduced to 3 credits). Evening exams may be scheduled.

Lec, T Th S 11:15; lab, as for 214 or 310. Fall, J. Orear; spring, R. O Pohl.

**310 Intermediate Experimental Physics** Fall or spring. 3 credits. Prerequisite: 208 or 213. May be taken concurrently with 214 or 218 in place of the laboratory work offered in 214, with consent of student's adviser.

Lab, T W or Th F 1:25-4:25. Fall, A. Silverman.  
Students select from a variety of experiments, and as a final project design and perform an experiment of their own choice. An individual, independent approach is encouraged. Facilities of the 410 lab will be available for some experiments.

**315 Phenomena of Microphysics** Spring. 3 credits. Primarily for students of engineering and prospective majors in physics. Prerequisites: 214, and Math 294.

Lec, T Th S 11:15. D. R. Yennie.  
Introduction to the physics of atoms, solids, and nuclei, emphasizing the description of phenomena using the results of elementary quantum and statistical physics. At the level of *Fundamental University Physics*, Vol. III, by Alonso and Finn.

**318 Analytical Mechanics** Spring. 4 credits. Prerequisites: 208 or 214, one of Math 421, 422, or 423, or permission of instructor. Intended for physics majors concentrating in physics. Similar material is covered in 431 at a less demanding analytical level. (Applied and Engineering Physics A&E 333, fall term, is approximately equivalent.)

Lec, M 11:15-1:15, W 11:15. N. W. Ashcroft.  
Newtonian mechanics of particles and systems of particles including rigid bodies; oscillating systems; gravitation and planetary motion; moving coordinate systems, relativistic kinematics; wave propagation; Euler's equations; Lagrange's equations; Hamilton's equations; normal modes and small vibrations. At the level of *Introduction to the Principles of Mechanics*, by Hauser.

**325 Electricity and Magnetism** Fall. 4 credits. Prerequisites: 208 or 214, and coregistration in one of Math 421, 422, or 423, or permission of instructor. Intended for physics majors concentrating in physics. Similar material is covered in 432 at a less demanding analytical level.

Lec, T Th S 11:15, Th 1:25. J. W. Wilkins.  
Electrostatics: electric charge and fields, potential, multipoles, conductors, Laplace equation and formal solutions, field energy, dielectric materials, polarization. Magnetostatics: currents, magnetic fields and vector potential, magnetic materials, field

energy. Maxwell's equations, Poynting vector. Electrodynamics: plane waves, fields from moving and oscillating charges. At the level of *Lectures on Physics*, Vol. II, by Feynman and *Foundations of Electromagnetic Theory* by Reitz and Milford.

**326 Electromagnetic Waves and Physical Optics** Spring. 4 credits. Prerequisite 325.

Lec, T Th S 9:05, W 1:25. A. Silverman.  
Electrodynamics: applications of Maxwell's equations, wave equation, transmission lines, wave guides, radiation, special relativity. Physical optics: reflection, refraction, dispersion, polarization, Fresnel and Fraunhofer diffraction. At the level of *Classical Electromagnetic Radiation* by Marion.

**330 Modern Experimental Optics** Spring. 3 credits. Prerequisite: one year of physics.

Lec, M 1:25-3:20; lab, T W Th or F 1:25-4:15. H. Mahr.  
A practical, lab-based course for students of physical and biological sciences. Students will select four or five subject units to match their interests and backgrounds. The list of units includes: physics of lasers, image formation, holography, spectroscopy, light pulses, coherence and correlation, diffraction and interference, light sources and detectors. Each unit involves one or more experiments from a set of varying difficulty and sophistication, and readings, supplementary notes, and problems. The course will serve as an introduction to modern optical techniques and equipment used in current research in biology, chemistry, physics, astronomy, etc.

**341 Thermodynamics and Statistical Physics** Fall. 4 credits. Prerequisites: 214 and Math 294.

Lec T Th 9:05, T 2:30. B. Gittelman.  
Statistical physics, developing both thermodynamics and statistical mechanics simultaneously. Concepts of temperature, laws of thermodynamics, entropy, thermodynamic relations, free energy. Applications to phase equilibrium, multicomponent systems, chemical reactions and thermodynamic cycles. Application of statistical mechanics to physical systems; introduction to treatment of Maxwell-Boltzmann, Bose-Einstein, and Fermi-Dirac statistics with applications. Elementary transport theory. At the level of *Fundamentals of Statistical and Thermal Physics* by Reif, or *Thermal Physics* by Morse.

**360 Introductory Electronics** Fall or spring. 4 credits. Prerequisite: 208 or 213 or permission of instructor; no previous experience with electronic circuits is assumed. However, the course moves through the introductory topics (dc and ac circuits, basic circuit elements) rather quickly. Students wishing a somewhat slower-paced treatment might consider Elec E 210 to precede Physics 360. Technical skills of calculus are not required, although such concepts as the time derivative and integral of a function are utilized.

Lec, M 1:25-3:20; lab, T Th or W F 1:25-4:25. Fall, D. M. Lee.  
Basic analysis and design of semiconductor circuits useful in electronic instrumentation, such as: amplifiers; oscillators and waveform generators; switching, digital, and timing circuits; power supplies. Course notes will be supplied; the level is that of *Introductory Electronics for Scientists and Engineers*, 1974, by Simpson (this text is not followed in detail).

**400 Informal Advanced Laboratory** Fall or spring. (Usually offered also during Summer Session.) 3 credits. Prerequisite: two years of physics and permission of instructor.

Lab, as for 410.  
Experiments of widely varying difficulty in one or more areas, as listed under course Physics 410, may be done to fill the student's special requirements.

**410 Advanced Experimental Physics** Fall or spring. 4 credits. Limited to seniors except by special permission. Prerequisites: 214 (or 310 or 360), 318, and 325; or permission of instructor.

Lec, M 2:30-4:25; lab, T W or Th F 1:25-4:25.  
P. Hartman and Staff.

Lectures and problems on selected topics in experimental concepts and techniques. About seventy different experiments are available among the subjects of mechanics, acoustics, optics, spectroscopy, electrical circuits, electron and ion physics, heat, X rays and crystal structure, solid-state physics, cosmic rays, and nuclear physics. The student is expected to perform three to six diverse experiments, depending on difficulty, selected to meet individual needs and interests. Independent work is stressed.

#### 431-432 Introductory Theoretical Physics I and II

431, fall; 432, spring. 4 credits per term. Prerequisites: 431, 207-208, and Math 294 or equivalent; 432, 431 or equivalent; or permission of instructor. Primarily for physics majors with concentrations outside physics, and for graduate students in a science other than physics (e.g., chemistry, engineering, biology, geology). Physics 318 and 325 cover similar material at a higher analytical level, and are intended for physics majors concentrating in physics.

Lec, M W F S 11:15. Fall, D. H. White; spring, J. C. Scott.

431: mechanics. Includes Newtonian mechanics, Lagrange's and Hamilton's equations, central forces, rigid-body motion, and small oscillations. At the level of *Classical Dynamics* by Marion. 432: electricity and magnetism. Includes electrostatics, magnetostatics, boundary value problems, dielectric and magnetic media, circuit theory, Maxwell's equations, and electromagnetic waves. At the level of *Classical Electromagnetic Radiation*, 3rd ed., by Marion.

#### 443 Introductory Quantum Mechanics

Fall. 4 credits. Prerequisites: 318 and 325, or 431-432; Math 421; and some knowledge of atomic physics at the level of *Fundamental University Physics*, Vol. III, by Alonso and Finn.

Lec, M W F 9:05, M 1:25. L. N. Hand.

Introduction to concepts and techniques of quantum mechanics, at the level of *Introduction to Quantum Mechanics*, by Dicke and Wittke.

#### 444 Nuclear and High-Energy Particle Physics

Spring. 4 credits. Prerequisite: 443 or permission of instructor.

Lec, M W F 9:05, F 1:25. K. Berkelman. Behavior of high-energy particles and radiation; elementary particles; basic properties of nuclei; nuclear reactions; nuclear forces; cosmic rays; general symmetries and conservation laws. At the level of *Subatomic Physics* by Frauenfelder and Henley.

#### 454 Introductory Solid-State Physics

Spring. 4 credits. Prerequisite: 443, or Chem 793, or permission of instructor.

Lec, T Th S 10:10, Th 3:35. N. D. Mermin. An introduction to modern solid-state physics, including lattice structure, lattice vibrations, thermal properties, electron theory of metals and semiconductors, magnetic properties, and superconductivity. At the level of *Solid State Physics* by Ashcroft and Mermin.

#### 464 Physics of Macromolecules

Fall. 3 credits.

Prerequisite: a course in quantum mechanics.

Lec, T Th 10:10; disc or guest lec, T 2:30. D. B. Fitchen.

An introduction to the physics associated with the models for, and the experimental investigation of, the structure and physical properties of macromolecules. Primary emphasis will be on macromolecules of biological interest.

#### 481-489 Special Topics Seminars

Fall or spring. 2 credits. S-U grades only. Prerequisite: senior physics major status or permission of instructor.

F 2:30-4:25.

One selected topic of current interest will be studied. Students will participate in organization and

presentation of material.

**490 Independent Study in Physics** Fall or spring. 1-3 credits. Ordinarily limited to seniors. Prerequisite: permission of professor who will direct proposed work.

Individual project work (reading or laboratory) in any branch of physics.

All courses numbered 500 or above carry 3 credits a term, except as noted.

#### 500 Informal Graduate Laboratory

Fall or spring.

Variable credit.

#### 505-506 Design of Electronic Circuitry

505, fall; 506, spring. 3 credits.

Lec, T Th 10:10. Fall, R. O. Pohl; spring, R. M. Cotts. Circuit techniques and design in electronic measurement and instrumentation with emphasis on pulse wave forms. At the level of *Pulse Electronics*, by Littauer.

#### 510 Advanced Experimental Physics

Fall or spring.

Lab, T W or Th F 1:25-4:25. P. Hartman and Staff. About seventy different experiments available among subjects of mechanics, acoustics, optics, spectroscopy, electrical circuits, electronics and ionics, heat, X rays, crystal structure, solid-state, cosmic rays, nuclear physics. Student expected to perform four to eight experiments selected to meet individual needs. Stress on independent work.

#### 520 Projects in Experimental Physics

Fall or spring. 1-3 credits. To be supervised by faculty member.

Projects of modern topical interest that involve some independent development work by student. Opportunity for more initiative in experimental work than is possible in 510.

#### 551 Formalism of Classical Mechanics

Fall. 2 credits.

Lec, T Th 10:10. R. M. Talman. Lagrangian and Hamiltonian formulation of classical mechanics. At the level of *Mechanics*, by Landau and Lifshitz.

#### 553-554 General Relativity

553, fall; 554, spring.

3 credits per term. Offered in alternate years. Prerequisite: knowledge of special relativity at the level of *Classical Mechanics*, by Goldstein.

Lec, T Th 8:30-9:55. S. A. Teukolsky. 553, A systematic introduction to Einstein's theory, with emphasis on modern coordinate-free methods of computation. Topics include: review of special relativity, modern differential geometry, foundations of general relativity, laws of physics in the presence of a gravitational field, experimental tests of gravitation theories. At the level of *Gravitation*, by Misner, Thorne, and Wheeler.

554, A continuation of 553 with emphasis on applications to astrophysics and cosmology. Topics include: relativistic stars, gravitational collapse and black holes, gravitational waves, cosmology.

#### 561 Classical Electrodynamics

Fall. 3 credits.

Lec, M W F 10:10. G. V. Chester. Maxwell's equations, electromagnetic potentials, electrodynamics of continuous media (selected topics), special relativity, radiation theory. At the level of *Classical Electrodynamics* by Jackson.

#### [562 Thermal, Statistical, and Continuum Physics

Not offered in 1976-77. Chem 796 is approximately equivalent.]

#### 572 Quantum Mechanics I

Fall or spring.

3 credits.

Lec, M W F 11:15. Fall, J. B. Kogut; spring,

K. G. Wilson.

Dirac's formulation of quantum mechanics,

transformation theory. Symmetries: angular momentum, the exclusion principle, time reversal. Elements of scattering theory and of perturbation theory. At the level of *Quantum Mechanics* by Gottfried. Familiarity with elementary aspects of Schroedinger equation, including its application to simple systems such as hydrogen atom, assumed.

#### 574 Quantum Mechanics II

Spring. 3 credits.

Lec, M W F 11:15. R. Kinoshita.

Discussion of various applications of quantum mechanics such as collision theory, theory of spectra of atoms and molecules, theory of solids, emission of radiation, relativistic quantum mechanics. At the level of *Intermediate Quantum Mechanics*, by Bethe and Jackiw. Required of all Ph.D. majors in theoretical physics.

#### 612 Experimental Atomic and Solid-State Physics

Fall. 3 credits.

Lec, M W F 1:25. R. C. Richardson.

Lectures on techniques and design principles, emphasis on study of solids by their interactions with electromagnetic fields. Topics: sources and detectors, scanning and resonance techniques, signal-processing, sample characterization, environmental control.

#### [614 Experimental High-Energy Physics

Not offered 1976-77.]

#### 635 Solid-State Physics I

Fall. 3 credits.

Lec, T Th 11:15-12:45. N. W. Ashcroft.

Introduction to solid-state physics including studies of lattice vibrations, electronic structure of metals and insulators, with applications to electrical, thermal, transport properties. At the level of *Introduction to Solid State Physics* (4th Edition) by C. Kittel.

#### 636 Solid-State Physics II

Spring. 3 credits.

Lec, T Th 2:30-4. J. A. Krumhansl.

Concepts developed in 635 extended and applied to survey of the following: band theory and Fermi surface in metals, localized states, magnetism, neutron and light scattering, phenomenological superconductivity.

#### 645 Nuclear Physics

Fall. 3 credits.

Lec, M W F 11:15. D. G. Cassel.

Properties, structure, reactions of nucleons and nuclei, emphasizing interaction between theory and experiment in developing basic ideas. Topics: nucleon-nucleon interaction; nuclear masses, moments, sizes; nuclear models; alpha, beta, gamma decay; nuclear reactions. At the level of *Introduction to Nuclear Physics*, by Enge.

#### 646 High-Energy Particle Physics

Spring. 3 credits.

Lec, M W F 9:05.

Physics of nucleons, mesons, strange particles from an experimental point of view. High-energy phenomena, as opposed to classical nuclear physics. At the level of *High Energy Hadron Physics*, by Perl.

Only S-U grades will be given in courses numbered 650 or above.

#### 651 Advanced Quantum Mechanics

Fall. 3 credits.

Lec, T Th 12:50-2:15. D. R. Yennie.

Relativistic quantum mechanics with emphasis on perturbation techniques. Extensive applications to quantum electrodynamics. Introduction to renormalization theory. At the level of *Relativistic Quantum Mechanics* by Bjorken and Drell.

#### 652 Quantum Field Theory

Spring. 3 credits.

Lec, M W F 10:10. T.-M. Yan.

Canonical field theory, model field theories, Green's functions, renormalization. Introduction to analytic properties of scattering amplitudes and dispersion relations. Applications to strong interactions. At the level of *Relativistic Quantum Fields* by Bjorken and Drell.

**653 Statistical Physics** Fall. 3 credits.

Lec, M W F 9:05. N. D. Mermin.  
Survey of topics in statistical physics such as approximation methods; scattering of light, X-rays, neutrons; Boltzmann equation; phenomenological Fermi liquid theory and theory of simple fluids; introduction to Kubo formulae; superfluidity and superconductivity; computer experiments. At the level of *Statistical Physics* by Landau and Lifshitz.

**654 Theory of Many-Particle Systems** Spring. 3 credits.

Lec, T Th 10:10-11:35. J. W. Wilkins.  
Equilibrium and transport properties of microscopic systems of many particles studied at zero and finite temperatures. Thermodynamic Green's function techniques introduced and applied to such topics as normal and superconducting Fermi systems, superfluidity, magnetism, insulating crystals.

**661 High-Energy Phenomena** Fall. 3 credits.

Lec, M Th F 3:35. K. Gottfried.  
Topics of current interest in theory of strong interactions. At the level of *Dispersion Relations* by Klein.

**665 Topics in Theoretical Astrophysics** Fall. 3 credits.

Lec, M W 2:30-4. E. E. Salpeter.  
Typical topics: solid-state astrophysics, theory of stellar atmospheres, theories of interstellar medium. Topics and their treatment vary from year to year. (Usually offered in fall term of even calendar years.)

**681-689 Special Topics** Offerings to be announced each term.

Typical topics are: group theory, analyticity in particle physics, weak interactions, superfluids, stellar evolution, plasma physics, cosmic rays, general relativity, low-temperature physics, X-ray spectroscopy or diffraction, magnetic resonance.

**690 Independent Study in Physics** Fall or spring.

Variable credit. Special graduate study in some branch of physics, either theoretical or experimental, under the direction of any professional member of the staff.

## Psychology

B. P. Halpern, chairman; E. K. Adkins, H. A. Alker, A. W. Boykin, U. Bronfenbrenner, J. Catlin, R. B. Darlington, J. M. Farber, H. M. Feinstein, E. J. Gibson, J. J. Gibson, R. E. Johnston, S. C. Jones, R. Kraut, W. W. Lambert, H. Levin, D. Levitsky, J. B. Maas, R. D. Mack, L. Meltzer, M. P. Naditch, U. Neisser, D. T. Regan, T. A. Ryan, S. R. Shattuck-Hufnagel, K. E. Weick, D. Zaborik.

### The Major

Prerequisites for admission are: (a) any three courses in psychology (Human Development and Family Studies 115 may be counted toward the three-course requirement); students often begin with Psychology 101; (b) no grade below C+ in any psychology course; (c) acceptance by the admissions committee of the Department of Psychology.

Application forms may be obtained at the departmental office and should be filed two weeks before the preregistration period.

Requirements for the major are: (a) a total of forty credits in psychology (including prerequisites) in

which students majoring in psychology are expected to choose, in consultation with their advisers, a range of courses that cover the basic processes in psychology; laboratory and/or field experience is recommended; (b) completion, before the beginning of the senior year, of an approved course in statistics, or the passing of an achievement examination administered by the department.

With the permission of the major adviser, courses in other departments may be accepted toward the major requirements.

### Concentration in Social Psychology

In cooperation with the Department of Sociology, a concentration in social psychology is available. Psychology majors who wish to specialize in social psychology are expected to meet the general requirements set by the department, including statistics. To ensure a solid interdisciplinary grounding, students in the concentration will be permitted to include in the major courses in sociology and related fields. Advisers will assist the student in the selection of a coherent set of courses in social organization, cultural anthropology, experimental psychology, social methodology, and several aspects of social psychology. Seniors in the concentration may elect graduate seminars.

### The Honors Program

The honors program is intended to give students an opportunity to examine selected problems in depth, and to carry out independent research under the direction of a faculty member. During the spring term of the junior year, an honors student will develop a proposal and begin work on a research project. The student will consult with an honors adviser and a faculty sponsor. At the end of the spring term, a report of the semester's work will be submitted for faculty review.

By the fall term of the senior year, honors students will have begun work on their final research projects. They will also enroll in a senior honors seminar in which research projects will be discussed. Thesis research will continue in the spring with enrollment in Psychology 498, Senior Honors Dissertation. Final honors standing is based on a written thesis and an oral defense of the thesis, as well as on general academic performance.

Prospective applicants are advised to file applications early in the fall term of their junior year. It is possible for a student who has satisfactorily completed independent study or research to be admitted to the program at the end of the junior year. For consideration by the honors committee of the Department of Psychology, applicants must have a minimum cumulative grade average of B in all courses in psychology.

### Distribution Requirement

The distribution requirement in social science is satisfied by any two courses in psychology. (Human Development and Family Studies 115 and Education 110 may be counted.)

**101 Introduction to Psychology: the Frontiers of Psychological Inquiry** Fall. 4 credits. Students may not receive credit for both Psychology 101 and Education 110.

M W F 10:10 and 1 seminar, hours to be arranged. J. Maas.

The study of human behavior from the standpoint of the basic processes. Topics include brain control, sleep and dreaming, psychological testing, perception, learning, motivation, abnormal behavior, psychotherapy, and other aspects of applied psychology. Emphasis is upon contemporary problems confronting psychologists.

**HDFS 115 Human Development: Infancy and Childhood** Fall. 3 credits.

M W F 11:15. H. Ricciuti, J. Weicz.

Provides a systematic analysis of the forces affecting human development from infancy through childhood. Attention is focused on the interplay of biological factors, interpersonal relationships, social structure, and cultural values in changing behavior and shaping the individual. Special emphasis is given to the social implications of existing knowledge.

**123 Introduction to Psychology: Biopsychology** Fall. 3 credits.

T Th 9:05 and 1 section, hours to be arranged. E. Adkins.

A survey of behavior emphasizing evolutionary and physiological approaches, designed to introduce students to the interface between biology and psychology. Both human and nonhuman behavior will be included, together with theoretical issues pertaining to the application of biological principles to human behavior. Films, discussion.

**128 Understanding Personality and Social Behavior** Spring. 4 credits.

M W F 10:10 and 1 seminar, hours to be arranged. S. C. Jones.

An examination of personality and social influences on the individual's adjustment to himself and his environment. Both classic and contemporary viewpoints will be considered and evaluated in the light of empirical evidence.

**201 Introduction to Psychology as a Laboratory Science** Fall. 3 credits. Prerequisite: one course in psychology [normally 101, 123, or 128 (formerly 102)]. High school credit in psychology may meet this prerequisite with permission of instructor.

Lec, M W 10:10; lab, T or Th 9:05-11 or M or W 1:25-3:20. D. Zaborik.

Lectures and laboratory exercises will emphasize basic concepts of measurement, research design, and the relation between theory and experiment. Experiments will be drawn from several areas of psychology, and will be designed to provide experience with some of the most useful psychological research procedures.

**205 Perception** Fall. 4 credits.

M W F 9:05. J. Farber.

Basic concepts and phenomena in the psychology of perception, with emphasis on the stimulus variables and sensory mechanisms involved. Visual and auditory perception will be discussed in detail, with some attention paid to other senses. Weekly laboratory sessions will demonstrate important phenomena.

**206 Psychology in Business and Industry (also Hotel Administration 314)** Spring. 3 credits.

Prerequisites: 101, 123, or 128 (formerly 102), or HDFS 115, or permission of instructor. Not recommended for upperclass students in ILR.

M W F 12:20. S. Davis.

The principles of psychology applied to industrial and business systems; personnel selection; placement and training; problems of people at work including evaluation, motivation, efficiency, and fatigue; and the social psychology of the work organization.

**207 Motivation Theory: Contemporary Approaches and Applications** Fall. 4 credits.

Prerequisite: an introductory psychology course; 201 recommended but not required.

T Th 10:10-12:05. A. W. Boykin.

Models and research in human motivation are examined and integrated. Traditional approaches are utilized as departure points for the study of more current themes, such as intrinsic motivation and achievement motivation. Attention is given to how pertinent are various themes to real-life behavioral settings. Periodic demonstration-discussion sections are conducted.

**210 Attention and Memory** Spring. 3 credits.

Prerequisite: an introductory course in psychology. M W F 9:05. U. Neisser.

A study of the relations between the constructive processes of attention and memory, emphasizing recent studies of attentive processes in vision, of selective listening, of short-term memory, mental imagery, cognitive organization, and long-term recall.

### 212 Historical Roots of Modern

**Psychology** Spring, 4 credits. Prerequisite: one course in psychology or permission of instructor.  
M W F 12:20. J. Catlin.

A survey of the major historical antecedents of contemporary psychology, including the philosophical traditional (from Aristotle through the Enlightenment), the medical-therapeutic tradition, and the rise of modern science and experimental psychology.

**215 Linguistics and Psychology** Spring, 3 or 4 credits. The 4-credit option involves an additional laboratory project or paper. Open to first-year students.

M W F 1:25. S. Shattuck-Hufnagel.  
An introductory course covering the recent developments in a new field of study based on psychology and linguistics. Topics covered will be the nature of language and its acquisition, the influence of the sounds and grammar of language on preception, memory, and production of sentences.

**[280 Social Influences Processes: Attitude and Behavior Change (also Sociology 280)]** Spring, 3 credits. D. Regan. Not offered 1976-77. Will be offered 1977-78.]

**281 Interpersonal Relations and Small Groups (also Sociology 281)** Spring, 3 credits. Limited to 40.

Lec, M 1:25-2:15; lab, W 12:20-2:15 or F 1:25-3:20. L. Meltzer.  
Lectures and readings will concern the processes, relationships, and social arrangements in small groups. The laboratory will involve the class in self-study, as individual personalities and as group participants. The two approaches should develop sensitivity to group processes as well as to the effects we ourselves have on other persons.

**282 Sex Roles (also Sociology 282)** Fall, 3 credits. Prerequisite: a course in sociology or 128 (formerly 102).  
M W F 2:30. J. L. Laws.

The consequences of being born female (or male) are systematically examined. Topics include: 1) role theory: what do we mean by roles? 2) sex roles; 3) sex-role socialization; 4) sex and education; 5) sex and occupational role; 6) sex and family roles; 7) sex roles and sex; 8) sex-role liberation; 9) comparative studies of sex role.

**[284 Applied Social Psychology (also Sociology 284)]** Fall, 3 credits. Prerequisite: 128 (formerly 102) or a course in social psychology. L. Meltzer. Not offered 1976-77.]

**285 Personality and Social Systems (also Sociology 285)** Fall, 4 credits. Prerequisite: one course in either psychology or sociology.  
T Th 10:10-11:25. Staff.

Perspectives will be developed for understanding personality and behavior in a cultural context. A number of theories and conceptual approaches that have been used to understand the relationship between personality and social systems will be critically examined. Some themes in contemporary American culture will be discussed.

**289 Conformity and Deviance (also Sociology 289)** Spring, 4 credits. Prerequisites: one course in psychology or sociology.

M W F 1:25. R. Kraut.  
What are the ways in which conformity pressures, in all their variations, can lead to deviance? To attempt an answer we will examine some of the conformity bases for run-of-the-mill, normal behavior, and then use the concepts developed to illuminate such

behavior as mob violence, suicide, juvenile crime, and craziness.

**[303 Learning** Spring, 3 credits. Prerequisite: 201 or a 300-level laboratory course in psychology. D. Zahorik. Not offered 1976-77. Will be offered 1977-78.]

**[304 Learning Laboratory** Spring, 2 credits. Prerequisite: 201 or a 300-level laboratory course in psychology. D. Zahorik. Not offered 1976-77. Will be offered 1977-78.]

**305 Visual Perception** Spring, 3 or 4 credits depending on whether the student chooses to do an independent laboratory project. Prerequisite: 205 or permission of instructor.  
M W F 11:15. J. Farber.

A detailed examination of theories and processes in visual perception. Topics will include the perception of color, space, and motion; perceptual constancies; adaptation; pattern perception; and aspects of perceptual learning and development.

**[307 Motivation** Fall, 4 credits. Prerequisites: 101 and 201, or 303-304, or permission of instructor. Not offered 1976-77.]

**308 Perceptual Learning** Fall, 3 credits. Prerequisite: 201 or 305 or permission of instructor.  
M W F 11:15. E. Gibson.

Theories of perceptual learning will be compared and evaluated in the light of current research and their application to the reading process.

**309 Development of Perception and Attention** Spring, 3 credits. Prerequisite: 201, 305, or 308, or permission of instructor.  
M W F 10:10. E. Gibson.

Effects of early rearing conditions on development; development in children of perception of objects, events, the spatial layout, pictures, and symbols.

**[313 Cognitive Processes** 3 credits. Prerequisite: six credits of psychology or permission of instructor. Not offered 1976-77.]

**316 Auditory Perception** Fall, 4 credits. Prerequisite: 205 or permission of instructor.  
M W F 1:25; lab, hours to be arranged.  
S. Shattuck-Hufnagel.

Basic problems in audition with special consideration of speech perception.

**322 Physiological Psychology (also Biological Sciences 322)** Spring, 3 credits. Prerequisites: 201 or a 300-level laboratory course in psychology, one year of introductory biology for majors, or its equivalent, and Chem 103-104 or its equivalent.  
T Th 10:10-11:30. E. Adkins.

Neural and hormonal mechanisms of sleep, activity, and arousal; learning and memory; aggressive and sexual behavior; regulatory behavior; maladaptive behavior; and motor activity.

**324 Physiological Psychology Laboratory (also Biological Sciences 324)** Spring, 3 credits. S-U grades optional. Enrollment limited. Prerequisites: 201, Bio Sci 321, and permission of instructor; also concurrent or prior registration in 322.  
T W 1:25-4:25. E. Adkins.

Experiments designed to provide research experience with neural and hormonal mechanisms of behavior. A variety of techniques, species, and behavior patterns will be included.

**325 Introductory Psychopathology** Fall, 3 or 4 credits. The 3-credit option entails the lectures, readings, and two exams. The 4-credit option requires an additional seminar-recitation meeting and a term paper. May be taken concurrently with 327 (for 3 credits in 325 and 2 credits in 327) with permission of instructor. Enrollment in 327 is limited. Prerequisite: a course in introductory psychology.  
M W 1:25-3:20. W. C. White.

An introduction to the study of the various forms of psychopathology, child and adult, as they relate to the experiences of human growth and development. Presents a description of the major syndromes, investigations, theories of etiology, and approaches to treatment.

**326 Comparative Psychology** Fall, 4 credits. Prerequisite: 201 or 205, or Bio Sci 101-102, or permission of instructor.  
Lec, M W F 10:10; lab, Th 2-5 or 7-10 p.m.  
R. Johnston.

Centers on communication and social behavior of animals and the evolution of behavior. The laboratory is an integral part of the course and provides an opportunity to observe the behavior of several different species and to learn several methods of recording behavior for quantitative analysis.

**327 Continuing Fieldwork in Psychopathology and the Helping Relationship** Fall or spring, 2 credits per term, not to exceed a total of 10 credits. Prerequisites: 325, or concurrent registration in 325, or 426, and permission of instructor.  
R. Mack.

Designed to allow students who have begun fieldwork as part of Psy 325 or 426 to continue their field placements, under supervision and for academic credit. In addition to the fieldwork, there will be a weekly seminar meeting to discuss the assigned readings and issues pertaining to the field placements.

**[329 Behavioral Maturation (also Biological Sciences 329)]** Fall, 3 credits. Prerequisites: one year of college biology and one physiological psychology course or equivalent. Enrollment limited to 50. Not offered 1976-77.]

**345 Afro-American Perspectives in Experimental Psychology (also Africana Studies 345)** Spring, 3 or 4 credits. Prerequisite: introductory course in psychology or AS&RC 171.

T Th 2:30-4:25, plus one hour to be arranged if taken for 4 credits. A. W. Boykin.  
Designed to examine crucial conceptual, empirical, and philosophical issues in experimental psychology that are directly relevant to Afro-Americans. Traditional approaches are probed and evaluated. Alternative thrusts from a black perspective are entertained and critiqued. Finally, the research process will be evaluated as a potential tool for analysis and action in black communities.

**350 Statistics and Research Design** Fall, 4 credits. Prerequisite: a course in the behavioral sciences. Evening preliminary examinations will be held September 28 and November 9.  
M W F 10:10. J. Vopava, D. Zahorik.  
Devoted about equally to elementary applied statistics—both estimation and hypothesis testing—through two-way analysis of variance, and to general problems in the design and analysis of research projects.

**361 Biochemistry and Human Behavior (also Nutritional Sciences 361)** Fall, 3 credits. Prerequisites: Bio Sci 101-102, Chem 103-104, Psych 123, or permission of instructor.  
M W F 11:15. D. Levitsky.

This course is intended to survey the scientific literature on the role of brain and body biochemical changes as determinants of human behavior. The topics covered will include action and effects of psychopharmacologic agents, biochemical determinants of mental retardation, biochemical theories of psychosis, effects of nutrition on behavior. A fundamental knowledge of human biology and chemistry is essential.

**381 Social Psychology (also Sociology 381)** Fall, 4 credits. Prerequisites: one course in psychology or three credits of sociology.  
M W F 12:20. W. Lambert.  
An advanced introduction to social psychology.

Topics covered include methodology, socialization, attitudes and attitude change, communication, propaganda, group processes, cognitive consistency, and attribution theory.

**[382 Individual Differences and Psychological Assessment (also Sociology 382)]** Spring. 4 credits. Prerequisites: a previous or concurrent course in statistics and junior standing. H. Alker. Offered in alternate years. Not offered 1976-77.]

**[385 Theories of Personality (also Sociology 385)]** Spring. 4 credits. Prerequisite: 101 or 128 (formerly 102), or permission of instructor. Not offered 1976-77.]

**386 Human Ethology** Fall. 4 credits. Prerequisites: a course in social psychology or animal social behavior or permission of instructor. Offered in alternate years.

M W 2:30-4. R. Kraut.  
Biological and other approaches to human social behavior will be examined using naturalistic observation techniques. One emphasis will be on parallels between nonhuman vertebrates and humans. Topics include nonverbal communication, use of space, bonding, and interaction rituals.

**387 Psychological Aspects of Political Behavior (also Sociology 387)** Fall. 4 credits. Prerequisites: junior standing and a course in social or personality psychology, or permission of instructor.

M W F 9:05. H. Alker.  
A survey of contributions from psychology and sociology to the explanation of political behavior. Topics include power styles, ideology, social movements, psychocultural theories of war, manipulation techniques, political competence, and Machiavellianism.

**401 Psychological Testing** Spring. 4 credits. Prerequisites: 6 credits in psychology and a course in elementary statistics. Offered in alternate years.

T Th 11:15-1:10. R. Darlington.  
Emphasis is on logical and mathematical problems in the interpretation, evaluation, and construction of tests. No training in administering tests.

**407 Selected Issues in Human Motivation** Spring. 4 credits. Limited to 20. Prerequisites: 207 or 10 credits in psychology, and permission of instructor.

W 2:30-5. A. W. Boykin.  
An in-depth probe of selected contemporary topics in the field of human motivation, such as motivation and academic achievement, intrinsic motivation, motivation in cognitive development. The course will combine instructor lectures and student presentations. Topic, spring, 1976: Intrinsic motivation.

**[408 In Search of the Engram]** 3 credits. Not offered 1976-77.]

**411 Memory as a Cognitive Skill** Fall. 4 credits. Prerequisite: 210 or permission of instructor. Enrollment limited to 20.

T Th 2:30-4. U. Neisser.  
Memory and other cognitive activities will be considered in their cultural context and in the terms of the skills involved. Topics include memory in children; individual and cultural differences; effects of meaningfulness, literacy, and schooling; specific cognitive skills including rehearsal, verbal labeling, categorization, imagery, and mnemonic devices.

**416 Psychology of Language** Fall. 4 credits. Prerequisite: 215 or permission of instructor.

M W F 1:25. J. Catlin.  
An advanced treatment of the nature of the human capacity for language. Topics will include the nature of linguistic theory, syntax and semantics, aspects of language use (comprehension, memory/knowledge, thought and action, communication), and language acquisition.

**[425 Brain and Behavior (also Biological Sciences 425)]** Fall. 3 credits. Prerequisites: one year of college biology, one physiological psychology course, or equivalent. Enrollment limited to 40. Not offered 1976-77.]

**426 Seminar and Practicum in Psychopathology** Spring. 4 credits. Prerequisites: open to majors in psychology or the equivalent (e.g. HDFS) who have taken 325 and have junior or senior status. Permission of instructor required in all cases.

T Th 1:30-3; fieldwork times to be arranged.  
R. Mack.  
A fieldwork and seminar course for advanced students who have mastered the fundamental concepts of personality and psychopathology. An opportunity to explore in depth the various forms of psychopathology, etiology, and treatment, to discuss these in seminar, and to work with mental health professionals and those who seek their help.

**440 Sleep and Dreaming** Spring. 4 credits. Prerequisites: advanced undergraduate or graduate standing and permission of instructor. Enrollment limited to 15.

T 10:10-12:05, plus some evening dates. J. Maas.  
Investigation of animal and human physiological and psychological research on sleep and dreaming. Explores the relationship between physiological evidence, empirical laboratory research, and clinical findings in the process and content of the dream state. Focuses on research designs and techniques used in the animal and human sleep laboratory.

**442 Physiological Mechanisms of Animal Social Behavior** Spring. 4 credits. Prerequisites: course experience in both physiology and behavior, 322 and 326 or Bio Sci 321, or permission of instructor.

T Th 10:10-12:05. R. Johnston.  
This course attempts to integrate physiological and behavior levels of analysis. It concentrates on the ways in which hormones affect behavior and behavior affects hormones. Species similarities and differences will be evaluated from a functional and evolutionary point of view.

**[444 Theories of Human Behavior]** Spring. 4 credits. Prerequisite: senior or graduate standing. Not offered 1976-77.]

**[445 Research Excursions in Black Psychology]** Spring. 4 credits. Prerequisites: 345, or 20 credits of behavioral sciences, or graduate standing, and permission of instructor. A. W. Boykin. Offered in alternate years. Not offered 1976-77.]

**[462 Intentional Behavior]** Fall. 4 credits. Prerequisites: one of 207, 303, 308, 310, 385, or permission of instructor. Not offered 1976-77.]

**[464 Motivation and Human Learning]** Spring. 4 credits. Prerequisites: 303-304, 307, or 310, or permission of instructor. Offered in alternate years. Not offered 1976-77.]

**[465 Mathematical Behavior Theory]** Fall. 4 credits. Prerequisite: one year of calculus. Not offered 1976-77.]

**[467 Seminar: The Examined Self—A Psychohistorical View]** Spring. 4 credits. Prerequisites: nine credits of psychology including 325 or equivalent, and permission of instructor before preregistration. H. Feinstein. Not offered 1976-77.]

**468 American Madness** Spring. 4 credits. Prerequisite: 325 and permission of instructor.  
M 1:25-3:30. H. Feinstein.  
This seminar will be devoted to an analysis of insanity as a psychological and historical phenomenon. Selected writings by the mentally ill and their definers will be studied.

**469 Seminar: Psychotherapy: Its Nature and Influence** Spring. 4 credits. Enrollment limited to

senior psychology majors. Prerequisites: 325 or equivalent and permission of instructor before preregistration.

Th 7:30-10 p.m. R. Mack.  
A discussion seminar on the nature of psychotherapy. Issues related to therapeutic goals, differing views of the nature of man, ethical concerns, and research problems also will be considered. Presentations by therapists of differing orientations and experiential and role-play exercises will be an integral part of the seminar experience.

**471-472 Statistical Methods in Psychology** 471, fall; 472, spring. 4 credits per term. Prerequisites: 101 or HDFS 115, 201, or permission of instructor; 471 or 350 is prerequisite to 472.

M W F 1:25. T. A. Ryan.  
An analysis of the methods of treating various kinds of psychological data. Fall term: probability and treatment of frequency data; tests of significance, confidence limits, and other methods of statistical inference; parametric and nonparametric tests. Spring term: analysis of variance and treatment of complex experimental designs; linear, curvilinear, and multiple regression, and correlation.

**[475 Analysis of Nonexperimental Data]** Fall. 4 credits. Prerequisite: 350 or equivalent. Offered in alternate years. R. Darlington. Not offered 1976-77.]

**480 Beliefs and Attitudes (also Sociology 480)** Fall. 4 credits. Prerequisite: 280 or Soc 280, or graduate standing, or permission of instructor.

M W F 11:15. L. Meltzer.  
An intensive analysis of theory and research on beliefs, attitudes, values, intentions, and behaviors. Cognitive consistency (balance, congruity, dissonance), Fishbein's expectancy-value formulation, and Rokeach's analysis of values will be given special attention.

**481 Advanced Social Psychology (also Sociology 481)** Fall. 4 credits. Prerequisite: a course in social psychology or permission of instructor.

T Th 10:10-11:25. D. Regan.  
Selected topics are examined in depth, with an emphasis on experimental research. Readings consist mainly of original research reports. Topics discussed include some of the following: social comparison theory, social and cognitive determinants of emotions, cognitive dissonance, attribution processes, interpersonal attraction, aggression, altruism, and research methods in social psychology.

**[483 Social Interaction (also Sociology 483)]** Spring. 4 credits. Prerequisites: one course in psychology and one course in sociology. Enrollment limited to 15. D. Hayes. Not offered 1976-77.]

**485 Advanced Personality** Spring. 4 credits. Prerequisites: previous course at 200 or 300 level in personality or graduate standing. Offered in alternate years.

M W F 9:05. H. Alker.  
Topics of current research or theoretical interest, such as situational specificity vs. personality consistency, humanistic vs. behavioristic personality change, information processing styles, time perspective, affect, and self-control.

**486 Research Issues in Human Sexuality (also Sociology 486)** Spring. 4 credits. Prerequisite: permission of instructor.

J. L. Laws.  
Dominant paradigms and established data from current research on human sexuality will be assessed from the perspective of the sociology of knowledge. Prospects and priorities for future research will be assayed. Course will not cover reproductive biology, sexual "problems," or counseling.

**[487 Selected Problems in Psychopathology and Society (also Sociology 487)]** Spring. 4 credits. Prerequisites: one course in personality or

psychopathology and one course in statistics. M: Naditch. Not offered 1976-77. Will be offered 1977-78.]

**488 Experiments in Real-Life Situations (also Sociology 488)** Spring. 4 credits. Prerequisites: two courses in social psychology or human development and one course in statistics, or permission of instructor.

T Th 2:30-4. U. Bronfenbrenner.  
An analysis of research designs and findings on human behavior and development in real-life social situations. Attention is focused on theoretical and methodological issues as well as implications for social policy.

**489 Seminar: Selected Topics in Social Psychology (also Sociology 489)** Fall. 4 credits. Prerequisites: one course in psychology and one course in social psychology or sociology and permission of instructor.  
T 2:30-4:30. S. C. Jones.

**492 Principles of Neurobiology Laboratory (also Biological Sciences 492)** Spring. 4 credits. Prerequisite: Bio Sci 397 (formerly 326), or Psych and Bio Sci 495 (formerly 427) (may be taken concurrently), or permission of instructors. Enrollment limited to 36.

M W or T Th 1:25-4:25. B. P. Halpern, T. Podleski, D. N. Tapper, and staff.  
Laboratory practice with neurobiological preparations and experiments, designed to teach the students the techniques, experimental designs, and research strategies used to study biophysical and biochemical properties of excitable membranes, sensory receptors, and the central nervous system transformation of afferent activity, and the characteristic composition and metabolism of neural tissue.

**494 Junior Honors** Spring. 4 credits. Prerequisite: admission to the departmental honors program.  
Staff.

**495 Sensory Function (also Biological Sciences 495)** Fall. 3 credits. Prerequisite: Bio Sci 321 or the equivalent. Offered in alternate years. Not offered 1977-78.

M W 11:15; disc, hours to be arranged.  
B. P. Halpern, D. N. Tapper.  
Sensory receptors and the central nervous system transformation of afferent activity will be considered in relation to the adaptive significance of behavior. The receptors will be examined in terms of anatomy, biochemistry, biophysics of transduction, and the central nervous system control of peripheral input.

**496 Supervised Study** Fall or spring. 2 credits. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade.  
Staff.

**497 Supervised Study** Fall or spring. 4 credits. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade.  
Staff.

**498 Senior Honors Dissertation** Fall. 4 credits. Prerequisite: Admission to the departmental honors program.  
Staff.

**499 Senior Honors Dissertation** Spring. 4 credits. Prerequisite: admission to the departmental honors program.  
Staff.

## Advanced Courses and Seminars

Advanced seminars are primarily for graduate students, but with the permission of the instructor, they may be taken by qualified undergraduates. The selection of seminars to be offered each term will be determined by the needs of the students.

A listing and description of advanced seminars is available at the beginning of each semester. Please contact the Department of Psychology office. Except where indicated, the following courses may be offered either term; 4 credits.

### 510-511 Perception

### 512-514 Visual Perception

### 513 Learning

### 515 Motivation

### 517 Language and Thinking

### 518 Psycholinguistics

### 519-520 Cognition

### 521 Psychobiology

### 523 Physiological Psychology

### 525 Mathematical Psychology

### 531 History of Psychology

### 535 Animal Behavior

### 541 Statistical Methods

### 543 Psychological Tests

### 545 Methods in Social Psychology

### 547 Methods of Child Study

### 561 Human Development and Behavior

### 580 Experimental Social Psychology (also Sociology 580)

### 583-584 Proseminar in Social Psychology (also Sociology 583-584)

### 586 Interpersonal Interaction

### 587 Personality (also Sociology 587)

### 588 Social Change, Personality, and Modernization (also Sociology 588)

### 591 Educational Psychology

### 595 The Teaching of Psychology

### 596 Improving College Teaching

### 599 Interactive Computer Applications in Psychological Research

### 611 Practicum in Research

### 621 Thesis Research

### 682 Social Psychology (also Sociology 682)

### 683 Seminar in Interaction (also Sociology 683)

### 684 Seminar: Self and Identity (also Sociology 684)

### 690 Nutrition and Behavior

### 691 Independent Research

### 692 Independent Study

## Semitic Languages and Literatures

D. I. Owen, chairman; B. Netanyahu, M. Pelli, I. Rabinowitz, M. B. Schub.

The Department of Semitic Languages and Literatures offers Cornell undergraduates access to the history and archaeology, civilization and culture, philosophy and thought of the cultures that produced Judaism, Christianity, and Islam, and that today help define and characterize the many millions of people who live in countries that comprise the region we call the Middle East. The Semitic languages are not only the languages of the old Testament and of the Koran but of literatures of intrinsic merit and interest, whose influence has permeated and enriched the literatures of many other civilizations, both Eastern and Western, ancient and modern, including our own. Studies pursued in this department, therefore, will be found of lasting benefit to all whose career interests involve the modern Middle East, and to all whose interest in the cultures of the ancient Near East is more than casual. The department offers students majors in Semitic languages and literatures, biblical and Near Eastern civilization, history of the Jewish people, or Hebrew language and literature.

## Semitic Languages and Literatures

Those who major in Semitic languages and literatures must successfully complete (a) proficiency in Hebrew and qualification in a second Semitic language; (b) twenty-four credits selected from courses listed under Akkadian, Arabic, Aramaic, Hebrew, Ugaritic, biblical literature, Arabic literature, history of Near Eastern civilization; (c) and fifteen credits in related subjects, listed under history of the Jewish people, general Judaic studies, modern Hebrew literature, or any courses in the humanities selected in conference with the adviser.

## Biblical and Near Eastern Civilization

Those who major in biblical and Near Eastern civilization must successfully complete (a) qualification in Classical Hebrew and one other Semitic language; (b) twenty-four credits selected from the courses listed under biblical literature, history of the Jewish people, history of ancient Near Eastern civilization, advanced Semitic language courses, as well as selected courses in archaeology; (c) and fifteen credits in related subjects. Related subjects for this purpose may be any courses in the humanities selected in conference with the adviser.

## History of the Jewish People

Those who major in history of the Jewish people must successfully complete (a) proficiency in Hebrew; (b) twenty-four credits selected from courses listed under Hebrew (above Semitics 301), general Judaic studies, history of the Jewish people, history of ancient Near Eastern civilization, (c) and fifteen credits of related courses listed under biblical literature, modern Hebrew literature, or any courses in the humanities selected in conference with the adviser.

## Hebrew Language and Literature

Those who major in Hebrew language and literature must successfully complete (a) proficiency in modern Hebrew equivalent to the completion of Semitics 302; (b) twenty-four credits of advanced courses listed under Hebrew, modern Hebrew literature, biblical literature, and general Judaic studies; (c) and fifteen credits in related subjects listed under history of the Jewish people, or any courses in the humanities selected in conference with the adviser.

## Program of Jewish Studies

For description of program see p. 121.

## Distribution Requirement

The distribution requirement in humanities is satisfied in Semitic studies by any two courses at the 200 level or above, except language courses. However, Hebrew 301-302, which also will emphasize literary aspects, will satisfy the distribution requirement.

## Hebrew

**101-102 Elementary Modern Hebrew I, II** 101, fall only; 102, fall or spring. 6 credits per term. Each section limited to 15. Prerequisite for 102: 101 or permission of instructor.

\*Section 1, M T W Th F 9:05.

\*\*Section 2, M T W Th F 10:10.

\*\*Section 3, M T W Th F 11:15.

\*Section 4, M T W Th F 1:25.

102, fall, M T W Th 9:05.

Semi-intensive course providing the fundamentals of modern Israeli Hebrew with emphasis on the development of reading, writing, listening, and speaking skills. Course conducted in small groups by native Hebrew speakers with supplementary work at the language laboratory.

\*For students with no Hebrew background.

\*\*For students with some Hebrew background.

**201-202 Intermediate Modern Hebrew I, II** 201, fall or spring; 202, spring only. 6 credits per term. Each section limited to 15. Prerequisites: for 201, 102 or permission of instructor; for 202, 201 or permission of instructor.

Section 1, M T W Th F 10:10.

Section 2, M T W Th F 11:15.

201, spring, M T W Th F 9:05.

Second-year modern Israeli Hebrew. Continued development of reading, writing, listening, and speaking skills. Review of grammar; readings from contemporary Israeli prose and poetry; guided conversation and composition. Course is conducted in small groups by native Hebrew speakers with supplementary work at the language laboratory.

**301-302 Advanced Modern Hebrew I, II** 301, fall; 302, spring. 4 credits per term. Limited to 15. Prerequisite: for 301, 202 or equivalent second-year Hebrew language course, or permission of instructor; for 302, 301 or permission of instructor. Course conducted in Hebrew.

Fall: T Th 12:20-1:35. M. Pelli.

Spring: T Th 1:25-2:15.

Development of speaking, writing, reading, and listening skills. Review of grammar and syntax. Analytical study of selected texts from biblical, postbiblical, and modern Hebrew literature. Introduction to the style, structure, and vocabulary of the Hebrew language in its various stages. Readings in current Israeli press, contemporary fiction, literary, and scientific material. Taped Israeli radio broadcasts, topical discussions, and written reports. 302, or equivalent, prerequisite for all 300-level Hebrew literature courses.

**303 Independent Study** Fall or spring. 2-4 credits. Open to qualified students.

## Arabic

**111-112 Elementary Arabic** 111, fall; 112, spring. 6 credits per term. Limited to 15. Prerequisite for 112: 111 or permission of instructor.

M T W Th F 12:20. M. Schub.

An introduction to the phonology, morphology, and syntax of classical and modern standard Arabic. A thorough background in grammar is stressed. Reading selections from the Qur'an, the classical period, and modern period are studied.

**211-212 Intermediate Arabic** 211, fall; 212, spring. 3 credits per term. Prerequisite: for 211, one

year of Arabic or permission of instructor; for 212, 211 or permission of instructor.

Hours to be arranged. M. Schub.  
The grammar of classical and modern standard Arabic is stressed. Extensive reading selections from the Qur'an, the classical period and the modern period are studied. Some introductory topics in Arabic dialectology are discussed.

**311-312 Advanced Arabic** 311, fall; 312, spring. 4 credits each term. Prerequisite: for 311, permission of instructor; for 312, 311 or permission of instructor.

Hours to be arranged. M. Schub.  
Reading of selected texts with a thorough review of grammar and composition. Some topics in Arabic dialectology and comparative Semitic linguistics are discussed.

**351 Independent Study** Fall or spring. 2-4 credits. Open to qualified students.  
M. B. Schub.

## Akkadian

**[323-324 Elementary Akkadian** 323, fall; 324, spring. 4 credits per term. D. I. Owen. Not offered 1976-77.]

**325 Readings in Akkadian Texts** Fall or spring. 3 credits. May be repeated for credit.

Hours to be arranged. D. I. Owen.  
Fall: Readings in literary texts. Spring: readings in historical texts.

## Aramaic

**327 Aramaic** Fall. 4 credits. Prerequisite: permission of instructor.

Hours to be arranged.  
The western Aramaic of the Bible, the Qumran Scrolls, and the Targums; reading of selected texts.

## Ugaritic

**[328 Ugaritic** Fall. 3 credits. Not offered 1976-77.]

## Ethiopic

**[329 Ethiopic** Fall or spring. 4 credits. Not offered 1976-77.]

## Biblical Literature

**330 The Literature of Ancient Israel (also Comparative Literature 323)** Fall. 4 credits. Not open to freshmen.

M W F 9:05. I. Rabinowitz.  
The ancient Israelite beliefs and cultural assumptions needed to comprehend the Bible as literature will be discussed. All readings in English.

## Modern Hebrew Literature

**[260 Modern Hebrew Literature in English Translation: The National Renaissance (1881-1914)** Fall. 4 credits. M. Pelli. Not offered 1976-77.]

**[261 Modern Hebrew Literature in English Translation: The Israeli Short Story** Spring. 4 credits. M. Pelli. Not offered 1976-77.]

**[264 Modern Hebrew Literature in English Translation: The Israeli Novel** Fall. 4 credits. M. Pelli. Not offered 1976-77.]

**266 Themes in Modern Hebrew Literature: The Holocaust** Spring. 3 credits. No prerequisites. Course conducted in English.

T Th 10:10-11:25. M. Pelli.  
The traumatic experience of the Holocaust in Europe as expressed and depicted in contemporary Hebrew

literature. Emphasis will be placed on such topics as the theological, ethical, psychological, and social implications of the Holocaust in their literary manifestations.

**267 The Hebrew Creative Mind: Survey of Hebrew Literature in Translation** Fall. 3 credits. No prerequisites. Course conducted in English.  
T Th 10:10-11:25. M. Pelli.

A survey of the creative expressions of Hebrew civilization as found in the literature of the Jewish people from the biblical period to the Enlightenment period. Representative works in English translation will be chosen from the Hebrew Bible, the Apocrypha and Pseudepigrapha, the Mishnah and the Talmud, medieval Hebrew poetry and prose, and from the polemics and apologetics. Selected literary forms, styles, genres, and themes will be highlighted and evaluated.

**361-362 Seminar in Modern Hebrew Literature: The National Renaissance (1881-1914)** 361, fall; 362, spring. 4 credits per term. First term not prerequisite to the second. Prerequisite: 302 or equivalent advanced Hebrew language course, or permission of instructor. Course conducted in Hebrew.  
T Th 8:45-10. M. Pelli.

An analytical study of the major works of the post-Enlightenment period in Europe, reflecting the principal genres, forms, and themes of the modern national renaissance literature. The works will be discussed against the background of the social, national, and intellectual evolution of the Jewish people in Europe. Among the writers whose works will be discussed and analyzed: Mendele, Frishman, Feilerberg, Peretz, Bialik, and Berditchevsky (361); Ben-Zion, Bershady, Steinberg, Gnessin, Brenner, and Tchernichovsky (362).

**[363-364 Seminar in Modern Hebrew Literature: The Enlightenment (1780-1880)** 363, fall; 364, spring. 4 credits per term. M. Pelli. Not offered 1976-77.]

**365 Hebrew Poetry of the Twentieth Century** Fall. 4 credits. Prerequisite: 302 or equivalent advanced Hebrew language course, or permission of the instructor. Course conducted in Hebrew.

T Th 2:30-3:45. M. Pelli.  
A study of the poetic imagination, language, genres, forms, and structures of the most outstanding Hebrew poets, representing the various poetic schools from the beginning of the twentieth century in Europe, through the Palestinian period (1920-1947), and into the Israeli period (1948-to the present). Among the poets to be discussed are Bialik, Tchernichovsky, Shimon, Lamdan, U. Z. Greenberg, Shlonsky, Alterman, Preil, Gilboa, Gouri, Amichai, Sach, and Ravikovich.

**[366 Seminar in Modern Hebrew Literature: The Israeli Short Story** Spring. 4 credits. M. Pelli. Not offered 1976-77.]

**368 Agnon and Hazaz** Spring. 4 credits. Prerequisite: 302 or equivalent Hebrew language course, or permission of instructor. Course conducted in Hebrew.

T Th 12:20-1:35. M. Pelli.  
A study of the literary art of two outstanding figures in contemporary Hebrew letters whose works depict major problems of modern man and modern Jew in a changing world.

**369 Independent Study** Fall or spring. 2-4 credits per term. Prerequisite: permission of instructor. Open to majors and other qualified students. M. Pelli.

## General Judaic Studies

**240 What is Judaism?** Fall. 3 credits.  
T 3:35-4:25, Th 2:30-4:10. B. Netanyahu.

A general introduction to the teachings of Judaism as they evolved through the ages, up to the time of Maimonides (twelfth century), with special attention to the rise and development of major ethical and social concepts. The basic differences between Judaism and Christianity in the period of Jesus and Paul will form a major topic of discussion. Also designed to acquaint students with the range and structure of Jewish studies.

**[320 From Spinoza to Buber** Fall. 4 credits.  
B. Netanyahu. Not offered 1976-77.]

**[321 Nationalism and Religion in Modern Jewish History, 1789-1948** Spring. 4 credits.  
B. Netanyahu. Not offered 1976-77.]

### History of the Jewish People

**243-244 The History of Ancient Israel** 243, fall; 244, spring. 3 credits per term. First term not prerequisite to the second.

T Th 11:15-12:30. D. I. Owen.  
243: From earliest times to the Babylonian Exile. 244: From the Babylonian Exile through the fall of Masada and the Bar Kochba rebellion. A detailed survey of the history of ancient Israel based on biblical and Near Eastern sources and illustrated by the most recent archaeological discoveries.

**341 A Synoptic Course of the History of the Jewish People (614-1492)** Fall. 4 credits.

T 1:25-3:20, Th 1:25-2:15. B. Netanyahu.  
A general survey of the major political, social and intellectual developments in Jewish history from the last Jewish struggle against Roman rule in Palestine (614) to the expulsion of the Jews from Spain (1492). Centering upon the history of the Jews in the West, the discussion in this course will deal with the status of the Jews in medieval society; their relationship with the crown, church, nobility, and burghers; their contribution to the development of the cities, capitalism, and centralized government; the persecution of the Jews in the Middle Ages, and the establishment of the Spanish Inquisition.

**[342 A Synoptic Course of the History of the Jewish People (1492-1789)** Fall. 4 credits.  
B. Netanyahu. Not offered 1976-77.]

**[343 A Synoptic Course of the History of the Jewish People (1789-1973)** Fall. 4 credits.  
B. Netanyahu. Not offered 1976-77.]

**[344 Age of the Patriarchs** Fall. 4 credits.  
D. I. Owen. Not offered 1976-77.]

**348 Independent Study** Fall or spring. 2-4 credits. Open to qualified students. May be repeated for credit.  
D. I. Owen.

Directed readings on the history, culture and civilization of ancient Israel.

### History of Ancient Near Eastern Civilizations

**[282 Ancient Near Eastern Literature (also Comparative Literature 226)** Spring. 4 credits.  
D. I. Owen. Not offered 1976-77.]

**345 The History of the Ancient Near East** Fall. 4 credits.  
T Th 2:30-3:45. D. I. Owen.

An historical survey of the civilizations of the ancient Near East from earliest times to the Hellenistic period. Discussion and reports on assigned topics.

**Archaeology of the Ancient Near East (Archaeology 310)** Spring. 4 credits. E. Herscher.

**349 Independent Study** Fall or spring. 2-4 credits. Open to qualified students. May be repeated

for credit. Directed readings on the history, culture, and civilization of the ancient Near East.  
D. I. Owen.

### Social Relations Major

The major in social relations is offered jointly by the Department of Anthropology and the Department of Sociology. It provides the student with basic competence in cultural anthropology, social psychology, and sociology, and gives particular emphasis to the common methods of research in these disciplines. The student is expected to obtain a grasp of the common interests and unique insights of the three disciplines, and in the senior Social Relations Seminar is expected to integrate aspects of their theory and data.

Prerequisites: The candidate must apply to the Committee on Admission to the Social Relations Major, offering the following: (a) either a course in sociology or Anthropology 201; (b) either Psychology 101 or 128 (formerly 102), or Sociology 280; and (c) either Sociology 325 or Industrial and Labor Relations 210 or equivalent.

### The Major

The major calls for a minimum of thirty-six credits of course work as follows: (a) three pairs or other combinations of related courses at the 300 level or above, to be selected in consultation with the major adviser. These six courses must include two courses from each of the following disciplines: anthropology, social psychology, sociology; (b) at least one course in methods, to be selected from the following: anthropological methods, techniques of experimentation (psychology), methods in sociology, advanced psychological statistics, philosophy of science or of social science, advanced statistics (such as Industrial and Labor Relations 311); (c) at least one course in theory which is related to social relations; (d) the senior seminar in social relations (Sociology 497 or Anthropology 495). A list of the courses that may be used to satisfy the requirements for a major in social relations is available from any of the major advisers. Students seeking admission to the program in social relations should apply to the Social Relations Committee, 323 Uris Hall.

### Sociology

D. P. Hayes, chairman; H. A. Alker, P. D. Allison, B. A. Anderson, R. Avery, B. Bowser, S. Caldwell, P. Chi, R. K. Goldsen, G. Gordon, J. B. Jacobs, J. A. Kahl, R. Kraut, T. Krauze, W. W. Lambert, J. L. Laws, R. McGinnis, L. Meltzer, M. P. Naditch, B. C. Rosen, C. A. Sheingold, J. M. Stycos, W. F. Whyte, R. M. Williams, Jr.

### Sociology Major

Given the diversity of interests and careers for which sociology is relevant, there are three options available to students intending to major in sociology. In describing the options we have indicated specific courses which automatically fulfill the requirements. In many cases equivalent courses may be substituted with the consent of the adviser. Students are advised to consult early with the Director of Undergraduate Studies in Sociology (Uris Hall).

### Option I

This option provides students with extensive and rigorous training in sociological research and data analysis. Students who fulfill the requirements for this option will be qualified for some positions in research (e.g. Census Bureau, survey research). This option also provides graduate-level training in research methods and data analysis for those who contemplate pursuing a Ph.D. in sociology.

*Prerequisites:* Any two courses in sociology and one year of college mathematics, especially calculus and probability statistics (e.g. Math 107-108 or Math 111-112).

*Major program:* Students in this option must complete at least 44 additional credits of courses in sociology. These must include: (a) three courses in research methods (Sociology 321 or 521, Sociology 424 and 425. Note carefully the prerequisites for Sociology 424); (b) two courses in sociological theory: one historical and one contemporary (Sociology 402 and 404); (c) one semester of the honors sequence (Sociology 495) or a graduate seminar; and (d) at least two semesters of supervised research experience with faculty in sociology.

### Option II

This option provides students with extensive training in sociology. It differs from Option I in that it does not provide as extensive a background in advanced techniques of sociological research. This option represents an appropriate sociological background for those who contemplate professional careers outside of professional sociology (e.g. law, medicine, social work, business, education). It also provides an appropriate background for those contemplating graduate training in sociology but who do not desire advanced undergraduate training in research techniques and data analysis.

*Prerequisites:* Any two courses in sociology.

*Major program:* Students in this option must complete at least thirty-six additional credits of courses in sociology. Included are (a) two courses in research methods (Sociology 321 or 521 and Sociology 325); (b) two courses in sociological theory: one historical and one contemporary (Sociology 402 and 404); and (c) one semester of the honors sequence or a graduate seminar. Students should also include within the thirty-six credits at least one course in social institutions and one course in basic processes (in addition to courses in theory) at the 200 level or higher.

### Option III

This option is designed for students desiring a sociology major within a general liberal arts program. It provides the maximum flexibility with respect to course selections. Pursuit of this option does not foreclose any career choices (including graduate training in sociology) but it does not include extensive course requirements that are preprofessional in nature.

*Prerequisites:* Any two courses in sociology.

*Major program:* Students in this option must complete at least thirty-two additional credits of courses in sociology including one course in sociological methods and one course in theory (Sociology 402 or 404).

### Concentrations

Within any option, concentrations are available in social psychology and in population studies. Students in concentrations will be expected to select, in consultation with advisers, some of their research and advanced substantive courses or independent studies from within the concentration.

**Concentration in Social Psychology:** Sponsored jointly with the Department of Psychology. Most of the social psychology courses may be taken for credit in either sociology or psychology. Related specialties or areas which may be recommended to the student are social organization, social methodology, experimental psychology, and cultural anthropology.

**Concentration in Population Studies:** Courses covering the basic demographic concerns of fertility, mortality and morbidity, migration, urbanization and population policy, and techniques of analysis are primarily within the department, but students may be encouraged to take related courses in economics, planning, and international studies.

## Social Relations Major

See page 112.

## The Honors Program

For admission to the honors program, students should file application with the department during the second semester of their junior year. Honors candidates must have a general average of at least 2.7 and an average in departmental courses of at least 3.0 or show exceptional promise. Open to students in all three options.

## Distribution Requirement

The distribution requirement in social sciences is satisfied in sociology by any two courses in the Department of Sociology.

## Participation in Research

Participation in sociological research may be required as part of course work for any student when the instructor considers that it will be to the student's educational advantage.

### 107 Conflict and Cooperation

Fall, 3 credits. Limited to freshmen and sophomores.

M W F 11:15. R. M. Williams, Jr.  
Are human societies fundamentally cooperative or conflictual? In what ways? Why? And with what consequences? Examination of contemporary sociological analyses and the views of such precursors as Hobbes, Marx, Kropotkin, Ward, Sumner, Simmel, Durkheim, and Weber. Data from current research will be reviewed.

### 152 Opinion-Forming Institutions: Television

A Freshman Seminar course. Fall, 3 credits. Limited to 20 freshmen.

Th 1:25–3:20. R. K. Goldsen.  
Seminar will focus on how to analyze an institution; in particular, American television. Each student will prepare a case study of an aspect that interests him or her. The work will require reading, writing, and generation of original data through various kinds of observation and retrieval of primary source material (library searches).

## Introductions to Subject Areas

Open to freshmen through seniors, courses at the 200 level are introductions to special subject areas in sociology. These courses carry no prerequisites unless otherwise specified.

### 230 Population Problems

Spring, 3 credits. M W 12:20 and 1 hour to be arranged.

J. M. Stycos.  
The practical and scientific significance of population growth and composition. Fertility, migration, and mortality in relation to social and cultural factors and in relation to questions of population policy. National and international data will receive approximately equal emphasis.

### 240 Comparative Social Change

Fall, 3 credits. (4-credit option available).

T Th 10:10–11:25. B. C. Rosen.  
An examination of social and psychological factors that affect the modernization process. Emphasis is placed upon cross-national data that show how social structure and personality interact to influence the transition of communities from traditional to modern forms of social organization. Among topics to be covered are psychological factors in economic development, the impact of industrialization on family structure and socialization, and personality elements that affect the political process in developing societies.

### 241 Policymaking and Sociology

Fall, 3 credits.

M W F 10:10. S. Caldwell.

Can sociology be used to help make public policies? Ought it be used? Sociology for whom? Values, experts, objectivity, and representative government. Case studies of past use and misuse in such areas as the "war on poverty," counterinsurgency, family and child policies, equal opportunity, busing, housing, program evaluation, community action, and crime.

### 245 Inequality in America

Spring, 3 credits. (4-credit option available).

M W F 1:25. J. Kahl.  
Recent trends in the unequal distribution of income, occupation, and education in the United States; inheritance of riches and of poverty; importance of ethnic membership; sex differences; deliberate attempts by government policy to alter these trends; evaluation of the "war on poverty."

### 252 Public Opinion

Spring, 3 credits. (4 credit option is available).

T Th 10:10 and 1 hour to be arranged.  
R. K. Goldsen.  
Analysis of television, radio, and the press as institutions—how they work and how they saturate the cultural habitat within which public opinion forms.

### 253 Sociology of Sports

Spring, 3 credits. (4 credit option is available).

M W F 10:10. C. Sheingold.  
A sociological perspective on sport. The relationship between sport, as a social institution, to other social institutions and social processes (socialization, education, stratification, culture and values, etc.). An understanding of various aspects of sport through the application of sociological concepts and theories. One goal of the course will be to provide an introduction to sociological analysis by presenting such an analysis of sport.

### 264 Intergroup Relations: Social Conflict and Cooperation

Spring, 3 credits. R. M. Williams, Jr. Not offered 1976–77.]

### 272 Urban Society

Fall, 3 credits. M W F 11:15. B. Bowser.

The sociological analysis of urbanism and urbanization. Alternative explanations of industrial urban development will be assessed with a specific focus on urban community studies, historical and contemporary, which serve as models of social structure, and group (class, ethnic, race, etc.) divisions. Trends in the United States and in other countries will also be examined, using such information as a basis for considering contemporary problems and the urban future.

### 280 Social Influence Processes: Attitude and Behavior Change (also Psychology 280)

Spring, 3 credits. D. Regan. Not offered 1976–77.]

### 281 Interpersonal Relations and Small Groups (also Psychology 281)

Spring, 3 credits. Limited to 40.

Lec, M 1:25–2:15; lab W 12:20–2:15 or F 1:25–3:20. L. Meltzer.  
Lectures and readings will concern the processes, relationships, and social arrangements in small groups. The laboratory will involve the class in self-study, as individual personalities and as group participants. The two approaches should develop sensitivity to group processes as well as to the effects we ourselves have on other persons.

### 282 Sex Roles (also Psychology 282)

Fall, 3 credits. Prerequisite: one course in Sociology or Psych 128 (formerly 102).

M W F 2:30. J. L. Laws.  
The consequences of being born female (or male) are systematically examined. Topics include: 1) role theory; what do we mean by roles? 2) sex roles; 3) sex-role socialization; 4) sex and education; 5) sex and occupational role; 6) sex and family roles; 7) sex

roles and sex; 8) sex-role liberation; 9) comparative studies of sex role.

### 285 Personality and Social Systems (also Psychology 285)

Fall, 4 credits. Prerequisite: one course in psychology or sociology.

T Th 10:10–11:25. Staff.  
Perspectives will be developed for understanding personality and behavior in a cultural context. A number of theories and conceptual approaches that have been used to understand the relationship between personality and social systems will be critically examined. Some themes in contemporary American culture will be discussed.

### 289 Conformity and Deviance (also Psychology 289)

Spring, 4 credits. Prerequisite: one course in psychology or sociology.

M W F 1:25. R. Kraut.  
What are the ways in which conformity pressures, in all their variation, can lead to deviance? To attempt an answer we will examine some of the conformity bases for run-of-the-mill, normal behavior, and then use the concepts developed to illuminate such behavior as mob violence, suicide, juvenile crime, and craziness.

## Intermediate Courses

Courses at the 300 level or higher are open to all students who meet the course prerequisites.

### Institutional Analysis: Social Institutions

See also Sociology 152, 252 and 253 above.

### [352 Prison Communities

Fall, 4 credits. Prerequisite: one course in sociology. Offered alternate years. J. B. Jacobs. Not offered 1976–77.]

### 355 Sociology of the Schools

Fall, 4 credits. Prerequisite: one course in sociology. T Th 8:40–9:55. J. B. Jacobs.

An examination of the public school as an institution under pressure and in transition. The course focuses on the impact of politics, civil rights, law reforms, media, and bureaucratization on the school as an organization and on education as an organizational goal. Readings are drawn from a sociological tradition dating back at least as far as Durkheim, but primary emphasis is placed on the contemporary American scene. Course takes up such policy issues as school financing, busing, discipline, and local control.

### 452 Sociology of Mathematics and the Natural Sciences

Fall, 4 credits. Prerequisite: permission of instructor.

M 1:25–3:20. T. Krauze.  
Sociological analysis of the growth of scientific disciplines and emergence of areas of specialization with emphasis on social conditioning of scientific ideas. Processes of accumulation, systematization, and dissemination of scientific knowledge. Specificity of the intellectual organization of disciplines and their concomitant social structures.

### [453 Sociology of Science and Technology (was 403)

Spring, 4 credits. Prerequisite: upperclass or graduate standing. G. Gordon. Not offered 1976–77.]

### [457 Sociology of Health and Medicine

Fall, 4 credits. Prerequisite: background in the social sciences, premedical status, or permission of instructor. Not offered 1976–77.]

### Institutional Analysis: Basic Processes and Comparative Approaches

See also Sociology 107, 240, 241, 245, 264, 272 above.

### [343 The Family

Fall, 4 credits. Prerequisite: one course in sociology. Not offered 1976–77.]

**[344 Criminology]** Spring. 4 credits. Prerequisite: a course in sociology. J. B. Jacobs. Not offered 1976-77.]

**[363 The Structure of American Politics: A Sociological Perspective]** Spring. 4 credits. Offered in alternate years. Prerequisite: one course in sociology or permission of instructor. C. Sheingold. Not offered 1976-77.]

**367 After the Revolution: Mexico and Cuba** Fall. 4 credits. Prerequisite: two courses in the social sciences.

M W F 1:25. J. Kahl.

A comparison of the economic, political, and social development of Mexico and Cuba following their revolutions. Assigned readings will be in English.

**[368 Contemporary Brazil (also History 348)]** Fall. 4 credits. Prerequisite: two courses in the social sciences. J. Kahl, T. Holloway. Not offered 1976-77.]

**402 Social Theory** Spring. 4 credits. Prerequisite: two courses in the social sciences or permission of instructor.

Survey of selected theories and concepts in contemporary sociology, reviewed in historical perspective. Course will focus upon the sociology of knowledge and will be concerned with the social and historical location of human thought and the attendant problems, both under its initial formulation and its more recent development.

**404 Major Themes in Sociological Thought and Analysis** Spring. 4 credits. Prerequisite: undergraduate major in sociology or social relations or permission of instructor.

M 2:30-4:30. C. Sheingold.

An advanced undergraduate seminar in sociology. Focus of discussion will be a diverse selection of major sociological works. Goal of the course will be to provide the student with an exposure to and opportunity to develop a broad and integrated sense of the "sociological imagination."

**441 Structure and Functioning of American Society—I** Fall. 4 credits. Prerequisite: one course in sociology or permission of instructor.

T Th 9:05 and 1 hour to be arranged.

R. M. Williams, Jr.

Critical study of the institutions of kinship, stratification, the economy, the polity, education, and religion. Special attention is given to values and their interrelations, and to deviance and evasion. A survey of groups and associations making up a pluralistic nation is included.

**[442 Structure and Functioning of American Society—II]** Spring. 4 credits. Prerequisite: 441 or permission of instructor. R. M. Williams, Jr. Not offered 1976-77.]

### Social Psychology

See also Sociology 280, 281, 282, 285, 289 above.

**381 Social Psychology (also Psychology 381)** Fall. 4 credits. Prerequisite: one course in psychology or sociology.

M W F 12:20. W. Lambert.

An advanced introduction to social psychology. Topics covered include methodology, socialization, attitudes and attitude change, communication, propaganda, group processes, cognitive consistency, and attribution theory.

**[382 Individual Differences and Psychological Assessment (also Psychology 382)]** Spring. 4 credits. Offered alternate years. Prerequisite: junior class standing and a previous or concurrent course in statistics. H. Alker. Not offered 1976-77.]

**[385 Theories of Personality (also Psychology 385)]** Spring. 4 credits. Prerequisite: Psych 101 or 128 (formerly 102) or permission of instructor. Some

sociology or anthropology also helpful. Not offered 1976-77.]

**386 Human Ethology (also Psychology 386)** Fall. 4 credits. Offered alternate years. Prerequisite: a course in social psychology or in animal social behavior or permission of instructor.

M W 2:30-4. R. Kraut.

Biological and other approaches using naturalistic observation techniques to human social behavior will be examined. One emphasis will be on parallels between nonhuman vertebrates and humans. Topics include nonverbal communication, use of space, bonding and interaction rituals.

**387 Psychological Aspects of Political Behavior (also Psychology 387)** Fall. 4 hours. Prerequisites: junior class standing and a course in social or personality psychology or permission of instructor.

M W F 9:05. H. Alker.

A survey of contributions from psychology and sociology to the explanation of political behavior. Topics include power styles, ideology, social movements, psychocultural theories of war, manipulation techniques, political competence, and Machiavellianism.

**480 Beliefs and Attitudes (also Psychology 480)** Fall. 4 credits. Prerequisite: Psych or Soc 280 or graduate standing, or permission of instructor.

M W F 11:15. L. Meltzer.

An intensive analysis of theory and research on beliefs, attitudes, values, intentions, and behaviors. Cognitive consistency (balance, congruity, dissonance), Fishbein's expectancy-value formulation, and Rokeach's analysis of values will be given special attention.

**481 Advanced Social Psychology (also Psychology 481)** Fall. 4 credits. Prerequisite: a course in social psychology or permission of instructor.

T Th 10:10-11:25. D. Regan.

Selected topics in social psychology are examined in depth, with a heavy emphasis on experimental research. Readings consist for the most part of original research reports. Topics discussed may include some of the following: social comparison theory, social and cognitive determinants of the emotions, cognitive dissonance, attributive processes, interpersonal attraction, aggression, altruism, and research methods in social psychology.

**[483 Social Interaction (also Psychology 483)]**

Spring. 4 credits. Prerequisite: one course in sociology and one course in psychology. Enrollment limited to 15. D. Hayes. Not offered 1976-77.]

**485 Advanced Personality** Spring. 4 credits. Prerequisite: a previous course at 200 or 300 level in personality or graduate standing.

M W F 9:05. H. Alker.

Issues in contemporary personality research: self-confrontation and self-control, personality consistency vs. situational specificity, values and behavior, social learning vs. psychodynamic approaches, affect and personality changes, cognitive theories of personality.

**486 Research Issues in Human Sexuality (also Psychology 486)** Spring. 4 credits. Prerequisite: permission of instructor.

Hours to be arranged. J. L. Laws.

Dominant paradigms and established data from current research on human sexuality will be assessed from the perspective of the sociology of knowledge. Prospects and priorities for future research will be assayed. Course will not cover reproductive biology, sexual "problems," or counseling.

**[487 Selected Problems in Psychopathology and Society (also Psychology 487)]** Spring. 4 credits. Prerequisite: one course in personality or psychopathology and one course in statistics. M. Naditch. Not offered 1976-77.]

**488 Experiments in Real-Life Situations (also Psychology 488)** Spring. 4 credits. Prerequisites: two courses in social psychology or human development and one course in statistics or permission of instructor.

T Th 2:30-4. U. Bronfenbrenner.

An analysis of research designs and findings on human behavior and development in real-life social situations. Attention is focused on theoretical and methodological issues as well as implications for social policy.

**489 Seminar: Selected Topics in Social Psychology (also Psychology 489)** Fall. 4 credits. Prerequisites: one course in psychology and one course in sociology or social psychology and permission of instructor.

T 2:30-4:30. S. Jones.

### Demography

See also Sociology 230 above.

**330 Population and the Environment** Fall. 4 credits.

M W F 10:10. R. Avery.

Course will concentrate on the question of the existence of environmental problems related to population variables. Emphasis will be on the assumptions, framework of analysis, and underlying data used in theories relating population and the environment. National and international studies will be covered.

**378 Economics, Population, and Development (also Economics 378)** Spring. 4 credits.

Hours to be arranged. M. Haines.

An introduction to the economic aspects of population and the interaction between population change and economic change. Particular attention will be paid to economic views of fertility, mortality, and migration and to the impact of population growth on economic growth, development, and modernization.

**431 Techniques of Demographic Analysis** Spring. 4 credits. Prerequisite: 230 or 330. M W F 11:15.

A description of the nature of demographic data and the specific techniques used in their analysis. Mortality, fertility, migration, and population projection will be covered, as well as applications of demographic techniques to other classes of data.

**433 Human Fertility in Developed Nations** Spring. 4 credits. Offered alternate years. Prerequisite: 230 or 330 or permission of instructor.

T 3:35-5:30. R. Avery.

An analysis of the social causation of fertility in areas where fertility is fairly low. This course will review the major studies of differential fertility in the United States and other areas where contraception is widely used. The emphasis will be on reasons for differentials in fertility between groups and the reasons for changes in fertility patterns.

**[434 Human Fertility in Developing Nations]** Fall. 4 credits. Offered alternate years. Prerequisite: 230 or permission of instructor. J. M. Stycos. Not offered in 1976-77.]

**[435 Mortality and Morbidity]** Spring. 4 credits. Prerequisite: 230 or permission of instructor. R. Avery. Not offered 1976-77.]

**438 Human Migration and Residential Mobility** Spring. 4 credits. Prerequisite: 230 or 330 or permission of instructor.

T 1:25-3:20. P. Chi.

An analysis of international and internal migration as it affects the social and economic structure of societies and the groups in movement. Major theoretical and methodological investigations will be examined. Special emphasis will be given to determinants and

consequences of residential mobility within industrial urban centers.

## Methods

See also Sociology 431.

**321 Field and Laboratory Techniques in Sociology** Fall. 4 credits. Prerequisite: a course in sociology.

T Th 10:10; lab, hours to be arranged. D. Hayes. Research design and the operational side of laboratory methodology, with a series of field and laboratory projects. Students will carry out several studies from planning to analysis stages.

**325 Evaluating Statistical Evidence** Spring. 4 credits.

M W F 9:05. S. Caldwell. A first course in the use of statistical evidence in the social sciences. Theory is supplemented with numerous applications. Includes an introduction to multivariate causal analysis.

**420 Mathematics for Sociologists** Fall. 4 credits.

Hours to be arranged. Elementary matrix algebra, probability theory, and calculus.

**424 Multivariate Analysis with Quantitative Data** Spring. 4 credits. Prerequisite: a college course in statistics (e.g. Soc 325) and matrix algebra.

T Th 10:10-11:40. The general linear regression model with interval-scaled variables. Detecting violations of assumptions of the model in real data and providing remedies. Both single and multiple equation models (including path analysis).

**[425 Multivariate Analysis with Qualitative Data]** Fall. 4 credits. Prerequisite: 424 or equivalent. Not offered 1976-77.]

**425 Multivariate Analysis with Qualitative Data** Fall. 4 credits. Prerequisite: 424 or equivalent. Not offered 1976-77.]

**462 Research Methods** Spring. 4 credits.

Prerequisite: permission of instructor. Enrollment limited to 15. Th 1:25-3:20. R. K. Goldsen. In common with the arts, humanities, physical and biological sciences, social science methodology is an integration of reading, writing, information retrieval, disciplined observation, and critical and judicious evaluation. This course aims to help students improve these abilities through supervised research opportunities.

## Speciality and Advanced Courses and Seminars

**491 Selected Topics in Sociology** Fall or spring.

2 credits. By permission of instructor only. Hours to be arranged.

**492 Selected Topics in Sociology** Fall or spring.

4 credits. By permission of instructor only. Hours to be arranged.

**495 Honors Research: Senior Year** Fall or spring.

4 credits. Limited to sociology majors in Options I or II or honors program. Hours to be arranged. D. Hayes and staff.

**496 Honors Thesis: Senior Year** Fall or spring.

4 credits. Prerequisite: 495. Hours to be arranged. D. Hayes and staff.

**497 Social Relations Seminar (also Anthropology 495)** Spring. 4 credits. Limited to senior undergraduates majoring in social relations.

Staff.

**521 Advanced Techniques of Social Research** Fall. 4 credits. Prerequisites: graduate standing or permission of instructor and one course in college statistics.

Hours to be arranged.

Preanalysis aspects of research. Topics include problem definition, hypothesis formulation, design, measurement, and coding. Project organization, costs, and the meshing of theoretical concerns with constraints on data collection are stressed.

**529 Demographic and Ecological Models of Science** Spring. 4 credits. Prerequisite: permission of instructor.

Hours to be arranged. Models of science and their theoretical underpinnings are critically reviewed. Models of resource allocation, science manpower production, mobility, and communication processes are examined, with an emphasis on their policy implications.

**530 Introduction to Social Demography** Fall.

4 credits. Prerequisite: graduate standing or permission of instructor.

T Th 2:30-3:45. R. Avery. A survey of the methods, theories, and problems of contemporary demography. Special attention is directed to the social determinants and consequences of fertility, mortality, and migration. The populations of both developed and developing areas are examined.

**531 Population Policy** Fall. 4 credits.

Prerequisite: graduate standing or permission of instructor.

W 2-4. J. M. Stycos. Course will consider various population policies in the developed and developing world, with special reference to fertility.

**541 Social Organization and Change** Fall. 4 credits.

Prerequisite: graduate standing or permission of instructor.

T 2:30-3:20, Th 1:25-3:20. R. M. Williams, Jr. An analysis of major problems in theory and research, with emphasis on substantive knowledge and systematic hypotheses. Subjects included are social processes, social structures, cultural content, and social and cultural change. Attention is given to the nature and size of the social system (small groups, communities, large organizations, societies) and also to both macro and micro social processes and properties (integration, authority, conformity, and deviance).

**583-584 Proseminar in Personality and Social Psychology (also Psychology 583-584)** 583, fall;

584, spring. 4 credits. Prerequisite: graduate major or minor in social psychology or permission of instructor.

M Th 4-5:30. Fall. W. Lambert and staff; spring, L. Meltzer and staff.

New and emerging research issues and methods in personality and social psychology in the areas of personality and situations, attitude, interaction, socialization, organizations, sociolinguistics, and applied social psychology.

**585 Social Structure and Personality (also Psychology 585)** Fall. 4 credits. Prerequisite:

graduate standing or permission of instructor.

T 3:35-5:30. B. C. Rosen. A discussion seminar examining the impact of structural factors on personality development, and on the ways in which individual internal states and behavioral patterns affect the functioning of social systems.

**632 Research Seminar in Population** Spring.

4 credits. Prerequisite: permission of instructor. Hours to be arranged. Staff of the International Population Program.

**652 Field Research Practicum** Fall. 4 credits.

Prerequisite: permission of instructor. T 3:35-5:30. J. A. Kahl, C. Sheingold. Participation in the planning and execution of a research project using field methods of interviewing and observation.

**655 Seminar: Sociology of Latin American Politics (also Government 655)** Fall. 4 credits.

Prerequisite: graduate standing or permission of instructor. Reading knowledge of Spanish or Portuguese is recommended.

Th 2:30-4:25. J. A. Kahl, E. Kenworthy. Reading and discussion of various recent books on the social and political situation in Latin America.

**663 Seminar: Microsimulation and Policy Analysis** Spring. 4 credits. Prerequisite: permission of instructor.

Hours to be arranged. S. Caldwell. The DYNASIM model as a vehicle for comprehensive social theory construction and policy analysis.

**670 Seminar: Economic Demography and Development (also Economics 670)** Spring.

4 credits. Prerequisite: permission of instructor. Hours to be arranged. M. Haines. Economic aspects of population dynamics with particular emphasis on the interaction between population change and economic development. Topics include the role of economic factors in fertility, mortality, and migration; the place of population growth and migration in the development and modernization process; and policy implications of rapid vs. slow or zero population growth for economic development.

**684 Seminar: Self and Identity (also Psychology 684)** Fall. 4 credits. Prerequisite: permission of instructor.

Hours to be arranged. J. L. Laws. Many of the major problems in social psychology imply the existence of a self-directing self-awareness, yet the topic of the self is little explored. In this seminar, classic and current perspectives on the self are examined, guided by the questions: Do we need a concept of self? and, What phenomena must such a concept explain and predict? The empirical research on the self and related concepts (e.g. self-esteem, self-image) are explored. Methods for the study of the self are assessed.

**691-692 Directed Research** Fall or spring. Credit

(up to 4 hours) to be arranged. Prerequisite: permission of instructor only. Staff.

## Theatre Arts

M. A. Carlson, chairman; F. L. Churchill, J. H. Churchill, J. H. Clancy, S. Clancy, S. R. Cole, P. J. Curtis, J. Desmond, D. L. Fredericksen, M. Lawler, D. Marme, T. Postlewait, B. O. States, P. A. Stelzer.

All students who wish to major in theatre arts must complete Theatre Arts 240 and thirty additional credits in the department which will include substantial work in theatre history, literature, and theory, and in any two of the following four areas: (1) technical production and design, (2) acting/directing, (3) dance, (4) cinema. In addition, majors must complete at least twelve credits of related work outside the department.

Students who wish to major in dance must have completed or proved competency in intermediate modern technique by the beginning of their junior year. Dance majors are required to take a minimum of one technique class each term. The courses required of all dance majors are: (1) 301 (four semesters, one credit each semester), (2) 210-211, (3) 314-315, and (4) 316. In addition to the twenty-three credits listed above, dance majors are required to take twenty credits in related fields to be chosen in consultation with an adviser.

Opportunities for performance in theatre, dance, and cinematography are available to the entire student body through the facilities of the department.

Students may participate in the wide variety of theatrical performances presented each term in the University Theatre of Willard Straight Hall, the Drummond Studio in Lincoln Hall, and the Dance Studio in Helen Newman Hall, as actors, dancers, directors, playwrights, designers, or technicians. Auditions for particular productions are scheduled throughout the year.

The department administers the Charles B. Moss Scholarship. The recipient is chosen by the department from among those majors in the department who demonstrate exceptional ability.

### Distribution Requirement

The distribution requirement in the expressive arts is satisfied by any two of the three- or four-credit courses in the Department of Theatre Arts.

### Freshman Seminar Requirement

The Freshman Seminar requirement may be satisfied by Theatre Arts 120, 130, or 140. Interested students are directed to the Freshman Seminar booklet.

### Theatre Laboratory

Courses 151, 152 and 155 are offered either term. These courses may be repeated for credit but no student may earn more than four credits applicable towards graduation. Acting, directing, and managerial and technical responsibilities in production of theatre and dance are under the supervision of the departmental staff. Participation is also open to students without credit.

Courses 151, 152, and 155 may be added or dropped without penalty at any time during the semester.

**151 Technical Theatre** Fall or spring. 1 credit. S-U grades only.

First meeting in Willard Straight Theatre at 7:30 p.m. on first day of instruction. R. Churchill. Practice in construction, painting, and lighting for the University Theatre productions under the supervision of the set designer or the technical director.

**152 Technical Theatre** Fall or spring. 1 credit. S-U grades only.

First meeting in Willard Straight Theatre at 7:30 p.m. on first day of instruction. D. Marme. Practice in costuming for the University Theatre productions under the supervision of the costume designer.

**155 Rehearsal and Performance** Fall or spring. 1 credit. S-U grades only.

Credit for participation in producing the play (acting, directing, etc.) under the supervision of faculty of this department. The student should add this course after having received a position on the production staff or having been cast in a play.

### Acting

**280 Introduction to Acting** Fall or spring. 3 credits. Sections limited to 16 students. Prerequisite: registration through departmental roster in Room 104, Lincoln Hall.

Staff.  
Introduction to the problems and basic technique of the actor. Practice in creative exercises, improvisation, psychological sets, and physical images.

**380 Intermediate Acting** Fall or spring. 3 credits. Sections limited to 16 students. Prerequisite: 280 and registration through departmental roster in Room 104, Lincoln Hall.

Staff.  
Continuation of Introduction to Acting 280 with emphasis on methodology and scene study.

**381 Advanced Acting** Fall or spring. 3 credits. Prerequisite: 380 and permission of instructor.

P. Stelzer, S. Cole.  
Practical emphasis upon integration of conception, preparation of role, and techniques of presentation.

**780 Graduate Acting** Fall or spring. 4 credits. May be repeated for credit.

S. Cole, P. Stelzer.  
Study and practice of fundamental and advanced techniques and methodology.

### American Mime

**575 American Mime Orientation I** Fall. 2 credits. Prerequisite: 280.

P. Curtis and other teachers from the American Mime Theatre.  
American Mime is a complete theatre medium different from the pantomime of the French school or the dance of Eastern Mime disciplines. Essentially, it is a medium for actors who, in characterization, perform symbolic activities through a unique form of movement. Students enrolled in American Mime must contact the Department of Theatre Arts about supplies one month before the beginning of classes.

**576 American Mime Orientation II** Spring. 2 credits. Prerequisite: Orientation I or permission of instructor.

P. Curtis and other teachers from the American Mime Theatre.  
Continuation of Theatre Arts 575.

### Voice and Speech

**682 Voice and Speech for Performance** Fall. 2 credits.

Staff.  
Emphasis is on ear training and the techniques of voice production to achieve precision of articulation, and to improve vocal range, resonance, and flexibility.

**683 Voice and Speech for Performance** Spring. 2 credits. Prerequisite: 682.

Staff.  
Stage dialects and continued work in the techniques of voice production to improve range, resonance, and flexibility.

**782 Advanced Voice and Speech for Performance** Fall. 2 credits.

Staff.  
Emphasis on vocal interpretation of roles. Application of special skills and vocal technique in building character.

**783 Advanced Voice and Speech for Performance** Spring. 2 credits.

Staff.  
Continuation of Theatre Arts 782.

### Dance

Enrollment in all dance courses will be in Helen Newman Hall.

Courses in dance technique are offered each semester—modern: elementary through advanced; ballet: elementary and intermediate. Freshmen and sophomores may satisfy the physical education requirement by taking any of the technique courses. Juniors and seniors may earn one credit each semester for high intermediate and advanced modern technique only.

**200 Dance and Movement for the Theatre** Fall. 3 credits.

Staff.  
Basic dance technique, improvisation, and composition designed to help the actor improve use of the body as an expressive instrument.

**201 Dance and Movement for the Theatre** Spring. 3 credits. Prerequisite: 200.

Staff.  
Continuation of Theatre Arts 200.

**210 Beginning Dance Composition and Music Resources (also Women's Physical Education 210)** Fall. 4 credits. Prerequisites: Music 141,

intermediate technique level, and permission of instructor.  
Staff.  
Parallel studies in the basic vocabulary of movement and in fundamental problems of musical expression in relation to dance.

**211 Beginning Dance Composition and Music Resources (also Women's Physical Education 211)** Spring. 4 credits. Prerequisite: 210.

Staff.  
Continuation of Theatre Arts 210.

**301 Dance Technique (also Women's Physical Education 301)** 1 credit. S-U grades only. May be repeated for credit. See Women's Physical Education for schedule of sections.

Staff.  
Credit will be given only for enrollment in high intermediate or advanced modern technique and only to students of at least junior standing.

**310 Advanced Dance Composition (also Women's Physical Education 310)** Fall. 4 credits.

Prerequisite: 211.  
Staff.  
Problems in composition for groups, and music resources for dancers.

**311 Advanced Dance Composition (also Women's Physical Education 311)** Spring. 4 credits. Prerequisite: 310.

Staff.  
Further problems in composition for groups.

**314 History of Dance** Fall. 3 credits.

M W F 3:35. P. Lawler.  
A survey of the history of dance from ancient times to the Renaissance, with emphasis on the development of theatrical forms in Western civilization.

**315 History of Dance** Spring. 3 credits.

M W F 3:35. P. Lawler.  
A survey of the history of dance from the Renaissance to contemporary times with emphasis on the development of theatrical forms in Western civilization.

**[316 Human Biology for the Performing Arts (also Anthropology 316)]** Not offered 1976-77.]

**318 Period Dance** Spring. 2 credits. Prerequisite: elementary ballet or elementary modern technique.

P. Lawler.  
A sampling of the social dances from the Renaissance to the present, with emphasis on pinpointing basic differences in movement styles and customs in the various periods.

**410 Individual Problems in Composition (also Women's Physical Education 410)** Fall or spring. 3 credits. Prerequisite: 311.

Staff.  
Individual problems in composition.

**418 Seminar in History of Dance** Spring. 3 credits. Prerequisite: 315 or permission of the instructor.

P. Lawler.  
See instructor for description of the particular aspect of history of dance to be investigated.

### Directing

**398 First Principles of Directing** Fall. 3 credits. Prerequisites: one semester of acting class and one

semester of stagecraft or stage design.

M W F 2:30. J. Clancy.

The structure of visual and temporal patterns as interpretation of the script; rehearsal procedures and techniques; the relationship of the technical and design arts to the directorial approach.

**498 Advanced Directing** Spring. 4 credits.

Prerequisite: 398 or permission of instructor.

M W F 2:30. J. Clancy.

Investigation of the theatrical meaning of a play and the methods by which such meaning may be communicated in the modern theatre.

**499 Projects in Directing** Fall or spring. Credit to

be arranged. Prerequisite: permission of the departmental staff.

Staff.

The planning and execution of directing projects by advanced students in the public facilities of the Department of Theatre Arts.

## Theatre Production and Design

**351 Theatre Practice** Fall or spring. 2 credits.

May be repeated for credit. Prerequisites: previous technical assistance in Cornell University Theatre productions, and permission of instructor.

J. Churchill, R. Churchill.

Advanced projects in design or technical production under the supervision of the set designer or the technical director.

**352 Theatre Practice** Fall or spring. 2 credits.

May be repeated for credit. Prerequisites: previous technical assistance in Cornell University Theatre productions and permission of instructor. Department majors will have priority. Sec. 1: Advanced projects in design or technical production under the supervision of the costume designer. Sec. 2: Make-up Lab.

Sec. 1, hours to be arranged. D. Marme.

Sec. 2, T 4:30-6:30. D. Marme.

**354 Stagecraft** Fall or spring. 4 credits.

M W 12:20. R. Churchill.

Lectures and demonstrations on theatre structure and equipment, scene construction and painting, and stage lighting. Practice in scene construction and lighting for University Theatre productions.

**362 Stage Lighting** Spring. 3 credits.

Prerequisite: 354.

T Th 11:15. R. Churchill.

An introduction to lighting design for the theatre, concentrating on the principal approaches for the designer using light as the medium. A technical foundation in the types and functions of the different lighting instruments, control equipment, light sources, and color will be dealt with during arranged laboratory sessions.

**364 Stage Design I** Fall. 4 credits. Prerequisite:

354 or permission of instructor.

T Th 10:10. J. Churchill.

Stage scenery design from the specifics of mass, space, and color to the completed theatrical design.

**365 Stage Design II** Spring. 4 credits.

Prerequisite: Stage Design I or permission of instructor.

T Th 10:10. J. Churchill.

Continuation of Stage Design I.

**366 Costume Design I** Fall. 4 credits.

Prerequisite: permission of instructor.

T Th 12:20 and lab to be arranged. D. Marme.

Practice in costume design, period research, rendering techniques, and construction.

**367 Costume Design II** Spring. 4 credits.

Prerequisite: Costume Design I or permission of instructor.

T Th 12:20 and lab to be arranged. D. Marme.

Continuation of Costume Design I.

**466 Advanced Costume Design** Fall or spring.

Credit to be arranged. Prerequisite: permission of instructor. May be repeated for credit.

D. Marme.

Projects in stage costume design and rendering techniques. Emphasis on design of total production.

**467 Advanced Costume Construction** Fall or

spring. Credit to be arranged. Prerequisite: consent of instructor. May be repeated for credit.

D. Marme.

Projects in application of historical patterning for the stage.

## Playwriting

**348 Playwriting** Fall. 4 credits. Prerequisite:

permission of instructor.

M 2-4:30. B. States.

A laboratory for the discussion of student plays. Each student is expected to write two or three one-act plays, or one full-length play.

**[349 Advanced Playwriting** Not offered

1976-77.]

## Theatre History, Literature, and Theory

**240 Introduction to the Theatre** Fall or spring.

3 credits.

M W F 10:10. Staff.

A survey of the elements of drama and theatre intended to develop appreciation and rational enjoyment of the theatre in all its forms. Not a production course.

**300 Independent Study** Fall or spring. 1-4 hours;

no more than four credits per semester. May be repeated for credit.

Staff.

Individual study of special topics. Open to juniors and seniors with permission of the departmental member directing the study.

**325 Classic and Renaissance Drama (also**

**Comparative Literature 352)** Fall. 4 credits.

M W F 10:10. B. States.

Readings in world drama from the Greeks to Shakespeare, including such dramatists as Aeschylus, Sophocles, Aristophanes, Plautus, Seneca, Machiavelli, Lope de Vega, Calderón, Marlowe, Shakespeare, Jonson, and Webster.

**326 European Drama, 1660 to 1900 (also**

**Comparative Literature 353)** Spring. 4 credits.

T Th 10:10-11:25. M. Carlson.

Readings from major dramatists from Molière to Ibsen, including such authors as Racine, Congreve, Sheridan, Schiller, Goethe, Hugo, Büchner, Gogol, Turgenev, Zola, Hauptmann, and Chekhov.

**327 Modern Drama (also Comparative Literature**

**354)** Spring. 4 credits.

M W F 10:10. S. McMillin.

Major dramatists of the modern period, including Ibsen, Chekhov, Shaw, Pirandello, Brecht, O'Neill, Miller, and Becket.

**333 History of the Theatre I** Fall. 4 credits.

M W F 11:15. Staff.

A survey of the characteristics of primitive theatre and of theatrical styles and production modes in Classical Greece and Rome, medieval Europe, the Orient, Renaissance England, and Spain.

**334 History of the Theatre II** Spring. 4 credits.

M W F 11:15. M. Carlson.

A survey of theatrical styles and production modes since 1642. Among the areas considered will be Renaissance France, the English Restoration, the eighteenth and nineteenth centuries in England, France, and Germany, and the modern international stage.

**335 American Drama and Theatre** Spring.

4 credits.

M W F 9:05. Staff.

A study of the American theatre and representative American plays with emphasis on the drama from O'Neill to the present.

**336 Theory of the Theatre and Drama** Spring.

4 credits.

M W F 12:20. T. Postlewait.

A study of various theories of dramatic form and theatrical presentation from Aristotle and Horace to Artaud and Brecht, with emphasis on the romantic and modern period, including Lessing, Hugo, Wagner, Strindberg, Stanislavsky, Appia, Craig, Yeats, Langer, Frye, Burke, Fergusson, and Grotowski.

**427 Shakespeare: *King Lear* and the Stages of**

**History (also English 427)** Spring. 4 credits.

M W F 1:25. M. Carlson, S. McMillin.

An interdisciplinary study of theatre history and dramatic criticism from Shakespeare's time to our own, focused on *King Lear*.

**442 Ibsen and Strindberg (also Comparative**

**Literature 472)** Fall. 4 credits.

T Th 10:10-11:40. M. Carlson.

Study of the major dramas of Ibsen and Strindberg in historical perspective and as illustrations of the development of each author's dramatic technique.

**730 Literature and the Theatre** Fall or spring.

4 credits. May be repeated for credit.

M W 10:10-11:40. J. Clancy.

Analysis of various types of dramatic literature from the point of view of the theatrical medium.

**[633 Seminar in Theatre History** Not offered

1976-77.]

**636 Seminar in Dramatic Criticism** Spring.

4 credits.

Staff.

**[637 Seminar in Dramatic Theory** Not offered

1976-77.]

**[638 Seminar in Theory of the Theatre** Not

offered 1976-77.]

**[699 Seminar in Theories of Directing** Not

offered 1976-77.]

**700 Introduction to Research and Bibliography**

**in Theatre Arts** Fall. 1 credit.

M 2. M. Carlson.

**990 Theses and Special Problems in Drama and the Theatre**

See also:

**Shakespeare (English 227)**

**Introduction to Drama (English 272)**

**Shakespeare (English 327)**

**Svevo and Pirandello (Italian 381)**

**Drama of the Spanish Golden Age (Spanish 362)**

**Greek Tragedy: Writing on Violence and Violence of Writing (Classics 340)**

**Russian Theatre and Drama (Russian 332)**

**French Tragedy from Hardy to Racine (French 361)**

**Racine (French 462)**

**Problems in the Analysis of Drama (German 201)**

**Nineteenth-Century Drama (German 359)****Twentieth-Century German Drama in English Translation (German 362)****Twentieth-Century German Literature: Bertolt Brecht (German 638)****Seminar on Nô as a Performing Art (Society for the Humanities 422)****Cinema**

**375 History and Theory of the Cinema I** Fall. 4 credits. A charge of five dollars is made to help defray the expenses of screenings. This sum is to be paid in class during the first week.

T Th 2-4:25. D. Fredericksen.  
Within the context of history, the description, interpretation, and evaluation of feature films as works of art and as objects for mass consumption. Emphases include "realism," "popular art," and "modernism." Contemporary methods of analysis such as auteur theory, genre theory, and semiotics are introduced.

**376 History and Theory of the Cinema II** Spring. 4 credits. A charge of five dollars is made to help defray the expenses of screenings. This sum is to be paid in class during the first week.

T Th 2-4:25. D. Fredericksen.  
Introduction to documentary and experimental films. Documentary figures covered include Vertov, Flaherty, Grierson, Ivens, Lorentz, Riefenstahl, Capra, and direct-cinema filmmakers. Within the history of experimental films, emphases are the avant-garde of the twenties, the movement toward documentary in the thirties, and American experimental films from the forties to the present.

**377 Fundamentals of Cinematography** Fall. 4 credits. Prerequisite: permission of instructor. Limited to 15.

M W F 2-4:25. D. Fredericksen.  
The mechanics and expressive potentials of 16mm filmmaking. Each student makes two short films. No prior filmmaking experience is assumed.

**475 Seminar in the Cinema** Spring. 4 credits. May be repeated for credit. Prerequisite: 375 or 376, or permission of instructor. Limited to 15.

W 2-4:25. D. Fredericksen.  
Topic for Spring 1977: Freud, Marx, and the Cinema. Consideration of a small set of Freudian and Marxist-based notions germane to thinking about film, including "dreamwork," "fetishism," Christian Metz's "imaginary signifier," "alienation," "dialectic," and "exchange value."

**Special Programs and Interdisciplinary Studies****Africana Studies and Research Center**

J. Turner, director; R. Bailey, R. Bell, Y. ben-Jochannan, W. Cross, R. Harris, H. Maalim, C. Mbata, R. Murapa, B. Parker.

The Africana Center has a unique and specialized program of study that offers an undergraduate degree through the College of Arts and Sciences and a graduate degree (Master of African and African-American Studies) through the University's Graduate School.

The purpose of the program is to prepare students for professional careers relevant to the learning and leadership needs of the African-American community. It envisions that the knowledge and methodology of various fields and disciplines will be brought to bear

upon the history, present state, and dynamics of the black people and cultures in the Americas, Africa, and the Caribbean. Our curriculum is designed to reflect a multidisciplinary approach to the experience of African peoples throughout the world. The Africana Center's courses are open to both majors and nonmajors.

**Africana Major**

The undergraduate program offers interdisciplinary study of the fundamental dimensions of the Afro-American and African experiences. Because of the comprehensive nature of the program, it is to the students' advantage to declare themselves as Africana majors as early as possible. The following are prerequisites for admission to the major. Students should submit: (1) a statement of why they want to be an Africana studies major; (2) a tentative outline of what area of study they are considering (African or Afro-American) for the undergraduate concentration; (3) a full transcript of courses taken and grades received. The center's undergraduate faculty representative will review the applications and notify students within two weeks of the status of their request.

After acceptance as a major in the Africana Center, a student must maintain a C+ cumulative average in the center's courses while completing the major program. The Africana major must complete thirty-six credits in courses offered by the center, to include the following four core courses: 231, 290, 360, 431. Beyond the core courses, the student must take eight credits of center courses numbered 200 or above and fifteen credits numbered 300 or above. Within this selection the student must take at least one of the following AS&RC courses: 203, 204, 283, or 301. The program of an undergraduate major may have a specifically Afro-American focus or a specifically African focus.

**Joint Majors**

The center encourages joint majors in the College of Arts and Sciences and in other colleges. Joint majors are individualized programs that must be worked out between the concerned departments. The center's undergraduate faculty representative, Professor Robert Harris, will assist students in the design and coordination of joint major programs. However, in any joint major program the center will require that at least sixteen credits be taken in AS&RC courses, including 290.

**Double Majors**

In the case of double majors (as distinct from joint majors) students undertake to carry the full load of stipulated requirements for a major in each of the two departments they have selected.

**The Honors Program**

The honors program offers students the opportunity to complete a library research thesis, a field project in conjunction with a report on life field experience, or a project/experiment designed by the student. The requirements for admission to the honors program for all students—regular majors, joint majors, and double majors—are a B- cumulative average in all courses and a B+ cumulative average in the center's courses. Each student accepted into the honors program will have an honors faculty committee, consisting of the student's adviser and one additional faculty member, which is responsible for final evaluation of the student's work. The honors committee must approve the thesis or project proposal before May 1 of the student's junior year. The completed thesis and/or project report should be filed with the student's faculty committee by May 10 of the senior year.

**Distribution Requirement**

The following AS&RC courses satisfy distribution

requirements in the categories as listed. Social sciences: any two of 171, 172, 231, 290, 301, 302, 344, 345, 346, 351, 352, 410, 420, 460, 484, 485, 495. History: any two of 203, 204, 231, 283, 344, 360, 361, 370, 381, 460, 475, 483, 490. Humanities: any two of 219, 340, 422, 431, 432, 465, 492. Expressive arts: any two of 137, 138, 285, 303, 465.

**Language Requirement**

Swahili fulfills the College of Arts and Sciences language requirement. Successful completion of AS&RC 131, 132, 133, and 134 gives qualification in Swahili. Successful completion of AS&RC 202 gives proficiency in Swahili. Africana majors are not required to take Swahili, but the center recommends the study of Swahili to complete the language requirement.

**Freshman Seminar Courses**

The following Africana Center courses satisfy the Freshman Seminar requirement: 137, 138, 171, 172, 203, 204, 290.

**131 Swahili** Fall. 4 credits. Requires no previous knowledge of the language.

M W F 10:10. H. Maalim.  
Beginning Swahili. Grammar Part I.

**132 Swahili** Spring. 4 credits. Prerequisite: Swahili 131 or previous study of the language.

M W F 9:05. H. Maalim.  
Elementary reading and continuation of grammar.

**133 Swahili** Fall. 4 credits. Prerequisites: Swahili 131, 132.

M W F 11:15. H. Maalim.  
Advanced study in reading and composition.

**134 Swahili** Spring. 4 credits. Prerequisites: Swahili 131, 132, 133 or permission of instructor.

M W F 10:10. H. Maalim.  
Advanced study in reading and composition.

**137 Afro-American Writing and Expression** Fall. 4 credits.

T Th 11:15-12:40. R. Bell.  
Designed to promote clear and effective communication skills, using black-oriented materials as models for writing assignments and oral discussions.

**138 Afro-American Creative Writing and Expression** Spring. 3 credits.

T Th 11:15-12:40. R. Bell.  
Designed to produce effective and accurate writing which combines basic research techniques and the individual's creative abilities, using black language and culture as resources. A variety of literary forms will be studied.

**171 Infancy, Family, and the Community** Fall. 4 credits.

T Th 3:35-4:50. W. Cross.  
Survey of key psychological dimensions of the black experience covering such issues as (1) race and intelligence; (2) black identity; (3) black family structure; (4) black English; (5) black middleclass; and (6) nature of black psychology.

**172 Teaching and Learning in Black Schools** Spring. 4 credits.

T Th 3:35-4:50. W. Cross.  
A course designed for freshmen and sophomores that will be devoted to the history and contemporary issues of black education, such as the struggle for, black studies, the development of independent black grammar, and problems of public schools in black communities.

**190 An Introduction to Modern Political Systems** Fall or spring. 4 credits.

An analytical interpretation of the sociopolitical and

economic systems of sub-Saharan African countries as well as the nationalist struggles in southern Africa.

**202 Swahili Literature** Fall. 4 credits.

Prerequisites: Swahili 134.

H. Maalim.

Students will gain mastery over spoken Swahili and at the same time be introduced to the predominant Swahili literary forms.

**203 History and Politics of Racism and Segregation** Fall. 4 credits.

T Th 1:25-3:20. C. Mbata.

A cross-cultural study in historical context of the evolution of racist thought and practice in southern Africa and North America.

**204 History and Politics of Racism and Segregation** Spring. 4 credits.

T Th 1:25-3:20. C. Mbata.

The course will deal in an historical context with patterns of racism and segregation using southern Africa and North America as case histories. The study will be undertaken within a theoretical framework that broadly defines racism and segregation and their implications.

**219 Issues in Black Literature** Fall. 4 credits.

M W 3:35-4:50. B. Parker.

The course will examine literature written for black children and analyze the literature as it pertains to black life from 1960 to the present. Students will engage in writing a pamphlet containing their essays, fiction, and poetry, as well as compiling a bibliography of literature for black children.

**231 Black Political Thought in the United States** Fall. 3 credits.

M W F 1:15-2:15. R. Bailey.

This is an introductory course that will review and analyze the major political formulations developed and espoused by black people in the struggle for liberation. Such themes as slave resistance, nationalism, Pan-Africanism, emigration, anti-imperialism, socialism, and the political thought of black women will be discussed. Black political thought will be viewed in its development as responses to real conditions of oppression and exploitation.

**283 Black Resistance: South Africa and North America** Fall. 4 credits.

C. Mbata.

A study of black political movements in South Africa and North America and their responses to the situations of race relations that formed the contexts of their operations.

**285 Perspectives in Black Theatre** Spring. 3 credits.

An examination and analysis of black theatre classics: their structure, design, and intent. The extent and duration of their impact on theatre students and audiences and their special or unique approaches to dramatic form will be examined in dramaturgical terms.

**290 The Sociology of the Black Experience** Fall. 3 credits.

M W 2:30-4:10. J. Turner.

An introductory course to the sociology of the black experience, and to the field of Afro-American studies. Required for all undergraduate students majoring at the Africana Center.

**301 Seminar: Psychological Aspects of the Black Experience** Fall. 4 credits. Prerequisite: permission of instructor.

W. Cross.

Existing research will be used to raise specific questions about new cultural political awareness in the black community. The focus of the course will be individual conversion experiences within the context of social movements. The transformations of political groups (for example, Black Panther Party) and outstanding activists/intellectuals (such as Malcolm

X) are utilized as reference points for analytical discussion of theory.

**302 Social and Psychological Effects of Colonization and Racism** Spring. 4 credits.

Offered in alternate years.

Staff.

**303 Blacks in Communication Media and Film Workshop** Spring. 3 credits.

The course will focus on the general theory of communications, the function of media in an industrialized society, and the social, racial, and class values implied in the communication process. There will be group writing projects, a term paper, and the screening of significant American and Third World films.

**340 Culture, Politics, and Black Writers** Fall. 4 credits.

B. Parker.

The course will concentrate on an examination of the emergence of selected black journals from 1917 to the present. Analysis will focus on literary trends, economic and political problems of the journals, and the relationship between the editors and writers.

**344 Neo-Colonialism and Government in Africa: Problems of Africanization and Development** Fall. 3 credits.

R. Murapa.

Designed to study the problems of government in Africa with emphasis on Ghana, Nigeria, Kenya, Uganda, Tanzania, Zambia, and Malawi.

**345 Afro-American Perspectives in Experimental Psychology (also Psychology 345)** Spring. 3 or 4 credits. Prerequisite: introductory course in psychology or AS&RC 171.

A. W. Boykin.

Designed to examine crucial conceptual, empirical, and philosophical issues in experimental psychology that are directly relevant to Afro-Americans. Traditional approaches are probed and evaluated. Alternative thrusts from a black perspective are entertained and critiqued. Finally, the research process will be evaluated as a potential tool for analysis and action in black communities.

**346 African Socialism and Nation Building** Spring. 4 credits.

R. Murapa.

This course is designed to explore and critically analyze the various theories of African socialism as propounded by theorists and practitioners. It will seek to compare those ideas extending from Nyerere's "Ujamaa" (for example, traditional social and economic patterns of African society) to Nkrumah's "Scientific Socialism" (such as the desirability and practicality of the Marxian type of socialism in Africa).

**351 Politics in the Afro-Caribbean World: An Introduction** Fall or spring. 4 credits. Offered according to demand.

A study of the social, political, economic, and psychological forces that have conspired to shape Caribbean societies.

**352 Pan-Africanism and Contemporary Black Ideologies** Spring. 4 credits.

R. Murapa.

An historical study of Pan-Africanism that will review and analyze the literature and activities of early black Pan-African theorists and movements.

**360 Ancient African Nations and Civilizations** Fall. 3 credits. An introduction to African history beginning with early civilizations in pre-European Africa.

**361 Afro-American History (from African Background to the Twentieth Century)** Fall. 3 credits.

M W F 10:10-11. R. Harris.

Designed to explore major themes of the black

historical experience in America from African origin to the twentieth century. A major concern will be the changing status of black people over time and their attempts to cope with bondage, racism, circumscription, and oppression.

**370 Afro-American History: The Twentieth Century** Spring. 3 credits.

T Th 10:10-11:15. R. Harris.

The course will explore major themes of the black historical experience in America during the twentieth century, and will assess the socioeconomic, political, and cultural condition of Afro-Americans after a presence of more than three hundred and fifty years in this country.

**381 The Slave Trade of Africans** Spring. 3 credits.

This course presents an historical study of the relationship between the early development of Western capitalism and the European slave trade and the impact on development in America.

**400 Ideology and Development** Fall. 4 credits.

The course will survey literature on the political economy of the West African subregion. Emphasis will be placed on contemporary West African economic problems and prospects.

**410 Black Politics and the American Political System** Fall. 4 credits.

T Th 3:35-4:50. R. Bailey.

The course is designed to engage students in a survey and analysis of the theoretical and empirical basis of black politics in America. It is a sociohistorical investigation and evaluation of the variety of practical political activities among black people in the United States.

**420 Politics and Black Community Organization** Spring. 4 credits. Offered in alternate years.

J. Turner.

**422 African Literature** Spring. 4 credits.

Th 5:40-7:40. R. Bell.

The main focus will be on the basic themes in the twentieth-century literature produced by Africans south of the Sahara.

**425 Advanced Seminar in Black Theatre** Fall. 4 credits.

The course involves the study and production of the total black theatre.

**431 History of Afro-American Literature** Fall. 4 credits.

M W 11:15-12:40. R. Bell.

This course will be an extensive examination of the impact that Afro-American literature has had on describing, explaining, and projecting the Afro-American experience from 1619 to the present.

**432 Modern Afro-American Literature** Spring. 4 credits.

M 3-5:30. B. Parker.

A study of fiction by black writers, focusing on the political and sociological components that influenced the development and growth of black writing in relationship to literary themes and attitudes current in specific periods and movements from post-World War I to the present.

**460 History of African Origins of Major Western Religions** Fall or spring. 4 credits. Prerequisites: sophomore status or permission of instructor.

M 5:40-7:40. Y. ben-Jochannan.

The course is designed to develop an understanding of the basic origins of the philosophical, theosophical, and magical-religious teachings responsible for Judaism, Christianity, and Islam.

**465 Black Critique: Towards Defining and Developing a Black Aesthetic** Spring. 4 credits.

A study of aesthetic-moral-cultural values and

judgments that black people can develop, recognize, and viably respect as black aesthetics.

**475 Black Leaders and Movements in Afro-American History** Spring. 4 credits.  
T Th 3:35–4:50. R. Harris.

This course will provide the opportunity for a comprehensive analysis of the personalities, ideas, and activities central to the struggle for Afro-American liberation, ranging from eighteenth-century figures to the present time. Rebellion, emigration, assimilation, nationalism, accommodation, protest, cultural pluralism, separation, integration, and revolution will mark some of the central issues.

**483 Themes in African History** Offered in alternate years. 4 credits.  
C. Mbata.

**485 Racism, Social Structure, and Social Analysis Seminar** Spring. 4 credits.  
W 2:30–5. J. Turner.

The course will be directed toward an examination of the social structure of American society and the relationship of racial and class categories to social stratification. An analysis of power structures and the social salience of socioeconomic connections of governmental decision makers and the corporate structure will be developed.

**495 Political Economy of Black America** Spring. 4 credits.  
T Th 12:20–1:35. R. Bailey.

An examination of the role that black labor has played in the historical development of United States monopoly, capitalism, and imperialism. Emphasis will be placed on the theory and method of political economy, and a concrete analysis of the exploitation of black people as slave labor, agricultural labor, and proletarian labor.

**498–499 Independent Study** 498, fall; 499, spring.

Hours to be determined. Africana Center faculty. For students working on special topics with selected readings, research projects, etc., under the supervision of a member of the Africana Studies and Research Center faculty.

**500 Political Ideology, Planning, and Development in Africa** Spring. 4 credits. Offered in alternate years. Prerequisite: 344, 346, or permission of instructor.  
C. Mbata.

**505 Workshop in Teaching About Africa** 4 credits. Offered in alternate years. Prerequisites: 203 and 204, or 360 and 361, or permission of instructor.  
C. Mbata.

**510 Historiography and Sources (The Development of Afro-American History)** Fall. 4 credits. Prerequisite: upperclass or graduate standing, or permission of instructor.  
T Th 11:15–12:40. R. Harris.

Through a critical examination of the approach, methodology, and philosophy of major writers in this field such as James W. C. Pennington, George Washington Williams, W. E. B. DuBois, Carter G. Woodson, John Hope Franklin, Benjamin Quarles, Lerone Bennett, Jr., and Vincent Harding, we will trace the evolution of Afro-American history from its origin to the present. The nature and purpose of Afro-American history, especially the role of the black historian in the context of a racist and oppressive society, will be analyzed. Attention will be given to sources for studying black history with each participant fashioning a conceptual framework for application to the materials and evidence of the black experience in America.

**515 Comparative Political History of the African Diaspora** 4 credits. Offered in alternate years. Prerequisites: upperclass or graduate standing, or

two of the following courses: 203, 204, 283, 360, 361, 475, 484, 490.

**520 Historical Method, Sources, and Interpretation** Fall. 4 credits. Offered in alternate years. Prerequisites: upperclass or graduate standing, or two of the following courses: 203, 204, 361, 475, 484, 490.  
C. Mbata.

**551 Political History of Social Development in the Caribbean** 4 credits. Offered according to demand. Prerequisite: upperclass or graduate standing or permission of instructor.

**571 Seminar: Psychological Issues in the Black Community** Spring. 4 credits. Prerequisite: permission of instructor.  
W. Cross.

A critical examination of existing theory and research on identity development and identity transformation in Afro-American life, including black identity metamorphosis that occurs within the context of social movements. Particular attention will be given to the following: (1) the interface between social systems and identity development and maintenance; (2) dual consciousness; (3) functions of identity in daily life; (4) conversion and deconversion within the contexts of the contemporary black movement; (5) the psychohistorical implications of unidimensional theories of black self-concept; (6) the relationships among identity, behavior, and ideology.

**698–699 Thesis** 698, fall; 699, spring. Africana Studies and Research Center students only.  
Africana Center faculty.

## Ancient Mediterranean Studies

Study of the major ancient cultures of the Mediterranean involves a large number of disciplines in several departments at Cornell. The concentration in Ancient Mediterranean Studies aims at providing a coordinated program for students who do not elect to major in this area. (Relevant majors are offered by the Department of Classics and the Department of Semitic Languages and Literatures.) There are no prerequisites for the concentration, which is open to freshmen as well as upperclass students regardless of their majors. The concentration will serve one or both of two main purposes: (1) An introduction to the group of cultures that form the roots of modern Western culture. Mediterranean traditions of politics, religion, thought, literature, and art have continued and developed in new ways in the West since the end of antiquity. An understanding of those traditions as well as the issues and concerns from which they grew is valuable in itself and provides an illuminating perspective essential to understanding our own culture. (2) An introduction to the liberal arts through the study of works of the highest quality in literature, art, history, philosophy, government, and science.

Courses are listed below under four headings: General Courses, Civilization (history, art, and archaeology), Literature, and Thought. General courses are intended to be introductory to all three areas of civilization, literature, and thought. To fulfill the requirements of the concentration the student must complete a minimum of five courses selected in consultation with an adviser in the concentration. Advisers are listed below under civilization, literature, and thought.

### Types of Programs

A student may wish to concentrate entirely in one of the three main areas (civilization, literature, or thought), or to elect a program which draws from two or all three of these areas, such as a study of the civilization, literature, and thought of one period—for example, Classical Greece (fifth and fourth centuries, B.C.). Many other coherent programs may be arranged by the student and adviser.

## General Courses

**The Greek Experience (Classics 211)**

**The Roman Experience (Classics 212)**

**The Near East in Biblical Times (Semitics 345)**

**Classical Antiquity: Classical Greece (History 261)**

**Classical Antiquity: Classical Rome (History 262)**

## Civilization

A. Bernstein (history), K. Clinton (Classics), J. E. Coleman (Classics), W. Cummer (architecture), D. Owen (Semitics), A. Ramage (history of art), J. Scott (history of art).

**Beginnings of Civilization (Art History 210)**

**Art of the Ancient Near East (Art History 316)**

**Architecture of the Ancient Near East (Architecture 340)**

**The History of Ancient Israel (Semitics 243–244)**

**[The Age of the Patriarchs (Semitics 344)** Not offered 1976–77.]

**Biblical Law (Comparative Literature 325)**

**Minoan-Mycenean Art and Archaeology (Classics 221)**

**Introduction to Classical Archaeology (Classics 220)**

**The Archaeology of Classical Greece (Classics 320)**

**Art of the Classical World (Art History 220)**

**Introduction to Roman Law (Classics 304)**

**Women in Classical Greece and Rome (Classics 363)**

**Painting in the Greek and Roman World (Art History 323)**

**Hellenistic and Roman Architecture (Architecture 341)**

**Numismatics (Art History 424)**

**Classical Greece, 510–404 B.C. (History 463)**

**Classical Greece, 404–338 B.C. (History 464)**

**Greek Sculpture (Art History 431)**

**The Roman Revolution, 146–44 B.C. (History 461)**

**Early Imperial Rome, 44 B.C.–A.D. 70 (History 462)**

**Art of Roman Empire (Art History 322)**

**Roman Cities, People, and Monuments (Art History 105)**

**[Pagan and Christian at Rome (Classics 332)** Not offered 1976–77.]

## Literature

F. M. Ahl (Classics), A. Betensky (Classics), K. Clinton (Classics), W. R. Johnson (Classics), G. M. Kirkwood (Classics), D. L. Malone (Classics), G. M. Messing (Classics), D. Owen (Semitics), P. Pucci (Classics).

**Greek and Roman Drama (Classics 300)**

**Greek Foundations of Western Literature (Classics 331)**

**Latin Foundations of Western Literature (Classics 333)**

**Ancient Wit... Comic and Satiric Writing... (Classics 339)**

**Genre and Period in Greek and Roman Literature (Classics 430)**

**Ancient Near Eastern Literature (Semitics 262)**

**The Literature of the Old Testament (Comparative Literature 328)**

**Readings in the New Testament (Comparative Literature 429)**

**Classic and Renaissance Drama (Theatre 325)**

Most courses in ancient literatures are given in the original languages. These and introductory language courses are given by the Department of Classics (listed under Greek and Latin), and by the Department of Semitic Languages and Literature (listed under Hebrew, Akkadian, and Aramaic). Any of the language courses or the literature courses offered in the original languages may be taken as courses in the concentration.

### Thought

E. Asmis (Classics), C. M. Carmichael (comparative literature), W. J. Dannhauser (government), G. J. Fine (philosophy), T. H. Irwin (philosophy), N. Kretzmann (philosophy), L. P. Williams (history).

### Philosophy

**Ancient Thought (Philosophy 210)**

**Ancient Philosophy (Philosophy 211)**

**Greek Philosophy—Plato and Predecessors (Classics 224)**

**Greek Philosophy—Aristotle and Successors (Classics 225)**

**Socrates (Classics 334)**

**Plato (Philosophy 309)**

**Aristotle (Philosophy 310)**

**Foundations of Western Thought (Classics 336)**

**Topics in Ancient Philosophy (Philosophy 314)**

**Special Topics in the History of Philosophy (Philosophy 315)**

**Topics in Ancient Philosophy (Philosophy 413)**

### Science

**Science in Western Civilization (History 281)**

**Science in Classical Antiquity (History 481-482)**

**Ancient Philosophy of Science (Classics 335)**

**Greek Science (Classics 222)**

### Law and Politics

**Greek Political Philosophy (Government 360)**

**Biblical Law (Comparative Literature 325)**

**Introduction to Roman Law (Classics 304)**

### Religion

**Greek Mythology (Classics 236)**

**Greek Religion (Classics 363)**

**Greek and Roman Mystery Cults (Classics 415-416)**

**The Literature of the Old Testament (Comparative Literature 328)**

**Readings in the New Testament (Comparative Literature 328)**

**Studies in Christian Origins (Semitics 334)**

**Pagan and Christian at Rome (Classics 332)**

**Topics in the Philosophy of Religion (Philosophy 363)**

## College Scholar Program

The College Scholar Program exists because of the conviction that some students will feel more satisfied with their educations if they are completely responsible for their own academic programs. Each year forty freshmen are chosen for the program. These students, in consultation with their faculty advisers, design their own programs which must involve 120 credits of regular academic courses and four terms of physical education. College Scholars do not have to meet the letter of the distribution requirements, but there is a strong feeling among the members of the College Scholar Advisory Board that the spirit of those requirements is a good one.

Obviously the College Scholar Program is meant for students who are especially able and mature and who have a good sense of what they would like to derive from their Cornell experience. However, College Scholars need not know exactly what courses they will want to take. The program can be used to explore the College's many offerings with a little more freedom than is available to other students.

The College Scholar Program is also a kind of honors program. Each year two or three seminars will be offered that are intended to help students approach some basic problems and texts in our Western tradition. College Scholars will be encouraged to take these seminars and to write an integrative senior essay.

The deadline for applying to the program is the end of February. Students should contact the Office of Special Programs, 159 Goldwin Smith, for more information.

**College Scholar 396-397 Independent Study** 396, fall; 397, spring. 1 or 2 credits. Permission of program office required.

**College Scholar 398-399 Independent Study** 398, fall; 399, spring. 3 or 4 credits. Permission of program office required.

**College Scholar 284 Undergraduate Seminar in the History of Biology (also Biological Sciences 204 and History 284)** Spring. 3 credits. Limited to 20. J. Fessenden-Raden and W. Provine. Biological determinism with regard to race, sex and intelligence.

**College Scholar 465 Cicero and his Age (also Classics 465 and History 465)** Spring. 4 credits. A. Bernstein and R. Johnson.

## German Area Studies Major

See p. 90.

## Programs in Greek and Roman Civilization

Greek Civilization: E. Asmis, director; Roman Civilization: W. R. Johnson, director.

No new students will be admitted to these programs in 1976-77. Continuing students should consult with E. Asmis or W. R. Johnson concerning their courses for this year. For students who are interested in programs in Greek and Roman civilization, there are now two relevant programs: the Concentration in Ancient Mediterranean Studies (see p. 120) and the major in Classical Civilization in the Department of Classics (see p. 60).

## Independent Major Program

The Independent Major Program is a College program designed to provide an option for students to design their own interdisciplinary major when their interests are in one fairly specialized field that cuts across several departments. Proposals for independent majors are reviewed by a board of faculty members which considers whether the plan is equivalent in coherence, breadth, and depth to a departmental major and whether it is well suited to the student's academic preparation and ability. For more information consult the director, L. S. Abel, 159 Goldwin Smith Hall.

When independent, supervised study is needed to focus an independent major, students may register for the special, independent major courses listed below.

**Independent Major 301-302 Independent Study** 301, fall; 302, spring. 2 credits. Permission of program office required.

**Independent Major 351-352 Independent Study** 351, fall; 352, spring. 3 or 4 credits. Permission of program office required.

**Independent Major 398 Honors Research** Fall or spring. Credit variable to 8 credits per year. For honors candidates only.

**Center for International Studies**  
See p. 193.

## Program of Jewish Studies

The Program of Jewish Studies is included in the framework of the Department of Semitic Languages and Literatures. The program has grown out of the conviction that Judaic civilization merits comprehensive and thorough treatment. The other view that helped form the guidelines of the program is that proper understanding of any literature is inconceivable without adequate knowledge of the history of the people that created it. Accordingly, the department's offerings in the area of Hebrew language and literature have been considerably expanded and have branched out to include Jewish history.

Although further expansion of the program is still called for to encompass the broad spectrum of disciplines in the field, the program, as it is constituted at present, already enables students to obtain basic instruction and specialization in the fields of Hebrew and Aramaic languages, the Old Testament, the Apocryphal and Tannaitic literatures, medieval Hebrew literature, modern Jewish thought, modern Hebrew literature, and ancient, medieval, and modern Jewish history. In all these fields students may take courses on a graduate and an undergraduate level.

Students may get more precise counsel from their advisers or from the department head. For descriptions of the courses included in the program, see p. 111.

**Latin American Studies**

T. E. Davis, director; S. Barraclough, J. Converse, L. Crowder, M. Drosdoff, D. Freebairn, R. Goldsen, W. Goldsmith, R. González, J. Henderson, T. Holloway, J. Kahl, L. Kerr, E. Kenworthy, L. King, T. Lynch, R. McDowell, J. Murra, M. Oettinger, B. Rosen, J. Scott, D. Solá, J. M. Stycos, M. Suñer, H. D. Thurston, W. Whyte, L. Williams, P. Wilson, F. Young.

The Latin American Studies Program encourages and coordinates faculty and student interests in Latin America. A variety of special lectures, films, and seminars supplement the regular course offerings.

Undergraduate students may arrange a Latin American concentration or an independent major in Latin American studies, and graduate students may pursue a minor in Latin American studies while majoring in the graduate field of their choice. The College of Arts and Sciences offers Latin American studies courses in anthropology, economics, government, history, history of art, and sociology. In addition, there is a varied language, literature, and linguistics curriculum in Spanish, Portuguese, and Quechua. The student may also pursue Latin American studies in the College of Agriculture and Life Sciences: the College of Architecture, Art, and Planning; the College of Human Ecology; and the School of Industrial and Labor Relations.

Courses offered in the various departments include:

**Economics of Agricultural Development (Agricultural Economics 464)**

**Seminar on Latin American Agricultural Policy (Agricultural Economics 665)**

**Geography and Appraisal of Soils of the Tropics (Agronomy 401)**

**[The Discovery of America (Anthropology 150) Not offered 1976-77.]**

**[Urban Anthropology (Anthropology 313) Not offered 1976-77.]**

**Oral Traditions and Written Sources in Ethnology and Archaeology (Anthropology 318)**

**[Ethnology of South America (Anthropology 332) Not offered 1976-77.]**

**Ethnology of the Andean Region (Anthropology 333)**

**The Earliest Civilizations (Anthropology 350)**

**[Archaeology of the Americas I (Anthropology 354) Not offered 1976-77.]**

**Archaeology of the Americas II (Anthropology 355)**

**Mesoamerican Thought and Culture (Anthropology 356)**

**[Middle America (Anthropology 631) Not offered 1976-77.]**

**[Tribal Peoples of Lowland South America (Anthropology 632) Not offered 1976-77.]**

**Andean Research (Anthropology 633)**

**[Origins of Mesoamerican Civilization (Anthropology 667) Not offered 1976-77.]**

**Regional Planning and Development in Latin America (City and Regional Planning 863)**

**Economic History of Latin America (Economics 325/525)**

**Economic Problems of Latin America (Economics 565)**

**[Contemporary Brazil (Economics 568) Not offered 1976-77.]**

**Politics of Latin America (Government 340)**

**Sociology of Latin American Politics (Government 655 and Sociology 655)**

**Latin American History to 1825 (History 210)**

**Latin American History Since 1825 (History 211)**

**Agrarian Societies in Latin American History (History 347)**

**[Contemporary Brazil (History 348 and Sociology 368) Not offered 1976-77.]**

**Undergraduate Seminar in Latin American History (History 449)**

**Seminar in Latin American History (History 649)**

**[History of Art (History of Art 210) Not offered 1976-77.]**

**Pre-Columbian Art (History of Art 315)**

**[Latin American Art (History of Art 392) Not offered 1976-77.]**

**[Seminar in Pre-Columbian Art and Archaeology (History of Art 415) Not offered 1976-77.]**

**Special Studies of Problems of Agriculture in the Tropics (International Agriculture 602)**

**Portuguese Basic Course (Portuguese 101-102)**

**Portuguese Elementary Course (Portuguese 131-132)**

**Portuguese Intermediate Composition and Conversation (Portuguese 203-204)**

**Portuguese Advanced Readings (Portuguese 305-306)**

**Quechua Elementary Course (Quechua 131-132)**

**Quechua Intermediate Course (Quechua 133-134)**

**Seminar in Quechua Linguistics (Quechua 700)**

**Readings in Modern Spanish-America (Romance Studies 317)**

**[Spanish-American Literature to "Modernismo" (Romance Studies 329) Not offered 1976-77.]**

**[Twentieth-Century Spanish-American Drama (Romance Studies 332) Not offered 1976-77.]**

**Spanish-American Short Story: the "Genre Fantastique" (Romance Studies 334)**

**Latin American Writing of Self-Awareness (Romance Studies 434)**

**The Modern Spanish-American Novel (Romance Studies 435)**

**Graduate Seminar in Spanish-American Literature: Carpentier (Romance Studies 635)**

**Application of Sociology to Development Programs (Rural Sociology 751)**

**Population Problems (Sociology 230)**

**Comparative Social Change (Sociology 240)**

**After the Revolution: Mexico and Cuba (Sociology 367)**

**[Human Fertility in Developing Nations (Sociology 434) Not offered 1976-77.]**

**Population Policy (Sociology 531)**

**Research Seminar in Population: Costa Rica (Sociology 632)**

**History of the Spanish Language (Spanish 401-402)**

**Grammatical Structure of Spanish (Spanish 408)**

**Hispanic Dialectology (Spanish 601)**

**Linguistic Structures of Ibero-Romance (Spanish 602)**

**Contemporary Theories of Spanish Phonology (Spanish 603)**

**Contemporary Theories of Spanish Grammar (Spanish 604)**

**Seminar in Ibero-Romance Linguistics (Spanish 700)**

**Law and Society**

The existence at Cornell of a wide variety of courses concerning the law as a social and historical phenomenon make it possible for students to study law and society as a minor field. Students who wish to graduate with a concentration in law and society should consult one of the advisers listed below to work out a coherent program of study including at least four courses from among those approved for this purpose.

The law and society advisers for the 1976-77 year are: H. Alker (psychology), C. Carmichael (comparative literature), D. J. Danelski (government), D. B. Lyons (philosophy), M. B. Norton (history), D. T. Regan (psychology), D. Resnick (government), C. A. Sheingold (sociology).

The following courses currently qualify for the concentration in law and society:

**Introduction to Roman Law (Classics 304)**

**Seminar on Literature and the Law (Comparative Literature 423)**

**Economics and the Law (Economics 304)**

**Public Regulation of Business (Economics 352)**

**Law and Society (Government 100)**

**The Nature, Functions, and Limits of Law (Government 313)**

**Law and Social Science (Government 324-325)**

**[Civil Liberties in the United States (Government 327) Not offered 1976-77.]**

**International Law (Government 389)**

**Constitutional Politics (Government 428)**

**American Constitutional Development (History 318)**

**Law, Society, and Morality (Philosophy 324)**

**Contemporary Ethical Theory (Philosophy 441)**

**Biblical Law (Semitics 333)**

**[Criminology (Sociology 353) Not offered 1976-77.]**

**The Law and Environmental Control (Civil and Environmental Engineering 615, College of Engineering)**

**Labor Relations Law and Legislation (Industrial and Labor Relations 201, School of Industrial and Labor Relations)**

**Protective Labor Legislation (Industrial and Labor Relations 341, School of Industrial and Labor Relations)**

**Legal and Market Controls of Technological Change (The Law School)**

**The Frederick George Marcham Scholar Program**

Each year the Frederick George Marcham Scholar Program supports a special seminar program. For information contact L. S. Abel, 159 Goldwin Smith Hall.

**Medieval Studies**

A. B. Groos, graduate faculty representative, B. B. Adams, F. M. Ahl, A. J. Berger, V. T. Bjarnar, R. G. Calkins, A. M. Colby, R. T. Farrell, R. A. Hall, Jr., T. D. Hill, J. J. John, R. E. Kaske, N. Kretzmann, G. Mazzotta, G. M. Messing, C. Morón-Arroyo, J. M. Najemy, B. Netanyahu, D. M. Randel, B. Tierney, F. van Coetsem, J. F. Vigorita, W. Wetherbee III.

Undergraduates interested in medieval studies have an opportunity to take courses in the following areas of instruction: medieval Hebrew, medieval Arabic, medieval Latin, Old English, Middle English, medieval Irish and Welsh, Old Provençal, medieval French, medieval Spanish, medieval Italian, Old Saxon, Old High German, Middle High German, Gothic, Old Norse (Old Icelandic), Old Russian, comparative literature, medieval art and architecture, medieval history, Latin paleography, medieval philosophy, musicology, comparative Slavic linguistics, comparative Romance linguistics, and comparative Germanic linguistics.

Undergraduates who wish to undertake an independent major in medieval studies should consult the graduate faculty representative for medieval studies, Professor A. B. Groos, 182 Goldwin Smith Hall.

Information for prospective graduate students is contained in the *Announcement of the Graduate School* and in a brochure on medieval studies, which can be obtained from the graduate faculty representative.

**Freshman Seminars**

**101 The Literary Experience of the Middle Ages** Fall, 3 credits.

M W F 12:20, T Th 10:10-11:25. Staff.

An exploration of several major works and their historical, social, and philosophical contexts. Readings for discussion include: *Beowulf*, Old English poetry, an Icelandic saga, an Arthurian romance by Chrétien de Troyes, *Tristan and Isolde*, selections from Chaucer or Malory, and a "medieval" work by a modern writer such as J. R. R. Tolkien or T.H. White.

**102 The Literary Experience of the Middle Ages** Spring, 3 credits.

M W F 12:20, T Th 10:10-11:25. Staff.

An exploration of several major works and their historical, social, and philosophical contexts. Readings for discussion include: an Icelandic saga, a Germanic epic (*Nibelungenlied*), an Arthurian romance of Chrétien de Troyes, the Grail quest (*Parzival*), selections from Chaucer or Malory, and a "medieval" work by a modern writer such as J. R. R. Tolkien or T. H. White.

For further information about the following and related courses, including those offered in alternate years, consult the listings for Classics, Comparative Literature, English, Germanic Studies, History, History of Art, Modern Languages and Linguistics, Music, Philosophy, Romance Studies, Russian Literature, and Semitic Languages and Literatures.

**Classics**

216 Vergil

316 Roman Philosophical Writers

368 Medieval Latin Literature

680 Roman Rhetoric

**Comparative Literature**

326 Studies in Christian Origins

343 Medieval Literature

441 The Other World in Medieval Romance

446 Allegory and Symbolism

**English**

313 Middle English Literature

319 Chaucer

411 Old English in Translation

415 The English Language

611 Readings in Old English

612 *Beowulf*

613 Middle English Literature

619 Chaucer

710 Graduate Seminar in Medieval Literature (also German Literature 650)

712 Advanced Old English

718 Graduate Seminar in Medieval Literature

**French**

401-402 History of the French Language

447 Medieval Literature

602 Linguistic Structures of Old and Middle French

649 Introduction to French Philology

**Germanic Studies**

401 Introduction to Germanic Linguistics

402 History of the German Language

405 Introduction to Medieval German Literature

603-604 Old Saxon, Old High German, Old Low Franconian, Old Frisian

609-610 Old Norse

612 Seminar in Old Norse Literature

650 Graduate Seminar in Medieval Literature (also English 710)

710 Seminar in Germanic Linguistics

720 Seminar in Comparative Germanic Linguistics

753 Tutorial in Middle High German Literature

**History**

263 The Earlier Middle Ages

264 The High Middle Ages

350 Early Renaissance Europe

366 Medieval Culture 1100-1300

367 Church and State During the Middle Ages

369 The History of Florence 1250-1530

668-669 Seminar in Medieval History

**History of Art**

337 The Medieval Illuminated Book

342 Medieval and Renaissance German Art

531 Problems in Medieval Art and Architecture

**Italian**

335 Boccaccio

437 Petrarch

**Linguistics**

404 Comparative Methodology

410 Historical Linguistics

623-624 Old Irish

627 Advanced Old Irish

628 Comparative Celtic Grammar

671-672 Comparative Slavic Linguistics

**Philosophy**

313 Medieval Philosophy

315 Special Topics in the History of Philosophy

612 Medieval Philosophy

**Romance Linguistics**

321-322 History of the Romance Languages

323-324 Comparative Romance Linguistics

**Russian**

401-402 History of the Russian Language

**Semitic Languages and Literatures**

341 History of the Jewish People 614-1492

**Spanish**

440 Medieval Literature

**Religious Studies**

J. B. Long, chairman; C. M.-Arroyo, J. P. Bishop, R. A. Borke, R. G. Calkins, K. M. Clinton, M. J. Colacurcio, J. J. John, A. T. Kirsch, N. Kretzmann, N. Malcolm, S. J. O'Connor, D. I. Owen, A. E. Paris, D. Randel, J. F. Scott, S. C. Strout, B. Tierney, A. W. Wood and M. W. Young.

Religious studies is an interdisciplinary program reflecting a wide variety of academic interests and disciplines. The intention of the program is to provide a formal structure for the study of the religions of

mankind at the undergraduate level. A student may fulfill the requirements for a Concentration in Religious Studies by completing a minimum of four courses that have been approved by an adviser in the area of the concentration. The program is administered by a committee; the chairman is J. Bruce Long, 158 Rockefeller Hall.

Courses in religious studies are offered in the following departments: Anthropology, Archaeology, Asian Studies, Classics, Comparative Literature, English, History, History of Art, Philosophy, and Semitic Languages and Literatures.

*Methodology and Interdisciplinary Approaches*

**Introduction to the Study of Religion (Asian Studies 203)**

**Introduction to Cultural Anthropology (Anthropology 103)**

**Myth, Ritual, and Symbol (Anthropology 424)**

*Anthropology*

**Comparative Religious Systems (Anthropology 322)**

**Social Thought and Social Studies (Anthropology 417)**

**Ethnology of Island Southeast Asia (Anthropology 334)**

**Ethnology of Mainland Southeast Asia (Anthropology 335)**

**Anthropological Approaches to the Study of Buddhism (Anthropology 619)**

*Asian Studies*

**[Introduction to Asian Civilizations: Origins to 1600 (History 190) Not offered 1976-77.]**

**Introduction to Hinduism (Asian Studies 301)**

**Introduction to Buddhism (Asian Studies 302)**

**Chinese Philosophical Literature (Asian Studies 371)**

**Chinese Imaginative Literature (Asian Studies 372)**

**Japanese Poetry and Drama (Asian Studies 375)**

**[Japanese Nō Theatre (Asian Studies 400) Not offered 1976-77.]**

**Issues and Problems in Indian Philosophy (Asian Studies 405)**

**Paths of Liberation in the Bhagavad Gītā (Asian Studies 406)**

**[Myths and Symbols in Indian Religion (Asian Studies 410) Not offered 1976-77.]**

**Medieval Chinese World (History 492)**

*The Classics*

**[Greek Religion (Classics 360) Not offered 1976-77.]**

**The Greek Experience (Classics 211)**

**The Roman Experience (Classics 212)**

**Greek and Roman Mystery Cults (Society of the Humanities 424-425; Classics 415-416)**

*Comparative Literature*

**The Literature of Ancient Israel (Comparative Literature 323; also Semitics 330)**

**Biblical Law (Comparative Literature 325)**

**Literature and Religion (Comparative Literature 329; Spanish 399)**

**Seminar on the Deuteronomistic School of Writers (Comparative Literature 428)**

**Readings in the New Testament (Comparative Literature 429)**

**Studies in Christian Origins (Comparative Literature 326)**

**[Dante (Comparative Literature 344) Not offered 1976-77.]**

**Seminar on Coded Communication (Comparative Literature 423)**

**Allegory and Symbolism (Comparative Literature 446)**

**[Medieval Seminar: The Miracle Play (French 642) Not offered 1976-77.]**

*English Literature*

**Milton (English 329)**

**Early American Literature (English 361)**

**The American Renaissance (English 362)**

**The Eden Myth in Literature (English 408)**

**American Transcendentalism (English 662)**

*History*

**Medieval History (History 263-64)**

**Major Themes in American Religious History (History 346)**

**[Medieval Culture, 400-1150 (History 365) Not offered 1976-77.]**

**Medieval Culture, 1100-1300 (History 366)**

**Church and State During the Middle Ages (History 367)**

**[Undergraduate Seminar on Religion and Culture in the Middle Ages (History 368) Not offered 1976-77.]**

*History of Art*

**[Introduction to Art History: Beginnings of Civilization (History of Art 210) Not offered 1976-77.]**

**[Introduction to Art History: Medieval Art (History of Art 230) Not offered 1976-77.]**

**Introduction to Art History: Asian Traditions (History of Art 280)**

**Pre-Columbian Art (History of Art 315)**

**Art of the Ancient Near East (History of Art 316)**

**Medieval Manuscripts (History of Art 337)**

**Medieval and Renaissance German Art (History of Art 342)**

**[Studies in Indian and Southeast Asian Art (History of Art 386) Not offered 1976-77.]**

*Philosophy*

**Religion and Reason (Philosophy 263)**

**Medieval Philosophy (Philosophy 313)**

**Topics in the Philosophy of Religion (Philosophy 363)**

*Semitic Languages and Literatures*

**What is Judaism? (Semitics 240)**

**History of Ancient Israel (Semitics 243-44)**

**[Ancient Near Eastern Literature (Semitics 282; also Comparative Literature 226) Not offered 1976-77.]**

**Archaeology of the Ancient Near East (ArKeo 310)**

**[From Spinoza to Buber (Semitics 320) Not offered 1976-77.]**

**[Nationalism and Religion in Modern Jewish History (Semitics 321) Not offered 1976-77.]**

**A Synoptic History of the Jewish People (Semitics 341)**

**[Age of the Patriarchs (Semitics 344) Not offered 1976-77.]**

**History of the Ancient Near East in Biblical Times (Semitics 345)**

**Major in Russian and Soviet Studies**

The College offers a major in Russian and Soviet studies, the requirements for which are:

1. Qualification in Russian, as defined on p. 45.
2. At least one course relating to Russia, at the 200 level or above, in each of the following departments: Russian literature, government, economics, and history. (A course in another department may be substituted for one of the above with the consent of the major adviser.)
3. At least three additional courses, at the 300 level or above, in one of the following departments: Russian literature, government, economics, or history. These courses shall be selected in consultation with the student's adviser and shall be approved as appropriate for a major in Russian and Soviet studies.

Each student majoring in Russian and Soviet studies will be assigned a major adviser in the department of his or her special interest who is also a specialist on Russia. Interested students should contact W. M. Pintner, Department of History, or M. Rush, Department of Government.

**Science, Technology, and Society**

See p. 193.

**Social Relations Major**

See p. 112.

**Society for the Humanities**

Henry Guerlac, director. Fellows for 1976-77: Jerald Bullis (Lawrence University); Karen Brazell (Cornell University); Kevin Clinton (Cornell University); Philip Grierson (Cambridge University); Clive Holmes (Cornell University); Terence Irwin (Cornell University); John Kelleher (Harvard University); Frédéric Nef (Ecole Pratique des Hautes Etudes); Victor Skretkovicz, Jr. (University of Ottawa).

The Society awards annual fellowships for research in the humanities in three categories: Senior Fellowships, Faculty Fellowships, and Junior

Postdoctoral Fellowships. The Fellows offer, in line with their research, informal seminars intended to be off the beaten track. Details about these seminars are circulated to interested departments.

Unlike other courses, the Society's seminars begin the second week of each semester. These seminars are open to graduate students and suitably qualified undergraduates. Students wishing to attend should telephone the Society (6-4725) early in the first week of the term to arrange a short interview with the Fellow offering the course. There are no examinations, and it is at the discretion of the Fellow whether to require only oral reports, or, in addition, a research paper. Students wishing credit for the course should formally register in their own college. Persons other than those officially enrolled may attend as visitors with permission of the Fellow.

All seminars are held in the Society's quarters, A. D. White Center for the Humanities, 27 East Avenue.

## Seminars

### 414 Interpretation of Coin Finds Fall, 4 credits. M 1:25-3:10. P. Grierson.

Coin finds are an important source for numismatists, archaeologists, and historians. Their interpretation depends on their nature and structure, and on other types of evidence that illuminate the circumstances of loss or burial. The seminar examines such circumstances, with an estimate of the usefulness of this kind of evidence for scholars.

### 415 The Confidence Man, the Bard, and the Savants Spring, 4 credits.

T 1:25-3:10. J. Kelleher.  
The seminar will concentrate on the many-sided controversy centering on James Macpherson's "translations" of the poems of the supposed third-century bard, Ossian, son of Fingal. The difficulties facing the eighteenth-century historian or antiquary will be examined, as well as the problems arising from old Scottish, Irish, and British pseudohistory.

### 416 Short Poems Fall, 4 credits. T 1:25-3:10. J. Bullis.

Reading and discussion of perhaps 100 short poems, from the fifteenth century to the present.

### 417 Long Poems Spring, 4 credits. M 3:35-5:20. J. Bullis.

Reading and discussion of certain long poems of the late eighteenth century and twentieth century in English and American literature, including poems by Whitman, G. M. Hopkins, Robert Bridges, Stevens, and Roethke.

### 418-419 Elizabethan Prose Fiction 418, fall; 419, spring, 4 credits per term.

W 1:25-3:10. V. Skretkovic.  
A study of selected writings with regard to their classical and continental sources, influence on the works of their contemporaries, and followers.

### 420-421 Leibniz and Modern Linguistic Theory 420, fall; 421, spring, 4 credits per term. Th 3:35-5:20. F. Neff.

Leibniz's philological and etymological theories, followed by a detailed discussion of Leibniz's philosophy of language in the light of modern semiotic methods. Special attention will be paid to the works on discursive and narrative analysis by A. J. Greimas.

### 422 Nō as a Performing Art Fall, 4 credits. T 3:35-5:20. K. Brazell.

A study of the theory and practice of movement and dance, rhythm, song, instrumental music, masks, costumes and props in the Nō theatre. Students will use this knowledge to analyze Nō plays or to create their own experimental works.

### 423 Literary and Performing Arts of Medieval Japan Spring, 4 credits.

T 3:35-5:20. K. Brazell.

A study of literary and performing arts in Japan from the thirteenth through the fifteenth centuries including song, dance, theatre, story telling, kickball, and linked verse as well as Zen aesthetics and the concept of an "artistic way."

### 424-425 Greek and Roman Mystery Cults (also Classics 415-416) 424, fall; 425, spring, 4 credits per term.

W 3:35-5:20. K. Clinton.  
The development and character of Mystery cults from the original *Mysteria* of Demeter and Persephone to the Christian "Mysteries." These cults include: the Kabirol, the great Gods of Samothrace, Dionysus, the Great Mother (Cybele), Roman Bacchus, Isis and Osiris, and other cults of Asia Minor, and the Near East. Investigation will focus on the distinctive features of the Mystery cults which contributed to their success.

### 426 The Preindustrial Community Fall, 4 credits. Th 1:25-3:10. C. Holmes.

A comparative analysis of the major studies, both anthropological and historical, concerned with community structure in preindustrial society. Emphasis will be given to community consciousness; the problem of dissidence within the community; relationships between the community and other groups and structures; and the process of modernization as it impinges upon the community.

### 427 Law and Social Change Spring, 4 credits. Th 1:25-3:10. C. Holmes.

The seminar will discuss thinkers who consider the relationship between the legal systems and social structure, then examine the utility of these theories for an understanding of English commercial and property law in the sixteenth and seventeenth centuries, the works of major contributors to legal advance, and writings of present-day critics of the legal establishment.

### 428 Idealism in Ethics and Politics Fall, 4 credits.

M 3:35-5:20. T. Irwin.  
The idealist criticism of Kantian ethics; idealist ethical conceptions and theories, especially self-realization, and the theory of the state; strengths and weaknesses in the idealist position. Readings in Kant, Hegel, Marx, Bradley, Green, and more recent writers.

### 429 Aristotle: Nature, Man, and Society Spring, 4 credits.

M 1:25-3:10. T. Irwin.  
Aristotle's account of human nature in its metaphysical and biological context; the conclusions he draws about ethics and political theory. Problems will be discussed as they arise in Aristotle and in recent philosophical work on these questions.

## South Asia Program

The South Asia Program exists to encourage and correlate teaching and research in South Asian studies dealing with Bangladesh, India, Nepal, Pakistan, and Sri Lanka (Ceylon). The program faculty includes members from a number of disciplines. Undergraduates with a special interest in South Asia may major in Asian studies with a concentration in South Asia. Languages regularly offered are Hindi, Sinhalese, Tamil, Telugu, and Urdu. Cornell is a charter member of the American Institute of Indian Studies, and undergraduates, as well as graduate students, are eligible for AIIS three-month summer or nine-month intensive language programs in India. For courses available in South Asia and details on the major, see Asian studies. Students wishing further information should see the Director, South Asia Program, 130 Uris Hall.

## Southeast Asia Studies

See p. 53.

## Undergraduate Research Program

The Undergraduate Research Program offers students the opportunity to be involved in some faculty research. Students and professors agree on how much and what kind of work the students will contribute and how much credit they will earn. The office of Special Programs, 159 Goldwin Smith Hall, has descriptions of available projects.

## Women's Studies Program

R. A. Borker, J. H. Brewer, A. H. Cook, J. R. Egner, J. L. Ettin, J. Farley, H. Feldman, C. L. Griffeth, M. L. Hayes, M. F. Katzenstein, S. McConnell-Ginet, S. J. Morgan, M. B. Norton, W. B. Provine, E. L. Vatter, J. T. Younger. Lecturers, Spring, 1976: L. S. Abel, C. E. Cook, J. L. Ettin, I. Olsen-Tjensvold; Summer, 1976: J. Camhi, R. G. Possen.

Women's Studies, a University program in the College of Arts and Sciences, has three goals: to encourage the development of teaching about women for women and men; to examine assumptions about women in various disciplines and to develop, systematize, and integrate back into the disciplines new knowledge about women; and to cooperate in public service activities with the extension divisions of the University. Each term, the program offers undergraduate and graduate courses, both independently and in cooperation with other departments. Students in the College of Arts and Sciences wishing to major in Women's studies can design their own major through the Independent Major Program.

The program is guided by a faculty board composed of professors from five of the fourteen divisions at Cornell, elected representatives of the Women's Studies Program Lecturers, and elected representatives of the undergraduates and graduate students. The program serves as a clearinghouse for information about women's organizations on campus. Women's studies sponsors informal presentations about current research or a social issue affecting women each Friday noon during the academic year.

The following Women's studies courses satisfy the distribution requirement in the social sciences: Women's Studies 101 and any one of the following: 244, 321, 337, 353, 366, 384, 422, 635, 684. The humanities requirement can be satisfied by Women's Studies 360-361 or 648-748. Women's studies courses fulfilling the Freshman Seminar requirement are only those numbered Women's Studies 100.

## Freshman Seminars

### 100 Racism and Sexism: Literature by Afro-American Women Fall or spring, 3 credits. J. H. Brewer.

Literature by Afro-American women in a variety of genres will be the basis of an exploration of the effects of racism and sexism. Stress on the male/female dimension and on universals in the female experience extend the relevance of the course to male students as well as women of different cultures. Literary portraits will be measured against sociological studies and personal experience.

### 100 Women and Autobiography Spring, 3 credits.

J. L. Ettin.  
A course designed to develop skill in writing from experience. Students will keep journals and write frequent essays exploring the effects of sex roles in their lives. The readings will be drawn from autobiographical work by women—poems, essays, letters, and journals, as well as from formal autobiographies. Comparisons with male experience will be drawn in class discussion and student writing.

**100 African and Caribbean Women in Literature** Spring, 3 credits.

J. H. Brewer.

A study of the images of women in contemporary African and Caribbean novels, including an analysis of roles, self-concepts, and problems in social relationships. The fictional lives of women will be measured against the factual accounts of social scientists. The question of cultural continuity will be raised in relating the experiences of African and Caribbean women to those of Afro-American women.

**100 Women and Religion** Fall, 3 credits.

R. R. Possen.

A study of the use of the Bible in women's rights debates in the nineteenth century and today. Attention also will be given to a sampling of recent essays on related topics such as the extent to which the Bible dictates that women be subordinate to men.

**101 Women in America** Fall, 3 credits; with an extra research paper 4 credits.

J. Farley.

An analysis of the place of women in the social order in twentieth-century America; an introduction to women's studies. Topics include an historical perspective, the image of women reflected in literature and art, an analysis of the life cycle using evidence from the biological sciences, an analysis of the institutions in a male-oriented society that affect women and men and their lives together, and the prospects for change in the future.

**150 Legislation Affecting Women** Spring, 1 credit.

C. E. Cook.

An examination of the principal areas of the law that affect women adversely and the leading federal and state legislative corrective proposals including maternity benefits, day care, minimum wage, pension rights, estate taxation, abortion, community property, professional licensing and certification, civil service classification, and the Equal Rights Amendment. In addition to improving the students' understanding of these issues, the course will attempt to develop insights into the legislative process which would be useful to persons interested in working for change.

**244 Sex Roles and Linguistic Behavior (also Linguistics 244)** Spring, 4 credits. Prerequisite: Ling 101, Psych 215, or permission of instructor.

M W F 1:25, S. McConnell-Ginet.

Types of linguistic phenomena where sex (of conversational participants or of referent) is a relevant variable will be surveyed; situations in different speech communities will be contrasted. Workshop sessions will include analysis of recorded interviews and conversational materials to increase understanding of English male/female speech differences. Possible origins and implications of sex-differentiated linguistic behavior will also be considered.

**245 Dress: A Reflection of American Women's Roles (also Design and Environmental Analysis 245)** Spring, 3 credits.

A. Racine.

An historical survey of changing patterns of the American woman's dress from the colonial period to present day, and other socio-cultural forces that affected her development with the social class structure. The Costume Collection and illustrated lectures will help students develop an awareness of historic costume, while assigned readings will focus on her expected roles. In addition, students will investigate topics dealing with the impact of dress on cultural assimilation of minority women in America.

**282 Sex Roles (also Psychology 282 and Sociology 282)** Fall, 3 credits. Prerequisite: one course in Sociology or Psych 128 (formerly Psych 102).

J. L. Laws.

The consequences of being born female (or male) are systematically examined. Topics include: 1) role

theory—what do we mean by roles?, 2) sex roles, 3) sex role socialization, 4) sex and education, 5) sex and occupational role, 6) sex and family roles, 7) sex roles and sex, 8) sex role liberation, 9) comparative studies of sex role.

**302 Women in American Religious History** Spring, 3 credits. Prerequisite: a course in American history recommended.

I. Olsen-Tjensvold.

A survey of the contributions of women to American religion from 1620 to the present. It will cover all the major American religions, with particular emphasis on Protestantism, but also including Catholicism, Judaism, native American religions, and the black churches. The focus will be on women's religious roles, traditional and nontraditional, formal and informal. Work studied will range from biography to theology, and will include works by Robert Bellah, Martin Marty, Robert T. Handy, and Mary Daly.

**321 The Anthropology of Women (also Anthropology 321)** Fall, 4 credits.

R. A. Borke.

This course will explore insights anthropology can provide for the study of women. These fall into two general categories: (1) those from the data dealt with by anthropology, particularly from non-Western societies, and (2) those from the theoretical perspectives anthropologists bring to those data. The course focuses on a number of problems regarding the place of women in society and culture and will present a number of ways in which these problems can be approached.

**337 Women, Race, and Politics (also Government 337)** Spring, 4 credits.

M. Katzenstein, L. Williams.

An initial consideration of the meaning of liberation for black and white women. The relationships among race, sex, and politics will then be examined by looking at the ways in which black and white women affect, and are affected by, the processes of political socialization, organization, and legislation.

**353 Women and Politics (also Government 353)** Fall, 4 credits. Prerequisite: one course in women's studies, in a social science, or permission of instructor.

M. F. Katzenstein.

This course will probe the following questions: What factors propel women into politics? Why are the rates of political participation among women high in certain countries, low in others? What effect does public policy and women's involvement in policymaking have on the status of women in different countries?

**The Family as a Context for Adult Development (Human Development and Family Studies)****353** Spring, 3 credits. Prerequisites: Human Development 150 or introductory course in sociology.

H. Feldman.

Describes development within the family from late adolescence through late adulthood. Emphasizes intrafamilial experiences and relates them to external social forces (particularly occupational experiences) affecting adults and families. Stresses the ways in which family settings influence adult development.

**360 Black Woman as Novelist** Fall, 3 credits.

J. H. Brewer.

This course will focus upon the works of black women novelists. Novels that span the period from the 1920s to the present will be studied in order to determine black women's perceptions of the world, their needs, and the strategies they employ in coping with their frustrations and anxieties. Works studied will include those by Nella Larsen, Zora Hurston, Ann Petry, Paule Marshall, Alice Walker, and Sarah Wright. Other genres—poetry, drama, and autobiography—will be examined to gain a broader perspective of the black woman as creative writer.

**361 Women Writers of Africa, Afro-America, and the Caribbean** Spring, 3 Credits.

J. H. Brewer.

This course is an attempt to use the methods of comparative literature to bring about a fuller understanding of the culture of black women in the United States, the Caribbean, and Africa. Emphasis will be placed on African novelists (Flora Nwapa, Bessie Head, Grace Ogot, and Ama Ata Aidoo) and Caribbean novelists (Simon Schwartz-Bart, Marion P. Jones, Merle Hodge, and Silvia Wynter).

**363 Women in Classical Greece and Rome (also Classics 363)** Spring, 4 credits.

L. S. Abel.

In this course students will examine the evidence about the social and political position of women in ancient Greece and Rome. The purpose will be to trace the origins of some Western attitudes about women and to address general historical questions about the nature of evidence, basic chronology, and the development of political systems.

**364 The Body and The Soul: Women in Medieval Literature** Fall, 4 credits.

B. Buettner.

A study of women and their roles in the social order as portrayed in the literature of the Middle Ages. Readings will illustrate the change and development of attitudes from asceticism and antifeminism to the development of "romantic" courtly love, both marital and adulterous, and the debates over the proper attitudes and roles in the late Middle Ages. Works to be studied in English translation will include a play of Hroswitha and Gandersheim, the *Nibelungenlied*, selected Mariological and mystical poems, courtly love lyric, *Parzival*, *Tristan and Isolde*, selections from the *Romance of the Rose*, and the "Marriage Group" in Chaucer's *Canterbury Tales*.

**366 Woman at Work (also Industrial and Labor Relations 366)** Spring, 4 credits. Prerequisite: Women's Studies 101 or Industrial and Labor Relations 120 or equivalent.

J. Farley.

This course examines various aspects of female occupational roles in twentieth-century America. Historical, social, and legal factors that influence women's choice of careers, work socialization and training, and subsequent labor market experience are considered. Women's entry-level jobs, opportunities for advancement, and income are also analyzed. Occupations in which women predominate are compared to occupations in which women are underrepresented.

**[384 Social Psychology of Women (also Psychology 384 and Sociology 384)** J. L. Laws. Not offered 1976-77.]**411 Time-Use Decisions in Families (also Consumer Economics and Public Policy 411)** Fall, 3 credits. S-U grades optional.

Prerequisite: one course in sociology and one in microeconomics recommended.

K. Walker.

A seminar in time as a human resource in a consumption-oriented society with emphasis on decision making and alternative time uses in households. The meaning of time and implications for its use for society and families as work roles of people change. Review of research in use of time. Individual projects applied to special professional interests of students.

**422 Special Problems in the Anthropology of Women (also Anthropology 422)** Spring, 4 credits.

Prerequisite: Women's Studies/Anthropology 321 or permission of instructor.

R. A. Borke.

Each year this seminar will focus on a particular area of concern within the anthropology of women, building upon the work done in 321. The basic orientation of the course will be research and exploration.

**[426 Undergraduate Seminar in Early American History (also History 426)]** M. B. Norton. Not offered 1976-77.]

**499 Directed Study** Fall or spring. Variable credit. Prerequisite: one course in women's studies and permission of a member of the Women's Studies Faculty Board. Members of the Faculty Board Women's Studies Program.

**569 Personnel Development (also Education 569)** Fall. 3 credits. Prerequisite: graduate standing. J. R. Egner.

Focus is on the development of a conceptual framework for understanding roles and functions of educational personnel responsible for personnel development and on developing skills in identifying and analyzing personnel problems, planning alternative strategies to cope with problems, and evaluating selected courses of action. A module focusing on women in education related to occupational decision making, career development, and self-awareness is part of the course. Opportunity is provided for independent study and special projects concerning personnel development of women in educational organizations.

**635 Working Women in Nine Countries (also Industrial & Labor Relations 635)** Fall. 3 or 4 credits. Prerequisite: one course in labor relations, economics, comparative government, or women's studies.

A. H. Cook.

The course will draw on materials from various countries, with particular attention to factors bringing women into the labor market. Emphasis will be placed on the contrast between Communist and non-Communist countries. Students will develop individual studies on such topics as occupational selection, training, promotion, wage classification, maternity and child care leave; community support programs for working mothers including child care, transportation, health and recreation programs, housing, housekeeping, and time-use.

**651 Seminar on Women's Roles in International Rural Development (also Community Service Education 651)** Fall.

K. Rhodes.

The seminar has been planned because of increasing interest in the role and status of rural women in developing countries. The aim of the seminar will be to isolate some of the determinates of women's role and status as it is affected by changing human ecological conditions related to national programs of rural development. Students will be expected to prepare papers concerned with their area of interest.

**655 Allocation of Time to Nonhousehold Activities (also Consumer Economics and Public Policy 655)** Fall. 3 credits. S-U grades optional.

Prerequisite: intermediate economic theory or permission of instructor; Women's Studies/Consumer Economics and Public Policy 411 recommended but not required.

J. Gerner.

This course examines the public sector policies that influence family time-allocation decisions. Particular attention will be given to the time allocated by female family members to nonhousehold activities and to how these activities are influenced by outside economic forces and internal family characteristics.

**670 Seminar on the American University**

Spring. 3 credits, S-U grades optional.

W 10-12. K. M. Moore.

Topic for 1977: Academic Women. Designed for students who intend to become academic professionals, teachers, counselors, or do research on women in higher education. Students will assist with assertive training workshop and oral history project on professors emerita.

**684 Seminar: Self and Identity (also Psychology 684 and Sociology 684)** Fall. 4 credits.

Prerequisite: permission of instructor.

J. L. Laws.

Many of the major problems in social psychology imply the existence of a self-directing self-awareness; yet the topic of the self is little explored. In this seminar, classic and current perspectives on the self are examined, guided by the questions: Do we need a concept of self? What phenomena does such a concept explain and predict? The empirical research on the self and related concepts (e.g. self-esteem, self-image) are explored. Methods for the study of the self are assessed.

**697 Sex Roles and Career Patterns (also Industrial and Labor Relations 697)** Spring. Three credits, or with an extra research paper four credits.

Prerequisite: graduate standing or six credits of women's studies or manpower studies, or permission of instructor.

J. Farley.

The purpose of this course is to examine the extent to which sex-role expectations affect career patterns of women and men in twentieth-century United States.

## Division of Biological Sciences

R. D. O'Brien, director; S. Zahler, associate director for academic affairs; E. Adkins, K. Adler, M. Alexander, J. Anderson, H. Banks, J. Barlow, D. Bates, A. Bensadoun, C. Berg, A. Blackler, E. Brothers, W. Brown, P. Bruns, P. Brussard, R. Buskirk, T. Cade, J. Calvo, J. Camhi, R. Capranica, B. Chabot, J. Cisne, R. Clausen, R. Clayton, L. Cole, L. Daniel, P. Davies, E. Delwiche, W. Dilger, S. Edelstein, T. Eisner, S. Emlen, H. Evans, H. Everett, P. Feeny, G. Feigenson, J. Fessenden-Raden, G. Fink, R. Foote, E. Gasteiger, J. Gaylor, A. Gibson, Q. Gibson, P. Gilbert, J. Gillespie, R. Hallberg, B. Halpern, G. Hammes, W. Hansel, L. Heppel, G. Hess, P. Hinkle, T. Hout, H. Howland, R. Hoy, J. Hudson, A. Jagendorf, W. Keeton, E. Keller, K. Kennedy, J. Kingsbury, R. Korf, S. Leonard, S. Levin, G. Likens, R. MacDonald, R. MacIntyre, J. Madison, P. Marks, R. McCarty, D. McCormick, W. McFarland, K. Moffatt, P. Moore, H. Naylor, A. Neal, W. Nelson, J. Novak, D. Paolillo, M. Parthasarathy, D. Pimentel, T. Podleski, F. Pough, W. Provine, E. Racker, E. Raney, M. Richmond, J. Roberts, R. Root, M. Salpeter, H. Seeley, R. Spanswick, A. Srb, H. Stinson, E. Stone, D. Tapper, J. Thompson, C. Uhl, L. Uhlir, V. Utermohlen, P. VanDemark, A. van Tienhoven, V. Vogt, G. Wallace, J. Whitlock, R. Whittaker, H. Williams, D. Wilson, W. Wimsatt, L. Wright, R. Wu, D. Zilversmit.

The Division of Biological Sciences offers a major in biological sciences to students enrolled in either the College of Agriculture and Life Sciences or the College of Arts and Sciences. Prior to preregistration for the junior year, all students wishing to be admitted to the major should schedule an appointment with the associate director for academic affairs in Stimson 118. Freshmen and sophomores in the process of completing the required prerequisites may be admitted to the major on a provisional basis. Final admission to the major requires superior performance in the completion of the following:

- (1) 1 year of introductory biology for majors (Bio Sci 101–102 and 103–104, or 105–106). Advanced placement may be allowed at the student's choice, on receipt of a score of 5 on the Advanced Placement Examination of the College Entrance Examination Board or a score of 4 and completion of Bio Sci 107. Freshmen who have not taken the CEEB examination may register for a biology advanced standing examination administered during Orientation Week.
- (2) 1 year of general chemistry (preferably Chem 207–208 or 215–216).
- (3) 1 year of college mathematics, including at least 1 semester of calculus (Math 105–106 or 111–112). Whenever possible, students should include the above 3 subjects in their freshman schedule and complete the organic chemistry requirement (see below) in their sophomore year. A student is not encouraged to undertake a major in biological sciences unless performance in the above 4 subjects gives evidence of capacity to do superior work at a more advanced level.

In addition to the introductory courses in biology, chemistry, and mathematics, each student majoring in biological sciences must complete the following:

- (1) Organic Chemistry 253 and 251, or 253 and 301, or 357–358 and 251, or 357–358 and 301.
- (2) Physics 101–102 or 207–208.
- (3) Genetics (Bio Sci 281).
- (4) Biochemistry (Bio Sci 330 [432] or 331 [431]).
- (5) One of the concentration areas outlined below.
- (6) Breadth requirement outlined below.
- (7) Qualification in a modern foreign language. Students may satisfy this requirement by (a) having studied a modern foreign language for 3 or more years in high school, (b) attaining a score of 560 or more on the reading portion of the College Entrance

Examination Board (CEEB) Achievement Test, or (c) successfully completing 6 hours of college credit in a modern foreign language.

### Concentration Areas and Requirements

Students accepted into the biological sciences major must choose a concentration area. The concentration requirements are designed to help students achieve depth in one area of biology while ensuring that the selection of advanced courses will form a coherent and meaningful unit. Due to the flexibility allowed in satisfying these requirements, students should consult their faculty advisers. No more than 4 credits of research courses may be used in completion of the requirements in the area of concentration. The possible concentration areas are:

(1) *Animal Physiology and Anatomy*: The Vertebrates (Bio Sci 274) and one course each from list A and list B.

List A: Histology: The Biology of the Tissues (Bio Sci 313); Vertebrate Developmental Anatomy (Bio Sci 389); Vertebrate Morphology (Vet 700); Invertebrate Zoology (Bio Sci 310).

List B: General Animal Physiology (Bio Sci 416 and 418); Mammalian Physiology (Bio Sci 414); Introductory Animal Physiology (Vet 346 and 348); Fundamentals of Endocrinology (Anim Sci 427); Ecological Animal Physiology (Bio Sci 315).

(2) *Neurobiology and Behavior*: The introductory course in Neurobiology and Behavior (Bio Sci 321), and 12 additional credits, including a second course from the neurobiology and behavior offerings. The remainder of the 12 credits may be in any course (e.g., physiology, developmental biology, cellular biology, ecology, vertebrate or invertebrate biology, etc.) approved by the adviser as appropriate preparation for work or advanced study in neurobiology and behavior or in related subjects.

(3) *Biochemistry*: Quantitative Chemistry (either Chem 300 or Chem 215–216) must be taken. One of the following organic chemistry laboratory sequences must also be taken: Chem 301–302, or Chem 251–252–302, or Chem 301, or Chem 251–252. In addition, the student must take a physical chemistry sequence (Chem 389–390 or Chem 287–288) and a biochemistry laboratory sequence (Bio Sci 638, or Bio Sci 430, or Bio Sci 432 and 434). It is recommended that students take the more rigorous organic chemistry and physics sequences (Chem 357–358 and Phys 207–208), and a third semester of calculus.

(4) *Botany*: 4 courses fulfill the concentration requirement, as follows: (a) Plant Physiology (Bio Sci 242 or 342); (b) Taxonomy of Vascular Plants (Bio Sci 346); (c) either Plant Anatomy or Cytology (Bio Sci 345 or 347); and (d) either Plant Biology (Bio Sci 245), Phycology (Bio Sci 348), Comparative and Developmental Morphology of the Embryophyta (Bio Sci 444), Introductory Mycology (Plant Path 309), or Plant Ecology (Bio Sci 463 and 465). A student may elect to complete the required 4 courses by taking both courses in group c rather than taking any in group d.

(5) *Ecology, Systematics, and Evolution*: General Ecology (Bio Sci 360), Organic Evolution (Bio Sci 477), a physiology course, and at least one 400-level course with accompanying laboratory from within the concentration offerings. In addition to the latter course, students in this area must select at least 2 laboratory courses above and beyond those required of all biology majors (e.g., introductory biology, genetics, and organic chemistry). These 2 laboratory courses may include the physiology course, and/or courses counted toward fulfillment of the breadth requirement. It is strongly recommended that students planning graduate study take a course in statistics (ILR 210 or 311).

(6) *Genetics and Development*: 9 credits usually selected from the following courses: Human Genetics

(Bio Sci 282); Cytology (Bio Sci 347); Developmental Biology (Bio Sci 385–386); Vertebrate Developmental Anatomy (Bio Sci 389); Cytogenetics (Bio Sci 446); Plant Growth and Development (Bio Sci 641); Organic Evolution (Bio Sci 477); Population Genetics (Bio Sci 481); Molecular Evolution (Bio Sci 484); Microbial Genetics (Bio Sci 485 and 487); Genetics of Lower Eucaryotes (Bio Sci 488); Animal Cytogenetics (Anim Sci 419); Statistical Methods I (Stat Biom 501); Physiological Genetics of Crop Plants (Plant Breed Biom 505).

(7) Students who, for good reason, wish to undertake a course of study not covered by the 6 existing concentration areas may petition the Division of Biological Sciences Curriculum Committee.

### Breadth Requirement

To fulfill the breadth requirement in the biological sciences major, students must pass a total of 2 courses outside of their concentration area and selected from 2 of the categories listed below. Faculty advisers should be consulted when choosing the courses to meet this requirement.

- (1) *Neurobiology and Behavior*: Bio Sci 321, 322 (323), 421; Psych 201.
- (2) *Developmental Biology*: Bio Sci 347, 385.
- (3) *Ecology and Evolution*: Bio Sci 260 (261), 300 (301), 360 (361), 477 (476).
- (4) *Microbiology*: Microbio 290.
- (5) *Morphology*: Bio Sci 274 (273), 310 (316), 313, 345; Plant Path 309.
- (6) *Physical Science and Mathematics*: Chem 287, 389; Compr Sci 101, 102, 211; Geo Sci 101; Math 214–216–218, 221; Phys 360; Stat Biom 407, 408, 501.
- (7) *Physiology*: Bio Sci 242, 315 (314), 342 (340), 414, 416 (410); Vet 346, 347.
- (8) *Taxonomy*: Bio Sci 346 (371), 348 (344), 471, 472 (474), 475 (473), 479 (470); Entom 212.
- (9) *History of Biology*: Hist 287, 288.

### Independent Research and Honors Program

Individual research projects under the direction of a faculty member are encouraged as part of the program of study within a concentration. Applicants for research projects are accepted by the individual faculty members, who take into account students' previous academic accomplishments, interests, and goals, and the availability of space and equipment suitable for the proposed project. Students accepted for independent research will enroll for credit in a research course with the written permission of the faculty supervisor. No more than 4 credits of research courses may be used in completion of the requirements in the area of concentration.

The honors program in biological sciences is designed to offer advanced training in laboratory or field research through the performance of an original research project under the direct guidance of a member of the faculty. Applications for the honors program are available in the Office for Academic Affairs (Stimson 118), and must be submitted to the Honors Program Committee by the first week of classes of the senior year. To qualify for the program, students enrolled in the College of Agriculture and Life Sciences must have at least a 3.0 cumulative grade average; those in the College of Arts and Sciences must have at least a 2.7 cumulative grade average. All students must have at least a 3.0 cumulative grade average in biology, chemistry, and mathematics, and should have completed at least 30 credits at Cornell. In addition, candidates must have a faculty member to supervise their research. Any faculty member in the Division of Biological Sciences may act as a supervisor. Faculty supervisors outside the division are acceptable only if a faculty member of the division agrees to take full responsibility for the quality of the work. An honors candidate will enroll for credit in a research course under the direction of the faculty member acting as honors supervisor.

Recommendation to the faculty that a candidate graduate with honors will be the responsibility of the Honors Program Committee. Students interested in the honors program should consult their faculty adviser during their junior year. Details pertaining to thesis due dates, seminars, and other requirements may be obtained from the chairperson of the Honors Program Committee. Information on faculty research activities is available in the Behrman Biology Center (Stimson G-20).

**Curriculum Committee**

Many decisions pertaining to the curriculum, to division-wide requirements, and to depth and breadth areas are made by the Curriculum Committee of the division. The committee has faculty and elected student members, and welcomes advice and suggestions from all interested parties.

**Advising**

Students in need of academic advising or counseling are encouraged to consult their advisers, come to the Behrman Biology Center (Stimson G-20), or contact the associate director for academic affairs (Stimson 118).

**Current and Former Course Numbers**

101	129	397 (326)	132
102	129	401	130
103	129	402	130
104	129	403	130
105	129	404	130
106	129	405	130
107	129	409	130
108	129	410 (418)	131
109	129	412	131
110	129	414	131
132 (130)	133	416 (410)	131
204	130	418 (411)	131
205 (206)	130	419	131
206 (207)	130	420 (620)	132
231	133	421	132
233	133	423	132
242	134	425 (424)	132
245 (145)	134	427 (523)	132
246 (350)	134	429	132
260 (261)	136	430	133
274 (273)	136	432 (437)	133
281	138	434 (438)	133
282 (280)	138	435	133
300 (301)	130	436	133
309	130	439	134
310 (316)	130	442 (466)	135
312	130	444	135
313	130	445 (545)	135
315 (314)	130	446 (440)	135
318	130	447 (547)	135
321	131	448	135
322 (323)	131	449	135
324 (322)	131	461	136
326 (324)	132	462	136
329 (328)	132	463 (464)	136
330 (432)	133	464 (463)	136
331 (431)	133	465	136
342 (340)	134	466 (467)	136
343	134	467 (468)	136
344 (342)	134	468 (460)	136
345	134	469 (479)	136
346 (371)	135	470	137
347	135	471	137
348 (344)	135	472 (474)	137
360 (361)	136	473 (472)	137
362	136	474	137
364	136	475 (473)	137
365	136	476 (477)	137
384	138	477 (476)	137
385	138	478	137
386	138	479 (470)	137
389	138	481 (480)	138
395 (425)	132	484	138
396 (325)	132	485	138

487 (486)	138	662 (562)	137
488	138	665 (565)	137
489	138	666 (566)	137
492 (420)	132	668 (568)	137
494 (426)	132	669	137
495 (427)	132	670 (671)	137
497 (428)	132	692 (524)	133
603 (503)	130	694 (525)	133
604 (504)	130	695 (625)	133
612 (512)	131	696 (528)	133
614 (513)	131	697 (526)	133
622 (520)	132	699 (527)	133
624 (522)	132	720 (629)	133
626 (622)	132	723 (623)	133
628 (624)	132	730 (639)	134
631	134	731 (631-632)	134
632	134	733 (633)	134
633	134	734 (634)	134
635	134	739 (535)	134
636 (534)	134	740 (643)	135
638 (530)	134	749	136
640 (647)	135	762 (661)	137
641 (441)	135	765 (665)	137
642	135	766 (666)	137
643 (543)	135	767 (667)	137
644	135	768 (668)	137
645 (663)	135	780 (680)	138
647 (649)	135	832 (536)	134
648 (548)	135	840 (645)	136
649 (549)	135		
661 (561)	137		

**General Courses**

**101-102 Biological Sciences, Lectures** 101, fall; 102, spring. 2 credits per term. Prerequisite: concurrent enrollment in 103 and 104. 101 is prerequisite to 102, unless written permission is obtained from instructor. May not be taken for credit after 105-106, 107, or 109-110.

Lec, M W 9:05 or 10:10. 2 preliminary exams given at 7:30 p.m. W. T. Keeton.

Designed both for students who intend to specialize in biological sciences and for those specializing in other subjects, such as the social sciences or humanities, who want to obtain a thorough knowledge of biology as part of their general education. Plant and animal materials are considered together rather than in separate units. The fall semester covers the chemical and cellular basis of life, energy transformations, anatomy and physiology, and behavior. The spring semester covers genetics and development, evolution, ecology, the origin of life, and the diversity of living organisms. Each topic is considered in the light of modern evolutionary theory.

**103-104 Biological Sciences, Laboratory** 103, fall; 104, spring. 2 credits per term. Prerequisite: concurrent enrollment in 101 and 102.

Lec, F 9:05 or 10:10; lab, M T W or Th 1:25-4:25, T or Th 8-11, F 10:10-1:10, or M or W 7:30-10:30 p.m. One 3-hour lab each week and a weekly lecture section for discussions, special lectures, etc. J. C. Glase and staff.

This is a laboratory course with a main emphasis on student design and execution of investigations in biology. In preparation for performing research, students are exposed to basic biological concepts, research methods, relevant statistical ideas, instrumentation, and laboratory techniques. Research projects include experimental design, data analysis, and communication of investigative results and conclusions. Each student-initiated investigation leads to the production of a written research report.

**105-106 Introductory Biology** 105, fall; 106, spring. 4 credits per term (or less by arrangement with instructor). Prerequisite: written permission of instructor. All students *must* register for 105 during registration whether or not they have preregistered.

Appointment cards for registration in Uris Library will be available in the Biology Center (Stimson G-20) for students who do not receive them in their registration packets.

Lec, M W F 12:20; additional hours to be arranged. Instructor to be announced.

Designed for students who intend to specialize in the biological sciences and for nonmajors. Also open to transfer students who may need fewer than 6 credits in introductory biology. Course material is divided into core units which must be completed by all students and optional units of which students can choose to complete a variable number, depending upon the grade they are working for. The course offers an introduction to cellular structure, function and chemistry, plant and animal physiology and anatomy, heredity, evolution, ecology, and behavior. In addition, some areas of biology of particular interest for their social and cultural implications are identified and some are studied in detail in particular units of course work. An autotutorial format is used and students are expected to schedule their hours in the learning center at their convenience. Laboratory work is an integral part of the course.

**107 Biological Discovery** Fall. 4 credits. Limited to 60 students. Open to freshmen who achieve a grade of 4 or 5 on either the biology advanced placement exam of the College Entrance Examination Board or an advanced placement exam administered during freshman Orientation Week. Prerequisite: written permission of instructor. All students *must* register for this course during registration whether or not they have preregistered. Appointment cards for registration in Uris Library will be available in the Biology Center (Stimson G-20) for students who do not receive them in their registration packets. Not open to students who have credit for more than 1 semester of introductory biology or to students who have credit for 101-102, 105-106, or 109-110. Passing 107 comprises fulfillment of introductory biology requirements in terms of (1) electing more advanced biology courses and (2) fulfilling the biology distribution requirement for nonmajors. Students with advanced placement grades of 5 receive 8 credits for previous work in biology and are permitted to exempt all introductory courses including 107. If they take and pass 107, they receive an additional 4 credits. Students with advanced placement grades of 4 receive 4 credits for previous work in biology plus 4 credits for passing 107.

Lec, T Th 9:05; lab, to be arranged. 2 lectures and 2 labs weekly. J. M. Camhi.

Designed to instruct students in the ways that scientists ask questions about living things, and design and carry out observations or experiments to answer these questions. In the laboratory, students work in small groups on extended research problems which they help design. Instruction is highly individualized and aims at improving each student's ability to ask meaningful questions, organize and quantify observations, analyze research data, and relate results to previously reported biological findings. Specific research techniques will be introduced when need arises.

Lectures are intended to expand the scope of the laboratory experience, treating the conceptual and technical underpinnings of biological science and illustrating these with examples from diverse animal and plant disciplines. It is hoped that this course will be useful to both potential scientists and others wishing to attain a deeper insight into the nature of biological science.

**108 Interactive Computing for Students of Biological Sciences** Spring. 1 credit. Not open to students with prior courses in computing.

Lec, T 1:25; lecture every other week. An introduction to computing using the interactive language FOCAL with a discussion of other algebraic computing languages such as BASIC and elementary FORTRAN. Students will be issued tickets for 5 hours of computing time at the Division of Biological Sciences interactive computing facility. Applications to problems in the biological sciences will be emphasized.

**109-110 Biology for Nonmajors** 109, fall; 110, spring. 3 credits per term. Limited to 680 students.

This course may be used to fulfill the distribution requirement in the Colleges of Agriculture and Life Sciences, Arts and Sciences, and Human Ecology, but may not be used as an introductory course for the major in biological sciences. *Note that this course may not always satisfy as a prerequisite to second- and third-level courses in biology.* 109 is prerequisite to 110, unless written permission is obtained from instructor. May not be taken after 101-102 or 105-106.

Lec. M W F 9:05 or 11:15; lab, M T W Th or F 2-4:25 or T 10:10-12:35. Each student must attend a lab on alternate weeks. 2 preliminary exams given at 7:30 p.m. Staff.

Students who do not plan to major in biology have the opportunity of taking this broad introductory course in modern biology without the necessity of the more detailed study normally required. Nevertheless, it is not a course in social biology but addresses itself to biological principles with academic rigor. The content is designed to appeal to anyone who seeks a comprehensive knowledge of biology as part of a general education. Laboratory sections enable small groups of students to meet with the course staff, and will be used for problem-solving experiments, demonstrations, and discussions.

#### 204 Undergraduate Seminar in History of Biology (also History 284 and College Scholar 284)

Spring. 3 credits. S-U grades optional. Primarily for sophomores and juniors. Limited to 20 students. Prerequisite: 1 year of introductory biology.

T 1:25-3:20; plus independent meetings with instructors and a substantial research paper. J. M. Fessenden-Raden, W. B. Provine.

Biological determinism, focusing on issues related to race, sex, and intelligence.

#### 205 (206) Biomedical Ethics (also Philosophy 245)

Fall. 3 credits. Primarily for sophomores, juniors, and seniors. Prerequisite: written permission of instructor.

Lec and disc, M W 1:25-3. S. M. Brown, L. M. Purdy.

An elucidation and analysis of certain fundamental ethical concepts by application to biomedical examples. The ethical concepts will include justice, basic goods, individual freedom, self-respect, and utility. The biomedical examples will include population limitation; experimentation on human beings; organ transplants; genetic defects; and prolonging the life of the aged, the grossly defective, and the dying.

#### 206 (207) Environmental Ethics (also Philosophy 246)

Spring. 3 credits. Open to sophomores, juniors, seniors, and graduate students. Limited to 35 students. Prerequisites: 1 year of introductory biology and written permission of instructor.

Lec and disc, M W 1:25-3. S. M. Brown, L. M. Purdy.

Complement to 205 (206). An elucidation and analysis of certain fundamental ethical concepts by application to environmental problems. The ethical concepts will include intrinsic and extrinsic values, prudence, survival, and distributive justice (over generations and amongst nations and societies). The environmental problems will include the preservation of the environment in its "natural" state, food, the conservation of irreplaceable resources, population, pollution, and the interaction of all these.

#### 300 (301) Laboratory Methods in Biology

Fall or spring. 3 credits. Limited to juniors, seniors, and graduate students; 20 students each section. Prerequisites: 1 year of introductory biology or equivalent, and written permission of instructor. Lec and demo, T or F 10:10-12:05; lab, to be arranged. Lecture and demonstration cover the work for the following week. Lab periods covered by leaving lab open at all times. The equivalent of at least 1 lab period per week required and sometimes several, depending on the nature of the work. No formal exams. Grade based on required

work, turned in at the end of the semester. L. D. Uhler.

For students who intend to teach or follow some phase of biology as a profession. Subjects covered: collection, preservation, and storage of materials; the preparation of bird and mammal study skins; injection of circulatory systems with latex; clearing and staining of small vertebrates; and the preparation and staining of squashes, smears, whole mounts, and sections.

#### 309 Minicourse in Laboratory

**Methods** Intersession. 1-3 credits. These minicourses are designed, via audiovisual materials and actual experience, to teach students techniques needed for independent research and honors projects. The following minicourses are offered: [(1) *Techniques in Animal Handling and Surgery* 2 credits. Limited to 18 students, with preference given to students who are preregistered in an independent research course. Prerequisite: written permission of instructor. Not offered 1976-77.]

M T W Th F 9-4:30. A. van Tienhoven.]

(2) *Independent Project in Biochemistry* 1-3 credits. Enrollment limited. Prerequisites: 430 or equivalent, and written permission of instructor.

M T W Th F 9-5. R. R. Alexander.

#### 401-402 Biology Education at Cornell

401, fall; 402, spring. 1 credit per term. May be repeated for credit. S-U grades only. Limited to biology majors involved in new-student academic advising. Prerequisite: written permission of instructor.

Hours to be arranged. S. A. Zahler.

#### 403-404 Teaching Experience

403, fall; 404, spring. 1-4 credits. S-U grades optional with consent of instructor. Enrollment limited. Prerequisites: previous enrollment in the course to be taught or equivalent, and written permission of instructor.

Hours to be arranged. Staff.

Designed to enable qualified undergraduate students to obtain teaching experience by actual involvement in the design and teaching of biology courses. This experience may include leading a discussion group; preparing, assisting, or teaching a biology laboratory; teaching field biology; or tutoring. Several biology courses currently offer such experience, including 103-104, 105-106, 109-110, 274 (273), 300 (301), 324 (322), 330 (432), 360 (361), 430 (473), 478, 492 (420), 495 (427), and Vet 346 and 348.

#### 405 Optics in Biology (also Engineering A&EP 605)

Fall. 2 credits. Limited to 20 students. Prerequisites: Chem 104 or 208, Math 108 or 111, and Phys 102 or 208, or written permission of instructor.

M 1:25-3:20. R. K. Clayton.

Lectures, problems, demonstrations, and laboratory experience in applications of optics to biology. Methods for generating, controlling, and measuring light; analysis by optical absorption and fluorescence. Experiments in photosynthesis, vision, and effects of ultraviolet.

#### 409 Undergraduate Research in Biology

Fall or spring. Variable credit. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade.

Hours to be arranged. Staff.

Practice in planning, conducting, and reporting independent laboratory and/or library research programs.

#### 603 (503) Electron Microscopy for

**Biologists** Fall. 3 credits. S-U grades optional. Primarily for graduate students, but open to upperclass students. Limited to 12 students, with preference given to students with research projects requiring electron microscopy. Prerequisites: 300 (301), 313, 345, or 347, or equivalent, and written permission of instructor. Preregistration recommended.

Lec, T 11:15; lab, M W 1:25-4:25, T Th 1:25-4:25,

or W F 8-11. M. V. Parthasarathy. Principles of electron microscopy; histological techniques for electron microscopy such as ultrathin sectioning, negative staining and metal shadowing, and interpretation of results. A brief introduction to scanning electron microscopy is also included.

#### 604 (504) Advanced Electron Microscopy for

**Biologists** Spring. 3 credits. S-U grades optional. Primarily for graduate students with a major interest in ultrastructure. Limited to 6 students. Prerequisites: 603 (503) and written permission of instructor.

Lec, T 11:15; lab, T Th 1:25-4:25.

M. V. Parthasarathy.

Selected topics in cell ultrastructure and interpretation, and introduction to special techniques such as freeze-etching, enzyme digestion techniques, visualization of DNA strands, and autoradiography are included. The student will also be required to do a project involving one of the specialized techniques.

### Animal Physiology and Anatomy

#### 310 (316) Invertebrate Zoology

Fall or spring. 4 credits. Enrollment limited, with preference given to upperclass students. Prerequisite: 1 year of introductory biology for majors.

Lec, W F 11:15; lab, W F 2-4:25. Each student will be expected to do a significant amount of independent work and a term paper may be required. J. M. Anderson.

Lectures on selected topics in the development, structure, function, and interrelations of invertebrate animals, with particular attention to phylogenetic aspects. Intensive laboratory work on representative invertebrates, utilizing living or fresh specimens wherever possible.

#### 312 Anatomy of the Gull

Summer. 1 credit. S-U grades only. Prerequisite: 1 year of introductory biology.

Daily lectures, lecture-demonstrations, and laboratories for 1 week. H. E. Evans.

The functional anatomy of all organ systems with emphasis on sensory, nervous, digestive, and respiratory systems.

A special course offered at the Shoals Marine Laboratory of Cornell University on an island off Portsmouth, N.H. For more details and applications, consult the Office of Marine Biology, 202 Plant Science Building.

#### 313 Histology: The Biology of the Tissues

Fall. 4 credits. Prerequisite: 1 year of introductory biology; a background in vertebrate anatomy and organic chemistry or biochemistry recommended.

Lec, T Th 11:15; lab, T Th 2-4:25. W. A. Wimsatt.

Provides the student with a basis for understanding the microscopic, fine structural, and functional organization of vertebrates as well as the methods of analytic morphology at the cell and tissue levels. The dynamic interrelations of structure, composition, and function in cells and tissues are stressed.

#### 315 (314) Ecological Animal Physiology

Fall. 4 credits. Enrollment limited. Prerequisite: 1 year of introductory biology for majors. Offered in alternate years. Not offered 1976-77.

Lec, M W F 10:10; lab, W or Th 1:25-4:25.

W. N. McFarland, F. H. Pough.

An introductory course for students interested in ecology and physiology. The characteristics of the physical environment that are important to organisms are discussed; and the physiological, behavioral, and morphological adaptations of vertebrate and invertebrate animals to environment are analyzed.]

#### 318 Cellular Physiology

Summer. 3 credits. Prerequisites: 1 year of introductory biology and chemistry, or written permission of instructor.

Lec, M T W Th F 11-12:15. M. V. Hinkle.

A basic course on physiological processes at the cellular level. Particular emphasis is placed on

eucaryotic cells and on membrane-related phenomena. Topics include: active, passive, and bulk transport across membranes; structure and function of cell organelles; cell growth and proliferation; intercellular communication; cell movement; excitability; contractility; specialized cells of the immune and endocrine systems; and current problems. Course may be used as an introduction to organ or medical physiology.

**410 (418) Seminar in Anatomy and Physiology** Fall or spring. 1 credit. May be repeated for credit only once. S-U grades only. Limited to upperclass students.

Hours and topics to be arranged. Organizational meeting first Tuesday of each semester at 7:30 p.m. in Biology Center (Stimson G-20). Staff (Coordinator—A. van Tienhoven).

**412 Special Histology: The Biology of the Organs** Spring. 4 credits. Limited to 18 students. Prerequisite: 313 or written permission of instructor. Offered in alternate years.

Lec, W F 9:05; lab, W F 2–4:25. W. A. Wimsatt. A continuation of 313. The microscopic and ultrastructural organization of the principal vertebrate organ systems are studied in relation to their development, functional interaction, and special physiological roles. Courses 313 and 412 together present the fundamental aspects of the microscopic and submicroscopic organization of the vertebrate. The organization of the course involves student participation in lecture-seminars, and the prosecution of independent project work supplementary to the regular work of the laboratory. The latter enables students to gain practical experience with histological and histochemical preparative techniques.

**414 Mammalian Physiology** Spring. 6 credits. Prerequisite: 1 year of introductory biology for majors; courses in biochemistry, histology, and gross anatomy recommended. Students desiring registration are requested to file a written application form at N205 Martha Van Rensselaer.

Lec, M W F 8; lab, M or W 1:25–4:25; disc, S 10:10. A. Bensadoun, W. Hansel, K. A. Houpt, H. Kasprzak.

This course for advanced undergraduate and graduate students emphasizes laboratory experience in advanced experimental methods dealing with the physiology of circulation, cardiac function, respiration, renal function, acid-base balance, endocrinology, and the nervous system. A background in experimental methods is desirable. Although the lectures parallel and supplement the laboratory exercises, students must allocate significant periods of time for outside reading and for preparation of written reports that interpret data they derive from laboratory exercises designed to demonstrate physiological principles in mammals.

**416 (410) General Animal Physiology: A Quantitative Approach, Lectures** Spring. 3 credits. S-U grades optional. Prerequisites: 1 year of biology and physics; courses in chemistry, organic chemistry, biochemistry, and computing recommended.

Lec, M W F 10:10. Instructor to be announced. The principles of animal physiology are developed through consideration of the functioning of cells, tissues, and organs. Specific topics discussed include respiration, metabolism, circulation, excretion, body mechanics, muscle contraction, nerve action, sensory reception, and central nervous system function. A quantitative, systems-theoretical approach is emphasized.

**418 (411) General Animal Physiology, Laboratory** Spring. 2 credits. Prerequisite: concurrent enrollment in 416 (410) or equivalent.

Lec, 1 hour to be arranged; lab, M T or Th 1:25–4:25.

Students are introduced to basic techniques utilized in the study of the physiology of animal tissues. Experiments cover topics dealing with respiration,

properties of muscle, circulation, activity of nerves, and osmotic phenomena.

**419 Undergraduate Research in Animal Physiology and Anatomy** Fall or spring. Variable credit. S-U grades optional. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade.

Hours to be arranged. Staff. Practice in planning, conducting, and reporting independent laboratory and/or library research programs.

**612 (512) Comparative Physiology, Lectures** Spring. 2 credits. Limited to 12 students. Prerequisites: concurrent enrollment in 614 (513) and a background in chemistry (inorganic, organic, and biochemistry) and physics in addition to a course in invertebrate or vertebrate zoology. Offered in alternate years.

Lec, W F 11:15. J. W. Hudson. Lectures emphasize the comparison of physiological processes of organs and organ systems in various invertebrate and vertebrate classes in relation to their evolution and environmental adaptation.

**614 (513) Comparative Physiology, Laboratory** Spring. 2 credits. Limited to 12 students. Prerequisites: concurrent enrollment in 612 (512) and written permission of instructor. Offered in alternate years.

Lec, T Th 1:25–4:25. J. W. Hudson. Laboratories will involve measurements of cardiovascular, respiratory, muscular, excretory, endocrine, alimentary, thermoregulatory, and nervous system function in selected invertebrates and vertebrates.

**Introductory Animal Physiology (Veterinary Medicine 346)** Spring. 4 credits. Prerequisites: 1 year of college biology, chemistry, and mathematics.

Lec, M W F 11:15; disc, to be arranged. D. N. Tapper. A general course in vertebrate physiology emphasizing the basic characteristics of the circulatory, nervous, pulmonary, renal, and gastrointestinal systems; energy metabolism; endocrinology; and reproductive physiology. Neural and hormonal control of function is emphasized. (See Veterinary Medicine 348 for associated laboratory.)

**Introductory Physical Biology (Veterinary Medicine 347)** Fall. 3 credits. Prerequisites: 1 year of introductory biology for majors, chemistry, and calculus, or written permission of instructor.

Lec, M W F 10:10. R. H. Wasserman, F. W. Lengemann, H. Moraff.

The specific application of quantitative and physical concepts to biological problems. This course provides background or is complementary to other courses at this or advanced levels that deal with physiology, nutrition, radioisotopes in biological research, cellular membranes, quantitative ecology, and biophysics. Topics include the interrelations of biological and physical sciences; mathematical approach to physiological problems; principles of tracers, kinetics, and compartmental analysis; systems analysis and control theory; membranes and transport processes; physicochemical aspects; thermodynamics and biological systems; ion binding to macromolecules; and ion selectivity theory.

**Introductory Animal Physiology, Laboratory (Veterinary Medicine 348)** Spring. 1 credit. Limited to 100 students, with preference given to students concentrating in animal physiology. Prerequisite: concurrent or previous enrollment in Vet 346.

Lec, M T W or Th 1:25–4:25. Each student must attend a lab on alternate weeks. D. N. Tapper. Laboratory sessions will consist of demonstrations, instructor-assisted experiments, and student-run experiments covering the nervous, pulmonary, renal, circulatory, and gastrointestinal systems.

**Special Projects in Anatomy (Veterinary Medicine 600)** Fall or spring. Variable credit. Prerequisite: written permission of instructor.

Hours to be arranged. Staff.

**Vertebrate Morphology (Veterinary Medicine 700)** Spring. 3 credits. Designed for graduate students in animal science and biological science. Prerequisite: graduate standing or Bio Sci 274 (273). Lab, T Th 9:05–12:05. H. E. Evans.

A dissection of the dog serves as the basis for a functional consideration of the major component parts of mammalian organ systems. This is followed by a dissection of the cow. Other species of interest to members of the class may also be dissected.

See also:

**Advanced Work in Animal Parasitology (Veterinary Medicine 737)**

**Comparative Physiology of Reproduction of Vertebrates (Animal Science 428)**

**Developmental and Microscopic Anatomy (Veterinary Medicine 502)**

**Elementary Neurophysiology (Biological Sciences 397 [326])**

**Fundamentals of Endocrinology (Animal Science 427)**

**General Photobiology (Biological Sciences 447 [547])**

**Insect Morphology (Entomology 322)**

**Introductory Parasitology and Symbiology (Veterinary Medicine 330)**

**Neuroanatomy (Veterinary Medicine 504)**

**Optics in Biology (Biological Sciences 405)**

**Parasitic Helminthology (Veterinary Medicine 440)**

**Sensory Function (Biological Sciences 495 [427])**

**Teaching Experience (Biological Sciences 403–404)**

**The Vertebrates (Biological Sciences 274 [273])**

**Vertebrate Developmental Anatomy (Biological Sciences 389)**

**Vision (Biological Sciences 395 [425])**

## Neurobiology and Behavior

**321 Neurobiology and Behavior** Fall. 3 credits. Prerequisite: 1 year of introductory biology.

Lec, M W F 12:20. T. Eisner and staff. A general introduction to the field of neurobiology and behavior. Topics include evolution of behavior, cueing of behavior, animal orientation, social and nonsocial behavior, neuroanatomy, neurophysiology, neurochemistry, neural networks, and memory.

**322 (323) Physiological Psychology, Lectures (also Psychology 322)** Spring. 3 credits. Prerequisites: 1 year of introductory biology for majors or equivalent, Psych 201 or a 300-level laboratory course in psychology, and Chem 103–104 or equivalent.

Lec, T Th 9:05. E. K. Adkins. Neural and hormonal mechanisms of sleep, activity, and arousal; learning and memory; aggressive and sexual behavior; regulatory behavior; maladaptive behavior; and motor activity.

**324 (322) Physiological Psychology, Laboratory (also Psychology 324)** Spring. 3 credits. S-U grades optional with consent of instructor. Enrollment

limited. Prerequisites: 321, Psych 201, concurrent or previous enrollment in 322 (323), and written permission of instructor.

Lab, T W 1:25-4:25. E. K. Adkins.  
Experiments designed to provide research experience with neural and hormonal mechanisms of behavior. A variety of techniques, species, and behavior patterns will be included.

**[326 (324) Animal Social Behavior** Spring, 4 credits. Not open to students who have already taken 427 (523). Prerequisite: 1 year of introductory biology for majors. Not offered 1976-77.]

**[329 (328) Behavioral Maturation (also Psychology 329)** Fall, 3 credits. Prerequisites: 1 year of college biology, and 1 physiological psychology course or equivalent. Not offered 1976-77.

Lec, M F 12:20.  
Emergence of behavior will be studied in the light of developmental biology, including behavioral genetics, neuroembryology and morphogenesis, physical maturation of the brain, transformation and allometry as well as retarding influences from the environment.]

**[395 (425) Vision (also Engineering A&EP 611)** Fall, 2 credits. Prerequisites: Chem 104 or 208, Math 108 or 111, Phys 102 or 208, or written permission of instructor; concurrent or previous enrollment in 405 recommended. Offered in alternate years. Not offered 1976-77.

Lec, T Th 10:10. R. K. Clayton.  
A study of the mechanism of seeing, embracing biological, physical, and chemical approaches to the subject.]

**396 (325) Cellular Organization of the Nervous System** Spring, 3 credits. Prerequisites: 1 year of introductory biology for majors and 321, or written permission of instructor.

Lec, T Th 11:15; rec, to be arranged.  
M. M. Salpeter.  
Special emphasis is on development, functional relationships, and ultrastructure.

**397 (326) Elementary Neurophysiology** Fall, 3 credits. Prerequisite: 396 (325) or written permission of instructor.

Lec, T Th 9:05; disc, W 7:30 p.m. T. R. Podleski.  
Lectures will examine the biophysical and biochemical properties of the excitable membranes of nerve cells and muscle. Topics to be studied include the origin of bioelectric potentials, excitability, synaptic transmission, neural circuits, the specificity of neural membranes, and possible mechanisms for plasticity.

**420 (620) Seminar in Neurobiology and Behavior** Fall or spring, 1 credit. May be repeated for credit. S-U grades optional. Primarily for undergraduates.

Hours to be arranged. Organizational meeting first Monday of each semester at 8 p.m. in Caldwell 100. Staff.

In most semesters at least 3 seminars on different topics will be offered. Topics and instructors will be listed in the Catalog Supplement at beginning of semester.

**421 Comparative Vertebrate Ethology** Fall, 3 credits. S-U grades optional. Prerequisites: 1 year of introductory biology for majors, 321, and written permission of instructor.

Lec, T Th 9:05; lab, to be arranged. Independent research project required. W. C. Dilger.  
A survey of the methods and principles of vertebrate ethology, including such topics as aggression, fear, sex, feeding, and other normal activities. Emphasis is placed on the causation, function, biological significance, and evolution of species-typical behavior. The laboratories are designed to give firsthand knowledge of the material covered in lectures. This course will also be offered during the

3-week Summer Session. During the summer, field trips and field projects are substituted for many of the laboratories.

**[423 Animal Communication** Fall, 4 credits. Limited to 32 students. Prerequisites: 321 and either Phys 102 or 208. Not offered 1976-77.

Lec, T Th 10:10; lab, T or Th 1:25-4:25; and other meetings to be arranged.  
R. R. Capranica, R. R. Hoy.

The functional aspects of biological signals, their physical properties, and the physiological mechanisms underlying their generation and reception. Lectures will examine in detail selected biological communication problems from each of the known sensory modalities. Discussion will cover signal analysis, transmission properties, and the limitation of each type of communication. Laboratories will include behavioral observations under both field and captive conditions, and individual experience with the techniques of signal recording and analysis.]

**[425 (424) Brain and Behavior (also Psychology 425)** Fall, 3 credits. Prerequisite: familiarity with theories of perception, memory, and physiological psychology, or written permission of instructor. Not offered 1976-77.

Lec, Th 2:30-4:25.  
A theoretical introduction to human neurology. This survey of clinical symptoms and their etiology is designed to enable students to make use of disease for research purposes.]

**[427 (523) Vertebrate Social Behavior** Fall, 3 credits. Prerequisites: 321 and 360 (361), or their equivalents, and written permission of instructor. Offered in alternate years. Not offered 1976-77.

Lec, M W F 10:10; disc, to be arranged.  
S. T. Emlen.  
A discussion of vertebrate social behavior, with emphasis upon behavioral adaptations to the environment; ecological significance of diverse social systems; advantages of territoriality, coloniality, and nomadism; evolution of cooperative and communal social organizations; feeding and flocking strategies; ecological constraints on monogamous, polygamous, and promiscuous mating systems; and role of social behavior in population regulation.]

**429 Undergraduate Research in Neurobiology and Behavior** Fall or spring. Variable credit. S-U grades optional. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade.

Hours to be arranged. Staff.  
Practice in planning, conducting, and reporting independent laboratory and/or library research programs.

**492 (420) Principles of Neurobiology, Laboratory (also Psychology 492)** Spring, 4 credits. Limited to 36 students. Prerequisite: 397 (326) or 495 (427) (may be taken concurrently), or written permission of instructor.

Lab, M W or T Th 1:25-4:25. B. P. Halpern, T. R. Podleski, D. N. Tapper, and staff.  
Laboratory practice with neurobiological preparations and experiments, designed to teach the students the techniques, experimental designs, and research strategies used to study biophysical and biochemical properties of excitable membranes, sensory receptors, and the central nervous system transformation of afferent activity as well as the characteristic composition and metabolism of neural tissue.

**[494 (426) Neuropharmacology** Spring, 3 credits. Prerequisites: 321 and either 330 (432) or 331 (431), or written permission of instructor. Not offered 1976-77.

Lec, M W F 8.  
Deals with drugs that affect the nervous system, both central and peripheral. Emphasis will be on

mechanisms of drug action whereby basic biochemical processes and neurophysiological and behavioral phenomena are bridged. Among the topics discussed are stimulants, anesthetics, hallucinogens, and neurotoxins. Topics covered will also include drug addiction, psychopharmacology, endocrine pharmacology, and the biochemical basis of the therapeutic uses of drugs in diseases of the nervous system.]

**495 (427) Sensory Function (also Psychology 495)** Fall, 3 credits. Prerequisite: 321 or equivalent. Offered in alternate years.

Lec, M W 11:15; disc, to be arranged.  
B. P. Halpern, D. N. Tapper.  
Sensory receptors and the central nervous system transformation of afferent activity will be considered in relation to the adaptive significance of behavior. The receptors will be examined in terms of anatomy, biochemistry, biophysics of transduction, and the central nervous system control of peripheral input.

**[497 (428) Neurochemistry** Fall, 3 credits. Limited to 50-100 students. Prerequisites: 321 and either 330 (432) or 331 (431). Not offered 1976-77.

Lec and disc, M W F 9:05.  
Special features of the composition and metabolism of neural tissue will be discussed. The identification of synaptic transmitters in the nervous system, including their specific localization, biosynthesis and metabolism, release, inactivation, and action on postsynaptic receptors, will be considered in detail.]

**622 (520) Chemical Communication (also Chemistry 622)** Spring, 3 credits. Primarily for research-oriented students; seniors and graduate students only. Limited to 30 students. Prerequisites: 1 year of introductory biology for majors or equivalent, course work in biochemistry, and Chem 357-358 or equivalent. Offered in alternate years.

Lec, M W F 12:20. T. Eisner, J. Meinwald, W. L. Roelofs, and guest speakers.  
The production, transmission, and reception of chemical signals in communicative interactions of animals, plants, and microorganisms. Specific topics will be treated with varying emphasis on chemical, biochemical, neurobiological, ecological, and evolutionary principles.

**624 (522) Behavioral Neurogenetics** Spring, 3 credits. S-U grades optional. Primarily for research-oriented students. Prerequisites: 321 and 281; course work in developmental biology recommended. Offered in alternate years.

Lec, T Th 9:05; disc and demo, to be arranged.  
R. R. Hoy.  
The neurogenetic basis of behavior in animals. The study of "simple" behaviors that can be analyzed genetically and neurobiologically. Both vertebrate and invertebrate animals will be discussed, although emphasis will be on the invertebrates. Lectures and assigned readings will draw heavily from journal articles.

**[626 (622) Seminar in Ecological Animal Behavior** Spring, 2 credits. S-U grades optional. Limited to 12 students. Prerequisites: course work in animal behavior and ecology, and written permission of instructor. Not offered 1976-77.  
Hours to be arranged. R. E. Buskirk.]

**628 (624) Field Methods in Animal Behavior** Spring, 4 credits. Limited to 20 students. Prerequisites: 321 and either 421 or 427 (523), or their equivalents, and written permission of instructor.  
Lec and disc, T Th 10:10; lab, T 1:25-4:25.

Independent project required. It will be mandatory for enrolled students to participate in all of these aspects of the course and no partial credit will be given. R. E. Buskirk.  
A practically oriented course for seniors and first-year graduate students who will be pursuing field studies. Lecture-discussion areas include the scope and design of field behavior projects, sources of variability, and evaluation of relevant publications.

Laboratory periods are devoted to introduction, demonstration, and practice of techniques, and to individual fieldwork.

**692 (524) Behavioral Neurophysiology** Spring, 3 credits. Limited to 25 students. Prerequisite: 321 or equivalent; 397 (326) recommended. Offered in alternate years.

Lec and disc, T Th S 9:05. J. M. Camhi.

The overall subject is the determinants of motor outputs. Topics to be considered include peripheral innervation patterns, interactions among motoneurons, interneuron-motoneuron relationships, interactions among interneurons, etc. Simpler systems, such as invertebrates, will be stressed and will serve as model systems for understanding more complex problems of vertebrates. Most readings will be research papers which will be analyzed in the weekly discussion.

**694 (525) Behavioral Neurophysiology, Laboratory** Spring, 2 credits. Limited to 10 students. Prerequisite: concurrent enrollment in 692 (524). Offered in alternate years.

Lab, to be announced. J. M. Camhi.

After learning basic techniques, students will work on extended research projects under direction of the staff.

**[695 (625) Physiological Optics** Fall, 3 credits. Limited to 24 students. Prerequisites: courses in elementary biology, physiology, computing, and physics, and written permission of instructor. Offered in alternate years. Not offered 1976-77.

Lec and lab, to be arranged. 2 lectures and one 3-hour lab weekly. H. C. Howland.

This theoretical and experimental course is intended primarily for seniors and graduate students who intend to pursue research in vision. Topics covered include elementary geometrical optics, subjective and objective methods of refracting human and animal eyes, methods for measurement of the aberration of the eye, computational methods for the determination of the modulation transfer function of the eye with known aberrations, mechanisms of accommodation and convergence, pupillary reflexes, optical properties of the retina, and visual defects. Stereopsis, motion perception, visual illusions, color vision, and the pharmacology of the eye will also be treated insofar as they relate to fundamental ophthalmological measurements. Optics in the course will be taught on the level of Smith's *Modern Optical Engineering*, and a variety of texts including Helmholtz's *Treatise on Physiological Optics* will be used in addition to selections from the current research literature. Students will be asked to undertake an independent laboratory project at the conclusion of the regularly scheduled exercises.]

**696 (528) Bioelectric Systems (also Electrical Engineering 626)** Spring, 3 or 4 credits (4 credits with laboratory). Prerequisite: 423 or 495 (427) or 692 (524), or Elec E 312, or Phys 360; written permission of instructor required for laboratory.

Lec, M W 9:05; disc and demo, Th 2-4:25; lab, to be arranged. M. Kim.

Application of electrical systems techniques to biological problems. Electrical activity of nerve cells; generation and propagation of nerve impulse; voltage clamp technique and its phase-plane analysis; neuromuscular systems; synaptic transmission; models of nerve cells, sensory receptors, and encoding in the nervous system; analysis of electrophysiological data; and electrodes and instrumentation techniques.

**697 (526) Functional Organization of the Mammalian Nervous System, Lectures (also Veterinary Medicine 753)** Fall, 3 credits. Prerequisite: 2 years of college biology; courses in biochemistry, physics, and neural anatomy recommended. Offered in alternate years.

Lec, M W F 10:10. E. L. Gasteiger.

Cellular, sensory, central integrative, and motor aspects of the nervous system will be considered.

with an emphasis on the electrophysiological approach.

**699 (527) Functional Organization of the Mammalian Nervous System, Laboratory (also Veterinary Medicine 753)** Fall, 3 credits.

Prerequisite: concurrent enrollment in 697 (526). Offered in alternate years.

Lab, W 1:25-4:25. E. L. Gasteiger.

Studies will include electrical activity of cells, reflexes, decerebrate rigidity, acoustic microphonic response, subcortical stimulation, and evoked and spontaneous cortical activity.

**720 (629) Seminar in Advanced Topics in Neurobiology and Behavior** Fall or spring.

Variable credit. May be repeated for credit. S-U grades only. Primarily for graduate students; written permission of instructor required for undergraduates.

Hours to be arranged. Staff and students.

Designed to provide several study groups each semester on specialized topics. A group may meet for whatever period is judged adequate to enable coverage of the selected topics. Ordinarily, topics will be selected and circulated during the preceding semester. Suggestions for topics should be submitted by faculty or students to the chairperson of the Section of Neurobiology and Behavior.

**723 (623) Graduate Seminar in Vertebrate Social Behavior** Fall, 2 credits. May be repeated for credit. S-U grades only. Enrollment limited. Prerequisites: 321, 360 (361), 477 (476), or their equivalents, and written permission of instructor.

Hours to be arranged. S. T. Emlen, R. E. Buskirk. Intended as a graduate-level follow-up to 427 (523). An advanced, participation-format seminar dealing with various aspects of the evolution of social organization in vertebrates.

See also:

**Teaching Experience (Biological Sciences 403-404)**

## Biochemistry

**132 (130) Orientation Lectures in Biochemistry** Spring. Noncredit. Primarily for freshmen, sophomores, and transfer students.

Lec, S 9:05-10:30, first 3 Saturdays of term.

Section chairperson and staff.

Lectures and demonstrations covering modern research and training in biochemistry and molecular and cell biology.

**231 Introductory Biochemistry** Fall, 3 credits.

May not be taken for credit by students who have completed a more advanced course in this section. Prerequisite: Chem 104 or 208, or equivalent.

Lec, T Th 12:20-1:35. J. M. Griffiths.

A brief survey of organic chemistry as related to biological compounds and a discussion of selected biochemical topics and reactions associated with the metabolism of animals, plants, and microorganisms. Especially designed as a general course for four-year students.

**233 Introduction to Cell Biology** Fall, 3 credits.

Prerequisites: 1 year of college chemistry and biology, or advanced placement in both

Lec, T Th 12:20-1:35. V. M. Vogt, V. Utermohlen.

An introduction to the structural and functional properties of cells, including basic biochemical processes, genetic expression, cell growth, immunology, and virology.

**330-331 (432-431) Principles of**

**Biochemistry** Note: During 1976-77, 330-331 will be given in two formats: individualized instruction (330) and lectures (331). *Individualized instruction will be offered to a maximum of 150 students each term. Lectures will be given fall term only.* All students intending to take 330 or 331 in the fall should attend

the first class meeting, M 10:10. See specific listings below.

**330 (432) Principles of Biochemistry, Individualized Instruction** Fall or spring, 4 credits. Prerequisite: Chem 253 or equivalent.

Disc, M W F 8 or 10:10; additional hours to be arranged. There are no formal lectures.

Organizational meeting first Monday of each semester at 10:10. Midterm and final exams may be scheduled in the evening. M. Ferger, G. P. Hess, and staff, fall; J. M. Calvo, J. M. Griffiths, and staff, spring.

The focal point for this course is a study center where students find materials, get help, participate in discussions, and take exams. The study center will be open mornings, afternoons, and evenings. Students are required to master a minimum body of core material. The pace at which this material is assimilated, to a large extent, will be self-determined. Students who wish to go beyond core material will have available a wide range of electives, including discussions of research papers, independent study of a variety of problems, *Scientific American* articles, and original research literature. Grades will be determined primarily by the amount of elective work satisfactorily completed and by a final exam. Each group of 25 students will have contact with an instructor, a teaching assistant, and an undergraduate assistant.

**331 (431) Principles of Biochemistry, Lectures** Fall, 4 credits. Prerequisite: Chem 253 or equivalent.

Lec, M W F S 10:10. G. W. Feigenson, R. E. McCarty.

The chemistry of biological substances is presented in a lecture format. The course content is similar to that of 330 (432).

**430 Basic Biochemical Methods** Fall or spring, 2 or 4 credits. Prerequisites: 330 (432) or 331 (431), and written permission of instructor.

Lec-disc, F 1:25 (all students); lab, Th 12:20-4:25 (2 credits), M W 12:20-4:25 or T 9:05-4:25 (4 credits). R. R. Alexander, L. D. Wright, V. Utermohlen.

A modular course designed to meet the practical biochemical needs of students concentrating in other disciplines. An enzymology module is taken by all students. For students enrolled for 4 credits, 2 of the following modules may be chosen: clinical and nutritional biochemistry; immunology; lipids; or isolation and characterization of cell components.

**432 (437) Cell Biology** Spring, 3 credits. Primarily for upperclass students. Prerequisite: some knowledge of biochemistry.

Lec, M W F 8. A. J. Gibson, R. E. MacDonald.

An introduction to the properties of cells, singly and in communities. The concepts of cell growth, structure, and differentiation in prokaryotic and eukaryotic communities will be examined and compared, with emphasis on cellular dynamics and interactions.

**434 (438) Laboratory in Cell Biology** Spring, 3 credits. Enrollment limited. Prerequisites: concurrent enrollment in 432 (437) and written permission of instructor.

Lab, M W 1:25-4:25 or F 9:05-4:25; disc, to be arranged. A. J. Gibson, R. E. MacDonald.

An introduction to techniques of handling cells in the laboratory. Cell material will vary to give the students the widest practical experience with the problems inherent in different systems.

**435-436 Undergraduate Biochemistry Seminars** 435, fall; 436, spring, 1 credit per term. May be repeated for credit. S-U grades optional with consent of instructor. Limited to upperclass students. Enrollment limited. Prerequisite: 330 (432) or 331 (431), or written permission of instructor.

Hours to be arranged. Organizational meeting first Tuesday of each semester at 4 p.m. D. B. Wilson, fall; Q. H. Gibson, spring.

A group of selected papers from the literature will be critically evaluated during 6 or 7 two-hour meetings. Fall term, regulation of protein synthesis; spring term, heme enzymes.

#### 439 Undergraduate Research in

**Biochemistry** Fall or spring. Variable credit. Primarily for undergraduate students concentrating in biochemistry. Prerequisite: adequate ability and training for the work proposed. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade.

Hours to be arranged. Staff. Special work in any branch of biochemistry on problems under investigation by individual members of the staff of the section. Arranged jointly by the section chairperson and the research adviser.

**631 Protein Structure and Function** Fall, 2 or 3 credits (3 credits with discussion). Prerequisites: 330 (432) or 331 (431), Chem 287-288 (may be taken concurrently), and Chem 357-358, or written permission of instructor.

Lec, M W 9:05; disc, F 9:05. K. Moffat and staff. Lectures on protein structure and the nature of enzymatic catalysis. Discussions will cover some of these areas in more depth, through recent research papers and advanced lectures.

**632 Bioenergetics and Membranes** Spring, 2 or 3 credits (3 credits with discussion). Prerequisites: 330 (432) or 331 (431), and Chem 357-358, or written permission of instructor; physical chemistry recommended.

Lec, M W 9:05; disc, F 9:05. P. C. Hinkle and staff. Oxidative phosphorylation, photophosphorylation, active transport, muscle contraction, and the structure of biological membranes. Discussions will deal principally with current research.

**633 Biosynthesis of Macromolecules** Fall, 2 or 3 credits (3 credits with discussion). Prerequisites: 330 (432) or 331 (431), and Chem 357-358, or written permission of instructor.

Lec, T Th 9:05; disc, to be arranged. D. B. Wilson, L. A. Heppel. DNA, RNA, and protein synthesis; regulation of gene expression; and other topics. Discussions will cover current papers on the same topics.

**635 Enzyme Mechanisms and Metabolism** Spring, 2 or 3 credits (3 credits with discussion). Prerequisites: 330 (432) or 331 (431), and Chem 357-358, or written permission of instructor; physical chemistry recommended.

Lec, T Th 9:05; disc, to be arranged. D. B. McCormick and staff. Lectures will include explicit cofactor functions and regulation of metabolism at the molecular level. Discussions will cover examples from the current literature.

**[636 (534) Biochemistry of the Vitamins and Coenzymes** Spring, 2 credits. Prerequisites: 330 (432) or 331 (431) or equivalent, and Chem 358. Offered in alternate years. Not offered 1976-77.

Lec, T Th 10:10. D. B. McCormick. The chemical, biochemical, and nutritional aspects of the vitamins and coenzymes.]

#### 638 (530) Intermediate Biochemical

**Methods** Spring, 4 credits. Primarily for undergraduates majoring in biochemistry and for graduate students with a minor in biochemistry. Prerequisites: 330 (432) or 331 (431), Chem 358, and written permission of instructor. Preregistration must be made with instructor by the last day of the preregistration period.

Lab, T or Th 9:05-4:25; disc, to be arranged. J. W. Roberts, D. B. Wilson, and staff. Selected experiments on carbohydrates, proteins, amino acids, and metabolism (cellular particulates, kinetics, and general enzymology) will illustrate basic biochemical principles. The course will emphasize

quantitative aspects rather than qualitative identifications.

**730 (639) Biochemistry Seminar** Fall or spring. Noncredit. F 4:15. Staff.

Lectures on current research in biochemistry presented by distinguished visitors and staff.

#### 731 (631-632) Research Seminar in

**Biochemistry** Fall and spring, 1 credit per term. May be repeated for credit. S-U grades only. Required of all graduate students (first-year students excepted) majoring in biochemistry. M 7:30-9 p.m. E. Racker.

#### 733-734 (633-638) Advanced Biochemistry

733, fall; 734, spring, 1 credit per term. May be repeated for credit. Prerequisite: 330 (432) or 331 (431), or written permission of instructor.

Lectures and seminars on specialized topics.

#### 733 (633) The Hemoglobin-Ligand Reaction

Fall. T Th 9:05. Middle 4 and 1/2 weeks of term. First class meeting, October 5. Q. H. Gibson.

#### 734 (634) Selective Topics in Nucleic Acid

**Biochemistry** Spring. T Th 9:05. First 4 and 1/2 weeks of term. L. A. Heppel.

**739 (535) Advanced Biochemical Methods I** Fall, 6 credits. Limited to graduate students majoring in biochemistry.

Lab, T Th 10:10-4:25; disc, to be arranged. E. B. Keller and staff. Each student will carry out a research project to learn the basic techniques of biochemical research.

#### 832 (536) Advanced Biochemical Methods II

Spring, 6 credits. S-U grades only. Limited to graduate students in the Field of Biochemistry.

Hours to be arranged. Staff. Students will do research in the laboratories of 3 different professors chosen by the student. Arrangements are made jointly between the field representative and the research adviser.

#### [Molecular Mechanisms of Hormone Action

**(Veterinary Medicine 758)** Spring, 2 credits. S-U grades optional. Prerequisite: written permission of instructor. Offered in alternate years. Not offered 1976-77. T Th 8. R. A. Corradino.

An advanced course developed from the current literature on endocrine mechanisms. Student presentation of selected topics required.]

See also:

#### Aspects of Plant Metabolism (Biological Sciences 648 [548])

#### Teaching Experience (Biological Sciences 403-404)

#### Vertebrate Biochemistry (Veterinary Medicine 525)

#### Botany

**242 Plant Physiology, Lectures** Spring, 3 credits. Primarily for undergraduates in agricultural sciences. Prerequisites: 1 year of introductory biology and introductory chemistry, and either concurrent enrollment in 344 (342) or written permission of instructor.

Lec, M W F 10:10. Instructor to be announced. Plant physiology as applied to plants growing in communities. Examples will deal with crop plants or higher plants where possible, though not exclusively. Topics will include cell structure and function; soil-plant-water relations; water uptake, transport, and transpiration; irrigation of crops; sugar transport; mineral nutrition of crops, respiration and photosynthesis; light relations in crops; growth and

development—hormones, flowering, fruiting, dormancy, and abscission; and chemical control of plant growth.

**245 (145) Plant Biology** Fall, 3 credits. Not for transfer students who have had botany. Prerequisite: 1 year of introductory biology for majors or equivalent.

Lec, T Th 9:05; lab, M T W Th or F 1:25-4:25, M or W 7-10 p.m., or S 8:30-11:30. Lab limited to 16 students each section. H. P. Banks. Introductory botany for those who plan to specialize in some aspect of, or to make some utilization of, the plant sciences. Emphasizes structure, reproduction, and classification of angiosperms, and the history of life on earth. Emphasis in laboratory is placed on the development of skills in handling plant materials, including identification. First 3 weeks of laboratory are field trips, starting with the first day of classes.

**[246 (350) Plants and Man** Spring, 3 credits. S-U grades optional. Intended for students in all colleges. Not offered 1976-77.

Lec and disc, M W F 8. D. M. Bates. A consideration of the role of plants in the human environment and in the evolution of civilizations. Emphasis is on ethnobotanical considerations and on historical to present-day utilization of plants in nutrition, housing, clothing, medicine, religion, and the arts.]

**342 (340) Plant Physiology, Lectures** Spring, 3 credits. Prerequisites: 1 year of introductory biology, organic chemistry, and either concurrent enrollment in 344 (342) or written permission of instructor.

Lec, T Th 10:10 and M 7:30 p.m. A. T. Jagendorf. The behavior, growth, transport processes, and environmental response of plants. Topics will include membrane properties, solute and water transport, and function of osmotic forces; mineral and organic nutrition; stress resistance; growth and hormonal action; metabolism, including photosynthesis and respiration; and responses to gravity, light, photoperiod, and temperature.

**343 Field Phycology** Summer, 4 credits. S-U grades only. Prerequisite: 364 or equivalent familiarity with the algae.

Daily lectures, laboratories, and fieldwork for 3 weeks. J. S. Prince (U. Miami), in charge; A. C. Mathieson (U. New Hampshire); J. M. Kingsbury (Cornell). An overview of the major marine algal groups, including aspects of anatomy, morphology, development, ultrastructure, life histories, physiology, and utilization. Laboratories and fieldwork will emphasize relationships between distribution and major environmental parameters such as exposure, nutrients, turbidity, and salinity, and will involve student projects.

A special course offered at the Shoals Marine Laboratory of Cornell University on an island off Portsmouth, N.H. For more details and applications, consult the Office of Marine Biology, 202 Plant Science Building.

**344 (342) Plant Physiology, Laboratory** Spring, 2 credits. Prerequisite: concurrent enrollment in 242 or 342 (340).

Lab, T W Th or F 1:25-4:25; disc, T W Th or F 12:20. Lab and discussion must be on same day. A. T. Jagendorf, R. Kaltaler.

**345 Plant Anatomy** Fall, 4 credits. Limited to 48 students. Prerequisite: 1 year of introductory biology or a semester of botany. This course is not intended for general education. Students who are in doubt about the level of their preparedness or the role of this course in their curricula are encouraged to consult the instructor before registering.

Lec, T Th 8; lab, T Th 10:10-12:35 or M W 2-4:25. D. J. Paolillo. A descriptive course with equal emphasis on development and mature structure. Lecture, laboratory, and reading are integrated in a study guide. The laboratory offers the opportunity to

develop the practical skills required to make anatomical diagnoses and to write anatomical descriptions.

**346 (371) Taxonomy of Vascular Plants** Spring, 4 credits. Prerequisites: introductory botany and written permission of instructor.

Lec and disc, T Th 9:05; lab, T Th 2-4:25.  
R. T. Clausen.

An introduction to the classification of ferns and flowering plants, with attention to principles, methods of identification, and literature. Field trips are held during laboratory periods in the last half of the term.

**347 Cytology** Fall, 4 credits. Prerequisite: 1 year of introductory biology for majors; 281 recommended.

Lec, M W 9:05; lab, M W or T Th 10:10-12:35.  
C. H. Uhl.

A study primarily of the structure of cells and their components, and the relation of these to function and heredity. Special attention is given to chromosomes. Both plant and animal materials are used.

**348 (344) Phycology** Spring, 4 credits.

Lec, M W F 10:10; lab, M W or F 2-4:25.  
J. M. Kingsbury.

An introduction to freshwater and marine algae, including consideration of their ecology as members of the plankton and benthos and their importance to man. The laboratory, utilizing field material and cultures from an extensive living collection, is designed to illustrate lecture topics, provide familiarity with algae in the field, and introduce the student to techniques used in isolating, culturing, and studying algae in the laboratory.

**[442 (466) Taxonomy and Evolution of Vascular Plants** Spring, 4 credits. Prerequisites: 346 (371) and written permission of instructor. Not offered 1976-77.

Lec and disc, T Th 9:05; lab, T Th 2-4:25.  
R. T. Clausen.

A study of the variation, evolution, and ecological distribution of vascular plants. Laboratory periods in the latter part of the term are devoted to the study of natural populations in the field.]

**444 Comparative and Developmental**

**Morphology of the Embryophyta** Spring, 4 credits. Prerequisite: 345. Offered in alternate years.

Lec, T Th 8; lab, T Th 2-4:25. D. J. Paolillo.

The life histories of bryophytes, vascular cryptogams, and seed plants are explored for their developmental attributes and for their bearing on concepts of evolution and group relationships. The course content is presented so that an awareness of the integration between morphology and other disciplines in biology can be developed.

**445 (545) Photosynthesis (also Engineering**

**A&E 601)** Fall, 2 credits. Prerequisites: Chem 104 or 208, Math 108 or 111, and Phys 102 or 208, or written permission of instructor; concurrent or previous enrollment in 405 recommended. Offered in alternate years.

Lec, T Th 10:10. R. K. Clayton.

A detailed study of the process by which plants use light in order to grow, emphasizing physical and physicochemical aspects of the problem.

**[446 (440) Cytogenetics** Spring, 3 credits.

Prerequisites: 347 and 281, or their equivalents. Offered in alternate years. Not offered 1976-77.

Lec, M W 9:05; lab, M or W 10:10-12:35. C. H. Uhl. Deals mainly with the cellular mechanisms of heredity, including recent research in cytology, cytogenetics, and cytotoxicology.]

**[447 (547) General Photobiology (also**

**Engineering A&E 603)** Fall, 2 credits. Prerequisites: same as for 445 (545); concurrent or previous enrollment in 405 recommended. Offered in alternate years. Not offered 1976-77.

Lec, T Th 10:10. R. K. Clayton.

A study of the major interactions between light and

living matter as encountered in photosynthesis, vision, regulation of physiology and development, bioluminescence, and damage by ultraviolet and visible light.]

**[448 Plants and Time (paleobotany)** Spring, 3 credits. Prerequisites: 345 and 444 recommended

(may be taken concurrently), or written permission of instructor. Offered in alternate years. Not offered 1976-77.

Lec, M W 11:15; lab, M 1:25-4:25. H. P. Banks. A survey of the evolutionary history of the major groups of plants. Emphasis will be placed on a consideration of the geologic time of appearance of major innovations in the plant kingdom and their subsequent adaptive radiations.]

**449 Undergraduate Research in Botany** Fall or spring. Variable credit. Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade.

Hours to be arranged. Staff. Students engaged in special problems or making special studies may register in this course. They must satisfy the instructor under whom the work is to be taken that their preparation warrants their choice of problem.

**640 (647) Special Topics in Plant Taxonomy** Fall

or spring, 1 credit a topic. S-U grades optional. Prerequisite: written permission of instructor.

Lec and disc, to be arranged. D. M. Bates,  
W. J. Dress, J. W. Ingram, H. E. Moore.

A series of 4 topics, 1 presented each term, designed to provide professional background in nomenclature, biosystematics, tropical families of phanerogams, and literature of taxonomic botany.

(1) Fall. *Nomenclature*. An analysis of the International Code of Botanical Nomenclature and its application to various plant groups. Lectures, discussions, and problems. W. J. Dress. May be taken concurrently with 644 (Botanical Latin). Offered in alternate years.

(2) Fall. *Biosystematics*. A consideration of biosystematic approaches to taxonomy, including chemical, numerical, cytological, and statistical methodologies as well as a review of classic studies. D. M. Bates. Offered in alternate years. Offered fall 1976; next offered spring 1979.

[(3) Fall. *Families of Tropical Phanerogams*. The families of flowering plants encountered solely or chiefly in tropical regions will be considered in lectures, discussions, and demonstrations, with the aim of providing basic points of recognition for and an understanding of diversity and relationships in these families for the student venturing into the tropics. H. E. Moore. Offered in alternate years. Not offered 1976-77.]

[(4) Spring. *Literature of Taxonomic Botany*. A survey of the basic reference works in taxonomy from the pre-Linnaean literature drawn on by Linnaeus to contemporary publications, with comments on the peculiarities of the books (when appropriate), on publication dates, typographic devices, and intricacies of bibliographic citation. Lectures, discussions, demonstrations, and problems. J. W. Ingram. Offered in alternate years. Not offered 1976-77.]

**[641 (441) Plant Growth and Development** Fall,

3 credits. Prerequisites: 345 and either 242 or 342 (340), or their equivalents, or written permission of instructor. Offered in alternate years. Not offered 1976-77.

Lec, M W F 10:10. P. J. Davies, D. J. Paolillo. This course explores the changes that occur during growth and development of plants and their control: morphological and anatomical changes in apices, tissue differentiation, organ formation, embryo development, nucleic acid and protein synthesis, gene regulation, hormone action and interaction, the influence of light in development, flowering, fruiting, dormancy, abscission, and senescence.]

**642 Topics in Ultrastructure of Plant**

**Cells** Spring, 3 credits. Primarily for graduate students, although upperclass students with adequate background will be allowed to enroll. No auditors. Prerequisites: 345 or 347, and written permission of course coordinator. Offered in alternate years.

Lec, M W F 9:05; disc, F 1:25 or to be arranged.

Staff (Coordinator—M. V. Parthasarathy). An advanced course dealing with organelles in depth, and in breadth where necessary. Topics will include salient ultrastructural features of some plant groups, and certain specialized cells and processes. Content of the course and staff direction will vary to some extent from year to year.

**643 (543) Plant Physiology, Advanced Laboratory Techniques** Fall, 4 credits. S-U grades

only. Primarily for graduate students doing work in plant physiology, but open to others if space permits. Prerequisites: organic chemistry, biochemistry, and a course in plant physiology.

Lab, T or W 8-5; disc, M 4:30-5:30.  
A. T. Jagendorf and staff.

An introduction to some modern methods in experimental plant biology.

**644 Botanical Latin** Fall, 1 credit. S-U grades optional. Prerequisite: written permission of instructor. Offered in alternate years.

Lec and disc, to be arranged. W. J. Dress. Basic grammar and vocabulary, and exercises in writing and reading the Latin of plant taxonomy as well as applications to botanical nomenclature.

**[645 (663) Seminar in Taxonomy and Evolution**

**of Vascular Plants** Fall, 1 credit. May be repeated for credit. Prerequisites: 442 (466) and written permission of instructor. Not offered 1976-77.

Disc, M 11:15. R. T. Clausen. A consideration of primary problems concerned with the classification, evolution, and environmental relationships of vascular plants.]

**647 (649) Seminar in Systematic Botany** Fall,

1 credit. May be repeated for credit. Prerequisite: written permission of course coordinator required for undergraduates.

Lec and disc, F 1. Staff (Coordinator—D. M. Bates). Lectures and discussions led by staff, visitors, and students on topics of current importance to systematic botany.

**[648 (548) Aspects of Plant Metabolism** Spring,

3 credits. Prerequisites: organic chemistry, biochemistry, and a course in plant physiology. Offered in alternate years. Not offered 1976-77.

Lec, M W F 9:05. A. T. Jagendorf, R. E. McCarty, J. F. Thompson, and staff. Selected areas of plant biochemistry will be reviewed in the context of the plant life cycle and responses to the environment. Topics include: metabolism of lipids, carbohydrates, organic acids, proteins, and pigments; nitrogen and sulfur assimilation; hormone metabolism; respiration; photosynthesis; development and replication of chloroplasts; and cell wall composition and properties. Attention will be paid to operation of control mechanisms.]

**649 (549) Transport of Solutes and Water in**

**Plants** Fall, 3 credits. Prerequisite: 342 (340) or equivalent. Offered in alternate years.

Lec, M W F 10:10. R. M. Spanswick. Transport of ions, water, and organic materials in plants; mechanisms of ion transport; relationships between ion transport and metabolism; ion uptake and transport in higher plants; phloem transport; and water relations of single cells and whole plants.

**740 (643) Plant Physiology Seminar** Fall and

spring. Noncredit. Required of graduate students doing work in plant physiology.

F 11:15. Staff. Lectures on current research in plant physiology presented by visitors and staff.

**749 Graduate Research in Botany** Fall or spring. Variable credit. May be repeated for credit. S-U grades optional.

Hours to be arranged. Staff.  
Similar to 449, but intended for graduate students who are working with faculty members on an individual basis.

**840 (645) Current Topics in Plant Physiology** Fall or spring. 2 credits. May be repeated for credit. S-U grades optional.

Hours to be arranged. Staff.  
Seminar reports by graduate students on current literature in experimental plant physiology or related areas.

See also:

**Advanced Mycology (Plant Pathology 579)**

**Current Topics in Mycology (Plant Pathology 649)**

**Introductory Mycology (Plant Pathology 309)**

**Optics in Biology (Biological Sciences 405)**

**Plant Ecology (Biological Sciences 463 [464], 465)**

**Plant Ecology Seminar (Biological Sciences 669)**

**Taxonomy of Fungi (Plant Pathology 599)**

**Teaching Experience (Biological Sciences 403-404)**

## Ecology, Systematics, and Evolution

**260 (261) Introductory Ecology** Fall or spring. 3 credits. Prerequisite: 1 year of introductory biology or written permission of instructor.

Lec, T Th 11:15; disc, T or Th 1:25, 2:30, or 3:35.  
P. F. Brussard, fall; staff, spring.

This course will give students an introduction to biological phenomena that occur at the population, community, and ecosystem levels of organization. The relevance of ecological principles to current environmental problems will be examined.

**274 (273) The Vertebrates** Spring. 5 credits. Primarily for sophomores; this course is a prerequisite for many advanced courses in vertebrate biology, anatomy, and physiology. Lab limited to 20 students each section. Prerequisite: 1 year of introductory biology for majors.

Lec, T Th 10:10; lab, M W 1:25-5, T Th 1:25-5, or T Th 7-10 p.m. 1 midterm exam given at 7:30 p.m.  
Staff.

An introduction to the evolution, classification, comparative anatomy, life history, and behavior of vertebrate animals. Laboratory dissection and demonstration are concerned with structure, classification, systematics, biology of species, and studies of selected aspects of vertebrate life.

**360 (361) General Ecology** Fall or spring. 3 credits. For students with concentration in ecology or related subject. Not open to freshmen. Prerequisite: 1 year of introductory biology for majors.

Lec, T Th 9:05; disc, W or Th 1:25, 2:30, or 3:35.  
P. L. Marks, P. P. Feeny, fall; B. F. Chabot, spring.  
Principles concerning the interactions between organisms and their environment; influence of competition, predation, and other factors on population size and dispersion; analysis of population structure and growth; processes of speciation; interspecific competition and the niche concept; succession and community concepts; influence of climate and past events on the diversity and stability of communities in different regions of the world; and role of energy flow and biogeochemical cycling in determining the structure and productivity of ecosystems. Modern evolutionary theory will be stressed throughout and attention given to conflicting ecological hypotheses.

**[362] Introduction to Nautical Science** Summer. 3 credits. S-U grades only. No prerequisites, but intended for students with 1 completed year of college or equivalent. Offered in alternate years. Not offered 1976-77.

Daily lectures, practice, and assigned readings.  
Staff.

Topics include aspects of navigation, rules of the road, seamanship, weather, naval architecture, and marine engineering.

A special course offered at the Shoals Marine Laboratory of Cornell University on an island off Portsmouth, N. H. For more details and applications, consult the Office of Marine Biology, 202 Plant Science Building.]

**364 Introduction to Marine Science** Summer. 5 credits. S-U grades only. Prerequisite: 1 year of college biology or other supporting subject.

Daily lectures, laboratories, and fieldwork. The course is taught by 3 core faculty assisted by approximately 25 visiting lecturers including representatives of governmental agencies and commercial fishermen. J. M. Kingsbury and staff. Designed for the student who desires an initial overview of the marine sciences, this course emphasizes living material in natural habitats. Most of the course work is concerned with the biology of intertidal plants and animals, biological oceanography, ichthyology, and fisheries. Attention is given also to introductory physical and chemical oceanography and marine geology. Marine ecology and the effects of human activity on the marine environment are included.

A special course offered twice each summer at the Shoals Marine Laboratory of Cornell University on an island off Portsmouth, N. H. For more details and applications, consult the Office of Marine Biology, 202 Plant Science Building.

**365 Underwater Research** Summer. 1 or 2 credits. S-U grades only. Prerequisites: recognized certification and a medical examination.

Daily lectures and practice. The course will be team-taught. Each team will consist at minimum of a diving safety officer and a faculty member, plus guest lecturers.

For competent divers only, this course will cover the special problems of research underwater, including random sampling, use of dive tables, underwater instrumentation, special diving equipment, photographic techniques of record, integration with boats and shore facilities, and emergency procedures. Practice in use of equipment underwater will be emphasized and at least 1 demonstration project will be undertaken.

A special course offered at the Shoals Marine Laboratory of Cornell University on an island off Portsmouth, N. H. For more details and applications, consult the Office of Marine Biology, 202 Plant Science Building.

**461 Oceanography** Fall. 3 credits. Prerequisites: college physics and either 260 (261) or 360 (361), or written permission of instructor.

Lec, T Th 10:10; additional lecture Th 12:20 alternating with discussion, M T W or Th 1:25.  
J. P. Barlow.

A general introduction to the oceans, with some emphasis on physical and chemical processes that interact with marine communities. Discussions will include demonstrations of field techniques as well as discussions of methods of analysis and interpretation of oceanographic data.

**462 Limnology, Lectures** Spring. 3 credits. Prerequisite: 260 (261) or 360 (361), or written permission of instructor.

Lec, M W F 11:15. G. E. Likens.  
A study of the interaction of biological communities and their aquatic environment. Lectures deal with the physical, chemical, and biological dynamics of freshwater ecosystems.

**463 (464) Plant Ecology, Lectures** Fall. 3 credits. Prerequisites: 2 advanced-level courses in biology including 360 (361), or written permission of instructor; concurrent enrollment in 465 strongly recommended.

Lec, M W F 11:15. P. L. Marks, R. H. Whittaker.  
Principles of plant-environment interactions in relation to the evolution, distribution, structure, and functioning of plant communities.

**464 (463) Limnology, Laboratory** Spring. 2 credits. Prerequisite: concurrent or previous enrollment in 462.

Lab, T W Th or F 1:25-5; 1 all-day field trip.  
G. E. Likens.

Laboratories devoted to both field studies and experiments on model ecosystems.

**465 Plant Ecology, Laboratory** Fall. 1 credit. Prerequisite: concurrent enrollment in 463 (464) or an equivalent background in plant ecology.

Lab, F 12:20-5. P. L. Marks.  
Laboratory and field exercises in plant ecology. Field study of plant communities, and techniques for the analysis of community data, are emphasized.

**466 (467) Chemical Ecology** Spring. 2 credits. S-U grades optional. Prerequisites: 1 year of introductory biology for majors and either Chem 353 or 357-358, or written permission of instructor. Offered in alternate years.

Lec, M F 12:20. P. P. Feeny, M. Alexander, T. E. Eisner, J. Meinwald, W. L. Roelofs, R. H. Whittaker.

Ecological and evolutionary significance of chemical interactions of organisms; summary of key processes in regulation of natural populations; survey of major classes of natural products with emphasis on appropriate analytical techniques; chemical adaptations for reproduction, defense, habitat selection, dispersal, feeding efficiency, and competition in animals, plants, and microorganisms; choice of adaptive strategy in relation to energy flow; and practical applications of chemical ecology.

**[467 (468) Species Distribution and Abundances** Fall. 3 credits. Prerequisite: 360 (361); introductory statistics strongly recommended. Not offered 1976-77.

Lec, T Th 1:25; field projects by arrangement.  
P. F. Brussard.

An advanced course emphasizing the unifying principles of ecology, biogeography, and population biology. Topics include the distribution of organisms in time and space, biogeographic regions, continental and island patterns of distribution, ecology of dispersal and colonization, ecological and genetic considerations of population structure, and factors determining population size. Includes projects and exercises designed to give students firsthand contact with field techniques and data analysis.]

**468 (460) Systems Ecology** Spring. 3 credits. S-U grades optional. Limited to 30 students. Prerequisites: 360 (361), calculus, and written permission of instructor.

Lec, T Th 9:05; disc, T or Th 1:25-3. C. A. S. Hall.  
An introduction to the quantitative study of populations, communities, and ecosystems, and their interacting components. The emphasis will be on the development and validation of models based on component interactions and entire systems. Topics covered will include relevant ecological principles, system diagramming, rudimentary mathematical techniques, simulation modeling, and the use of analog and digital computers. The format will include student presentations and guest lectures describing individual case histories in which a variety of methods were used for ecological analysis, simulation, or prediction.

**469 (479) Undergraduate Research in Ecology, Systematics, and Evolution** Fall or spring. Variable credit. Undergraduates must attach to their

preregistration material written permission from the section chairperson and staff member who will supervise the work and assign the grade.

Hours to be arranged. Staff.

Practice in planning, conducting, and reporting independent laboratory and/or library research programs.

**470 Undergraduate Ecology Seminar** Fall or spring. 1 or 2 credits. May be repeated for credit. From time to time different seminars will be offered.

Two 1-hour meetings each week to be arranged.

Organizational meeting first day of classes at 4 p.m. in the Biology Center (Stimson G-20).

F. H. Pough.

(1) Fall 1976: *Seminar in Mimicry*. 2 credits. Enrollment limited. A survey of selected examples of mimicry among animals. Students will present critical evaluations of published work. A term paper will be required. Several speakers from outside the University will visit to discuss their own research.

**471 Mammalogy, Lectures** Fall. 3 credits.

Prerequisite: 1 year of introductory biology for majors.

Lec, M W F 11:15. J. W. Hudson.

Lectures on the evolution, classification, distribution, ecology, behavior, and adaptations, both physiological and morphological, of mammals.

**[472 (474) Herpetology, Lectures** Fall. 3 credits.

Prerequisite: 274 (273) or equivalent experience in vertebrate zoology. Offered in alternate years. Not offered 1976-77.

Lec, M W F 12:20. F. H. Pough.

The evolution, distribution, and adaptations of amphibians and reptiles. Emphasis on ecology, behavior, physiology, and zoogeography.]

**473 (472) Mammalogy, Laboratory** Fall. 3

credits. Prerequisite: concurrent enrollment in 471.

Lab, M W 1:25-4:25, T Th 1:25-4:25, or M W 7-10 p.m.; 1 weekend field trip required and 5 lab preparation lectures T 7:30-9 p.m. J. W. Hudson.

Laboratory and fieldwork on systematics, physiological ecology, and natural history of mammals of the world, with primary emphasis on the North American fauna. Systematics laboratories to be held in museum, Research Park.

**[474 Herpetology, Laboratory** Fall. 2 credits.

Enrollment limited. Prerequisite: concurrent enrollment in 472 (474). Offered in alternate years. Not offered 1976-77.

Lab, W F 1:25-4:25; several required field trips and at least 1 Saturday field project. Some of the lab work requires measurements to be made at intervals during the day and evening. F. H. Pough.

Laboratory and fieldwork on systematics, ecology, behavior, and physiology.]

**475 (473) Ornithology** Fall. 4 credits.

Prerequisites: 274 (273) or equivalent, and written permission of instructor.

Lec and lab, T Th 12:20-4:25; occasional field trips and special projects. T. J. Cade.

Lectures cover various aspects of the biology of birds, including anatomy, physiology, classification, evolution, migration and orientation, behavior, ecology, and distribution, and are fully integrated with laboratory studies. Laboratory includes studies of external and internal morphology, pterylosis, molts and plumages, specimen identification of birds of New York, and families of birds of the world. Several demonstration periods emphasize hybridization, evolution, adaptive radiation, mimicry, and geographic variation.

**476 (477) Biology of Fishes** Fall. 4 credits.

Prerequisite: 274 (273) or equivalent experience in vertebrate zoology with written permission of instructor. Offered in alternate years.

Lec, M W F 9:05; lab, to be arranged.

E. B. Brothers.

An introduction to the study of fishes: their structure,

classification, evolution, distribution, ecology, physiology, and behavior.

**477 (476) Organic Evolution** Fall. 4 credits.

Prerequisites: 281 and a working knowledge of elementary algebra and logarithms; a course with some taxonomic content, or experience in making a collection of some plant or animal group, recommended.

Lec, T Th 11:15; lec or disc, Th 12:20; optional sessions to be arranged. W. L. Brown.

Lectures and class discussions on organic evolution, with primary emphasis on the mechanisms of animal speciation and adaptation.

**478 Biology of Fishes, Laboratory** Fall. 1 credit.

Limited to 15 students. Prerequisite: concurrent enrollment in 476 (477). Offered in alternate years.

Lab, M 1:25-4:25; plus irregular hours as required for experiments and some required field trips.

E. B. Brothers, J. B. Heiser.

Laboratory and fieldwork on structure, identification, ecology, physiology, and behavior of fishes, with emphasis on local species.

**[479 (470) Ichthyology** Fall. 5 credits.

Prerequisites: 274 (273), 476 (477), 478, and written permission of instructor. Offered in alternate years. Not offered 1976-77.

Lec, M W 9:05; lab, T Th 1:25-5; plus irregular hours as required for experiments and some

required field trips. E. B. Brothers, J. B. Heiser.

Lectures on advanced aspects of the biology of fishes, including systematics, ecology, life history, and literature. Laboratory studies of the orders, major families, and principal genera, and of systematic procedures. Field studies of the ecology and life history of local species.]

**[661 (561) Quantitative Ecology** Fall. 4 credits.

Prerequisites: 1 year of college biology and written permission of instructor; organic chemistry and some college mathematics recommended. Not offered 1976-77.

Lec, T Th S 11:15; lab, W 1:25-4:25.

A quantitative course on selected ecological topics for advanced undergraduates and graduate students. Topics include the origin and interpretation of habitat differences, toleration and response physiology, population dynamics, construction and uses of life tables, spatial distribution patterns, and approaches to the quantitative analysis of biotic communities.]

**[662 (562) Ecology of Pest Management** Spring.

3 credits. Prerequisite: written permission of instructor. Offered in alternate years. Not offered 1976-77.

Lec, T Th 11:15. Special problem required. D. Pimentel and staff.

The focus will be on the ecology of pest management for the development of safe, economical population-control measures. The "systems approach" to the management of pests (insects, algae, weeds, animal and plant pathogens, birds, and mammals) will be emphasized.]

**665 (565) Limnology Seminar** Fall. 1 credit. May

be repeated for credit. S-U grades optional. Primarily for graduate students; written permission of instructor required for undergraduates.

Hours to be arranged. G. E. Likens.

A seminar course on advanced limnological topics.

**[666 (566) Marine Ecology** Spring. 3 credits.

Enrollment limited. Prerequisites: 360 (361) and 461, or written permission of instructor. Not offered 1976-77.

Lec, M W F 9:05. J. P. Barlow.

A survey of some current topics in biological oceanography.]

**[668 (568) Estuarine Ecology** Spring. 2 credits.

Limited to 30 students. Prerequisites: 360 (361) and either 461 or 462. Not offered 1976-77.

Lec, M W 9:05. J. P. Barlow, C. A. S. Hall.

The structural and functional characteristics of estuaries as ecosystems. Lectures will deal with the origin and geomorphology of basins; the physics of water movement and exchanges with the sea; the chemistry of water and sediments; the basic taxonomy, adaptations, and distribution of organisms; energy and nutrient dynamics of communities; and some aspects of the interaction of man and estuaries. There will be a brief, worldwide literature tour of estuarine and coastal systems, followed by a weekend trip to a research area.]

**669 Plant Ecology Seminar** Fall. 1 credit. May be

repeated for credit. S-U grades optional. Suggested for students majoring or minoring in plant ecology.

Hours to be arranged. B. F. Chabot, P. L. Marks. A seminar course including review of current literature, student research, and selected topics of interest to participants.

**670 (671) Graduate Seminar in Vertebrate**

**Biology** Fall or spring. 1 credit. May be repeated for credit. Primarily for graduate students; written permission of instructor required for undergraduates.

Hours to be arranged. Vertebrate biology staff. Seminar presentations and discussions by students on areas of current research in vertebrate biology. Topics vary from semester to semester.

**762 (661) Seminar in Population and Community**

**Ecology.** Spring. 1 credit. May be repeated for credit. Prerequisite: written permission of instructor.

Lec, T 4:25. S. A. Levin, R. B. Root.

**[765 (665) Autecology** Fall. 3 or 4 credits (4

credits with term paper). Offered in alternate years. Not offered 1976-77.

Lec, W F 8-9:55. B. F. Chabot and staff.

Comparison of the responses and adaptations of organisms to environment in selected ecosystems. Emphasis on similarities and differences in molecular and organismal mechanisms by which plants and animals cope with their environments.]

**[766 (666) Population Ecology** Spring. 3 or 4

credits (4 credits with term paper). Prerequisite: graduate standing with some background in calculus, statistics, ecology, and evolutionary theory, or written permission of instructor. Offered in alternate years. Not offered 1976-77.

Lec and disc, W F 8-9:55. P. F. Brussard, S. A. Levin.

Critical examination of the properties and dynamics of populations. Emphasis on theories of population structure, dynamics, and regulation. Discussion of experimental approaches to analyses of natural populations.]

**767 (667) Community Ecology** Fall. 3 or 4 credits

(4 credits with term paper). Prerequisite: 766 (666) or written permission of instructor. Offered in alternate years.

Lec, T Th 10:10-12:05. R. H. Whittaker.

The structure and dynamics of natural communities; patterning and sampling problems; species diversity; niches and gradient relations; and ordination, classification, succession, climax, and disturbance. Comparative aspects of terrestrial, marine, and freshwater communities will be stressed.

**768 (668) Ecosystems** Spring. 3 or 4 credits (4

credits with term paper). Prerequisite: 767 (667) or written permission of instructor. Offered in alternate years.

Lec, T Th 10:10-12:05. G. E. Likens,

R. H. Whittaker.

Analysis of ecosystems in terms of energy flow, materials circulation, and model systems. Emphasis on the functional properties of ecosystems considered from simple systems to the biosphere as a whole.

**Introductory Parasitology and Symbiology****(Veterinary Medicine 330)** Spring, 3 credits.

Prerequisite: 1 year of introductory biology.

Lec, T Th 11:15; lab, T 2-4:25. J. H. Whitlock, J. R. Georgi.

A study of unrelated species living together in intimate physiological association. Parasitoses that result in disease in the host are presented as important and special cases of the symbiotic spectrum. Emphasis is placed on an integrative study of the causation of disease in human beings and in cultivated and natural populations of plants and animals. The biological functions of disease and the impact of human activities on the disease structure of populations are examined. Laboratory exercises will involve a broad range of symbiotes and pathogens from viruses to nemas and arthropods.

See also:

**Advanced Insect Taxonomy (Entomology 531, 532, 533, 534)****Advanced Soil Microbiology (Agronomy 606)****Advanced Work in Animal Parasitology (Veterinary Medicine 737)****Bionomics of Fresh-Water Invertebrates (Entomology 471)****Ecological Animal Physiology (Biological Sciences 315 [314])****Insect Biology (Entomology 212)****Insect Ecology (Entomology 400)****Insect Ecology Field Course (Entomology 660)****Insect Pathology (Entomology 453)****Introductory Insect Taxonomy (Entomology 331)****Invertebrate Zoology (Biological Sciences 310 [316])****Microbial Ecology (Microbiology 492)****Parasitic Helminthology (Veterinary Medicine 440)****Phycology (Biological Sciences 348 [344])****Soil Microbiology Laboratory (Agronomy 407)****Soil Microbiology Lectures (Agronomy 406)****Taxonomy and Evolution of Vascular Plants (Biological Sciences 346 [371], 442 [466], 645 [663])****Teaching Experience (Biological Sciences 403-404)****Vertebrate Social Behavior (Biological Sciences 427 [523])****Genetics and Development**

**281 Genetics** Fall or spring, 5 credits. Not open to freshmen in fall semester. Prerequisite: 1 year of introductory biology or equivalent. Students who have taken 282 (280) may register only with written permission of instructor.

Lec, T Th 10:10-11:30; lab, M T W Th or F 2:30-4:25. Lab sections may also be scheduled T or Th 8-9:55, W or F 10:10-12:05, or S 10:10-12:05, if enrollment requires it. Students do not preregister for lab sections; lab assignments will be made at the end of the first lecture period. Preliminary exams may be scheduled in the evening. P. J. Bruns, fall; G. R. Fink, spring; R. J. MacIntyre and H. T. Stinson, lab; and staff. A general study of the fundamental principles of

genetics in eucaryotes and procaryotes. Discussions of gene transmission, gene action and interaction, gene linkage and recombination, gene structure, gene and chromosome mutations, genetic aspects of differentiation, genes in populations, breeding systems, and extrachromosomal inheritance. In the laboratory students perform experiments with microorganisms and conduct an independent study of inheritance in *Drosophila*.

**282 (280) Human Genetics** Spring, 3 credits.

Discussion limited to 25 students each section.

Prerequisite: 1 year of introductory biology or equivalent. Students who have taken 281 may register only with written permission of instructor.

Lec, M W 10:10; disc, Th or F 10:10 or 11:15 (1 discussion section Th 10:10, 2 sections Th 11:15, 4 sections F 10:10, and 1 section F 11:15). A. M. Srb. An introduction to biological heredity through consideration of the genetics of man. Advances in the science of genetics are having a profound effect on man's understanding of himself and on his potential for influencing his present and future well-being. The course is intended primarily to contribute to the student's general education in these matters. Although certain aspects of genetics will be considered with some rigor, the course is not designed to serve as a prerequisite to advanced courses in genetics.

**384 Invertebrate Embryology** Summer, 4 credits. S-U grades only. Prerequisite: 364 or a course in invertebrate zoology.

Daily lectures, laboratories, and fieldwork for 3 weeks. C. W. Walker and guest lecturers from Cornell and U. New Hampshire faculty.

A comparative study of aspects of reproduction and early development in selected invertebrates, providing a classical approach to the morphology of the gonads, fertilization, various kinds of cleavage and gastrulation, and the formation of larval forms. For each group, students will first consider gametes during formation in the gonads, then development of a new individual through fertilization and the formation of the early larval form.

A special course offered at the Shoals Marine Laboratory of Cornell University on an island off Portsmouth, N. H. For more details and applications, consult the Office of Marine Biology, 202 Plant Science Building.

**385-386 Developmental Biology** 385, fall; 386, spring, 3 credits per term. Prerequisites: 281 and either 330 (432) or 331 (431) (may be taken concurrently). 385 is prerequisite to 386.

Lec, M W F 11:15. R. L. Hallberg, A. W. Blackler. Morphogenetic, cellular, genetic, and molecular aspects of the developmental biology of animals and plants.

**389 Vertebrate Developmental Anatomy** Fall, 3 credits. Limited to 40 students, with preference given to seniors. Prerequisite: elementary knowledge of mammalian anatomy.

Lec, M 10:10; lab, W or F 1:25-4:25. A. W. Blackler and staff.

Lecture will serve as introduction to the laboratory session. Laboratory has a strong morphogenetic theme.

**481 (480) Population Genetics** Fall, 3 credits. S-U grades optional. Prerequisite: 281 or equivalent.

Lec, M W 10:10. B. Wallace. A study of factors that influence the genetic structure of Mendelian populations and that are involved in race formation and speciation. Four quizzes (on the mathematical aspects of population genetics) and an optional term paper will determine the final grade.

**[484 Molecular Evolution]** Spring, 3 credits. Prerequisites: 281 and organic chemistry. Offered in alternate years. Not offered 1976-77.

Lec, T Th 11:15. R. J. MacIntyre. An analysis of evolutionary changes in proteins and

nucleic acids, and gene-enzyme variability in natural populations. The role of natural selection in effecting these changes and maintaining genetic variation at the molecular level will be critically examined. Theories on the evolution of the genetic code and the construction of phylogenetic trees from biochemical data will be discussed.]

**485 Microbial Genetics, Lectures** Fall, 2 credits. S-U grades optional. Limited to upperclass and graduate students. Prerequisites: 281 and Microbio 290, or written permission of instructor.

Lec, W 7:30-9:25 p.m. S. A. Zahler. Genetics of bacteria and their viruses, with emphasis on the mechanisms of genetic phenomena.

**487 (486) Microbial Genetics, Laboratory** Fall, 3 credits. Primarily for upperclass students. Limited to 20 students. Prerequisites: 485 (may be taken concurrently), Microbio 291 or equivalent, and written permission of instructor.

Lab, T 1:25-4:25; 4 additional hours to be arranged. S. A. Zahler. Problem solving in bacterial genetics.

**488 Genetics of Lower Eucaryotes** Spring, 3 credits. S-U grades optional. Prerequisites: 281 and a course in organic chemistry.

Lec, M W 9:05. P. J. Bruns, G. R. Fink, A. M. Srb. Genetic aspects of the biology of a few eucaryotic microorganisms, primarily yeast, *Neurospora*, and ciliated protozoa, with emphasis on the use of these organisms as experimental tools. Major topics to be covered include gene action, control mechanisms, cytoplasmic genetic systems, recombination and conversion, morphogenetic systems, and evolutionary aspects of physiological systems. Extensive appropriate reading in the original literature of genetics is a primary component of the course.

**489 Undergraduate Research in Genetics and Development** Fall or spring. Variable credit.

Undergraduates must attach to their preregistration material written permission from the staff member who will supervise the work and assign the grade.

Hours to be arranged. Staff. Practice in planning, conducting, and reporting independent laboratory and/or library research programs.

**780 (680) Current Topics in Genetics** Fall or spring, 2 credits. May be repeated for credit. Primarily for graduate students, with preference given to majors in the Field of Genetics; written permission of instructor required for undergraduates. Limited to 20 students. No auditors.

Hours to be arranged. Staff. A seminar course with critical presentation and discussion by students of original research papers in a particular area of current interest. Content of the course and staff direction will vary from term to term, and will be announced a semester in advance.

See also:

**Animal Cytogenetics (Animal Science 419)****Cytogenetics (Biological Sciences 446 [440])****Cytology (Biological Sciences 347)****Organic Evolution (Biological Sciences 477 [476])****Physiological Genetics of Crop Plants (Plant Breeding 505)****Plant Growth and Development (Biological Sciences 641 [441])****Statistical Methods I (Statistics and Biometry 501)****Teaching Experience (Biological Sciences 403-404)**

## Graduate School of Business and Public Administration

### NCC Common Core Courses

- NCC 500 Managerial Accounting  
NCC 501 Quantitative Methods for Management  
NCC 502 Microeconomics for Management  
NCC 503 The Computer and Decision Making

### NBP Business Administration Program Core Courses

- NBP 500 Marketing Management  
NBP 501 Operations Management  
NBP 502 Corporate Financial Management  
NBP 503 Business Policy

### NBA Business Administration Elective Courses

- NBA 500 Intermediate Accounting  
NBA 501 Advanced Accounting  
NBA 502 Cost Accounting  
NBA 503 Financial Policy Decisions and Accounting II  
NBA 504 Introduction to Taxation Affecting Business and Personal Decision Making  
NBA 505 Auditing  
NBA 506 Evaluation of Financial Statement Information  
NBA 507 Cost Analysis for Management  
NBA 510 Law of Business Associations  
NBA 511 Advanced Business Law  
NBA 515 Short-term Financial Management  
NBA 516 Investment Management  
NBA 517 The Economics of Securities Markets  
NBA 518 Money Markets  
NBA 519 Seminar in Bank Management  
NBA 520 Advanced Topics in Finance and Managerial Economics  
NBA 521 Financial Policy Decisions and Accounting I  
NBA 522 Finance-Accounting Seminar  
NBA 523 Seminar in Investment Management  
NBA 530 Small Business Management  
NBA 540 Marketing Operations  
NBA 541 Marketing Research  
NBA 542 Advertising Management

- NBA 543 Marketing Strategy  
NBA 544 Marketing Practicum  
NBA 545 Seminar on Change in Marketing  
NBA 546 Seminar in Marketing Models  
NBA 547 Marketing Segmentation  
NBA 548 Service and Public Marketing  
NBA 549 Consumer Behavior  
NBA 550 International Marketing  
NBA 551 The Structure of the Advertising Agency Industry  
NBA 560 Problems and Techniques in Production Management  
NBA 561 Case Studies in Production and Operations Management  
NBA 562 Logistics Management  
NBA 580 Corporate Financial Management

### NPP Public Administration Program Core Courses

- NPP 500 The Conduct of Public Affairs I  
NPP 501 The Conduct of Public Affairs II

### NPA Public Administration Elective Courses

- NPA 500 Urban Government Operations  
NPA 501 Public Affairs Practicum  
NPA 502-503 Economics and Public Policy Workshop  
NPA 504 Science, Technology, and Public Policy  
NPA 505 Public Financial Management  
NPA 506 Politics of Decentralization and Local Reform  
NPA 507 Integrative Seminar: Education for Public Management Program (Part 1)  
NPA 508 Integrative Seminar: Education for Public Management Program (Part 2)  
NPA 509 Democracy and Bureaucracy in Industrial Society  
NPA 510 Public Administration in Action  
NPA 511 Seminar in Public Systems Analysis  
NPA 512 Congress and the Executive Branch  
NPA 513 The Politics of Technical Decisions  
NPA 514 Public Administration Colloquium

### NHP Hospital and Health Services Administration Program Core Courses

- NHP 500 Introduction to Hospital and Medical Care Organization  
NHP 501 Introduction to Clinical Medicine: The Physician, the Hospital, and the Medical Care Delivery System

### NHA Hospital and Health Services Administration Program Elective Courses

- NHA 500 The Social Psychology of Hospitals  
NHA 501 Evaluation of Community Health Services  
NHA 502 Psychiatric Institutions: Administration and Practice  
NHA 503 Sociopolitical Aspects of Community Health Services and Planning  
NHA 504 Legal Aspects of Hospital Administration  
NHA 505 Policy and Planning for Health Care  
NHA 506 Seminar in Health Services Research  
NHA 507 Health Economics  
NHA 508 Health and Welfare Policy: Foundations and Strategies for Analysis  
NHA 509 The Political Economy of Medical Care Services  
NHA 510 Health Operations Management and Planning  
NHA 511 The Financial Management of Hospitals  
NHA 512 Seminar in Hospital and Health Services Administration  
NHA 513 Field Studies in Health Administration and Research  
NHA 514 Seminar in Comprehensive Health Planning  
NHA 515 Seminar in the Political Economy of Medical Care  
NHA 516 Health and Social Services Administration and Planning  
NHA 517 Washington Health Policy Field Seminar  
NHA 518 New York Seminar in Hospital Management and Delivery of Urban Health Services

### NCE Common Course Electives

- NCE 500 Fund Accounting  
NCE 501 Managerial Accounting  
NCE 505 The International Monetary System  
NCE 506 International Business Policy  
NCE 507 American Business Operations Abroad  
NCE 508 Administration of Public Operations Abroad  
NCE 509 Political Development and Social Change  
NCE 510 Science, Technology, and Development  
NCE 511 Special Topics in International Finance  
NCE 512 Seminar on Development Administration  
NCE 513 Science, Technology, and International Relations

- NCE 514 The Administration of Agricultural and Rural Development
- NCE 520 Macroeconomics for Management
- NCE 523 Corporate Behavior and the Public Interest
- NCE 524 Managerial Economics and Policy
- NCE 525 Capital Budgeting: The Economic Evaluation of Capital Investment Projects
- NCE 526 Topics in United States Economic Policy
- NCE 527 American Industry, Economic Analysis, and Public Policy
- NCE 528 Cases and Problems in Economics and Finance
- NCE 529 Labor Relations in the Nonprofit Sector
- NCE 540 Organization Theory and Behavior
- NCE 541 Personnel Administration and Human Relations
- NCE 542 Processes and Techniques in Organizational Development
- NCE 543 Organizational Behavior and Administration
- NCE 544 Business and Industrial Personnel
- NCE 545 Seminar in Organization Theory
- NCE 546 Special Topics in Organizational Theory and Behavior
- NCE 547 Institutions and Values in Contemporary Society
- NCE 548 Human Relations in Administration
- NCE 560 Introduction to Probability Theory
- NCE 561 Introduction to Statistical Theory
- NCE 562 Operations Research I
- NCE 563 Operations Research II
- NCE 564 Multidimensional Measurement and Scaling
- NCE 565 Statistical Inference in Managerial Decisions and Research
- NCE 566 Bayesian Decision Theory
- NCE 567 Optimization Techniques
- NCE 570 Introduction to Management Information Systems
- NCE 571 Introduction to Computer Systems Analysis
- NCE 572 Management Planning and Control Systems
- NCE 580 Seminar in University Administration
- NRE 941 Strategies for Organizational Research
- NRE 942 Social Psychology of Organizing
- NRE 961 Workshop on Multi-attribute Decision Making

### **NRE Research**

- NRE 900 Research Seminar for Doctoral Candidates
- NRE 901 Doctoral Seminar in Business Administration

## College of Engineering

Engineering programs offered at Cornell lead to the degrees of Bachelor of Science, Master of Engineering, Master of Science, and Doctor of Philosophy. Descriptions of courses, including both undergraduate and graduate offerings, are given under the appropriate academic areas. Information about academic programs, admissions and financial aid, and special opportunities for engineering students is given in the *Announcement of General Information*, the *Announcement of the Graduate School*, and two special Announcements prepared by the College of Engineering: *Engineering at Cornell*, for prospective undergraduates, and *Graduate Study in Engineering and Applied Science*.

## Degree Programs

### Bachelor of Science Degree

Undergraduate engineering curricula all begin with a basic two-year program administered by the Division of Basic Studies of the College of Engineering (an exception is the program in agricultural engineering, discussed below). This provides a foundation in mathematics, science, and engineering fundamentals in addition to elective course work in engineering core sciences, liberal studies, and natural or social sciences. Specialization begins in the junior year with one of eight field programs or an individually arranged curriculum under the College Program.

The general requirement for the B.S. degree is forty courses (a minimum of 126 credits), normally taken in four years of study. The distribution of courses during the freshman and sophomore years is described in the section on Division of Basic Studies. Upperclass programs include the following course requirements:

	<i>Minimum credits</i>
Twelve field-designated courses (or the equivalent in a college program)	36
Four liberal studies electives, two of which must be at an upper-division level (300- or 400-level courses)	12
Two free elective courses	6
Two technical elective courses	6

### Field Programs

In the junior year most students enter field programs, which are offered in eight areas:

*Chemical Engineering*  
*Civil and Environmental Engineering*  
*Electrical Engineering*  
*Engineering Physics* (see Applied and Engineering Physics)  
*Geological Sciences*  
*Materials Science and Engineering*  
*Mechanical Engineering* (see Mechanical and Aerospace Engineering)  
*Operations Research and Industrial Engineering*

To major in *agricultural engineering*, students enroll in the College of Agriculture and Life Sciences for the first three years and in the College of Engineering (in the College Program) for the fourth year.

These programs are described under the appropriate academic schools or departments.

Students interested in bioengineering may arrange suitable curricula within most of the field programs, or

may take individually planned curricula under the College Program. Before preregistering for the sophomore year, bioengineering students should obtain from the Engineering Advising and Counseling Center a copy of *Bioengineering at Cornell*, which provides the information necessary for planning a suitable curriculum.

### College Program

Individually arranged courses of study under the College Program are possible for those whose educational objectives cannot be met by one of the regular field programs. Often the desired curriculum is in an interdisciplinary area. Each college program is developed by the student in consultation with faculty advisers and must be approved by the College Program Committee, which is responsible for supervising the student's work.

Every college program, with the exception of certain faculty-sponsored programs, must comprise an engineering major and a minor. The major may be in any subject area offered by schools or departments of the College; the minor may be in a second engineering subject area or in a logically connected nonengineering area. The combinations must clearly form, in scope and in substance, an engineering education, and should include engineering design and synthesis as well as engineering sciences. In addition to fourteen courses in the major and minor subjects, including at least seven engineering courses, each college program includes four liberal electives and two free electives.

A number of college programs have been developed and are sponsored by groups of faculty members; these are described below.

#### Sponsored Programs and Sponsored Majors

**Computer Science** Students wishing to concentrate in computer science develop a college program major in consultation with a faculty member of the Department of Computer Science. A minimum grade-point average of 2.5 is required. This major must be combined with a suitable supporting minor.

**Energy Conversion** The College Program in Energy Conversion combines elements of three conventional disciplines—nuclear, thermal, and electrical engineering—in a broadly based curriculum aimed at meeting the accelerating energy needs of society.

**Engineering Science** The College Program in Engineering Science, sponsored by faculty members of the Department of Theoretical and Applied Mechanics, requires additional mathematics, physics, mechanics, and engineering analysis courses beyond those in the underclass program.

**Environmental and Public Systems** Systems analysis is widely used in the planning and management of environmental quality and public systems, and students can specialize in this area with a sponsored college program. These students will generally concentrate in *water resources*, *ecosystems*, *management*, *transportation*, or other studies of public systems.

**Survey Engineering** The College Program in Survey Engineering is sponsored by faculty members of the School of Civil and Environmental Engineering and of the Department of Agricultural Engineering. It is designed to develop competence in modern sensing and measurement principles and techniques that are appropriate for determining the geometrical characteristics of physical features on, in, or near the earth. The extent to which this program meets the professional licensing requirements of various states should be discussed with the sponsoring faculty members.

Students apply to enter the College Program early in the second term of the sophomore year. A student

may receive assistance in developing a coherent program from professors in the proposed major and minor subject areas who may be recommended by the College Program Committee or suggested by the student. If approved, the program is the curricular contact to which the student must adhere.

Further information about the College Program, including the special sponsored curricula, may be obtained from the College Program Office, 170 Olin Hall.

### Dual Degree Option

A special academic option, intended for superior students, is the dual degree program in which both B. S. and A. B. degrees can be earned in five years. Students may register in either the College of Engineering or the College of Arts and Sciences as freshmen and begin the dual program in their second or third year. Those interested should contact Associate Dean M.S. Burton, 170 Olin Hall.

## Master of Engineering Degrees

The one-year M. Eng. programs prepare students for professional employment or for more advanced graduate study in Ph.D. programs. The curricula for the eleven field-designated degrees are described in indicated sections under College of Engineering:

*M. Eng. (Aerospace):* Mechanical and Aerospace Engineering  
*M. Eng. (Agricultural):* Agricultural Engineering  
*M. Eng. (Chemical):* Chemical Engineering  
*M. Eng. (Civil):* Civil and Environmental Engineering  
*M. Eng. (Electrical):* Electrical Engineering  
*M. Eng. (Engineering Mechanics):* Theoretical and Applied Mechanics  
*M. Eng. (Engineering Physics):* Applied and Engineering Physics  
*M. Eng. (OR&IE):* Operations Research and Industrial Engineering  
*M. Eng. (Materials):* Materials Science and Engineering  
*M. Eng. (Mechanical):* Mechanical and Aerospace Engineering  
*M. Eng. (Nuclear):* Applied and Engineering Physics

The M. Eng. curricula are integrated with undergraduate field programs in the Cornell College of Engineering, but are open also to qualified graduates of other schools. Cornell baccalaureate engineering graduates will generally be admitted if they have cumulative grade-point averages of at least 2.5 and/or if they have demonstrated by their performances in their major fields that they have the ability to be successful in graduate study; a petition is required if the grade-point average is below 2.5. Other applicants must have a baccalaureate degree from an engineering program accredited by the Engineers' Council for Professional Development, or the equivalent, in an area of engineering or science that is judged appropriate for the proposed field of study. They must also present evidence of undergraduate preparation equivalent to that provided by a Cornell undergraduate engineering education: a transcript, two letters of recommendation, and a statement of academic purpose. A candidate who is admitted with an undergraduate background that is judged inadequate must make up the deficiencies in addition to fulfilling the regular course requirements for the degree.

Application forms and further information are available from the Graduate Professional Programs Committee, 319 Upson Hall.

## Master of Science and Doctor of Philosophy Degrees

This research-oriented branch of graduate study in engineering and applied science at Cornell is organized under graduate fields, which generally coincide with the respective schools or departments of the College of Engineering. Courses offered by these units are described in the following sections. Prospective students should also consult the *Announcement of the Graduate School and Graduate Study in Engineering and Applied Science*.

## Division of Basic Studies

F. J. Ahimaz, director.

Students in the College of Engineering are enrolled for the first two years of their undergraduate education in the Division of Basic Studies.

The normal academic load is five courses each term. Many of these are elective, but the underclass program must be planned so as to satisfy certain requirements:

(1) A sequence of four courses in mathematics and a three-term sequence in physics are required of all undergraduates. Freshmen enroll in chemistry during the first term and should elect a second term of chemistry if they plan a chemistry-related upperclass program.

(2) A two-term sequence in basic engineering subjects, Engr 105 and 106, is required of freshmen. Students particularly interested in bioengineering or premedicine may substitute a biology course for 106.

(3) During the sophomore year students take four engineering core science courses, selected in consultation with a faculty adviser, from offerings in four areas, as outlined below.

(4) All engineering students are required to complete eight liberal studies courses (twenty-four credits) before graduation; four of these courses (twelve credits) are normally completed while the student is registered in the Division of Basic Studies. However, students whose career goals require them to do so, may substitute introductory courses in the natural sciences (e.g., biology or organic chemistry) for their liberal studies electives during the freshman or sophomore year, and defer these electives until the junior and senior years. The liberal studies electives may include courses in the humanities, social sciences, modern foreign languages, and expressive arts. At least two of the liberal studies elective courses (six credits minimum) must be at the upperclass level (300- or 400-level courses).

(5) All undergraduate students are required by the University to complete four terms of physical education. The requirement must be completed within the first four terms unless postponement is granted by the Faculty Committee on Physical Education. Requests for postponement should be made to the engineering registrar, 170 Olin Hall.

### Freshman and Sophomore Curricula

Typical programs for the freshman and sophomore years are given as examples. It should be noted that there are many variations, depending on students' individual backgrounds and educational and career plans.

Term 1	Credits
Math 191, Calculus for Engineers	4
Chem 207, General Chemistry	3
Freshman engineering course, Engr 105 or 106	3
Natural or social science elective*	3
Liberal studies elective	3
Term 2	
Math 192 or 194, Calculus for Engineers	4

Phys 112, Physics I  
Freshmen engineering course, Engr 105 or 106 or alternative†  
Natural or social science elective\*  
Liberal studies elective

#### Term 3

Math 293 or 295, Engineering Mathematics  
Phys 213, Physics II  
Engineering core science elective  
Engineering core science elective  
Liberal studies elective

#### Term 4

Math 294 or 296, Engineering Mathematics  
Phys 214, Physics III  
Engineering core science elective  
Engineering core science elective  
Liberal studies elective

\*Students who wish to major in chemical engineering and students who are interested primarily in bioengineering-premedicine must take Chem 208 during the freshman year. Chemical engineering students will select a considerably different program in the sophomore year (see discussion under Engineering Core Sciences).

†Students interested primarily in bioengineering or bioengineering-premedicine may substitute Bio Sci 102 plus 104 (laboratory) for Engr 106.

### Engineering Core Sciences

The four engineering core science courses required in the sophomore year are selected from the four groups listed below under Description of Courses, with at least three of the four groups represented in the choices.

An important consideration in the choice of these courses is that each upperclass field may specify a particular engineering core science as a prerequisite for enrollment in the junior year. The courses required for entry into the different field programs are:

Applied and Engineering Physics: M&AE 221  
Chemical Engineering: Chem E 110 or 111\*  
Civil and Environmental Engineering: T&AM 202  
Electrical Engineering: Elec E 210  
Materials Science and Engineering: no requirement  
Mechanical and Aerospace Engineering: T&AM 202  
Operations Research and Industrial Engineering: OR&IE 260

\*Students intending to enter Chemical Engineering must also take Chem 287, 289, and Chem 288, 290. Only two of the Group IV courses may be counted toward the four engineering core sciences required of all sophomores. Students who take the three courses from Group IV during the sophomore year may be unable to complete the engineering core science requirements that year, and may defer the fourth engineering core science until the junior year.

### Description of Courses

The courses offered through the Division of Basic Studies include certain engineering courses offered by the various schools and departments of the College of Engineering primarily for underclass students; these courses are described below. Additional engineering courses that may be taken during the freshman and sophomore years in the Division of Basic Studies are described under the appropriate subject areas. Courses in mathematics, physics, and chemistry are described under the appropriate departments of the College of Arts and Sciences.

### Engineering Basic Studies

**Engr 100 Bioengineering Seminar** Fall or spring, 1 credit. S-U grades only.  
Lectures by Cornell staff members, graduate

4 students, and visiting scientists and engineers on topics of interest in the field of bioengineering.

**Engr 103 Special Investigations in Engineering**  
3 On demand. Credit variable.  
3 Supervised study, by individuals or small groups, of one or more specialized topics not covered in regular courses.

**Engr 105 Elements of Engineering Communications** Fall or spring, 3 credits, 2 lec; no scheduled rec or lab, but optional rec offered.  
3 First eight weeks same as Compr Sci 100. Remaining weeks, principles of engineering graphics studied through projects related to design and modeling of physical processes. Emphasis on sketching to develop skill in visual communication.

**Engr 106 Engineering Perspectives** Fall or spring, 3 credits, 1 lec, 1 rec, 1 lab.  
3 Illustration of engineering point of view through detailed study of specific problems with major engineering aspects. Students choose "mini-courses" from selection offered by various faculty members in the College of Engineering. Small recitations and work sessions permit close contact between students and faculty. Lectures present an overview of the engineering profession.

### Engineering Core Sciences

#### Group I

**OR&IE 213 Systems Analysis and Design** Spring, 3 credits, 3 lec, 1 rec.

Discussion of the nature of systems analysis. Introduction to the uses of mathematical analysis in systems analysis and design, including production functions, marginal analysis, the formulation and solution of linear and nonlinear decision models, graphs and networks, dynamic programming, probability, Markov chains, and decision theory.

**OR&IE 260 Introductory Engineering Probability** Fall or spring, 3 credits, 3 lec.

Prerequisite: first-year calculus.  
In this course a student should acquire a knowledge of the basic tools of probability and their use in engineering. 260 may be the last course in probability for some students, or it may be followed by OR&IE 361, Stochastic Processes I, or by OR&IE 370, Statistics. Definition of probability; random variables; probability distributions, density functions, expected values; jointly distributed random variables; distributions such as the binomial, Poisson, and exponential that are important in engineering, and how they arise in practice; limit theorems.

**OR&IE 270 Basic Engineering Statistics** Fall or spring, 3 credits, 2 lec, 1 rec. Students who intend to enter the upperclass Field Program in Operations Research and Industrial Engineering should take OR&IE 260 instead of this course. Prerequisite: first-year calculus.

At the end of this course a student should command a working knowledge of basic statistics as it applies to engineering work. For many students this will be the only course in statistics. For students who wish to learn more about statistics, a course in probability (e.g., OR&IE 260) followed by a course in statistics (e.g., OR&IE 370) is recommended.

**Compr Sci 211 Computers and Programming** Fall or spring, 3 credits, 2 lec, 1 lab, 2 evening quizzes. Prerequisite: Compr Sci 100 or equivalent programming experience. Intermediate programming in PL/I: procedures, block structures, on conditions, recursion. Introduction to basic data structures and program analysis. Programming assignments for a variety of applications.

#### Group II

**Elec E 210 Introduction to Electrical Systems** Fall or spring, 3 credits, 3 lec-rec. Prerequisites: Math

192 and Phys 112.

Electrical circuit elements; circuit equations and methods of solutions; time functions and their representation; response of simple networks; impedance concept; pole-zero concept; modeling of electronic devices; elementary amplifiers; transfer function and frequency response.

**Elec E 230 Introduction to Digital Systems** Fall or spring. 3 credits. 2 lec, 5 lab experiments. Introduction to basic analysis and design techniques and methodology of digital and computer systems. Boolean algebra; integrated circuit components used in digital system implementation; codes and number systems; logic design of combinational circuits; logic design of sequential circuits.

**MS&E 262 Introduction to Electrical Properties of Materials** Spring. 3 credits. 2 lec, 1 rec, or lab. Electronic structure of atoms, molecules, and crystalline solids. Electrical conductivity and other electrical properties of metals, semiconductors, and insulators. Semiconductors and their applications in electronic devices. Magnetism and magnetic materials. Introduction to lasers.

**A&EP 206 The Physics of Life** Fall. 3 credits. 2 lec. Prerequisite: concurrent registration in Phys 213 or permission of instructor.  
A. Lewis.

An in-depth study of four biological topics from a physical point of view. Topics covered are photosynthetic conversion of light into chemical energy, proteins as transport and production machines, membranes, and biophysical aspects of replication. Topics are chosen to illustrate the unity and interdependence of living matter.

**A&EP 217 Contemporary Topics in Applied Physics** Spring. 3 credits. 2 lec, 1 rec-lab. Prerequisite: Phys 213.

R. A. Buhrman and staff.  
Two subjects, such as nuclear physics and superconductivity, that represent modern applications of physics are presented. The objective is to develop an understanding of underlying physical principles and the limitations these principles place on technological applications.

#### Group III

**T&AM 201 Introduction to Applied Mechanics** Fall. 3 credits. Students may not receive credit for both 201 and 202. Prerequisite: registration in Math 293.  
Integrated treatment of solid and fluid mechanics. Introduction to basic concepts of statics, dynamics, continuum mechanics, properties of materials. Practical applications: extension, torsion, and bending of solid structural members; fluids at rest and in motion.

**T&AM 202 Mechanics of Solids** Fall or spring. 3 credits. 2 lec, 1 rec, 1 lab. Evening exams. Prerequisite: registration in Math 293.  
Principles of statics, force systems, and equilibrium. Mechanics of deformable solids, stress, strain, statically indeterminate problems. Properties of engineering materials. Axial force, shearing force, bending moment, singularity functions. Plane stress, Mohr's circle. Bending and torsion of slender bars; buckling and plastic behavior.

**T&AM 203 Dynamics** Fall or spring. 3 credits. 2 lec, 1 rec, 1 lab. Evening exams. Prerequisite: registration in Math 294.  
Newtonian dynamics of a particle, systems of particles, and a rigid body. Kinematics, motion relative to a moving frame. Impulse, momentum, angular momentum energy. Rigid body kinematics, angular velocity, moment of momentum and the inertia tensor, Euler equations, the gyroscope. Advanced methods in dynamics.

**MS&E 261 Introduction to Mechanical Properties of Materials** Fall or spring. 3 credits. 2 lec, 1 rec or lab.

The relation of mechanical properties to microscopic structures and defects inside metals and other materials. Deformation of rubber-like polymers. Permanent changes in the shape of crystals caused by the action of stresses. Effect of movement of atoms on the strength of solids at high temperatures. Manipulation of microscopic structure for high strength. Fracture and fatigue failure.

#### Group IV

**Chem 287, 289 Introductory Physical Chemistry and Laboratory** Fall. 5 credits. 2 or 3 lec, 1 rec in 287; 1 lec, 2 labs in 289. Prerequisites: Chem 208 or 216 and Math 191-192.

A systematic treatment of the fundamental principles of physical chemistry. The development of needed experimental skills.

**Chem 288, 290 Introductory Physical Chemistry and Laboratory** Spring. 5 credits. 2 or 3 lec, 1 rec in 288; 1 lec, 2 labs in 290. Prerequisite: Chem 287, 289.  
A continuation of Chem 287, 289.

**Chem 357 Introductory Organic Chemistry** Fall. 3 credits. 3 lec, optional rec may be offered. Prerequisite: Chem 208 or 216.

A systematic study of the more important classes of carbon compounds, reactions of their functional groups, methods of synthesis, relations, and uses.

**Chem 358 Introductory Organic Chemistry** Spring. 3 credits. 3 lec, optional rec may be offered. Prerequisite: Chem 357.  
A continuation of Chem 357.

**M&AE 221 Thermodynamics** Fall or spring. 3 credits. 3 rec. Prerequisites: Math 191-192 and Phys 112.

The definitions, concepts, and laws of thermodynamics. Applications to ideal and real gases, multiphase pure substances, gaseous mixtures, and gaseous reactions. Heat-engine and heat-pump cycles. An introduction to statistical thermodynamics.

**Chem E 110 or 111 Mass and Energy Balances** Fall or spring. 3 credits. Prerequisite: one year of freshman chemistry or permission of instructor.

R. G. Thorpe.  
Engineering problems involving material and energy balances. Batch and continuous reactive systems in the steady and unsteady states. Humidification processes. The course 110 differs from 111 in that it uses *only self-paced audiovisual instruction at the convenience of the student*. A minimum of 70 clock hours of audiovisual instruction is required to master the subject matter. Student performance in 110 is evaluated by nine tests, two preliminary examinations, and a final examination; superior students may earn exemption from the final examination.

## Aerospace Engineering

See Mechanical and Aerospace Engineering.

## Agricultural Engineering

E. S. Shepardson, director; L. D. Albright, R. D. Black, J. R. Cooke, R. B. Furry, W. W. Gunkel, D. A. Haith, L. H. Irwin, L. G. James, W. J. Jewell, G. Levine, R. C. Loehr, H. A. Longhouse, R. T. Lorenzen, D. C. Ludington, W. F. Millier, G. E. Rehkugler, N. R. Scott, M. F. Walter.

## Bachelor of Science

Students who wish to major in agricultural engineering as part of an engineering program register for the first three years in the College of Agriculture and Life Sciences and for the fourth year in the College of Engineering. The curriculum is summarized as follows:

Term 1	Credits
Math 191, Calculus for Engineers	4
Chem 103 or 207	3
Ag Engr 151, Introduction to Agricultural Engineering and Computing	3
Bio Sci 101 and 103 or 109	4
Liberal studies elective (Freshman Seminar)	3
Term 2	
Math 192, Calculus for Engineers	4
Phys 112, Physics I	4
Ag Engr 152, Engineering Graphics	3
Bio Sci 102 and 104 or 110	4
Liberal studies elective (Freshman Seminar)	3
Term 3	
Math 293, Engineering Mathematics	4
Phys 231, Physics II	4
Engineering core science	3
Engineering core science	3
Liberal studies elective	3
Term 4	
Math 294, Engineering Mathematics	4
Phys 214, Physics III	4
Engineering core science	3
Engineering core science	3
Liberal studies elective	3

In addition to these courses, all freshmen and sophomores must satisfy the University's requirement in physical education.

The curriculum for terms 5 through 8 must include:

1. Engineering: minimum of thirty credits
  - a. Agricultural engineering: minimum of twelve credits at the 450 level or higher
  - b. Engineering sciences
2. Biological sciences or agricultural electives: minimum of twelve credits
3. Liberal studies electives: minimum of twelve credits
4. Free electives: minimum of six credits

## Master of Engineering (Agricultural)

The program for the M.Eng. (Agricultural) degree is intended primarily for those students who plan to enter engineering practice rather than for those who expect to study for the doctorate. The curriculum is planned as an extension of the Cornell undergraduate program in agricultural engineering, but can accommodate graduates of other institutions. General admission and degree requirements are described in the introductory section under College of Engineering.

A candidate for the M.Eng. (Agricultural) degree may choose to concentrate in one of the subareas of agricultural engineering or take a broad program without specialization. The subareas are: (a) power and machinery, (b) soils and water engineering, (c) agricultural structures and associated systems, (d) electric power and processing, and (e) agricultural waste management. Engineering electives are chosen from among subject areas relevant to agricultural engineering, such as thermal engineering, mechanical design and analysis, theoretical and applied mechanics, structural engineering, hydraulics, sanitary engineering, soil engineering, and waste management.

## Master of Science and Doctor of Philosophy

Programs offered by the graduate Field of Agricultural Engineering are described in the *Announcement of*

the Graduate School and Graduate Study in Engineering and Applied Science.

## Description of Courses

See section on Agricultural Engineering under College of Agriculture and Life Sciences.

## Applied and Engineering Physics

B. W. Batterman, director; P. L. Hartman, associate director; R. A. Buhrman, K. B. Cady, D. D. Clark, R. K. Clayton, T. A. Cool, D. R. Corson, T. R. Cuykendall, H. H. Fleischmann, S. Humphries, V. O. Kostroun, J. A. Krumhansl, A. Kuckes, B. R. Kusse, A. Lewis, R. L. Liboff, R. V. Lovelace, M. S. Nelkin, E. L. Resler, Jr., T. N. Rhodin, M. M. Salpeter, B. M. Siegel, J. Silcox, R. N. Sudan, W. W. Webb, G. J. Wolga.

## Bachelor of Science

At the upperclass level students may enroll in the Field Program in Engineering Physics, which is designed to develop proficiency in physics and applied mathematics. Its distinguishing feature is a focus on fundamental knowledge that has broad applicability to engineering and to other sciences. The program allows students to choose areas of concentration within and outside of physics during the undergraduate years.

Most applied and engineering physics graduates go on to advanced study in a wide variety of fields, including astrophysics, atmospheric sciences, biophysics, energy conversion, environmental science, geophysics, materials science and engineering, nuclear engineering, nuclear physics, oceanography, plasma physics, quantum optics, and solid-state electronics. In addition to M.S. and Ph.D. programs in these areas, the possibilities include professional Master of Engineering programs in engineering physics, nuclear engineering, or aerospace engineering. Further study in other professional fields for which a background in applied science is less directly applicable is also a possibility. Some baccalaureate graduates go directly to industrial positions.

Underclass students who are planning to enter the Field Program in Engineering Physics are encouraged to register in honors sections of physics and mathematics during the first two years. Those who have advanced standing in mathematics when they matriculate in the College are advised of the possibility of taking Phys 112 in the fall term of the freshman year and Applied Math I in the spring term of the sophomore year. Of the core engineering sciences studied in the first two years, a course in thermodynamics (M&AE 221 or Chem 287) is required. The courses A&EP 217, Contemporary Topics in Applied Physics, and A&EP 206, The Physics of Life, are strongly recommended for the sophomore year.

The following curriculum, or its equivalent, constitutes the upperclass field program.

Term 5	Credits
A&EP 333, Mechanics of Particles and Solid Bodies	4
A&EP 355, Intermediate Electromagnetism	4
Applied Mathematics I*	4
Free elective	3 or 4
Liberal studies elective	3 or 4
<b>Term 6</b>	
A&EP 361, Introductory Quantum Mechanics	4
A&EP 356, Intermediate Electrodynamics	4
Applied Mathematics II*	4
Electronic Circuits†	3 or 4
Liberal studies elective	3 or 4
<b>Term 7</b>	
A&EP 423, Statistical Thermodynamics	4

Phys 410, Advanced Experimental Physics	4
Applied Mathematics III*	4
Technical elective	3 or 4
Liberal studies elective	3 or 4
<b>Term 8</b>	
A&EP 434, Continuum Physics	4
Applications of Quantum Mechanics‡	3 or 4
Free elective	3 or 4
Technical elective	3 or 4
Liberal studies elective	3 or 4

\*Applied Mathematics I and II may be either Math 421-422 or T&AM 610-611. Applied Mathematics III may be Math 423, T&AM 613-614, or another mathematics course such as Math 411, 427, or 371. Alternate courses will be considered on petition.

†Electronic Circuits may be A&EP 363 or an equivalent junior-level electronics course.

‡A choice of the following courses may be made: Phys 454, Introductory Solid State Physics; Phys 444, Nuclear and High-Energy Particle Physics; A&EP 609, Low-Energy Nuclear Physics (fall); A&EP 401, Physics of Atomic and Molecular Processes (fall); Elec E 731, Quantum Electronics 1 (fall).

Considerable flexibility is possible in the scheduling of these courses. For example, Phys 410 may be taken in term 7 or in term 8. Quantum mechanics can be studied in term 6 as A&EP 361 or in term 7 as Phys 443. The course in applications of quantum mechanics can be taken whenever the appropriate prerequisite has been met. If scheduling conflicts arise, the school may allow substitutions of courses nearly equivalent to the listed required courses: Phys 325-326 and Elec E 313-314 are similar to A&EP 355-356; Phys 318 (offered in the spring) and T&AM 670 are similar to A&EP 333; and a number of advanced courses in fluid mechanics or elasticity are similar to A&EP 434.

Free and technical electives need not be all formal course work; qualified students may undertake informal study under the direction of a member of the faculty. This may include research projects in areas in which faculty members are active. These areas include electron microscopy and diffraction, quantum electronics, solid-state and surface physics, atomic physics, geophysics, biophysics, nuclear structure physics, nuclear engineering, and plasma physics.

The engineering physics student is expected to pass every course for which he or she is registered and to attain each term a grade-point average of at least 2.3.

## Areas of Concentration

An area of concentration in an interdisciplinary study, such as biophysics, geophysics, nuclear engineering, lasers and quantum electronics, or plasma physics and materials science, may be arranged through a judicious choice of electives in the freshman and sophomore as well as the upperclass years. Examples of many such programs are described in a special brochure available from the School of Applied and Engineering Physics, Clark Hall. Students interested in this kind of program are advised to consult as early as possible with a professor active in the field of interest or with the associate director of the school, P. L. Hartman.

## Master of Engineering (Engineering Physics)

In addition to preparing students for professional employment, the M.Eng. (Engineering Physics) degree program serves as a basis for doctoral study in applied physics or in certain areas that involve a combination of engineering or applied physics with another professional but nontechnical discipline. Specific requirements for the degree are the following:

**Credits**

- The required thirty credits must include (a) a minimum of six in related graduate-level courses; (b) a graduate-level course that provides a good background in quantum mechanics; and (c) a fourth-year or graduate-level course in statistical mechanics or the equivalent. If the student's undergraduate program included courses that satisfy these requirements, he or she may substitute other graduate courses. Undergraduate courses that permit exploratory work in a special field of interest may be allowed, on approval of the program chairman. A further program requirement is attendance at approximately fifteen University seminars or colloquia chosen in consultation with the program chairman.

- An informal design study or project giving at least six credits is required. It may be experimental or analytical, but must represent individual effort and include a formal report. If the project is experimental, one graduate-level course in mathematics or applied mathematics is required; students whose mathematical background is not equivalent to that of graduates of the Cornell engineering physics undergraduate program may satisfy this requirement by taking one of the upperclass mathematics courses included in the Field Program in Engineering Physics. If the project is analytical, one graduate-level course in experimental laboratory physics, or its equivalent, is required.

## Master of Science and Doctor of Philosophy

Programs offered by the graduate Field of Applied Physics are described in the *Announcement of the Graduate School and Graduate Study in Engineering and Applied Science*.

## Description of Courses

**201 Nuclear Energy and the Environment** Fall. 3 credits. Prerequisites: knowledge of introductory physics, chemistry, and calculus, but previous knowledge of biology not required. Fundamentals of nuclear radiations and their interaction with matter; radiation chemistry, radiation biology, environmental effects of nuclear fuel utilization.

**206 The Physics of Life** Fall. 3 credits. 2 lec. Prerequisite: concurrent registration in Phys 213 or permission of instructor.  
A. Lewis.  
See description under Division of Basic Studies.

**217 Contemporary Topics in Applied Physics** Spring. 3 credits. 2 lec, 1 rec-lab. Prerequisite: Phys 213.  
R. A. Buhrman and staff.  
See description under Division of Basic Studies.

**303 Introduction to Nuclear Science and Engineering** Spring. 3 credits. Prerequisites: sophomore physics and math. For juniors and seniors not majoring in engineering physics. Low-energy nuclear physics and practical applications. Topics: elementary quantum mechanics; properties of nuclei; nuclear radiations and reactions, such as neutron activation and radioactive tracer analysis.

**333 Mechanics of Particles and Solid Bodies** Fall. 4 credits. 3 lec, 1 rec. Newton's laws; coordinate transformations; generalized coordinates and momenta. Lagrangian and Hamiltonian formulation; applications to oscillator, restrained motion, central forces, small vibrations of multiparticle systems, motion of rigid body.

**355 Intermediate Electromagnetism** Fall. 4 credits. Prerequisites: Phys 214 and 216 and coregistration in Math 421 or T&AM 610 or permission of instructor. Topics: vector calculus; electrostatics and

magnetostatics; Laplace's equation solutions in Cartesian, cylindrical, and spherical systems; conformal mapping; dielectrics; paramagnetic and diamagnetic materials, electric and magnetic forces; skin effect; quasistatics. Emphasis on physical concepts and applications.

**356 Intermediate Electrodynamics** Spring, 4 credits. Prerequisite: 355, coregistration in Math 422 or T&AM 611, or permission of instructor.

B. Kusse.  
Development of electromagnetic wave phenomena and radiation. Topics include transmission lines, waveguides, wave properties of dispersive media, radiation and scattering phenomena, reciprocity, physical optics, and special relativity.

**361 Introductory Quantum Mechanics** Spring, 4 credits. 3 lec, 1 rec. Prerequisites: 333 or Phys 318; coregistration in Math 422 or T&AM 611 and in 456 or Phys 326.

J. Silcox.  
A first course in the systematic theory of quantum phenomena. At the level of Chapters 4 through 9 of *Modern Physics and Quantum Mechanics* by Anderson.

**363 Electronic Circuits (also Phys 360)** Fall or spring, 4 credits. Prerequisite: Phys 208 or 213 or permission of instructor; no previous experience with electronics is assumed, 1 lec, 2 labs.

Basic analysis and design of semiconductor circuits useful in electronic instrumentation such as amplifiers; oscillators and waveform generators; switching, digital, and timing circuits; and power supplies. At level of *Introductory Electronics for Scientists and Engineers* by Simpson.

**401 Physics of Atomic and Molecular Processes** Fall, 3 credits. Prerequisite: 361, Phys 443, or permission of instructor.

An introduction to the basics of contemporary problems in the physics of atomic and molecular processes, including atomic structure, chemical bonding, polarization, radiation resonance processes, and atomic and molecular spectroscopy.

**423 Statistical Thermodynamics** Fall, 3 credits. M. Nelkin.

Quantum statistical basis for equilibrium thermodynamics, canonical and grand canonical ensembles and partition functions. Quantum and classical ideal gases and paramagnetic systems, Fermi-Dirac, Bose-Einstein, and Maxwell-Boltzmann statistics. Introduction to systems of interacting particles. At the level of *Thermal Physics* by Kittel and *Statistical and Thermal Physics* by Reif.

**424 Statistical Physics** Spring, 4 credits.

R. V. Lovelace.  
Kinetic theory of gases in terms of the single-particle distribution function; the Boltzmann equation and transport processes. Fluctuations and irreversible processes: Brownian motion and electromagnetic noise.

**434 Continuum Physics** Spring, 4 credits.

W. Webb.  
Linear elasticity theory; tensor and vector formalisms; elementary engineering applications, crystal anisotropy, dislocations. Elastic and inelastic waves. Hydrodynamics; Navier-Stokes equations, ideal and viscous fluids, compressible and incompressible flows; elementary applications, lift, drag, convection, surface waves, simple shocks, sound, introduction to linear response theory, dimensional analysis, instabilities and turbulence, subcritical and supercritical flows.

**490 Informal Study in Engineering Physics**

Laboratory or theoretical work in any branch of engineering physics under the direction of a member of the staff.

**601 Photosynthesis (also Bio Sci 445)** Fall, 2

credits. Prerequisites: Chem 104 or 208, Math 108, 111, or 191, and Phys 102, 208, or 214, or permission of instructor. Past or current registration in 605 recommended.

R. K. Clayton.  
A study of the process by which plants use light in order to grow, emphasizing physical and physico-chemical aspects.

**[603 General Photobiology (also Bio Sci 447)**

Fall, 2 credits. Prerequisites: Chem 104 or 208, Math 108, 111, or 191, and Phys 102, 208, or 214, or permission of instructor. Not offered 1976-77.

R. K. Clayton.  
Study of interactions between light and living matter, as in photosynthesis, vision, regulation of physiology and development, bioluminescence, and damage by ultraviolet and visible light.]

**605 Optics in Biology (also Bio Sci 405)** Fall, 2

credits. Prerequisites: Chem 104 or 208, Math 108, 111, or 191, and Phys 102, 208, or 214, or consent of instructor.

R. K. Clayton.  
Lectures, problems and laboratory experience in applications of optics to biology. Topics include applied geometrical optics, methods for studying biological effects of light, and analytical uses of optical absorption and fluorescence.

**606 Introduction to Plasma Physics (also Elec E**

**681)** Fall, 3 credits. 3 lec. Prerequisite: 355, 356, or equivalent. Open to fourth-year students at discretion of instructor.

R. N. Sudan.  
Plasma state; motion of charged particles in fields; collisions, coulomb scattering; transport coefficients, ambipolar diffusion, plasma oscillations and waves; hydromagnetic equations; hydromagnetic stability and microscopic instabilities; test particle in a plasma; elementary applications.

**607 Advanced Plasma Physics (also Elec E**

**682)** Spring, 3 credits. 3 lec. Prerequisite: 606.

R. N. Sudan.  
Boltzmann and Vlasov equations; Chew-Goldberger-Low theory; waves in hot plasmas; Landau damping. Micro-instabilities; effects of collisions and Fokker-Planck terms; method of dressed test particles; high-frequency conductivity and fluctuations; neoclassical toroidal diffusion, relativistic beams.

**608 Plasma Astrophysics (also Astro**

**660)** Spring, 2 credits.

R. V. Lovelace.  
Selected topics discussed in detail: (a) the solar corona and the solar wind; (b) the propagation of cosmic rays in interplanetary and interstellar space; and (c) the theory of aligned rotating magnetospheres.

**609 Low-Energy Nuclear Physics** Fall, 4 credits.

3 lec. Prerequisite: an introductory course in modern physics, including quantum mechanics.  
The nuclear interaction. Properties of ground and excited states of nuclei; models of nuclear structures; alpha, beta, gamma radioactivity, low-energy nuclear reactions—resonant and nonresonant scattering, absorption, and fission. At the level of *Introduction to Nuclear Physics* by Enge.

**610 Biophysical Processes** Fall, 3 credits.

Prerequisites: basic courses in biology, physics, physical chemistry, and mathematics, such as Math 422 or 433, Phys 315 or 341, Chem 390, or permission of instructor.

W. W. Webb.  
Statistical thermodynamics of biomolecules and electrolytes; dissipative processes; diffusive, electrochemical, coupled and convective transport; fluctuations and kinetics; cell membranes; biological macrostructures; physical probes.

**[611 Vision (also Bio Sci 395)** Fall, 2 credits.

Prerequisites: Chem 104 or 208, Math 108 or 111, Phys 102 or 208, or permission of instructor. Concurrent or previous enrollment in Bio Sci 405 recommended. Not offered 1976-77.

R. Clayton.  
Study of the mechanisms of seeing; biological, physical, and chemical approaches to the subject.]

**612 Nuclear Reactor Theory I** Fall, 4 credits. 3

lec. Prerequisites: a year of advanced calculus and some nuclear physics.  
Physical theory of fission reactors. Fission and neutron interactions with matter; theory of neutron diffusion, slowing down, and thermalization; calculations of criticality and neutron flux distribution in nuclear reactors. Reactor kinetics. At level of *Nuclear Reactor Theory* by Lamarsh.

**613 Nuclear Reactor Theory II** Spring, 3 credits.

A continuation of 612, primarily intended for students planning research in nuclear reactor physics and engineering. 3 lec. Prerequisite: 612.

K. B. Cady.  
The Boltzmann linear transport equation, its adjoint, and their approximate solutions are developed and applied to the heterogeneous neutron chain reactor.

**619 Molecular Energy Transfer** Spring, 3 credits.

T. A. Cool.  
Fundamentals of energy transfer by molecular collisions in gases. Energy transfer mechanisms in molecular and chemical lasers. Processes for interconversion of electronic, vibrational, rotational, and translational energy. Intermolecular potential, dispersion forces, multipole moment interactions, repulsive forces.

**621 Electron Microscopy: Image Formation, Image Processing, and Applications in Molecular Biology** Fall, 3 credits. Prerequisite: permission of instructor.

B. M. Siegel.  
Topics: (1) Imaging in electron microscope: electron optics, specimen-electron interaction, image formation; conventional and scanning transmission electron microscopes. (2) Image processing: optical reconstruction, computer processing, filtering, 2-D restoration, 3-D reconstruction. (3) Applications in biomolecular investigations: radiation damage, biomolecular structure.

**633 Nuclear Reactor Engineering** Fall, 4 credits.

Prerequisite: introductory course in nuclear engineering.

K. B. Cady.  
The fundamentals of nuclear reactor engineering: reactor siting and safety, fluid flow and heat transfer, control, and radiation protection.

**634 Nuclear Engineering Design Seminar**

Spring, 4 credits. Prerequisite: 633.

K. B. Cady.  
A group design study of a selected nuclear system. Emphasis is on safety, siting, and radiation protection in the design of nuclear systems.

**636 Seminar on Thermonuclear Fusion**

**Reactors** Fall, 3 credits. Prerequisite: basic course in plasma physics or nuclear reactor engineering, or permission of instructor.

Analysis of various technological and engineering problems in design and construction of fusion reactors. Topics include basic reactor schemes, materials, mechanical and heat transfer problems, radiation and safety, superconducting magnets, energy conversion, plasma impurities, and economics.

**651 Nuclear Measurements Laboratory** Spring,

4 credits. Two 2½-hour afternoon periods.

Prerequisite: some nuclear physics.  
Laboratory plus lectures on interaction of radiation with matter and its detection, including electronic circuits. Twenty experiments available in nuclear and

reactor physics and radiation protection; for example, radiation and detection, emission, absorption, neutrons, moderation, activation analysis of sub-critical assembly. Use of TRIGA Reactor. Student performs 8-10 selected experiments. At the level of *Nuclear Radiation Detection* by Price.

**652 Advanced Nuclear and Reactor Laboratory** Spring. 3 credits. Two 2½-hour afternoon periods. Prerequisites: 651 and 609 or 612. Offered on independent study basis or, if sufficient demand, as a formal course. Laboratory experiments and experimental methods in nuclear physics and reactor physics. Ten experiments available, some using the Zero Power Reactor critical facility.

**705 Topics in Statistical Physics** Fall. 3 credits. Prerequisite: general familiarity with statistical mechanics.

M. S. Nelkin.  
Selected topics of current interest in statistical physics. For example, in 1974 the subject was the nonlinear behavior of macroscopic systems driven far from thermal equilibrium; the primary illustrative examples were from fluid mechanics.

**711 Principles of Diffraction (also MS&E 706)** Fall. 3 credits.

B. Batterman.  
Introduction to diffraction phenomena as applied to solid-state problems. Scattering and adsorption of neutrons, electrons, and X-ray beams. Diffraction from two- and three-dimensional periodic lattices. Fourier representation of scattering centers, and the effect of thermal vibrations. Phonon information from diffuse X-ray and neutron scattering and Bragg reflections. Diffraction from almost-periodic structures, surface layers, gases, and amorphous materials. Survey of dynamical diffraction from perfect and imperfect lattices.

**751, 752 Project** 751, fall; 752, spring. Credit to be arranged. Informal study under direction of a member of the University staff. The objective is to offer some research experience, working on a special problem related to the student's field of interest.

**753 Seminar Topics in Applied Physics** Fall or spring. 1 credit. Primarily for candidates for the M.Eng. (Engineering Physics) degree. The student attends and writes brief summaries on a minimum of thirteen scheduled university seminars and/or colloquia in technical areas close to the student's main interest.

**761 Kinetic Theory (also Elec E 781)** Fall, alternate years. 3 credits. Prerequisite: Phys 561, 562 or permission of instructor.  
R. L. Liboff.  
See Elec E 781 for course description.

**762 Physics of Solid Surfaces (also MS&E 762)** Spring. 3 credits. Lecture course primarily for graduate and qualified upperclass students.  
T. N. Rhodin, J. M. Blakely.  
An approach to the physics and chemistry of phenomena in metals, semiconductors, and ionic solids related particularly to surface and interfacial effects. Quantum mechanical and kinetic analyses of the interaction of electrons, ions, and molecules with condensed matter. Application and theory of experimental methods in ultrahigh vacuum physics. Materials drawn from research papers and review articles.

## Chemical Engineering

J. C. Smith, director; K. B. Bischoff, G. G. Cocks, R. K. Finn, P. Harriott, F. Rodriguez, G. F. Scheele, M. L. Shuler, J. F. Stevenson, R. G. Thorpe, R. L. VonBerg, H. F. Wiegandt, R. York.

## Bachelor of Science

The undergraduate Field Program in Chemical Engineering comprises a coordinated sequence of courses beginning in the sophomore year and extending through the fourth year. Special programs in biological engineering, polymeric materials, and chemical microscopy are available. Underclass students who plan to enter the Field Program in Chemical Engineering register for Chem 287-288, Chem 289-290, and Chem E 110 or 111 during the sophomore year. The program for the upperclass years is as follows:

Term 5	Credits
Chem 357, Organic Chemistry	3
Chem 251, Organic Chemistry Laboratory	2
Chem E 311, Equilibria and Staged Operations	3
Chem E 430, Introduction to Rate Processes	3
Elective*	3
Liberal studies elective	3
Term 6	
Chem 358, Organic Chemistry	3
Chem E 321, Materials†	4
Chem E 431, Analysis of Separation Processes	3
Elective*	3
Liberal studies elective	3
Term 7	
Chem E 312, Chemical Engineering Thermodynamics	3
Chem E 432, Unit Operations Laboratory	3
Chem E 461, Chemical Process Evaluation	3
Elective*	3
Liberal studies elective	3
Term 8	
Chem E 410, Reaction Kinetics and Reactor Design	3
Chem E 462, Chemical Process Synthesis	4
Electives*	6
Liberal studies elective	3
Chem E 101, Nonresident lectures	0

\*The electives in Terms 5 to 8 must comprise three credits of the postponed engineering core science course (see the section on Basic Studies); six credits of technical electives; and at least six credits of free electives.

†Students who have an approved plan for concentration in a minor topical area and who require more elective courses than the number scheduled to accomplish their goals may substitute additional electives for Chem E 321, Materials (provided that MS&E 261, Introduction to Mechanical Properties of Materials, has been chosen as an engineering core science during the sophomore year). This option could be of interest to students planning concentrations in such areas as biological engineering, environmental studies, advanced chemistry, and systems and operations research.

## Master of Engineering (Chemical)

The professional master's degree, M.Eng. (Chemical), is awarded at the end of one year of graduate study with successful completion of thirty credits of required and elective courses in technical fields including engineering, mathematics, chemistry, physics, and biology. Courses emphasize design and optimization based on the economic factors that affect process, equipment, and plant design alternatives. A design project is involved in the required courses. General admission and degree requirements are described in the introductory section under College of Engineering.

## Master of Science and Doctor of Philosophy

Details of the programs for the M.S. and Ph.D. degrees with major or minor fields of study in chemical engineering are described in the *Announcement of the Graduate School and Graduate Study in Engineering and Applied Science*.

## Description of Courses

**101 Nonresident Lectures** Fall. Noncredit. 1 lec. Given by lecturers invited from industry and from selected departments of the University for the purpose of assisting students in their transition from college to industrial life.

**110 Mass and Energy Balances** Spring. 3 credits. Prerequisite: one year of freshman chemistry or permission of instructor.

R. G. Thorpe.  
Self-paced audiovisual instruction in the material of Chem E 111. See description under Division of Basic Studies.

**111 Mass and Energy Balances** Fall. 3 credits. 3 lec, 1 computing session. Prerequisite: one year of freshman chemistry or permission of instructor.  
R. G. Thorpe.  
See description under Division of Basic Studies.

**311 Equilibria and Staged Operations** Fall. 3 credits. 3 lec, 1 computing session. Phase equilibria and phase diagrams. The equilibrium stage, mathematical description of single and multistage operations, analytical and graphical solutions.

**312 Chemical Engineering Thermodynamics** Fall. 3 credits. 3 lec. Prerequisites: 311; Chem 287, 288.  
K. B. Bischoff.  
A study of the first and second laws with application to batch and flow processes. Physical and thermodynamic properties, availability, free energy, chemical equilibrium. Applications to gas compression, refrigeration, power generation, adiabatic reactors, and chemical process development.

**321 Materials** Spring. 4 credits. 3 lec, 1 lab.  
G. G. Cocks.  
An introduction to the structure and properties of solid materials. The polarizing microscope is used for examining materials in the laboratory. Topics include: testing of materials, bonding of atoms, crystal structure, phase transformation, forming and fabrication, production of materials, selection of materials, and behavior under service conditions. Laboratory topics include: optics of the microscope, geometrical and optical crystallography, and the physical chemical behavior of materials.

**410 Reaction Kinetics and Reactor Design** Spring. 3 credits. 3 lec. Prerequisite: 430.  
J. F. Stevenson.  
A study of chemical reaction kinetics and principles of reactor design for chemical processes.

**421 Industrial Organic Chemical Processes** Spring. 2 credits. 2 lec. Prerequisite: Chem 253 or 357.  
J. C. Smith.  
Study of commercial manufacturing processes for important organic chemicals.

**430 Introduction to Rate Processes** Fall. 3 credits. 3 lec, 1 computing session. Prerequisites: 111 and engineering mathematics sequence.  
F. Rodriguez.  
Fundamentals of fluid mechanics and heat transfer; solutions to problems involving viscous flow, heat conduction and convection, friction factors and heat transfer coefficients, macroscopic balances, elementary applications.

**431 Analysis of Separation Processes** Spring. 3 credits. 3 lec, 1 computing session. Prerequisites: 430 and familiarity with FORTRAN or PL/I.  
R. G. Thorpe.  
Analysis of separation processes involving phase equilibria and rate of mass transfer; extensive use of the digital computer. Phase equilibria; binary,

multicomponent, and extractive distillation; liquid-liquid extraction; gas absorption; crystallization.

**432 Unit Operations Laboratory** Fall. 3 credits. 2 lec, 1 lab. Prerequisites: 430, 431.

R. L. Von Berg and staff.  
Laboratory experiments in fluid dynamics, heat and mass transfer, other operations. Correlation and interpretation of data. Technical report writing.

**433 Project Laboratory** Fall or spring. Credit variable. Prerequisite: 432.

Special laboratory projects involving bench-scale or pilot-plant equipment.

**434 Transport Phenomena** Spring. 3 credits. 3 lec. Prerequisites: 430 and concurrent registration in 431.

G. F. Scheele.  
An introductory treatment of momentum, energy, and mass transport.

**461 Chemical Process Evaluation** Fall. 3 credits. H. F. Wiegandt.

A study of the important chemical processes.

**462 Chemical Process Synthesis** Spring. 4 credits.

R. L. Von Berg and staff.  
A consideration of process and economic alternatives in selected chemical processes; design and assessment.

**563 Process Equipment Design and Economics** Fall. 3 credits. 3 lec. Prerequisite: 430 and 431 or equivalent.

J. C. Smith.  
Performance, selection, and design of process equipment; storing, transporting, mixing, heating, and separating fluids and solids. Process development and design.

**564 Design of Chemical Reactors and Multiphase Contacting Systems** Spring. 3 credits. 3 lec.

P. Harriott.  
Design, scale-up, and optimization of chemical reactors with allowance for heat and mass transfer, nonideal flow, and catalyst aging. Selection of systems for gas-liquid-solid contacting, including stirred tanks and fluidized beds.

**565 Design Project** Spring. 3 or 6 credits. Prerequisites: 563, 564.

Staff.  
Design study and economic evaluation of a chemical processing facility, alternative methods of manufacture, raw material preparation, food processing, waste disposal, or some other aspect of chemical processing.

**595, 596 Special Projects in Chemical Engineering** Fall or spring. Credit variable. Research or studies on special problems in chemical engineering.

**611 Phase Equilibria** Fall. 3 credits. 3 lec. Prerequisite: physical chemistry.

R. G. Thorpe.  
A detailed study of the pressure-temperature-composition relations in binary and multicomponent heterogeneous systems where several phases are of variable composition. Prediction of phase data.

**621 Petroleum Refining** Fall. 3 credits. 3 lec. Prerequisite: 430.

H. F. Wiegandt.  
A critical analysis of the processes employed in petroleum refining.

**623 Synthetic Fuels** Spring. 3 credits. P. Harriott, J. C. Smith.

Energy resources and projected consumption. Gasification and liquefaction of coal and oil shale.

Synthesis of methane, methanol, and hydrogen. Efficiency and economics of fuel production and use.

**627 Nuclear and Reactor Engineering** Spring. 2 credits. 2 lec. Prerequisite: permission of instructor. R. L. Von Berg.

Fuel processing, isotope separation and radiation damage, shielding, radiation chemistry, waste disposal.

**628 Inventions, Patents and Trade Secrets** Fall. 3 credits.

R. York.  
Protection of inventions and trade secrets. Statutory and other level requirements for patentability of inventions. Evaluation of patents. Role and management of patents in planning growth and expansion into new product lines.

**629 Development Economics** Fall. 3 credits. R. York.

Planning, evaluation, and management of development activities in the process industries as related to research, processing, new products, markets, and long-range growth.

**640 Polymeric Materials** Fall. 3 credits. 3 lec. F. Rodriguez.

Chemistry and physics of the formation and characterization of polymers. Principles of fabrication.

**641 Polymer Rheology** Spring. 1-3 credits. 3 lec. Prerequisite: 640 and/or 430.

J. F. Stevenson, F. Rodriguez.  
Flow classification, experimental measurements, linear and nonlinear constitutive equations, analysis of injection molding, special topics.

**642 Polymeric Materials Laboratory** Spring. 2 or 3 credits. 1 or 2 labs. Prerequisite: 640.

F. Rodriguez.  
Experiments in the formation, characterization, fabrication, and testing of polymers.

**[643 Engineering Analysis of Physiological Systems** Spring. 3 credits. Not offered 1976-77.

K. B. Bischoff, J. F. Stevenson.  
Engineering analysis and mathematical description of flow, transport phenomena, and chemical reactions involved in physiological system function. Cell and body fluid properties, the circulatory system and blood flow, renal system models, transport of drugs and other solutes, artificial organ design.]

**644 Fermentation Engineering** Spring. 3 credits. 2 lec, 1 rec. Prerequisites or corequisites: Chem 288 and any course in microbiology.

R. K. Finn.  
An advanced discussion of fermentation as a unit process. Topics include sterilization, aeration, agitation, and continuous fermentation.

**645 Industrial Microorganisms** Fall. 2 credits. Prerequisites: organic chemistry and physical chemistry.

R. K. Finn.  
A brief introductory course in microbiology for students with a good background in chemistry.

**647 Wastewater Engineering in the Process Industries** Fall. 3 credits. Prerequisites: organic and physical chemistry; 430 or equivalent.

M. L. Shuler.  
Introduction to general and legal problems of pollution control, including some descriptive technology. Major emphasis, however, is on the quantitative engineering aspects of design and operation. Both biological and physical chemical methods, as they apply to the treatment of strong and special wastes from the chemical and allied industries, are discussed.

**648 Polymer Processes** Spring. 3 credits. 3 lec. Prerequisite: 640 or permission of instructor.

F. Rodriguez.

Production and applications of polymers. Discussion of stabilization and degradation, including processes for recycling and disposal of plastics and related products.

**651 Numerical Methods in Chemical Engineering** Fall. 3 credits. 3 lec.

G. F. Scheele.  
Solution of single and sets of algebraic equations, polynomial approximations, integration, initial and boundary valued ordinary differential equations, optimization, statistical design of experiments, steady-state chemical process simulation by computer using FLOWTRAN.

**661 Air Pollution Control** Fall. 3 credits. P. Harriott.

Origin of air pollutants, photochemical reactions in the atmosphere, diffusion in the atmosphere. Design of equipment for removal of particulate and gaseous pollutants formed in combustion and chemical processing.

**671 Process Control** Spring. 3 credits. 2 lec, 1 lab. Prerequisite: 430.

M. L. Shuler.  
Dynamic response of processes and control instruments. Use of frequency response analysis. Laplace transforms and electronic analogs to predict the behavior of feedback control systems.

**672 Applied Surface Chemistry** Spring. 3 credits.

Aspects of surface chemistry and physics that affect engineering practice. Both equilibrium and dynamic concepts are covered. Topics include capillarity, contact angle phenomena, critical surface tension, absorption, Marangoni effects, coalescence, electrokinetic phenomena and colloid stability, biomaterials and compatibility, and heat and mass transfer at mobile interfaces. Both fluid-solid and fluid-fluid interfaces are considered.

**680 Chemical Microscopy** Fall. 3 credits. 1 lec, 2 labs.

G. G. Cocks.  
The use of the light microscope to investigate chemical problems in biological or nonbiological systems. Topics include: the optics of the microscope, types of microscopes (transmission, reflection, polarizing, interference, phase and dark field), the preparation of specimens, qualitative and quantitative analysis, crystallography, and photomicrography.

**681 Electron Microscopy** Fall. 3 credits. 1 lec, 2 labs. Prerequisite: 680 or special permission.

G. G. Cocks.  
An introductory course designed to teach the student how to use the electron microscope. Topics include: optics of the microscope, the use and maintenance of the microscope, specimen preparative techniques (substrates, particulates, replication, microtomy, electron diffraction, and thinning of metals), photomicrographic techniques, and the interpretation of micrographs.

**682 Advanced Chemical Microscopy** Offered on demand either term. Credit variable. Prerequisite: 680 and/or special permission.

G. G. Cocks.  
This is primarily a projects course and offers the student the opportunity either to learn more about microscopes and their use or to apply the techniques of microscopy to the investigation of topics or problems of special interest.

**683 Laboratory in Optical Crystallography** Fall. Credit variable. 2 labs; lec as part of 1 lab. This is the normal laboratory for Geol Sci 355, but is open to students who want to take the laboratory only.

G. G. Cocks.  
An introduction to geometrical and optical crystallography for mineralogists, with instruction in the use of the polarizing microscope. Topics include

the optics of the polarizing microscope, and geometrical and optical crystallography.

**692, 693, 694 Research Project** Fall or spring. 3 credits; additional credit by special permission. Prerequisite: 430. Research on an original problem in chemical engineering.

### 711 Advanced Chemical Engineering

**Thermodynamics** Fall. 3 credits. 3 lec.

Prerequisite: 312 or equivalent.

Application of general thermodynamic methods to advanced problems in chemical engineering. Evaluation, estimation, and correlation of properties; chemical and phase equilibrium.

### 713 Advanced Chemical Engineering Kinetics

Fall. 3 credits. 3 lec. Prerequisite: 410 or equivalent.

P. Harriott.

Fundamentals of homogeneous reactions and heterogeneous catalysis. Development of kinetic rate expressions for homogeneous and heterogeneous systems. Effects of diffusion and temperature gradients. Problems in interpretation of data for real systems.

### 731 Advanced Transport Phenomena

Spring. 3 credits.

G. F. Scheele. An integrated treatment of momentum, mass and heat transfer. Molecular transport, the equations of change, viscous laminar flow of Newtonian and non-Newtonian fluids, perfect fluid theory, boundary layer theory, unsteady-state transfer, penetration theory, models of mass and heat transfer, flow stability, turbulent transport, simultaneous heat and mass transfer, applications to industrial operations.

### 751 Methods of Chemical Engineering Analysis

Fall. 3 credits. May be taken by undergraduates with the permission of instructor.

J. F. Stevenson.

Methods of mathematical analysis of direct applicability in thermodynamics, transport phenomena, and chemical reactor design.

### 790 Seminar

Fall or spring. 1 credit. General chemical engineering seminar required of all graduate students majoring in the Field of Chemical Engineering.

### 891, 892, 893 Thesis Research

Fall or spring. Thesis research for the M.S. degree in chemical engineering.

### 991, 992, 993, 994, 995 Thesis Research

Fall or spring. Thesis research for the Ph.D. degree in chemical engineering.

## Civil and Environmental Engineering

School of Civil and Environmental Engineering: W. R. Lynn, director; G. B. Lyon, assistant director.

Department of Structural Engineering: R. H. Gallagher, chairman; J. F. Abel, P. Gergely, J. N. Kay, W. McGuire, A. H. Nilson, T. Peköz, D. A. Sangrey, F. O. Slate, R. N. White.

Department of Environmental Engineering: D. P. Loucks, chairman; V. C. Behn, J. J. Bisogni, W. H. Brutsaert, F. J. Cesario, L. B. Dworsky, G. P. Fisher, C. D. Gates, D. A. Haith, J. A. Liggett, P. L-F. Liu, R. C. Loehr, W. R. Lynn, A. H. Meyburg, P. J. Murphy, N. Orloff, R. E. Schuler, C. Shoemaker, R. L. Willis.

Program in Environmental Sensing, Measurement, and Evaluation: T. Liang, G. B. Lyon, A. J. McNair.

## Bachelor of Science

There are two subject departments in the School of Civil and Environmental Engineering, and a Program in Environmental Sensing, Measurement, and Evaluation. Undergraduate specialties can be arranged in a number of subject areas encompassed by these units. The major areas in the Department of Structural Engineering are: analysis, behavior, and design of structures; structural materials, and soils and foundations. Within the Department of Environmental Engineering there are five major areas: environmental quality engineering; fluid mechanics and hydrology; public systems and environmental systems engineering; transportation; and water resources planning and analysis.

Students planning to enter the Field Program in Civil and Environmental Engineering as juniors are required to take T&AM 202, Mechanics of Solids, as one of the sophomore engineering core sciences. It is recommended that they also take OR&IE 260, Introductory Engineering Probability, and either T&AM 203, Dynamics, or MS&E 261, Mechanical Properties of Materials, as two of the other sophomore engineering core science courses. These three courses are required in the field program.

At the upperclass level the curriculum is planned to provide an introduction to the several diverse areas within the field of civil and environmental engineering and to permit more detailed study in at least one area through appropriate selection of electives. A recommended sequence, including the required courses, is given below.

Term 5	Credits
T&AM 203, Dynamics*	3
C&EE C301, Fluid Mechanics I	4
C&EE G301, Structural Engineering I	4
OR&IE 260, Introductory Engineering Probability*	3
Liberal studies elective	3
Term 6	
MS&E 261, Introduction to Mechanical Properties of Materials*	3
C&EE E301, Environmental Quality Engineering	4
C&EE D301, Elements of Soil Mechanics	3
C&EE B303, Engineering Economics and Systems Analysis	3
Liberal studies elective	3
Term 7	
Civil and Environmental engineering distribution courses (2)†	6
Technical elective	3
Free elective	3
Liberal studies elective	3
Term 8	
Civil and environmental engineering distribution courses (2)†	6
Technical elective	3
Free elective	3
Liberal studies elective	3

\*Satisfactory completion of these engineering core science courses in the Division of Basic Studies increases the number of technical electives accordingly.

†Information about distribution requirements may be obtained from the student's faculty adviser.

A student with a well-defined special interest may develop a more individualized program in consultation with a faculty adviser from the school and submit it to the Field Curriculum Committee for approval. It is advisable for a student planning such a program to submit an application as early as the first term of the sophomore year.

## Master of Engineering (Civil)

The M. Eng. (Civil) degree program is designed to prepare a student for professional practice in civil

and environmental engineering. Requirements, in addition to the general ones for the degree (see the introductory section under College of Engineering), include four required courses: two in professional engineering practice, C&EE K520 and K521, and two in design, C&EE K510 and K511 or the equivalent. The design sequence requires the completion of a project involving synthesis, analysis, decision making, and application of engineering judgment, and includes an intensive, full-day, three-week session between semesters.

The remainder of a student's program of studies is designed individually in consultation with an academic adviser and then submitted to the school's Professional Degree Committee for approval. The objectives in course planning are to provide breadth in the fundamentals of civil and environmental engineering, and specialization in one area with some concentration in a related area. Most students will have achieved the necessary breadth during their undergraduate years. Some, however, may require additional course work in the graduate program to fulfill the breadth requirement. Students in the School of Civil and Environmental Engineering may avail themselves of a number of graduate course offerings in fields related to their major interest but outside of the school.

## Master of Science and Doctor of Philosophy

The requirements for the degrees of Master of Science and Doctor of Philosophy are described in the *Announcement of the Graduate School and Graduate Study in Engineering and Applied Science*.

## Description of Courses

The courses in civil and environmental engineering are listed under the following headings: *Environmental Sensing, Measurement, and Evaluation; Public and Environmental Systems Engineering; Fluid Mechanics and Hydrology; Soil Mechanics and Foundations; Environmental Quality Engineering; Transportation; Structural Engineering; Water Resources Planning and Analysis; and Professional Practice*.

## Environmental Sensing, Measurement, and Evaluation

**A153 Principles of Navigation** Fall. 4 credits. 3 lec, disc and project period. May not be offered 1976-77.

A. J. McNair.

Coordinate systems, chart projections, navigational aids, instruments, compass observations, tides and current, soundings. Celestial navigation: time, spherical trigonometry, motion of stars and sun, star identification, position fixing, Nautical Almanac. Electronic navigation.

## A380 Engineering Surveying and

**Evaluation** Fall. 3 credits. 2 lec, 1 lab. Introductory course for juniors. May not be offered 1976-77.

Staff.

Surveying: principles of geometric measurements; surveying instruments and procedures; coordinate systems and mapping methods. Evaluation: engineering significance of the physical environment; its assessment from maps, airphotos, and ground data.

## A651 Field Astronomy

On demand. 2 credits. 1 lec, 1 lab (including evening observations). Prerequisite: A380 or permission of instructor. May not be offered 1976-77.

G. B. Lyon.

Theory and practice in the determination of latitude and longitude of points and azimuth of lines on the earth by observation of celestial bodies. Topics include: stellar and geographic coordinate systems, use of star catalogs, measurement of time, and pertinent observation and computation procedures.

**A652 Geometric Data Adjustments** On demand. 3 credits. 3 lec-disc. Prerequisites: Math 293, C&EE A380, and OR&IE 260, or permission of instructor. May not be offered 1976-77.

G. B. Lyon.

Theory and practice of adjustment of geometrically constrained observations with emphasis on surveying applications. Topics include: error theory, minimum variance and other bases for adjustment, and evaluation of precision of results.

**A656 Boundary Surveys** Spring. 3 credits. 3 lec. 1 lab. Prerequisite: permission of instructor. May not be offered 1976-77.

A. J. McNair.

Legal principles governing location of land boundaries. Historical development and methods of original land surveys. Retracement and restoration of property corners. Coordinate systems; mineral land surveys; riparian and littoral rights; environmental presentations; responsibilities of licensed surveyors.

**A661 Photogrammetry** Fall. 3 credits. 2 lec. 1 lab. Prerequisite: permission of instructor. May not be offered 1976-77.

A. J. McNair.

Terrestrial, aerial, and space photogrammetry. Photograph geometry: tilt and relief displacements; parallax distortions; control requirements; flight planning. Zeiss Stereometric Camera. Stereo plotting, relative and absolute orientation; Balplex, Wild Autographs, and Terragraph plotters. Geometry of remote sensors.

**A662 Analytic Aerotriangulation** Spring. 3 credits. 2 lec, 1 lab. Prerequisite: A661.

A. J. McNair.

Ground control types and required dispositions. Pyramid, coplanarity, and colinearity solutions for resection and orientation of single photo, stereo pair, triplet, subblock, and block assemblies. Solutions of large rectangular matrices in photogrammetry. Coordinate transformations.

**A671 Geodesy** Spring. 3 credits. 3 lec. Prerequisites: permission of instructor. May not be offered 1976-77.

A. J. McNair.

The figure of the earth and the precise determination of position on or near the earth's surface. Fundamentals of geometric geodesy, physical geodesy, satellite geodesy, and map projections.

**A685 Physical Environment Evaluation** Fall. 3 credits. 2 lec, 1 lab. Prerequisite: permission of instructor.

T. Liang.

Physical environment factors affecting engineering planning decisions: climate, soil and rock conditions, water resources. Evaluation methods; interpretation of meteorological, topographic, geologic, and soil maps, airphotos, and subsurface exploration records.

**A686 Advanced Physical Environment Evaluation** Spring. 3 credits. 2 lec, 1 lab. Prerequisite: A685 or A687.

T. Liang.

Study of physical environment by airphoto and other remote sensing methods. Conventional photography; spectral, space and sequential photography; thermal and radar imageries. Arctic, tropic, arid, and humid climatic regions. Application in projects.

**A687 Analyses and Interpretation of Aerial Photographs** Fall or spring. 3 credits. 2 lec, 1 lab. Prerequisite: permission of instructor.

Staff.

Identification of a broad spectrum of soils, rocks, and drainage conditions; significance of vegetative and cultural patterns. Specific fields of application are emphasized.

**A688 Advanced Interpretation of Aerial Photographs** Fall or spring. 3 credits. Prerequisite: A687.

T. Liang.

Lectures and team projects in laboratory and field. Facilities include material for projects in city-regional planning, soil mapping, conservation, ground and surface water, and civil engineering.

**A689 Remote Sensing** Spring. 3 credits. 2 lec. 1 lab. Prerequisite: permission of instructor.

T. Liang, W. Philipson.

Fundamentals of sensors and sensing in the electromagnetic spectrum. Emphasis is on nonphotographic forms. Coverage includes sensors, sensor and ground data acquisition, data geometry, analysis and interpretation, and mission planning.

**A691 Design Project** On demand. 1-6 credits. Staff.

Design problems, frequently associated with the Master of Engineering program.

**A692 Research** On demand. 1-6 credits. Staff.

For students who wish to study one particular area in depth. The work may take the form of laboratory investigation, field study, theoretical analysis, or development of design procedures.

**A693 Seminar** On demand. 1 credit. Staff.

Presentation and discussion of technical papers and current research in the general field or one of its specialized areas.

**A694 Special Topics** On demand. 1-6 credits. Staff.

Supervised study in small groups on one or more special topics not covered in the regular courses. Special topics may be of a theoretical or applied nature.

**A696 Seminar in Remote Sensing** Fall or spring. 1 credit per term.

T. Liang, W. Philipson.

Presentation and discussion of current research and development in remote sensing. Lectures by Cornell staff members and invited specialists from government and industry.

### Public and Environmental Systems Engineering

**B301 Economic Analysis of the Private Sector (also Econ 307)** Fall. 4 credits. Prerequisite: one year of college-level mathematics.

R. E. Schuler.

Intermediate microeconomic analysis similar to Econ 311 but emphasizing mathematical techniques. Theory of households, firms, monopoly and competitive markets, distribution and equilibrium. A liberal elective for engineers.

**B302 Economic Analysis of Government (also Econ 308)** Spring. 4 credits. Prerequisite: one year of college-level mathematics plus B301 or Econ 311.

R. E. Schuler.

Analysis of government intervention in a market economy. Public goods, public finance, cost-benefit analysis, environmental regulation, and macroeconomic topics.

**B303 Engineering Economics and Systems Analysis** Spring. 3 credits.

D. P. Loucks.

Aimed at the junior-senior level. Intended to give the student a working familiarity with the principles and main analytical techniques for reaching decisions about alternative engineering projects. Not intended for students with substantial background in business economics or methods of operations research.

**B305 Social Implications of Technology** Fall. 3 credits. Approved liberal elective. Not open to freshmen.

W. R. Lynn.

Examines selected issues pertaining to the development, implementation, and assessment of

technology. Special emphasis is given to social, political, and economic aspects of current problems that have important technological components.

**B614 Legal Methods** Fall. 3 credits. Prerequisite: permission of instructor.

N. Orloff.

An introduction to the structure and operation of our legal system. Development of legal skills, and the ability to do one's own basic legal research.

**B615 Environmental Law** Spring. 4 credits. Prerequisite: permission of instructor.

N. Orloff.

An introduction to the legal system, and how it handles environmental problems. Study of federal statutes, such as the National Environmental Policy Act, the Clean Air Act, and the Federal Water Pollution Control Act, and major judicial decisions in the environmental area.

### B616 Seminar in Technology

**Assessment** Spring. 3 credits. Prerequisite: permission of instructor.

N. Orloff.

An interdisciplinary seminar dealing with the social consequences of a future technological development and means by which technology can be guided in socially beneficial directions.

**B617 Public Systems Analysis** Fall. 3 credits.

An introduction to the philosophy, techniques, and applications of systems analysis to public sector problems in transportation, natural resources, public health, global planning, and energy-environmental quality issues.

**B693 Environmental and Water Resources Systems Analysis Colloquium** Fall or spring. 1 credit.

Staff.

Lectures in various topics related to environmental or water resources systems planning and analysis.

**B780 Environmental Control Workshop** On demand. 1-3 credits.

W. R. Lynn.

Development of research topics dealing with control of the environment (with special emphasis on biological and ecological aspects). Topics discussed in previous workshops include human population control, control of pest and parasite populations, study of species' strategic use of food supply, control of populations by use of predators, and host-parasite systems. Additional topics will be developed.

**B791 Environmental and Water Resources Systems Analysis Design Project** On demand. Credit variable. Prerequisite: permission of instructor. May extend over two semesters.

Staff.

Design of feasibility study of environmental or water resources systems, supervised and assisted by one or more faculty advisers; individual or group participation. Final report required.

**B792 Environmental and Water Resources Systems Analysis Research** On demand. Credit variable. Prerequisite: permission of instructor.

Preparation must be suitable to the investigation to be undertaken. Investigations of particular environmental or water resources systems problems.

**[B794 Special Topics in Environmental or Water Resources Systems Analysis** On demand. Credit variable. Not offered 1976-77.

Staff.

Supervised study, by individuals or small groups, of one or more specialized topics not covered in regular courses.]

### Fluid Mechanics and Hydrology

**C301 Fluid Mechanics I** Fall. 4 credits. 3 lec,

1 rec. Prerequisite: T&AM 203 (may be taken concurrently.)

J. A. Liggett.  
Hydrostatics, the basic equations of fluid flow, potential flow and dynamic pressure forces, viscous flow and shear forces, steady pipe flow, turbulence, dimensional analysis, selection of turbomachinery.

**C302 Hydraulic Engineering** Spring, 3 credits. 2 rec, 1 lab. Prerequisite: C301.

P. J. Murphy.  
Steady open channel flow, river modeling, unsteady pipe flow, theory of turbomachinery. Laboratory will include a number of experiments in hydraulic and river engineering. Field trips.

**[C609 Descriptive Hydrology** Spring, 2 credits. Intended for nonengineering majors. Prerequisite: permission of instructor. Not offered 1976-77.

W. H. Brutsaert.  
Introduction to hydrology as a description of the hydrologic cycle and the role of water in the natural environment. Topics include precipitation, infiltration, evaporation, ground water, surface runoff, floods, and droughts.]

**C615 Fluid Mechanics II** Fall, 3 credits. 3 lec. Prerequisite: C301.

P. L.-F. Liu.  
Introduction to tensor analysis: Conservation of mass, momentum, and energy from a rigorous point of view. Exact solutions of the Navier-Stokes equations. Asymptotic approximations at low and high Reynolds numbers. Similitude and modeling. Laminar diffusion of momentum, mass, and heat.

**C618 Dynamic Oceanography** Fall, 3 credits. Prerequisite: C301.

P. L.-F. Liu.  
The statics and dynamics of oceans and lakes. Currents in homogeneous and stratified bodies of water. Tidal motions. Waves in a stratified ocean.

**C620 Analytical Hydrology** Fall, 3 credits. Prerequisite: C301. May not be offered 1976-77.

W. H. Brutsaert.  
Physical and statistical analysis related to hydrologic processes. Hydrometeorology and evaporation. Infiltration and base flow. Surface runoff and channel routing. Linear and nonlinear hydrologic systems analysis. Storage routing and unit hydrograph theory.

**[C621 Flow in Porous Media and Ground Water** Spring, 3 credits. Prerequisite: C301. Not offered 1976-77.

W. H. Brutsaert.  
Fluid mechanics and equations of single-phase and multiphase flow; methods of solution. Aquifer hydraulics, pumping wells; drought flows; infiltration, ground water recharge; land subsidence; sea-water intrusion, miscible displacement; transient seepage in unsaturated materials.]

**C631 Coastal Engineering** Spring, 3 credits. Prerequisite: C301.

P. L.-F. Liu.  
Subjects in water waves and currents that are of interest to coastal and ocean engineers. Topics chosen from the following areas: small amplitude wave theory; interaction of coastal structures and waves; harbor resonance; tidal dynamics in estuaries; finite amplitude effects in shallow water waves; near-shore currents and coastal processes.

**C632 Sediment Transport and Channel Design** Spring, 3 credits. 3 lec. Prerequisite: C302.

P. J. Murphy.  
Fluid mechanics of small particles, turbulent processes in streams, erosion and deposition of sediment, sediment transport processes, canal design, river regulation.

**C641 Environmental Fluid Mechanics I** Fall, 3 credits. 3 lec. Prerequisite: C301.

P. J. Murphy.  
Natural circulation patterns in air and water, passive contaminant movement in air, surface water and ground water, thermal diffusion and buoyancy effects, pollutant dispersion applications.

**C643 Unsteady Hydraulics** Spring, 3 credits. Prerequisite: C302 or permission of instructor.

J. A. Liggett.  
The physical and mathematical basis for unsteady processes in hydraulic engineering, especially unsteady open channel flow. Water hammer, unsteady sediment transport, long waves on large bodies of water, circulation. Numerical methods of solution.

**C691 Project** On demand. Credit variable. Hours variable. Staff.

The student may elect a design problem or undertake the design and construction of special equipment in the fields of fluid mechanics, hydraulic engineering, or hydrology.

**C693 Hydraulics Seminar** Spring, 1 credit. Open to undergraduates and graduates and required of graduate students majoring in hydraulics or hydraulic engineering.

Staff.  
Topics of current interest in fluid mechanics, hydraulic engineering, and hydrology.

**C694 Special Topics in Hydraulics** On demand. Credit variable.

Staff.  
Special topics in fluid mechanics, hydraulic engineering, or hydrology.

**C742 Environmental Fluid Mechanics II** Spring, 3 credits. 3 lec. Prerequisite: C615 or equivalent.

J. A. Liggett.  
Turbulent flow theory. Effects of a stratified medium. Turbulent diffusion of momentum, mass, and heat. Approximate methods for calculating turbulent flows. Experimental and numerical models. Applications to environmental problems in streams and the atmosphere.

**C744 Experimental and Numerical Methods in Hydraulics and Hydrology** On demand. 2 credits.

P. J. Murphy.  
Methods used in planning and conducting laboratory and field experiments and in performing numerical analysis. Specific subject matter varies according to the interests of students and staff.

**C792 Research in Hydraulics** On demand. Credit variable.

Staff.  
The student may select an area of investigation in fluid mechanics, hydraulic engineering, or hydrology. The work may be of either an experimental or theoretical nature. Results should be submitted to the instructor in charge in the form of a research report.

#### Soil Mechanics and Foundations

**D301 Elements of Soil Mechanics** Spring, 3 credits. 2 lec, 1 lab.

D. A. Sangrey.  
Soil properties, permeability, principle of effective stress, compressibility, shear strength, the consolidation process. Introduction to design methods. Laboratory tests.

**D606 Engineering of Foundations and Earth Retaining Structures** Fall, 3 credits. 2 lec, one 2-hour period. Prerequisite: D301.

J. N. Kay.  
Principles of bearing capacity, stress distribution, and settlement. Soil exploration techniques; design of shallow and deep foundations; design of footing, raft, caisson, and pile foundations. Design of retaining walls, problems of construction and stability of excavations.

**D610 Engineering Properties of Soils** Fall, 3 credits. 3 lec. Prerequisite: D301. Undergraduates must have permission of instructor.

D. A. Sangrey.  
Chemical and physical nature of soils. Principle of effective stress; stress-strain relationships; shear strength and compressibility of natural geotechnical materials. Sensitivity, partial saturation, organic and frozen materials, anisotropy. Primary and secondary consolidation, permeability.

**D616 Slope Stability and Earth Dams** Spring, 3 credits. 2 lec, one 2-hour period. Prerequisite: D301.

J. N. Kay.  
Principles of stability for earth and rock slopes, earth and rockfill dam design, internal pore water pressures and drainage, instrumentation.

**[D631 Pavement Design and Construction (also Ag Engr 492)** On demand. 3 credits. 2 lec, 1 lab.

Prerequisite: D301 or permission of instructor. Not offered 1976-77. See Ag Engr 492 for course description.]

**D632 Highway Engineering (also Ag Engr 491)** On sufficient demand, usually in fall, 3 credits.

Principally directed study and individual or team investigation; one 2½-hour session arranged. Prerequisite: permission of instructor. See Ag Engr 491 for course description.

**D691 Design Project in Geotechnical Engineering** On demand. 1-6 credits.

Staff.  
Design problems frequently associated with the Master of Engineering program.

**D693 Seminar in Geotechnical Engineering** On demand. 1-2 credits.

Staff.  
Presentation and discussion of technical papers and current research in the general field of geotechnical engineering or one of its specialized fields.

**D694 Special Topics in Geotechnical Engineering** On demand. 1-6 credits.

Staff.  
Supervised study of special topics not covered in the regular courses. Special topics may be of a theoretical or applied nature.

**D712 Graduate Soil Mechanics Laboratory**

Fall, 3 credits. Prerequisite: D610.  
J. N. Kay, D. A. Sangrey.  
Laboratory measurement of soil properties. Strength and deformation tests. Permeability, compressibility, and swelling tests.

**D714 Advanced Geotechnical Engineering** Spring, 3 credits. 3 lec. Prerequisite: D606 or equivalent.

J. N. Kay.  
A review in more detail of topics covered in D606, with emphasis on recent developments in soil-structure interaction problems. Additional topics include horizontal loading of pile groups, buried conduits, and tunneling in soft ground.

**D715 Soil Dynamics** Fall, 3 credits. 3 lec. Prerequisite: permission of instructor.

D. A. Sangrey.  
Principles of vibration under harmonic and transient loading. Energy propagation by waves. The response of soils to dynamic and repeated loading and the measurement of these characteristics. Analytical models of simple foundations on elastic media, earth gravity structures, and response to earthquake loading. Analysis and design examples.

**D718 Case Studies in Geotechnical Engineering.** Spring, 3 credits. Prerequisite: D610.

D. A. Sangrey, J. N. Kay.  
Study of real engineering problems, importance of the geological environment, application of

mechanics and soil properties to obtain engineering solutions. Preparation of engineering reports.

#### D792 Research in Geotechnical Engineering

On demand. 1-6 credits.

Staff.

For students who wish to study one particular area of geotechnical engineering in depth.

#### Environmental Quality Engineering

##### E301 Environmental Quality Engineering

Spring. 4 credits. Prerequisite: C301.

Staff.

Introduction to the engineering aspects of environmental quality control. Emphasis on water quality control concepts, theory, and methods. Elementary analysis and design applicable to water supply and distribution and to wastewater and stormwater collection systems. Introduction to processes underlying water and wastewater treatment. Effects of wastewater on natural waters.

##### E602 Water Quality Control Engineering

Fall. 3 credits. 3 lec-rec. Prerequisite: E301 or permission of instructor.

Staff.

Biological, chemical, and physical fundamentals underlying water and wastewater treatment, and their application to the analysis and design of processes for the treatment of natural waters and wastewaters and for the disposal of solid and liquid residuals.

##### E603 Environmental Quality Laboratory

Spring. 3 credits. 1 lec, 2 labs. Enrollment limited to 12.

Prerequisite: E602.

V. C. Behn.

Laboratory methods in the measurement and control of environmental wastes.

##### E610 Chemistry of Water and Wastewater

Fall. 3 credits. 3 lec-rec. Prerequisite: one year of college chemistry or permission of instructor.

C. D. Gates.

Principles of physical, organic, and inorganic chemistry applicable to the understanding, design, and control of water and wastewater treatment processes and to reactions in receiving waters.

##### E611 Aquatic Chemistry

Spring. 3 credits. 3 lec. Prerequisite: E610 or Chem 287-288.

J. J. Bisogni.

Chemical equilibria in natural aquatic systems, including water and wastewater treatment systems. Chemical thermodynamics, acid-base systems, oxidation-reduction systems, coordination chemistry, solid-liquid-gas interfaces with regard to precipitation, dissolution, and adsorption. Chemical-biological interfaces in natural systems. Emphasis on phenomena, mathematical solution of chemical equilibria, and application to engineering management of water quality.

##### E613 Biological Phenomena and Processes

Fall. 4 credits.

J. J. Bisogni.

Theoretical and engineering aspects of biological phenomena and processes applicable to the removal of impurities from water, wastewater, and industrial wastes, and to their transformation in receiving waters. Biokinetic analysis and design of biological treatment processes. Pertinent laboratory studies.

##### E614 Chemical and Physical Phenomena and Processes

Spring. 4 credits.

J. J. Bisogni.

Theoretical and engineering aspects of chemical and physical phenomena and processes applicable to the removal of impurities from water, wastewater, and industrial wastes, and to their transformation in receiving waters. Analysis and design of treatment processes and systems. Residuals control and treatment. Pertinent laboratory studies.

##### [E620 Environmental Quality Control

Spring.

3 credits. 3 lec-disc. Prerequisite: senior or graduate standing. Not offered 1976-77.

Environmental pollution problems. Concepts, phenomena, and methodology fundamental to protection of the air-land-water environment. Engineering, technological, and regulatory aspects of water quality control, air quality control, and solid waste management.]

##### E630 Solid Waste Management

Spring. 3 credits. 3 lec. Prerequisite: permission of instructor.

V. C. Behn.

Study of municipal, industrial, and agricultural solid wastes. Emphasis on recovered energy and secondary materials from solid wastes. Reports.

##### E631 Industrial Waste Engineering

Spring. 3 credits. Prerequisite: knowledge of wastewater treatment.

C. D. Gates.

Sources and character of liquid, gaseous, and solid industrial wastes; their effects on receiving media. Treatment and disposal alternatives; monitoring and regulatory aspects of control. Cases studies of industrial waste problems and control in several industries, including energy production. Student papers on studies of specific waste problems.

##### E633 Environmental Quality Management

Fall; spring on demand. 3 credits (4 with approval of instructor). 2 lec-disc. For upperclass or graduate students.

L. B. Dworsky.

An introduction to environmental quality management; nature, causes, and control of environmental problems; interaction of physical, social, and cultural environments; emphasis on the interdependent social, economic, development, and environmental issues confronting society.

##### E634 Air Quality Control

Spring. 3 credits.

3 lec-disc. For upperclass or graduate students.

C. D. Gates.

An introduction to air quality and air pollution problems. Sources, nature, and effects of specific air pollutants; their dispersion and interactions in the atmosphere. Air quality standards and regulations. Control and monitoring technology.

##### E693 Environmental Quality Engineering

**Seminar** Fall or spring. 1 credit. Required of graduate students majoring or minoring in sanitary engineering. Open to undergraduates with permission of instructor.

Presentation and discussion of current topics and problems in sanitary engineering and environmental quality engineering.

##### E791 Design Project in Sanitary Engineering

On demand. Variable credit. Prerequisite: E301 or E602 or equivalent.

Staff.

The student will elect or be assigned a problem in the design of water or wastewater treatment processes or plants or wastewater disposal systems; or a laboratory project.

##### E792 Sanitary Engineering Research

On demand. Variable credit. Prerequisites will depend on the particular investigation to be undertaken.

Staff.

For the student who wishes to study a problem in greater depth than is possible in formal courses. Study may be any combination of literature, laboratory, or computational research.

##### E794 Special Topics in Sanitary Engineering

On demand. Credit variable.

Hours variable. Staff.

Supervised study in special topics not covered in formal courses.

#### Transportation

##### F620 Transportation Engineering

Fall. 3 credits.

Suitable foundation for advanced courses.

Introduction to technological, economic, and social aspects of transportation. Quantitative planning and operational models, especially for trip generation, distribution, assignment, and modal choice. Urban transportation. Institutional and policy issues. Terminals. Traffic flow theory. Traffic engineering. Human factors.

##### F621 Urban Transportation Planning I

Fall. 3 credits.

The urban transportation problem; its roots, manifestations, and implications; the systems analysis approach to transportation; the demand and supply side of transportation; the urban transportation planning process and its modeling components; generation and evaluation of alternatives. A laboratory period is designed for study-team research.

##### [F623 Urban Transportation Planning II

Spring, alternate years. 3 credits. Prerequisite: B301 and F621, or permission of instructor. Not offered 1976-77.

F. J. Cesario.

Advanced instruction in aggregate and disaggregate travel demand modeling. Emphasis is on new techniques and on directions for future research.]

##### F624 Transportation Systems Analysis

Spring. 3 credits. Prerequisite: F621, OR&IE 260, and OR&IE 320, or permission of instructor.

F. J. Cesario.

Application of optimization and simulation techniques in the analysis, planning, and design of transportation facilities for the movement of people and goods. Includes elements of traffic flow theory.

##### [F641 Airport Planning and Operations

Spring. 3 credits. Not offered 1976-77.

A. H. Meyburg.

The role of air travel within the overall transportation system, terminal access, location and site selection, terminal design and operations, metropolitan air transit systems, environmental impact of airport location, air traffic flow analysis, air traffic control, aircraft technology.]

##### F643 Design and Planning of Mass Transportation

Spring. 3 credits.

A. H. Meyburg.

A study of mass transportation of the past and present; innovative forms of mass and individual transportation in urban areas. The financing and organization of mass transportation; the "free transit" versus fares dilemma. Planning for mass transportation: special applications, implementation of plans, planning transportation in new towns.

##### F644 Transportation Systems Evaluation (Transportation Economics)

Fall. 3 credits.

Prerequisite: B301, F621, or equivalent.

F. J. Cesario.

Economic evaluation of transportation systems and facilities. Basic principles of welfare economics. Elements of benefit-cost analysis applications.

##### F645 Freight Transportation

Spring. 3 credits.

A. H. Meyburg.

Transportation planning methodology for inter- and intra-urban freight movements. Relationship to the urban transportation planning process. Problem identification, solution strategies, analysis techniques. Freight demand analysis. Alternative technologies in view of energy, efficiency, and environmental impacts.

##### F791 Transportation Design Project

On demand. Credit variable.

Staff.

Design or feasibility study of transportation systems, supervised by one or more faculty advisers. Intended primarily for students in the Master of Engineering (Civil) program. Individual or group participation.

**F792 Transportation Research** On demand.

Credit variable.

Staff.

In-depth investigation of a particular transportation planning or engineering problem mutually agreed upon between the student and one or more faculty members.

**F793 Transportation Colloquium** Fall or spring. 1 credit.

Lectures in various topics related to transportation planning and analysis.

**F794 Special Topics in Transportation** On demand. Credit variable.

Staff.

Supervised study, by individuals or small groups, of one or more specialized topics not covered in regular courses.

**Structural Engineering****G301 Structural Engineering I** Fall. 4 credits. 3 lec. One 2-hour lab. Evening exams. Prerequisite: T&AM 202.

A. H. Nilson.

Fundamental concepts of structural engineering. Behavior, analysis, design, structural planning. Loads, structural form, statically determinate analysis, approximate analysis indeterminate systems. Behavior and design of steel and concrete members.

**G302 Structural Engineering II** Spring. 4 credits. 3 lec. One 2-hour period. Evening exams. Prerequisite: G301.

R. N. White.

Fundamentals of statically indeterminate structures. Virtual work, flexibility and stiffness methods, moment distribution, applications to practical structures.

**G303 Structural Engineering III** Fall. 4 credits. Prerequisites: G302 and G351 (may be concurrent), or permission of instructor.

Continues the study of the behavior and design of steel, concrete, and timber structural elements, connections, and systems.

**G304 Structural Engineering IV** Spring. 3 credits. Prerequisite: G303.

Intended to develop an understanding of the structural design process. Comprehensive design project, drawing on material from previous courses in structures and materials.

**G305 Structural Behavior Laboratory** Spring. 2 credits. To be taken with G302 or G304.

R. N. White.

A lab course on behavior of structures, utilizing small-scale models. Elastic, inelastic, and nonlinear behavior of structural components and systems. Projects.

**G351 Engineering Materials** Fall. 3 credits. 2 lec, 1 lab.

F. O. Slate.

Engineering properties of concrete, steel, wood, and other structural materials. Design characteristics and significance of test results of materials used in engineering works. Extensive laboratory testing and report writing.

**G610 Fundamentals of Engineering Mechanics** Fall. 3 credits. Prerequisite: G303 (may be taken concurrently).

R. H. Gallagher.

Theory of elasticity, energy principles, plate flexure, failure theories, inelastic stress-strain relationships.

**G612 Advanced Structural Analysis** Fall. 3 credits. Prerequisites: G302, computer programming. Direct stiffness and flexibility methods in matrix formulation, use of standard analysis programs, error detection, substructuring, and special analysis procedures.**G614 Structural Model Analysis and Experimental Methods** Fall. 3 credits. 2 lec, 1 lab.

R. N. White.

Dimensional analysis and similitude. Model materials, fabrication, loading, and instrumentation techniques. Experimental stress analysis.

**G652 Advanced Plain Concrete** Spring. 3 credits. 2 lec, conf. Prerequisite: G351 or equivalent.

F. O. Slate.

Topics such as history of cementing materials, air entrainment, light-weight aggregates, petrography, durability, chemical reactions, properties of aggregates, and construction. Relationships among internal structure, physical properties, chemical properties, and mechanical properties.

**[G653 Structure and Properties of Materials**

Spring, alternate years. 3 credits. 2 lec, conf. For graduate students in engineering or physical sciences, or undergraduates by permission of instructor. Not offered 1976-77.

F. O. Slate.

Internal structure from amorphous to crystalline state. Forces holding matter together versus forces causing deformation and failure. Correlation of internal structures with physical and mechanical properties. Applications to various engineering materials.]

**[G654 Low-cost Housing Primarily for Developing Nations** Spring, alternate years. 3 credits. 2 lec, conf. Not offered 1976-77.

F. O. Slate.

A multidisciplinary course. Students do intensive study, usually in their own discipline, for a term project, while also being introduced to problems and approaches of other disciplines. Engineers investigate the technological aspects of the subject and other aspects that influence technological decisions, such as cultural and economic factors. Typical technological aspects are indigenous materials, structural systems, construction, maintenance, and effects of the physical environment. Coverage is from agrarian-rural to industrial-urban.]

**[G655 Low-Cost Housing for Developing Nations—Workshop for Physical Planning, Site Selection, and Design** Spring, alternate years. 3 credits. Prerequisite: permission of instructor. Not offered 1976-77.

F. O. Slate.

For a mixed class of advanced civil engineering and architecture students. Discussions and workshops on physical planning, site selection, choice of materials, and detailed design of individual structures and groupings.]

**[G690 Planning of Structural Systems** Fall. 3 credits. Prerequisite: G302. Recommended for seniors planning to enter M.Eng. (Civil) program. Not offered 1976-77.

T. Pekoz.

Functional, structural, and other considerations in the planning and selection of structural systems. Probabilistic description of loading and strength. Preliminary design—estimating overall dimensions and weights, proportioning of members and joints—and optimization. Preliminary analysis of frames, trusses, plates, and shells. Erection, construction, and stress control considerations. Computer structural analysis. Case studies with the participation of practicing engineers.]

**G693 Structural Engineering Seminar** Fall or spring. 1 credit. Open to qualified seniors and graduate students.

Presentation of topics of current interest in the field of structures.

**[G711 Stability: Elastic and Inelastic.** Spring. 3 credits. Not offered 1976-77.

T. Pekoz.

Analysis of elastic and plastic stability. Determination of buckling loads and postbuckling behavior of

columns. Solid and open web columns with variable cross section. Beam columns. Frame buckling. Torsional-flexural buckling. Lateral buckling of beams. Buckling loads and postbuckling behavior of plates, shear webs, and cylindrical shells. Critical discussion of current design specification.]

**G713 Finite Element Analysis** Spring. 3 credits. Prerequisite: G610 and G712.

R. H. Gallagher.

Theoretical and conceptual bases for finite elements in structural mechanics. Development of element relationships and system solution techniques for analysis of bars, beams, planar structures, solids, plates, and shells.

**[G715 Probabilistic Concepts in Structural Engineering** Spring, alternate years. 3 credits.

Prerequisite: G303. Not offered 1976-77. Probabilistic models, reliability, inference, decision analysis, design codes, second moment approaches.]

**G716 Prestressed Concrete Structures** Spring. 3 credits. 3 lec. Prerequisite: G303; G304 recommended.

A. H. Nilson.

Behavior, analysis, design of pretensioned and posttensioned prestressed concrete structures. Partial prestressing. Strength, serviceability, structural efficiency of beams, slabs, tension and compression members, frameworks, bridges.

**G717 Advanced Reinforced Concrete** Fall. 3 credits. 3 lec. Prerequisite: G303; G304 recommended.

A. H. Nilson.

Behavior, analysis, design of reinforced concrete structures. Strength, safety, serviceability, structural efficiency. Beams, columns, slabs, frameworks, composite members, ground-supported slabs, shear walls, deep beams, folded plates.

**G718 Advanced Design of Metal Structures** Fall. 3 credits. Prerequisite: G303.

W. McGuire.

Behavior and design, with emphasis on the design of single-story frames, plate girders, trusses, and plate structures. Behavior of connections.

**G719 Advanced Behavior of Metal Structures** Spring. 3 credits. Prerequisite: G303.

W. McGuire.

Behavior of beams, beam-columns, and single- and multistory frames. Torsion and combined torsion and flexure. Design specifications. Cold-formed structures. Fatigue and fracture.

**[G720 Shell Theory and Design** Fall. 3 credits. Not offered 1976-77.

Fundamentals of practical shell theory. Differential geometry of surfaces; membrane and bending theory of shells; analysis and design of cylindrical shells, polygonal domes, and paraboloids.]

**G722 Structural Design for Dynamic Loads** Spring. 3 credits.

P. Gergely.

Analysis, design, and behavior of structures subjected to dynamic effects, with emphasis on earthquake-resistant design.

**G732 Optimum Structural Design** Fall, alternate years. 3 credits.

R. H. Gallagher.

Design of minimum weight or cost structures. Includes fully-stressed design, classical minimization procedures, and mathematical programming methods.

**[G733 Numerical Methods in Structural Engineering** Spring, alternate years. 3 credits.

Prerequisite: G610 and G712. Not offered 1976-77.

J. F. Abel.

Numerical techniques for structural and geotechnical

engineering, such as residual, variational, finite-difference, and finite-element methods. Selected numerical analysis topics and solution algorithms with emphasis on linear equations and eigenvalue problems.]

#### G757 Civil and Environmental Engineering

**Materials Project** On demand. 1-3 credits.

F. O. Slate.

Individual projects or reading and study assignments involving engineering materials.

#### G791 Design Project in Structural Engineering

Fall or spring. Credit variable. Coregistration in G690 during fall term required.

Meets project requirement for M.Eng. students who cannot enroll in K510-K511.

**G792 Research in Structural Engineering** On demand. Credit variable.

Hours variable. Staff.

Pursuit of a branch of structural engineering further than can be done in regular courses. Theoretical or experimental investigation of suitable problems.

#### G794 Special Topics in Structural Engineering

On demand. Credit variable.

Hours variable. Staff.

Individually supervised study, or independent design or research, in specialized topics not covered in regular courses.

#### Water Resources Planning and Analysis

##### H615 Water Resources Problems and Policies

Fall. 3 credits. Lec-disc. Prerequisite: permission of instructor. Intended primarily for graduate engineering and nonengineering students but open to qualified upperclass students.

L. B. Dworsky.

Historical and contemporary perspectives of water problems, organization, and public policies.

##### H616 Water Resources Planning Seminar

Spring. 3 credits. Prerequisite: H615 or permission of instructor.

L. B. Dworsky.

The concepts, processes, and techniques of regional, multipurpose river-basin planning and development. The case study method, including the preparation of an integrated, comprehensive report for the study area.

##### H625 Groundwater Systems

Spring. 3 credits. Prerequisite: B303 or OR&IE 320.

R. Willis.

Planning and management of groundwater resource systems using simulation and optimization methods. The parameter identification problem and the use of numerical techniques (finite differences and finite elements) in subsurface hydrology. Conjunctive management of ground and surface water systems.

##### H626 Water Quality Modeling

Spring. 3 credits. Prerequisite: Math 294.

C. A. Shoemaker, D. A. Haith.

Predictive models of the behavior of biological and chemical substances in bodies of water and in surface runoff.

##### H627 Optimization Methods for Water Quality Management

Fall. 3 credits. Prerequisites: B303, OR&IE 320; Ag Engr 475.

R. Willis, C. A. Shoemaker.

Application of optimization techniques (linear, nonlinear, and dynamic programming) for regional water quality management. Development of mathematical programming models for treatment-plant design, investment planning, river-basin planning and parameter estimation.

##### H628 Surface Water Systems

Spring. 3 credits. Prerequisite: any introductory course in systems analysis.

D. P. Loucks, D. A. Haith, R. Willis.

Development and application of economics, engineering, and mathematical optimization and simulation models to multipurpose, multiobjective river-basin planning. Review of current literature. See also course listings above under Public and Environmental Systems Engineering.

#### Professional Practice

##### K502 Civil and Environmental Engineering Practice

On demand. 3 credits. For seniors and graduate students.

Analysis of large engineering works using case studies. Project organization, planning, feasibility, finances. Social and political implications.

##### K510 Civil and Environmental Engineering Design Project I

Fall. 2 credits. Normally required for students in the M.Eng. (Civil) program.

School faculty and visiting engineers. Design of major civil engineering project. Planning and preliminary design in fall term; final design in January intersession (K511).

##### K511 Civil and Environmental Engineering Design Project II

Spring. (work done during January intersession). 3 credits. Normally required for students in the M.Eng. (Civil) program. Prerequisite: K510.

School faculty and visiting engineers. Continuation of K510.

##### K520-521 Professional Practice in Engineering

K520, fall; K521, spring. 3 credits per term. Required for students in the M.Eng. (Civil) program.

Introduction to nontechnical aspects of engineering practice: legal, financial, social, and ethical aspects; personnel management; communications; professional organizations.

##### K531 Engineering Ethics

Spring. 3 credits. For candidates for the professional Master of Engineering (Civil) degree, and others with permission of instructor.

Introduction to ethical issues arising in the discharge of the professional engineer's obligations to clients and to the public. Systematic analysis of the implications of these issues in realistic engineering situations. Topics to be selected from the literature and from the experience of engineers and of students.

##### K801 Thesis

A thesis research topic is selected by the student with the advice of the faculty member in charge, and is pursued either independently or in conjunction with others working on the same topic. Registration for credit must be done with the professor at the start of each term.

## Computer Science

G. Salton, chairman; G. Andrews, R. L. Constable, R. W. Conway, A. Demers, J. E. Dennis, Jr., J. Donahue, D. Gries, S. P. Han, J. Hartmanis, J. E. Hopcroft, R. Teitelbaum, C. F. Van Loan, J. H. Williams.

At Cornell computer science is concerned with fundamental knowledge in automata, computability, programming languages, and systems programming, as well as with subjects (such as numerical analysis and information processing) which underlie broad areas of computer applications. Because of the wide implications of research in the field, the Department of Computer Science is organized as an intercollege department in the College of Arts and Sciences and the College of Engineering.

### Bachelor of Science

#### College Program in Computer Science

Although the department teaches a comprehensive

set of undergraduate courses, there is no undergraduate field program in computer science in the College of Engineering. To major in computer science the student may utilize the College Program leading to the degree of Bachelor of Science (see the introductory section under College of Engineering for a description of the College Program).

### Master of Science and Doctor of Philosophy

Programs in the graduate Field of Computer Science are described in the *Announcement of the Graduate School and Graduate Study in Engineering and Applied Science*.

### Description of Courses

#### 100 Introduction to Computer Programming

Fall or spring (first 8 weeks only). 2 credits. S-U grades optional. 2 lec, 1 rec (optional), 3 evening quizzes.

Elementary introduction to programming using PL/I language. An essentially nonmathematical treatment. See 106.

#### 101 Survey of Computers

Spring. 3 credits. S-U grades optional. 3 lec.

Overview of computer capability, programming, and applications. Discussion of implications of computer technology for society. Simple, nonmathematical programming examples.

#### 102 Introduction to FORTRAN Programming

Fall or spring (weeks 1 to 5 only). 1 credit. S-U grades optional.

Elementary programming concepts. Laboratory problems using FORTRAN IV language.

#### 104 Introduction to APL Programming

Fall or spring (weeks 6 to 9 only). 1 credit. S-U grades only. Introduction to interactive terminal computing using the APL language.

#### 106 Mathematical Applications of Computing

Fall or spring (weeks 9 to 14). 1 credit. S-U grades optional. 2 lec.

A continuation of 100, intended for students in engineering or quantitative sciences. Includes an introduction to FORTRAN.

#### 211 Computers and Programming

Fall or spring. 3 credits. 2 lec, 1 lab, 2 evening quizzes.

Prerequisite: 100 or equivalent programming experience.

Intermediate programming in PL/I: procedures, block structure, on conditions, recursion. Introduction to basic data structures and program analysis. Programming assignments for a variety of applications.

#### 280 Discrete Structures

Fall. 3 credits. 3 lec.

Prerequisite: 211 or permission of instructor. Mathematical aspects of programming and computing. Induction, logical proof, and discrete structures used in programs. Introducing functions, relations, homomorphisms, partially ordered sets, and Boolean algebras and concepts from automata and computability theory.

#### 305 The Computerized Society

Fall. 3 credits. 2 lec-seminars.

The economic, political, and cultural impact of computers and computer-related technology. The cashless society, systems approach to social problems, law enforcement, political campaigns, data banks and privacy, education, machine creativity, and machine intelligence.

#### 314 Introduction to Computer Systems and Organization

Fall or spring. 4 credits. 2 lec, 1 lab.

Prerequisite: 211 or equivalent. Logical structure of digital computers: representation of information, addressing mechanisms, storage and peripheral hardware, the input-output channel,

interrupts. Assembly language programming and macros. Brief description of the assembly process, loaders, operating systems.

### 321-322 Introduction to Numerical Analysis

321, fall; 322, spring. 4 credits per term. 3 lec. Prerequisites: Math 222 or 294 and knowledge of a programming language such as FORTRAN, ALGOL, or PL/I.

Students solve representative problems by programming appropriate algorithms. Numerical methods for systems of linear equations, eigenvalues, interpolation, differentiation, least squares, Chebyshev solution to discrete and continuous systems, and integration. Numerical solution of differential equations and nonlinear equations in several variables.

### 410 Data Structures and Programming Languages

Fall. 4 credits. 3 lec. Prerequisite or concurrent registration: 314.

Data structures and programming languages specially designed for their manipulation. Arrays and APL, lists and LISP, strings and SNOBOL. Trees, queues, stacks, multilinked structures, and their representations. Dynamic storage allocation and memory management. Searching and sorting methods.

### 414 Systems Programming and Operating Systems

Spring. 4 credits. 3 lec. Prerequisite: 314 or permission of instructor.

The logical design of systems programs with emphasis on multiprogrammed operating systems. Input-output methods, interacting processes, storage management, sharing, file systems. Case studies. Project to implement a small system.

### 481-482 Introduction to Theory of Computing I, II

481, fall; 482, spring. 4 credits per term. 3 lec. Prerequisites: 211 and 280 or equivalent mathematics, or permission of instructor.

Introduction to modern theory of computing. Covers automata theory, formal languages, effective computability, computational complexity, analysis of algorithms.

### 490 Independent Reading and Research

Fall or spring. 1, 2, 3, or 4 credits. Independent reading and research for undergraduates.

### 611 Advanced Programming Languages

Fall. 4 credits. 3 lec. Prerequisite: 410 or equivalent. Formal specification of programming languages, including LISP, ALGOL 60, and PL/I. Principles of structure and design and recent developments in programming languages, including ALGOL 68. Introduction to program schemata and semantics and their application in classifying and comparing programming languages.

### 612 Translator Writing

Spring. 4 credits. 3 lec. Prerequisite: 410 or permission of instructor. Discussion of the models and techniques used in the design and implementation of compilers. Topics include lexical analysis in translators, compilation of arithmetic expressions and simple statements, specifications of syntax, algorithms for syntactic analysis, code generation and optimization techniques, bootstrapping methods, translator writing systems.

### 613 Operating Systems Principles

Fall. 4 credits. 3 lec. Prerequisites: 414 and 611 or permission of instructor. Advanced techniques and models of operating systems. Synchronization of concurrent processes. Deadlock. Process nuclei. Dynamic memory allocation. Models of paging algorithms and program behavior. Scheduling: queuing models and deterministic models. Protection and security.

### 615 Machine Organization

Spring. 4 credits. 3 lec. Prerequisite: 314 or permission of instructor. Not offered 1976-77.]

### 616 Operations Research Models for Computer and Programming Systems

4 credits. 2 lec. Prerequisites: 611 and a course in probability (e.g. Math 371 or OR&IE 660) or permission of instructor. Not offered 1976-77.]

### 618 Picture Processing

Spring. 4 credits. 3 lec. Prerequisite: 611 or permission of instructor. Not offered 1976-77.]

### 621-622 Numerical Analysis

621, fall; 622, spring. 4 credits per term. 3 lec. Prerequisites: Math 411 and knowledge of a programming language such as FORTRAN, ALGOL, or PL/I, or permission of instructor. A more thorough treatment of the material of 321-322, at a faster pace, and covering additional topics. Emphasis on algorithms appropriate for use with computers.

### 632 File Processing (also OR&IE 682)

Fall. 4 credits. 2 lec. Prerequisite: 211. Concerned with problems of design, implementation, and operation of database systems.

### 635 Information Organization and Retrieval

Spring. 4 credits. 2 lec. Prerequisite: 410 or equivalent. Introduction to information retrieval. File organization and search algorithms. Statistical analysis and automatic classification of information. Structural language analysis. Dictionary techniques. Interactive retrieval. Questioning and answering and data base retrieval. Evaluation of retrieval effectiveness.

### 641 Mathematical Symbol Manipulation

Spring. 4 credits. Prerequisites: 410 and some knowledge of discrete mathematics (e.g., 280, 481, or Math 431). Not offered 1976-77.]

### 681 Theory of Algorithms and Computing I

Fall. 4 credits. 3 lec. Prerequisite: 482 or permission of instructor. Computational models, measures of complexity, analysis of algorithms, arithmetic complexity, lower bounds, reducibilities, polynomial complete problems.

### 682 Theory of Algorithms and Computing II

Spring. 4 credits. 3 lec. Prerequisite: 481 or permission of instructor. Advanced treatment of theory of computation and computational complexity theory.

### 709 Computer Science Graduate Seminar

Fall or spring. 1 credit. 1 seminar. For graduate students interested in computer science. Staff, visitors, and students. A weekly meeting for the discussion and study of important topics in the field.

### 711 Theory of Programming Languages

Spring, odd-numbered years. 4 credits. 2 lec. Prerequisites: 611 and 481. Advanced topics in formal semantics. Topics may include mathematical semantics, program verification systems, application of formal semantics to language design, variable-free languages, correctness of implementations.

### 712 Theoretical Aspects of Compiler Construction

Spring. 4 credits. 2 lec. Prerequisites: 612 and 481. Formal methods of syntactic analysis including precedence, bounded context, and LR techniques. General parsing methods and their time-space complexity. Noncanonical parsing techniques. Formal methods of object code optimization.

719 Seminar in Programming Fall or spring. 4 credits. 1 seminar. Prerequisite: 611 or permission of instructor.

### 721 Solutions of Nonlinear Equations and Nonlinear Optimization Problems

Fall. 4 credits. Prerequisite: 622 or permission of instructor. Emphasis on the rigorous analysis of practical numerical algorithms for nonlinear problems. Sample topics are: nonlinear functional analysis, constrained and unconstrained minimization, and computationally convenient modifications of Newton's method, including quasi-Newton and penalty function methods and nonlinear least squares.

### 723 Numerical Solution of Ordinary Differential Equations and Integral Equations

Fall. 4 credits. Prerequisite: 622 or permission of instructor.

### 725 Numerical Solution of Partial Differential Equations

Spring. 4 credits. Prerequisite: 622 or permission of instructor. Hours to be arranged. General classification, solution by method of characteristics, finite-difference methods for hyperbolic and elliptic equations, parabolic equations in two dimensions, direct solution of elliptic finite-difference equations, iterative methods for the solution of elliptic equations, block methods for large systems, singularities in elliptic equations, stability in relation to initial value problems, and nonlinear discretization algorithms.

### 727 Introduction to Approximation Theory

Spring. 4 credits. Prerequisite: 622 or permission of instructor.

### 729 Seminar in Numerical Analysis

Fall or spring. 4 credits. Prerequisite: permission of instructor.

### 733 Selected Topics in Information Processing (also OR&IE 789)

Fall. Credit and hours to be arranged. Prerequisite: 733.

### 739 Seminar in Information Organization and Retrieval

Fall or spring. 4 credits. Prerequisite: 635.

781 Advanced Theory of Computing Fall, alternate years. 4 credits. Prerequisites: 681 and 682, or permission of instructor.

At instructor's discretion, advanced topics, possibly including automata, computability, computational complexity, program schemata, semantics, and analysis of algorithms.

### 782 Advanced Theory of Computing

Spring, alternate years. 4 credits.

### 789 Seminar in Automata Theory

Fall or spring. 4 credits. 1 seminar. Prerequisite: permission of instructor.

### 790 Special Investigations in Computer Science

Fall or spring. Prerequisite: permission of a computer science adviser. Independent research.

### 890 Special Investigations in Computer Science

Fall or spring. Prerequisite: permission of a computer science adviser. Master's degree research.

### 990 Special Investigations in Computer Science

Fall or spring. Prerequisite: permission of a computer science adviser. Doctoral research.

## Electrical Engineering

G. C. Dalman, director; J. L. Rosson, associate director; P. D. Ankrum, J. M. Ballantyne, T. Berger, H. D. Block, R. Bolgiano, Jr., N. H. Bryant, R. R. Capranica, H. J. Carlin, V. W. S. Chan, L. F. Eastman, W. H. Erickson, D. T. Farley, T. L. Fine, J. Frey, M. C. Kelley, M. Kim, W. H. Ku, C. A. Lee, R. L. Liboff, S.

Linke, R. A. McFarlane, H. S. McGaughan, P. R. McIsaac, J. A. Nation, B. Nichols, R. E. Osborn, E. Ott, C. Pottle, L. B. Spencer, R. N. Sudan, C. L. Tang, R. J. Thomas, J. S. Thorp, H. C. Torng, N. M. Vrana, C. B. Wharton, G. J. Wolga.

## Bachelor of Science

Reflecting the large scope of this engineering discipline, the undergraduate Field Program in Electrical Engineering provides a broad foundation in a number of important areas in addition to specialization in one or more.

Students can choose, for example, to concentrate in bioengineering; computer engineering; control systems; electronic circuit design; information, communications, and decision theory; microwave electronics; plasma physics; power and energy systems; quantum and optical electronics; radio and atmospheric physics; or semiconductor devices and applications.

Required courses are included in the following general curriculum for the field program:

Term 5	Credits
Elec E 311, Analysis of Electrical Systems I	4
Elec E 313, Electromagnetic Fields and Waves	4
Elec E 220, Electrical Laboratory I	3
Liberal studies elective	3
Technical or free elective	3
Term 6	
Elec E 312, Analysis of Electrical Systems II	4
Elec E 314, Electromagnetic Fields and Waves	4
Elec E 316, Electrical Laboratory II	4
Liberal studies elective	3
Technical or free elective	3
Term 7	
Elec E 401, Random Signals in Systems*	4
Elec E 411, Quantum Theory and Applications*	4
Elec E elective with laboratory	3 or 4
Liberal studies elective	3
Technical or free elective	3
Term 8	
Elec E elective with laboratory	3 or 4
Elec E elective	3 or 4
Elec E elective	3 or 4
Liberal studies elective	3
Technical or free elective	3

\*Upon petition to the Faculty Committee, a student may be allowed to substitute an appropriate technical course for one of these required courses.

Specialization is achieved through the four senior-year electrical engineering electives, which are selected from more than sixty offerings of the school. With the approval of his or her faculty adviser, a student with special career goals may substitute appropriate technical or professional electives for two electrical engineering electives.

A brochure describing the field program and concentrations in detail may be obtained from the School of Electrical Engineering, Phillips Hall.

## Master of Engineering

The degree of M.Eng. (Electrical) prepares the student either for professional work in this area of engineering or for more advanced graduate study in the doctoral program. The M. Eng. differs from the M.S. program mainly in its emphasis, which is on design capability rather than research. The thirty-credit M.Eng. (Electrical) curriculum includes two two-term course sequences in electrical engineering and the design project, which gives three to twelve credits. General admission and degree requirements are described in the introductory section under College of Engineering.

## Master of Science and Doctor of Philosophy

Descriptions of the M.S. and Ph.D. degree programs are given in the *Announcement of the Graduate School and Graduate Study in Engineering and Applied Science*.

### Description of Courses

**210 Introduction to Electrical Systems** Fall or spring. 3 credits. 3 lec-rec. Prerequisites: Math 192 and Phys 112.

An engineering core science. See description under Division of Basic Studies.

**220 Electrical Engineering Laboratory I** Fall. 3 credits. 2 lec, 1 lab. Prerequisite: 210.

An experimental introduction to basic electrical measuring techniques and instruments, electronic devices, and circuits. Design of practical analog and digital circuits. Use of integrated circuits.

**230 Introduction to Digital Systems** Fall or spring. 3 credits. 2 lec, 5 lab experiments.

An engineering core science. See description under Division of Basic Studies.

**311 Analysis of Electrical Systems I** Fall. 4 credits. 3 lec, 1 rec. Prerequisites: 210 and Math 294 or equivalent.

Kirchhoff laws and network equations, topological methods in circuit analysis. Concept of state; state analysis of linear systems. Transient and steady-state response of networks to exponential excitations, impedance, and transfer functions.

**312 Analysis of Electrical Systems II** Spring. 4 credits. 3 lec, 1 rec-computing session. Prerequisite: 311.

Fourier series (response of linear systems to periodic excitation). Fourier integral (response of linear systems to aperiodic excitation), the convolution integral (time domain response) application to modulation methods, the single- and double-sided Laplace transform. Fast Fourier transforms.

### 313-314 Electromagnetic Fields and Waves

313, fall; 314, spring. 4 credits a term. 3 lec, 1 rec-computing session. Prerequisites: Phys 213 and 214 and Math 294, or equivalent.

Foundations of electromagnetic theory for static and dynamic fields, with applications to energy storage, propagation, and radiation. Topics will include Maxwell's equations, solution of electrostatic problems by separation of variables, Poynting's theorem; plane waves in isotropic dielectrics and conductors, energy in dispersive media, reflection and refraction of plane waves; transmission lines, waveguides, cavities; plane waves in anisotropic dielectrics; radiation and antennas. At the level of *Fields and Waves in Communication Electronics* by Ramo, Whinnery, and Van Duzer.

**316 Electrical Laboratory II** Spring. 4 credits. 2 lec, 1 lab. Prerequisites: 220 and 313.

Laboratory studies of solid-state phenomena and devices; experiments illustrating the use of the digital computer in electrical engineering; laboratory studies of high-frequency phenomena and devices; an introduction to ac and dc machinery.

**401 Random Signals in Systems** Fall. 4 credits. 3 lec, 1 rec-computing session. Prerequisite: 312 or equivalent.

Description of random signals and analysis of randomly excited systems. An introduction to the concepts of probability, random variables, expectation, random processes, and power spectra. Applications are drawn from the areas of communication, control, and pattern classification.

**411 Quantum Theory and Applications** Fall. 4 credits. 3 lec, 1 rec-computing session.

Prerequisites: 313-314 or equivalent.

Introductory quantum mechanics with particular emphasis on those concepts and results necessary for understanding modern solid-state and quantum electronic devices. The mechanics of the theory will be presented in terms of wave functions, operators, and solutions of Schrodinger's equation.

### 430 Introduction to Lasers and Optical

**Electronics** Spring. 4 credits. 2 lec, 1 lec-rec, 1 lab. Prerequisite: 314 (or equivalent such as A&EP 355 or 356) and 411 (or equivalent such as Phys 443).

G. J. Wolga.

An introduction to stimulated emission devices such as masers, lasers, and optical devices based on linear and nonlinear responses to coherent fields. Material discussed, based on quantum mechanical results; will employ phenomenological theories and will stress applications to modern devices.

**432 Solid-State Physics and Applications** Spring. 4 credits. 3 lec, 1 rec.

Prerequisite: 411 or permission of instructor.

L. F. Eastman.

Concepts: crystal structure, lattice, reciprocal lattice, X-ray diffraction, strains, sound waves, phonons in crystals, band theory, effective mass, electrons and holes, metals, insulators, semiconductors. Carrier transport in semiconductors (high electric field), dielectrics, and superconductors. Devices: junction diodes, transistors, lasers, solar cells, Gunn and avalanche diodes.

### 480 Thermal and Statistical Physics for

**Engineers** Spring. 3 credits. Prerequisite: 411 or equivalent.

R. Liboff.

Thermodynamic principles. Elementary theory of transport coefficients. Electrical noise. Quantum and classical statistics. Black body radiation. Thermal properties of solids. Elementary descriptions of the p-n junction, shock waves, superfluidity, superconductivity, and the laser.

### 499 Fundamentals of Acoustics (also T&M

**666)** Spring. 3 credits. 3 lec, biweekly lab.

See T&M 666 for course description.

**531-532 Electronic Circuit Design** 531, fall; 532, spring. 4 credits fall; 3 or 4 credits spring. 3 lec, 1 lab. Prerequisite: 316.

N. H. Bryant.

Design techniques for circuits used in electronic instrumentation. Circuits will be designed to provide specific functions, then constructed and tested in the laboratory. At the level of *Electronics for Scientists* by Malmstadt et al.

**551 Electrical Machinery I** Fall. 3 credits. 2 lec, 1 lab-computing session. Prerequisite: staff permission.

Practical dc and ac magnetization. Construction, parameters, measurements, and prediction of operating characteristics of high-efficiency and instrument transformers. Dc machines: heating, rating, operating characteristics, applications, controls, transfer functions, etc.

**552 Electrical Machinery II** Spring. 3 credits.

2 lec, 1 lab-computing session. Prerequisite: staff permission.

Theory, analysis, characteristics, operation, and applications of polyphase synchronous and asynchronous machines. Single-phase motors. Selsyn and other specialized machines.

**581 Wave Phenomena in the Atmosphere** Fall. 3 credits. 3 lec-rec. Prerequisites: 312 and 314.

R. Bolgiano.

An elementary treatment of wave phenomena in the atmosphere of the earth, including gravity waves, planetary waves, acoustic waves, radiowaves, and plasma waves; attention is directed to the role of these phenomena in various atmospheric processes and engineering problems such as weather, diffusive

transport, air-sea interaction radio communication, and remote sensing.

**582 Radio Engineering** Spring, 3 credits. 3 lec-rec. Prerequisites: 314 and 401.

Electrical systems for communications, control, detection, and other purposes in which radiowaves play a central role: system functions, including generation, modulation, transmission, reception, and demodulation; guidance, radiation, and propagation of radiowaves, including transmission lines and waveguides, antenna systems, and the effects of atmospheric inhomogeneity; system design problems.

**591-592 Senior Project** 591, fall; 592, spring. 3 credits.

Individual study, analysis, and, usually, experimental tests in connection with a special engineering problem chosen by the student after consultation with the faculty member directing his project; an engineering report on the project is required.

**621 Introduction to Biomechanics, Bioengineering, Bionics, and Robots (also T&AM 681)** See T&AM 681 for course description.

**623 Active and Digital Network Design** Fall, 3 or 4 credits (4 credits with lab). 3 lec, 1 lab. Prerequisite: 312.

W. H. Ku.  
Design of passive filters and matching networks. Active filter design using operational amplifiers. Design of transistor amplifiers. Digital signal processing. Z-transform and discrete Fourier transform (DFT). Design of nonrecursive and recursive digital filters. Fast Fourier transform (FFT) algorithms.

**624 Computer Methods in Electrical Engineering** Spring, 4 credits. Prerequisite: 311.

C. Pottle.  
Modern techniques for solving electrical engineering problems on the digital computer. Emphasis on efficiency and numerical stability rather than on theoretical implications. Solution of linear and nonlinear algebraic equations; integration; solution of ordinary differential equations; random number generators. Applications to power systems, control systems, communication systems, and circuit design.

**625 Computer-Aided Network Design** Fall, 4 credits. Prerequisite: 312.

C. Pottle.  
A study of algorithms for the analysis and design of electrical circuits on a digital computer. Frequency and time domain analysis of linear circuits. Dc and transient analysis of nonlinear circuits. Tolerancing and sensitivity calculations. Matrix methods for large circuit problems. Sparse matrix techniques. Modern numerical integration techniques. Introduction to optimization and other design methods.

**626 Bioelectric Systems** 3 credits (optional 1 hour lab by permission). 3 lec. Prerequisite: 312 or Bio Sci 326 or 423.

M. Kim.  
Application of electrical systems techniques to biological problems. Electrical activity of nerve cells; generation and propagation of nerve impulse; voltage clamp technique and its use in phase-plane analysis; neuromuscular systems; synaptic transmission; models of nerve cell, sensory receptors, and encoding in nervous system; analysis of electrophysiological data; electrodes and instrumentation techniques.

**627 Fundamentals of Linear Networks** Fall, 4 credits. 3 lec. Prerequisite: 312.

H. Carlin.  
Scattering and generalized network formalisms with applications. Nonreciprocal and active network properties. Applications of Tellegen's theorem. Passive and active network invariants applied to gain and stability problems.

**628 Network Theory and Applications** Spring, 4 credits. 3 lec. Prerequisite: 312.

H. Carlin.  
Circuit properties in complex frequency domain. Insertion loss design of lumped and microwave filters and equalizers, and linear phase structures. Gain bandwidth theory for broadband matching and wideband amplifiers.

**631-632 Semiconductor Electronics I and II** 631, fall; 632, spring. 4 credits per term. 3 lec, 1 lab. Prerequisite: 220 or equivalent.

P. D. Ankrum.  
Band theory of solids; properties of semiconductor materials; the physical theory of p-n junctions, metal semiconductor contacts, and p-n junction devices; fabrication and properties of semiconductor devices such as diodes and rectifiers, light-sensitive and light-emitting devices, field-effect and bipolar transistors, unijunction transistors, p-n-p-n devices (diodes, controlled rectifiers, and switches), integrated circuits, etc.; device equivalent-circuit models; the applications of semiconductor devices as active or passive elements in discrete-component and integrated circuits for use as power supplies, power controls, amplifiers, oscillators and multivibrators, pulse circuits, gates and switches, etc.; transistor noise. At the level of *Semiconductor Electronics* by Ankrum.

**633 Solid-State Microwave Devices and Subsystems I** Fall, 3 credits. 2 lec, 1 lab.

Prerequisite: 314.  
Theoretical and experimental studies of circuits, amplifiers, oscillators, detectors, receivers, and electrical noise at microwave frequencies. Typical topics: one- and two-port resonators; negative resistance amplifiers; oscillator load characteristics, locking and stabilization; microwave transistor amplifiers; resistor and shot noise; noise temperature, fm noise.

**634 Solid-State Microwave Devices and Subsystems II** Spring, 3 credits. 2 lec, 1 lab.

Prerequisite: 314.  
Basic theories of solid-state devices at microwave frequencies. Specific devices studied: varactors, avalanche diodes; transferred electron diodes; pnp oscillator diodes; tunnel diodes; pin diodes; and microwave transistors. Studies of experimental methods of characterizing these devices include use of H.P. network analyzer and other microwave equipment.

**635 Circuit Design for Integration** Fall, 3 credits.

2 lec, 1 lab. Prerequisite: permission of instructor.  
Concepts of design and analysis of digital and linear circuits to be realized in silicon integrated circuit technology. Circuit design as both limited and facilitated by technology. Bipolar logic systems (ECL, TTL, and  $I^2L$ ); MOS and CMOS logic systems, RAM and ROMs, and bipolar linear ICs, such as op amps and D/A converters. At the level of current papers in the *IEEE Journal of Solid-State Circuits*.

**636 Integrated Circuit Technology** Spring, 3 or 4 credits. 2 lec, 1 lab. Prerequisite: MS&E 262 or permission of instructor.

Integrated circuit techniques applicable in the fields of computer hardware, telecommunication systems, and optoelectronics, with emphasis on device technology. Diffusion, oxidation, ion implantation; limits on device performance and device design, both MOS and bipolar. Compound semiconductors. At the level of current papers in *IEEE Trans. on Electron Devices*.

**651-652 Electric Energy Systems I and II** 651,

fall; 652, spring. 4 credits per term. 3 lec-rec, 1 lab-computing session. Fall prerequisite: 316 or 210 and permission of instructor.

S. Linke.  
Engineering principles underlying operation of

modern electric power systems under steady-state and transient conditions emphasizing major power-system parameters. Digital computer used as dynamic "laboratory" model of complex power systems for load-flow, fault, stability, and economic-dispatch studies. At the level of *Elements of Power System Analysis* (3rd ed.) by Stevenson.

**661 Coding Algorithms** Fall, 3 or 4 credits (4 with lab). 3 lec, 1 lab. Lab prerequisite: FORTRAN, PL/I, or assembly language.

Coding algorithms for compression and storage of information and correction of errors in data processing and transmission. Design, analysis, and implementation of underlying codes. Linear block codes, maximum likelihood decoding, linear sequential machines, cyclic codes, BCH codes, burst error protection. Lab consists of computer simulation, modification, and evaluation of algorithms covered in lecture. At the level of *Error Correcting Codes* by Peterson and Weldon.

**662 Fundamental Information Theory** Spring, 3 or 4 credits (4 with lab). 3 lec, 1 lab. Prerequisite: 401 or equivalent. Prerequisite for lab only: 661 with lab.

Fundamental results of information theory with applications to data storage, compression, and transmission. Source codes, entropy, and other information measures. Channel capacity, rate-distortion functions, and Shannon's theorems. Gaussian channels. Lab projects investigate problems of statistical source and channel characterization via computer simulation and evaluate the coding algorithms introduced in 661.

**663 Statistical Aspects of Communication**

Spring, 4 credits. 3 lec, 1 rec. Prerequisite: 401.  
Analysis of analog and digital communication systems in the presence of random noise. Optimum filtering for smoothing and prediction. Time and frequency multiplex systems. Signal design for digital transmission. Optimum receiver design, error bounds for digital systems.

**664 Decision Making in Pattern Classification**

Spring, 3 or 4 credits. Prerequisite: 401 or equivalent.

T. Fine.  
Concepts and key results of decision theory will be developed and applied to problems of pattern classification (hypothesis testing). The design philosophies to be discussed include those of minimum expected loss, Neyman-Pearson, and minimax risk and regret. Laboratory projects, if elected, will require the computer-based design and simulation of pattern classifier.

**666 Optical Communication Systems** Spring,

alternate years only. 3 credits. Prerequisite: 401 or equivalent.  
The characterization, analysis, optimization, and design of optical communication systems. Models will be developed for transmitters, channels, and receivers. The effect of quantum noise on the fundamental limits of the performance of optical systems will be discussed. Topics include: models of free space, atmospheric and guided wave channels, stochastic models for detectors, receivers, and quantum communication theory.

**671-672 Feedback Control Systems** 671, fall;

672, spring. 3 credits per term (4 with lab). Prerequisite: 312 or permission of instructor.  
System performance specifications. Analysis of linear feedback control systems by root locus and frequency response methods. Classical cascade and feedback compensation techniques. State space approach; controllability, observability, infinite-interval optimal-control problem, parameter optimization, state variable feedback. Nonlinear feedback systems; stability by Nyquist, Lyapunov, and Popov conditions. Circle conditions. Limit cycle behavior by describing function techniques. Sampled-data systems and digital compensation. Laboratory work consists of familiarization with system frequency

response measurements, transfer function measurements, and transient response measurements; also, design and compensation of linear positional and speed control systems, analysis of nonlinear systems and sampled-data systems. Emphasis is on correlation of theoretical and experimental results.

**674 Hybrid Computation** Spring. 4 credits. 2 lec, 1 lab. Prerequisites: 311 and 675 or equivalent with permission of instructor.

N. M. Vrana.  
Design, characteristics, programming, and applications of hybrid computer systems; iterative procedures, steepest descent, parameter optimization. The laboratory work will be with the PDP-11/TR-48 hybrid computer system.

**675 Switching Circuits and Logic Design** Fall. 3 credits (4 with lab). 3 lec, 1 lab. Prerequisite: 210 or equivalent.

N. M. Vrana.  
Boolean algebra, combinational circuits, sequential circuits, fault detection. Application of principles to the design of digital circuits. Laboratory makes use of TTL integrated circuit chips.

**676 Computer Structures** Spring. 3 credits (4 with lab). Prerequisite: 675 or Compr Sci 314. Lab in 675 is prerequisite for lab in 676.

N.M. Vrana.  
Organization and design of digital computers, arithmetic hardware, I/O systems. Three laboratory groups combine efforts to design and build an 8-bit digital computer.

**677 Computer Architecture and Design I** Fall. 4 credits. Prerequisite: 676.

H. C. Torng.  
The sequence emphasizes the design principles and methodology of computers. Topics: implications and impacts of technologies, memory hierarchy, virtual memories, evaluation and modeling of memories, microprogramming, microprocessors, processor organizations, trade-offs between performance and cost.

**678 Computer Architecture and Design II** Spring. 4 credits. Prerequisite: 677.

H. C. Torng.  
Continuation of 677. Topics: I/O processing, evaluation and modeling of processors, interconnection studies, parallel processing, multiprogramming and multiprocessing, novel computer organizations, teleprocessing and computer networks, performance evaluation, reliability studies.

**680 Elementary Plasma Physics and Gas Discharges** Spring. 3 credits. 2 lec, 1 lab. Prerequisite: 314 or equivalent.

C. B. Wharton.  
Coordinated lectures and ten experiments. Discharges, arcs, reflex discharge. Positive column, collisions, diffusion, breakdown, sheaths. Langmuir probes. Electromagnetic waves, plasma oscillations, space-charge waves, cyclotron harmonic radiation.

**681 Introduction to Plasma Physics (also A&EP 606)** Fall. 3 credits. 3 lec. Prerequisite: 313, 314 or equivalent. Open to fourth-year students at discretion of instructor.

R. N. Sudan.  
Plasma state; motion of charged particles in fields; collisions, coulomb scattering; transport coefficients, ambipolar diffusion, plasma oscillations and waves; hydromagnetic equations; hydromagnetic stability and microscopic instabilities; test particle in a plasma; elementary applications.

**682 Advanced Plasma Physics (also A&EP 607)** Spring. 3 credits. 3 lec. Prerequisite: 681.

R. N. Sudan.  
Boltzmann and Vlasov equations; Chew-Goldberger-Low theory; waves in hot plasmas;

Landau damping. Micro-instabilities; effects of collisions and Fokker-Planck terms; method of dressed test particles; high-frequency conductivity and fluctuations; neoclassical toroidal diffusion, relativistic beams.

**683 Electrodynamics** Fall. 4 credits. 3 lec. Prerequisites: 312, 314.

Maxwell's equations, electromagnetic potentials, integral representations of the electromagnetic field. Special theory of relativity. Radiation of accelerated charges, Cerenkov radiation. Optional topics: electrodynamics of dispersive dielectric and magnetic media; elementary quantum electrodynamics, second quantization, interaction of electromagnetic fields with atoms. At the level of *Classical Electrodynamics* by Jackson.

**684 Microwave Theory** Spring. 4 credits. 3 lec. Prerequisites: 312, 314.

P. McIsaac.  
Theory of passive microwave devices. Homogeneous and inhomogeneous waveguides. Nonreciprocal waveguide devices. Scattering matrix analysis of multiport junctions, resonant cavities, directional couplers, isolators, circulators. Periodic waveguides. At the level of *Introduction to the Theory of Microwave Circuits* by Kurokawa.

**685-686 Upper Atmosphere Physics I and II**

685, fall; 686, spring. 3 credits per term. 3 lec.  
Physical processes in the earth's ionosphere and magnetosphere, the solar corona, and the solar wind. Diagnostic techniques including radar and in situ observations; production, loss, and transport of charged particles in the ionosphere and magnetosphere; airglow, tides, winds, and gravity waves; electric fields generated by the solar wind and winds in the neutral atmosphere and their effects on transport processes; the equatorial and auroral electrojets; instabilities in space plasmas; structure of the solar corona and solar wind and their interaction with the magnetosphere; acceleration and drift of energetic particles in the magnetosphere; precipitation of particles and the aurora; magnetic and ionospheric storms.

**687 Electromagnetic Wave Propagation I** Fall. 3 credits. 3 lec.

Some aspects of antenna theory; diffraction; refraction and ducting in the troposphere; propagation of radiowaves and cold plasma waves in the ionosphere and magnetosphere; Alfvén, whistler mode, and hybrid waves; the CMA diagram; WKB solutions of the coupled wave equations.

**688 Electromagnetic Wave Propagation II** Spring. 3 credits. 3 lec.

Full-wave solutions of the wave equations; interactions between particles and waves; scattering of radio waves from random fluctuations in refractive index; scatter propagation; incoherent scatter from the ionosphere and its use as a diagnostic tool; radio star and satellite scintillations and their use as diagnostic tools; radar astronomy.

**689 The Earth's Electric Field** 3 credits.

Prerequisite: 313 or equivalent. Offered alternate years only. Open to qualified seniors and graduate students.

M. Kelley.  
Electric fields are created in the atmosphere and near space region of the earth via interaction between the solar wind and the earth's magnetic field, large scale motion of the upper atmosphere and meteorological processes. These fields will be studied as will measurement techniques and the mapping of fields from one region to another.

**690-699 Special Topics in Electrical Engineering** 1-3 credits.

Seminar, reading course, or other special arrangement agreed upon between the students and faculty members concerned.

**721 Theory of Linear Systems** Fall. 4 credits.

Prerequisite: 401 or permission of instructor.  
The state-space model for linear systems. Fundamental and transition matrices. Matrix exponential functions, the Cayley-Hamilton theorem, and the Jordan form. Forced network and system response. Controllability, observability, stability, realizability. Applications of Fourier, Laplace, Hilbert Transforms. Paley-Wiener theorem. At the level of *System Theory* by Padulo and Arbib.

**722 Theory of Nonlinear Systems** Spring. 4 credits. 3 lec. Prerequisite: 721.

W. H. Ku.  
Analysis of nonlinear systems with applications. Phase-plane analysis; singular points, limit cycles, and equilibrium states. Stability of nonlinear systems; the methods of Lyapunov and Popov; circle criteria. Forced nonlinear systems; periodic systems, Floquet theory, Mathieu-Hill theory; applications to the stability of nonlinear and parametrically excited systems.

**731 Quantum Electronics I** Fall. 4 credits. 3 lec, 1 rec-computing session. Prerequisites: 313, 314, and 411 or Phys 443.

C. L. Tang.  
A detailed treatment of the physical principles underlying lasers and masers, related fields, and applications. Topics will include: a review of quantum mechanics and the quantum theory of angular momentum, the interaction of radiation and matter, the quantum mechanical density matrix and macroscopic material properties, theory of the laser and maser.

**732 Quantum Electronics II** Spring. 4 credits. 3 lec, 1 rec-computing session. Prerequisite: 731 or permission of instructor.

R. A. McFarlane.  
A continuation of 731. Topics will include: optical resonators; output power of amplifiers and oscillators; dispersive effects and laser oscillation spectrum; Lamb theory; spectroscopy of atoms, molecules, and ions in crystals as examples of laser media; survey of chemical and dye lasers; noise in optical devices; principles of electro-optic and parametric devices.

**733 Opto-Electronic Devices** Fall. 4 credits. 3 lec, 1 rec. Prerequisite: 411 and 432 or equivalent.

Aimed at providing an understanding of physical properties of solids that affect use in optical devices. Wave propagation in lossy, anisotropic, layered, and electro-optic media; microscopic and band-theoretic models for dielectric constant and loss; carrier transport, scattering and trapping; photoconductivity; electro-optics, photoemissive and photoconductive devices; noise in optical detectors.

**734 Theory and Applications of Nonlinear Optics** 4 credits. 3 lec, 1 rec. Prerequisite: 731 or 733 or equivalent of Phys 572.

C. L. Tang.  
Recent developments in the theory and applications of nonlinear optics and related electro-optic devices. Topics include: properties and theories on nonlinear optical processes; nonlinear and electro-optic properties of III-IV and II-VI compounds and other optical materials; optical mixing; spontaneous and stimulated processes involving nonlinear interactions of electromagnetic waves, phonons, and molecular vibrations.

**735 Solid-State Devices I** Fall. 4 credits. 3 lec. Prerequisite: 432 or equivalent.

C. A. Lee.  
Band structure, statistics, ambipolar transport, generation-recombination, p-n junction analysis, semiconductor contacts, secondary ionization, and noise are topics covered on a level sufficient for understanding current device research. Emphasis is on relating basic electronic properties to device performance. Term paper.

**736 Solid-State Devices II** Spring. 4 credits.

3 lec. Prerequisite: 735 or equivalent.

C. A. Lee.

General treatment of time dependence of secondary ionization, the simpler "Quasi-Static" approximation, and accumulation layer-domain analysis of transferred electron effect materials are given in context of designing avalanche and TE effect microwave diodes and broadband junction photomultipliers. Term paper.

**738 Physics of Solid-State Devices** Spring, 2-3 credits. 2 lec. Prerequisite: 736 or equivalent. Basic theory of electron and hole scattering in semiconductors. Examination of methods for obtaining high electric field solutions for the distribution function from the Boltzmann equation. Hot electron phenomena reviewed with emphasis on band-structure induced instabilities.

**761-762 Random Processes in Electrical Systems** 761, fall; 762, spring, 4 credits per term. 3 lec.

V. Chan.

The concepts of randomness and uncertainty and their relevance to the design and analysis of electrical systems. An axiomatic characterization of random events. Probability measures, random variables, and random vectors. Distribution functions and densities; Functions of random vectors. Expectation and measures of fluctuation. Moments and probability inequalities. Properties and applications of characteristic functions. Modes of convergence of sequences of random variables: laws of large numbers and central limit theorems. Kolmogorov consistency conditions for random processes. Poisson process and generalizations. Gaussian processes. Covariance stationary process, correlation functions, spectra; Bochner and Wiener-Khinchin theorems. Continuity, integration, and differentiation of sample functions. Optimum filtering and prediction. Spectral representation, orthogonal series representations. Markov chains and processes. Linear and nonlinear transformations of random processes.

**763 Advanced Topics in Information Theory** Fall, 4 credits. 3 lec. Prerequisites: 662 and either 761 or Math 571, or permission of instructor. An in-depth treatment of an information theory research area. The topic varies from year to year and will be chosen from the following subjects: source encoding (rate distortion theory), convolutional codes and sequential decoding, multiterminal communication networks, ergodic theory and information, and complexity and instrumentability of coding schemes.

**764 Foundations of Inference and Decision Making** Spring, 3 credits. 3 lec. Prerequisite: a course in probability and some statistics, or permission of instructor.

T. Fine.

An examination of methods for characterizing uncertainty and chance phenomena and for transforming information into decisions and optimal systems. Discussion of the foundations of inference includes: comparative probability; quantitative probability; relative frequency interpretations; computational complexity; randomness; classical probability and invariance; induction; subjective probability.

**771 Estimation and Control in Discrete Linear Systems** Fall, 4 credits. 3 lec. Prerequisite: 401 or permission of instructor.

Optimal control, filtering, and prediction for discrete time linear systems with extensive use of the APL/360 system. Approximation on discrete point sets. The principle of optimality. Kalman filtering. Stochastic optimal control.

**772 Optimal Control and Estimation for Continuous Systems** Spring, 4 credits. 3 lec. Prerequisite: 771 or permission of instructor. Control system design through parameter

optimization, with and without constraints. The minimum principle; linear regulators, minimum time and minimal fuel problems. Computational techniques; properties of Lyapunov and Riccati equations.

**[773 Random Processes in Control Systems** Spring, 4 credits. 3 lec. Prerequisites: 762 and 772. Not offered 1976-77.

Prediction and filtering in control systems: Gaussian-Markov process, prediction problem, stochastic optimal and adaptive control problems. Control of systems with uncertain statistical parameters, stochastic differential equations, optimal nonlinear filtering; stability of control systems with random parameters.]

**781 Kinetic Theory (also A&EP 761)** Fall, alternate years, 3 credits. 2 lec. Prerequisite: Phys 561, 562 or permission of instructor.

R. L. Liboff.

Theory of the Liouville equation. Prigogine and Bogoliubov analysis of the BBKGY sequence. Master equation, density matrix, Wigner distribution. Derivation of fluid dynamics. Transport coefficients. Boltzmann, Krook, Fokker-Planck, Landau, and Balescu-Lenard equations. Properties and theory of the linear Boltzmann collision operator. Chapman-Enskog and Grad methods of solution of the Boltzmann equation. Klimontovich formulation. At the level of *Introduction to the Theory of Kinetic Equations* by Liboff.

**782 Nonlinear Phenomena in Plasma Physics** Fall, 3 credits. Corequisite: 682.

(1) Coherent nonlinear processes (echoes, trapped particles, solitary waves, shocks, and parametric instabilities); (2) statistical theories of plasma turbulence (quasilinear theory, wave kinetic equations, the random phase approximation, resonant mode-mode coupling, nonlinear Landau damping, strong turbulence, and anomalous transport). Applications to controlled fusion and space plasmas.

**791-792 Electrical Engineering Colloquium** 791, fall; 792, spring, 1 credit per term. For students enrolled in the graduate Field of Electrical Engineering.

Lectures by staff, graduate students, and visiting authorities. A weekly meeting for the presentation and discussion of important current topics in the field.

**793-794 Electrical Engineering Design** 793, fall; 794, spring, 3 credits per term. For students enrolled in the M.Eng. (Electrical) degree program. Utilizes real engineering situations to present fundamentals of engineering design.

**795-799 Special Topics in Electrical Engineering** 1-3 credits. Seminar, reading course, or other special arrangement agreed upon between the students and faculty members concerned.

## Geological Sciences

J. E. Oliver, chairman; J. M. Bird, A. L. Bloom, J. L. Cisne, B. L. Isacks, D. E. Karig, S. Kaufman, R. W. Kay, G. A. Kiersch, W. B. Travers, D. L. Turcotte.

### Bachelor of Science

Study in geological sciences is offered for students who are preparing for careers in solid earth science, for those who want a broad background in the geological sciences as preparation for careers in other fields, or for those who wish to combine geological training with other sciences such as agronomy, astronomy and space science, biological sciences, chemistry, economics, mathematics, physics, or various fields of engineering. The

Department of Geological Sciences is organized as an intercollege department in the College of Arts and Sciences and the College of Engineering. College of Arts and Sciences students should consult the section on geological sciences given under that college as well as the course listing here.

In the College of Engineering, students interested in entering the Field Program in Geological Sciences follow the Basic Studies program for the first two years. It is recommended that Geol Sci 101 and 102, Chem 208, and, for those students interested in geobiology, Bio Sci 101-102 and 103-104 be taken as electives during this period. The upperclass curriculum is as follows:

Term 5	Credits
Geol Sci 355	4
Geol Sci 376	4
Required science course	3 or 4
Liberal elective	3
Technical or free elective	3 or 4
Term 6	
Geol Sci 356	4
Geol Sci 325	4
Required science course	3 or 4
Liberal elective	3
Geol Sci 704	6
or	
Technical or free elective	3 or 4
A summer field course is required unless approval for an alternative field experience is granted.	
Term 7	
Geol Sci 345	4
Required science course	3 or 4
Liberal elective	3
Technical or free elective	3 or 4
Term 8	
Geol Sci 388	4
Required science course	3 or 4
Liberal elective	3
Technical or free elective	3 or 4
Free elective	3 or 4

Students intending to specialize in *geophysics* should select their *required sciences* from the following courses or their equivalents: Math 421-422-423, Applicable Mathematics; T&AM 310-311, Advanced Engineering Analysis I and II; A&EP 355, Intermediate Electromagnetism; A&EP 333, Mechanics of Particles and Solid Bodies; A&EP 356, Intermediate Electrodynamics; A&EP 434, Continuum Physics; Phys 410, Advanced Experimental Physics; T&AM 450, Introduction to Continuum Mechanics.

Students intending to specialize in *geochemistry* (including petrology, mineralogy, and mineral deposits) should select their *required sciences* from the following courses or their equivalents: Chem 300, Introductory Quantitative Analysis; Chem 301, Experimental Chemistry I; Chem 302, Experimental Chemistry II; Chem 303, Experimental Chemistry III; Chem 357-358, Introductory Organic Chemistry; Chem 389-390, Physical Chemistry I and II; Chem 410, Inorganic Chemistry; MS&E 331, Structure and Properties of Materials; MS&E 335, Thermodynamics of Condensed Systems.

Students intending to specialize in *geobiology* should select their *required sciences* from the following courses or their equivalents: Bio Sci 310, Invertebrate Zoology; Bio Sci 330-331, Principles of Biochemistry; Bio Sci 245, Plant Biology; Bio Sci 448, Plants and Time (paleobotany); Bio Sci 360, General Ecology; Bio Sci 274, The Vertebrates; Bio Sci 477, Organic Evolution; Bio Sci 281, Genetics; Chem 253, Elementary Organic Chemistry; Geol Sci 471, Invertebrate Paleontology.

Students who wish to pursue further training or immediate employment in *applied geology* (environmental engineering geology, mineral exploration and exploitation, ground water, petroleum geology, or geological engineering) should select

their *required sciences* from the following courses or their equivalents, with two of four from the same field: Agron 301, Identification, Appraisal and Geography of Soils; Agron 701, Soil Chemistry; Agron 607, Soil Physics; C&EE D301, Elements of Soil Mechanics; C&EE D610, Engineering Properties of Soils; C&EE A685, Physical Environment Evaluation; MS&E 331, Structure and Properties of Materials; MS&E 446, Mechanical Properties of Materials; C&EE C301, Fluid Mechanics I; C&EE C302, Hydraulic Engineering; C&EE E301, Environmental Quality Engineering; Math 421–422–423, Applicable Mathematics; OR&IE 260, Introductory Engineering Probability; OR&IE 370, Introduction to Statistical Theory with Engineering Applications.

Students who want a more general background, or who wish to remain uncommitted with regard to specialty, must choose at least two of the four required science courses from the same field, and all four required science courses must be at the 300 level or above. The technical electives may be chosen from offerings in geological sciences or in other science or engineering fields, and may be courses also approved as required sciences. Outstanding students may request substitution of an honors thesis for a fourth-year technical elective.

Students intending to pursue graduate study in geology are reminded that many graduate schools require proficiency in reading the scientific literature in one or two of the three languages French, German, or Russian. Undergraduate preparation in at least one of these languages is therefore advantageous.

## Master of Science and Doctor of Philosophy

The Department of Geological Sciences maintains a number of strong interdisciplinary research programs. The curriculum is designed to accommodate students who have no introductory education in geology but are otherwise well qualified. A strong background in mathematics and the basic sciences is recommended. Descriptions of the program are given in the *Announcement of the Graduate School and Graduate Study in Engineering and Applied Science*.

## Description of Courses

The courses in geological sciences are listed under the following headings: *Freshman and Sophomore Courses*; *Junior, Senior, and Graduate Courses*; and *Field Courses*.

### Freshman and Sophomore Courses

**101 Introductory Geological Sciences** Fall or spring. 3 credits. 2 lec, 1 lab. Evening exams.

W. B. Travers, fall; J. M. Bird, spring.  
Earth processes, features, and history. Basic knowledge for more specialized courses or a major in geological sciences. Materials, structure, and internal condition of the earth, and the physical and chemical processes at work. Earth history, evolution of continents, oceans, mountain systems, and other features; development of animals and plants.

**102 Introduction to Historical Geology** Spring. 3 credits. 2 lec, 1 lab. Evening exams. Prerequisite: 101 or permission of instructor.

J. L. Cisne and staff.  
A continuation of 101. History of the earth and life in terms of evolutionary processes. The geologic record, its formation, and interpretation of earth history. Introduction to the evolution of life and to fossils and their use in reconstructing past environments and dating rocks.

**131 Geology and the Environment** Fall. 3 credits. 2 lec, 1 lab. Field trips.

G. A. Kiersch.  
The principles of geological science, with emphasis on the physical phenomena and rock properties as they influence the natural environments of man.

**241 Regional Landforms** Fall. 3 credits. (See

243, Regional Landforms Laboratory.) 3 lec. Prerequisites: none, but profitably follows 101 or 102. A. L. Bloom.

Geomorphic provinces of North America and selected overseas regions. Geologic basis of regional scenery for nongeologists. National and state parks and major airline and interstate highway routes emphasized. Goal is intelligent appreciation of geologic environments.

**243 Regional Landforms Laboratory** Fall. 1 credit. (To be taken concurrently with 241.) 1 lab.

A. L. Bloom.  
Map and aerial photo analyses of outstanding scenic regions. Ecologic and resource evaluation of scenery.

**262 Mineral and Energy Resources and the Environment** Spring. 3 credits. 2 lec, 3 disc.

Reading assignments, term projects. G. A. Kiersch.  
Occurrence, location, and scientific principles underlying the availability of mineral and energy resources of today and tomorrow. Limitations on utilization imposed by economic and environmental factors, hazards, patterns of usage, and industrial development. Relation to national and international policy and conservation.

### Junior, Senior, and Graduate Courses

Of the following, the core courses 325, 345, 355–356, 376, and 388 may be taken by those who have successfully completed 101–102 or the equivalent, or who can demonstrate to the instructor that they have adequate preparation in mathematics, physics, chemistry, biology, or engineering.

**325 Structural Geology and Sedimentation**

Spring. 4 credits. 3 lec, 1 lab. Prerequisite: 101 or permission of instructor.

W. B. Travers.  
Nature, origin, and recognition of geologic structures. Behavior of geologic materials. Geomechanical and tectonic principles applied to the solution of geologic problems. Introduction to the sedimentary and hydraulic processes and petrology of sedimentary rocks. Description, classification, provenance, transportation, diagenesis, and depositional environment of sediments.

**344 Geological Oceanography** Spring. 3 credits.

3 lec. Training cruise, depending on ship availability. Prerequisite: 102 or Bio Sci 461.

A. L. Bloom, D. E. Karig.  
Shoreline erosion, transportation, and deposition; origin and structure of continental shelves and ocean basins. Geologic processes and geomorphic development in the marine environment.

**345 Geomorphology** Fall. 4 credits. 2 lec, 1 lab.

Prerequisite: 102 or permission of instructor. A. L. Bloom.  
Description and interpretation of land forms in terms of structure, process, and stage.

**355 Mineralogy, Petrology, and Geochemistry I**

Fall. 4 credits. 2 lec, 1 lab. Assigned problems and readings; field trips. Prerequisite: 102 or permission of instructor.

R. W. Kay.  
Megascopic and optical properties, chemistry, and petrogenetic significance of rock-forming minerals. Principles of phase equilibria as applied to igneous and metamorphic systems. Description, classification, chemistry, photography, origin, and regional distribution of igneous and metamorphic rocks. Geochemical distribution of trace elements and isotopes in igneous and metamorphic systems.

**356 Mineralogy, Petrology, and Geochemistry II**

Spring. 4 credits. 2 lec, 1 lab. Assigned problems and readings; field trips.

R. W. Kay.  
A continuation of 355.

**376 Historical Geology and Stratigraphy** Fall. 4 credits. 2 lec, 2 labs. Additional assigned problems.

J. L. Cisne.  
Application of geologic principles to interpretation of earth history; development of the geologic column, geochronology, and geochronometry; correlation and the zone concept; sedimentary environments and provinces; geosynclines and platforms; problems of the pre-Cambrian and continental evolution.

**388 Geophysics and Geotectonics** Spring. 4 credits. 3 lec, 1 lab. Prerequisites: Math 112 and Phys 208 or equivalent.

B. L. Isacks, J. E. Oliver.  
Global tectonics and the deep structure of the solid earth as revealed by investigations of earthquakes, earthquake waves, the earth's gravitational and magnetic fields, and heat flow.

**410 Experiments and Techniques in Earth Sciences**

Spring. 2 credits. Prerequisites: Phys 207–208 and Math 191–192 or equivalents, or permission of instructor.

S. Kaufman.  
Lab and field experiments chosen in accordance with students' interests and designed to familiarize them with instruments and techniques used in earth sciences. Independent work is stressed.

**423 Petroleum Geology** Fall. 3 credits. 3 lec,

1 lab. Field trip. Recommended prerequisite: 325. W. B. Travers.

Sedimentation and tectonics as conditions of hydrocarbon entrapment. Problems of petroleum exploration, including geophysical investigations, subsurface mapping, the movement of underground fluids, and the geophysical properties of subsurface fluids and sediments. Organization and operation of the petroleum industry; on-shore and off-shore exploration and production techniques.

**424 Tectonics of Orogenic Zones; Modern and Ancient** Spring. 3 credits. 1 lec. Prerequisite: permission of instructors.

D. E. Karig, W. B. Travers.  
A comparative study of island arcs and mountain ranges.

**428 Geomechanics** Spring. 3 credits. 3 lec.

Prerequisites: Math 240 or 296; 101. D. E. Karig, D. L. Turcotte.

Use of mathematical analysis to explain such geological observations as ocean ridges—their thermal structure, elevation, heat flow, and gravity; ocean trenches—the structure and mechanics of the bending lithosphere; folding—buckling, viscous and plastic flow; faulting—a detailed mechanical and geological study of the San Andreas fault; intrusives—geothermal power.

**436 Rock Deformation** Spring. 3 credits. 3 lec.

Prerequisite: 325. G. A. Kiersch.  
Review of stress analysis and behavior of materials, both the rock mass and sample. Fundamentals of deformation pertaining to the crustal rocks and the problems of geological sciences.

**[461 Mineral Deposits: Metals]** Fall. 4 credits. 2 lec, 1 lab. Assigned problems and readings; field trip. Prerequisite: 356 or permission of instructor. Not offered 1976–77.]

**[462 Mineral Deposits: Nonmetals]** Spring. 4 credits. 3 lec, 1 lab. Field trips. Prerequisite: 461 or permission of instructor. Not offered 1976–77.]

**471 Invertebrate Paleontology** Fall. 4 credits. 2 lec, 2 labs. Prerequisites: 102; invertebrate zoology recommended.

J. L. Cisne.  
Paleobiology and classification of important fossil invertebrates. Problems of evolution. Use of organisms in reconstructing past environments.

**483 Marine Tectonics** Fall. 3 credits. 2 lec. Possible field trips. Prerequisites: 325 and a course in physics or geophysics.

D. E. Karig.  
Study of geophysical and geological characteristics of the earth's crust beneath the oceans. Review of strengths and limitations of marine exploratory techniques. Emphasis on recent geologic data concerning plate margins in the ocean, especially the island arc systems.

**485 Physics of the Earth I** Fall. 3 credits. 2 lec, 1 lab. Open to upperclass engineers, majors in the physical sciences, and others by permission of instructor.

D. L. Turcotte.  
Rotation and figure of the earth, gravitational field, seismology, geomagnetism, creep and anelasticity, radioactivity, earth's internal heat, continental drift, and mantle convection.

**488 Introduction to Geophysical Prospecting** Fall. 3 credits. 2 lec. Prerequisites: Phys 112-213 and Math 191-192, or equivalents, or permission of instructor.

S. Kaufman.  
Physical principles, instrumentation, operational procedures, and interpretation techniques in geophysical exploration for oil, gas, and minerals. Seismic reflection, seismic refraction, gravity, and magnetics methods of exploration.

**490 Senior Thesis** Fall or spring. 1 credit. Staff.

**632 Exploration Geology** Spring. 3 credits. 2 lec, 1 lab. Prerequisite: field geology and, usually, graduate standing.

G. A. Kiersch.  
Methods of exploration and appraisal of geologic data from both field and laboratory investigations. Assessment of environmental geology and the presentation of direct and indirect information for professional purposes.

**[633 Environmental/Engineering Geology: Theory** Fall. 3 credits. 2 lec, 1 lab. Field trips. Prerequisite: 325; 355-356 and 345 recommended. G. A. Kiersch. Not offered 1976-77.]

**635 Engineering Geology: Practice** Fall, alternate years. 3 credits. 2 lec, 1 lab. Field trips. Prerequisites: 633 or 325, 355-356, and 345. Offered 1976-77.

G. A. Kiersch.  
Geological principles applied to the planning, design, construction, and operation of engineering works. Case histories, analysis and evaluation of physical environmental factors, remedial treatment. Reports.

**642 Glacial and Quaternary Geology** Spring. 3 credits. 2 lec, 1 lab. Several Saturday field trips. Prerequisite: 345 or permission of instructor.

A. L. Bloom.  
Glacial processes and deposits and the stratigraphy of the Quaternary.

**673 Stratigraphy** Fall. 3 credits. 2 lec, 1 additional hour to be arranged. Prerequisite: 376. J. M. Bird.

Principles of stratigraphy, developed by detailed study of selected American and European systematic examples.

**681 Geotectonics** Fall. 4 credits. 2 lec. Prerequisite: permission of instructor.

J. M. Bird.  
Theories of orogeny; ocean and continent evolution. Kinematics of lithosphere plates. Rock-time assemblages of modern oceans and continental margins, and analogs in ancient orogenic belts. Time-space reconstructions of specific regions. Problems of dynamic mechanisms—corollaries and evidence from crustal features.

**685 Advanced Geophysics I** Fall. 3 credits. 3 lec. Prerequisite: 388 or 485.

D. L. Turcotte.  
Mantle convection, heat flow, the driving mechanism for plate tectonics, the energy balance, definition of the lithosphere.

**686 Advanced Geophysics II** Spring. 3 credits. 3 lec. Prerequisite: 388 or 485.

A. Kuckes.  
Gravity, figure of the earth, earth tides, magnetism, magnetic anomalies, origin of the earth's magnetic field.

**[687 Seismology I** Fall, alternate years. 3 credits. 3 lec-rec. Prerequisite: T&AM 611 or equivalent. Not offered 1976-77.

B. L. Isacks, J. E. Oliver.  
Generation and propagation of elastic waves in the earth. Derivation of the structure of the earth and the mechanism of earthquakes from seismological observations.]

**[688 Seismology II** Spring, alternate years. 3 credits. Prerequisite: 687. Not offered 1976-77. B. L. Isacks, J. E. Oliver. A continuation of 687.]

**690-699 Seminars and Special Work** Fall and spring. 2 credits per term. Prerequisite: permission of instructor.

Advanced work on original investigations in geological sciences.

**690:** Structural geology, sedimentation, and tectonics. W. B. Travers.

**691:** Petrology and Geochemistry. R. W. Kay.

**692:** Coastal geomorphology and Pleistocene geology. A. L. Bloom.

**693:** Environmental-engineering geology, geomechanics, and hydrogeology. G. A. Kiersch.

**694:** Geophysics, seismology, gravity, magnetism, heat flow, geotectonics. B. L. Isacks, D. E. Karig, S. Kaufman, J. E. Oliver, D. L. Turcotte.

**695:** Invertebrate paleontology and paleoecology. J. L. Cisne.

**696:** Mineral deposits and resources. Staff.

**697:** Environmental problems. W. B. Travers.

**698:** Marine geology. D. E. Karig.

**699:** Plate tectonics and geology. J. M. Bird.

#### Field Courses

**[601 Intersession Field Trip** 1 credit. Prerequisites: 101-102 or equivalent and permission of instructor. Not offered 1976-77.

A trip of one week to ten days in an area of interesting geology in the lower latitudes. Travel and subsistence expenses to be determined. Interested students should contact the instructor during the early part of the fall semester.]

**602 Introductory Field Geology** Spring. 1 credit. Weekend trips and 2 labs; times to be arranged. Prerequisites: one introductory course in geology and 325, or permission of instructor.

W. B. Travers.  
Techniques of field mapping, using selected localities in southern New York and vicinity. Use of Brunton compass, field descriptions of rock types, identification and field use of fossils, and description of land forms. Construction of detailed and regional geologic maps, cross sections and columnar sections. Emplacement of rocks and their subsequent geologic history.

**704 Western Field Course** Spring. 6 credits. Weekly lec and a 38-day trip to California, Nevada,

and Utah. Prerequisites: four courses in Geo Sci at the 300 level, and permission of instructor.

W. B. Travers.  
A comparative study of California Coast Range, Sierra Nevada, Basin and Range of Nevada, and Uinta Mountains, Utah. Pretrip seminars and extensive reading at Cornell. Study of Mesozoic subduction near San Luis Obispo, California; recent earth movements along the San Andreas fault near San Francisco; granitic pluton emplacement and volcanism in the northern Sierra Nevada; multiplephase mountain building, near Dixie Valley, Nevada; sedimentology and block faulting of the Uinta Mountains, Utah. Five-day raft trip on the Green River through the core of the Uinta Mountains. Visit to an oil field in California and a copper mine in Nevada. Lectures and field trips with local experts.

## Materials Science and Engineering

R. W. Balluffi, director; D. G. Ast, J. M. Blakely, M. S. Burton, L. DeJonghe, H. H. Johnson, C.-Y. Li, R. Raj, E. J. Kramer, D. L. Kohlstedt, A. L. Ruoff, S. L. Sass, D. N. Seidman.

### Bachelor of Science

No particular engineering core science is required for entry into the upperclass Field Program in Materials Science and Engineering. An example of the upperclass curriculum, including the required field courses, is given below. The sequence of the courses may vary, however, in accordance with the plan worked out by each student in consultation with his or her faculty adviser.

Term 5	Credits
MS&E 331, Structure and Properties of Materials	4
MS&E 335, Thermodynamics of Condensed Systems	3
MS&E 333, Research Involvement I or a Field-approved technical elective*	3
Free elective	3
Liberal studies elective	3
Term 6	
MS&E 336, Kinetics, Diffusion, and Phase Transformations	3
MS&E 440, Macroprocessing of Materials	3
MS&E 334, Research Involvement II or a Field-approved technical elective*	3
Free elective	3
Liberal studies elective	3
Term 7	
MS&E 445, Electrical and Magnetic Properties of Materials	3
MS&E 441, Microprocessing of Materials	3
MS&E 443, Senior Materials Laboratory I†	3
Technical elective	3
Liberal studies elective	3
Term 8	
MS&E 446, Mechanical Properties of Materials	3
MS&E 448, Current Topics in Materials	3
MS&E 444, Senior Materials Laboratory II†	3
Technical elective	3
Liberal studies elective	3

\*The Research Involvement option gives undergraduates the opportunity to work with faculty members and their research groups on current projects. The alternative technical elective provides students interested in industrial careers an additional opportunity to broaden their engineering education.

†One term of Senior Laboratory may be replaced by Phys 360, Introductory Electronics, or by a one-term project in association with a faculty member.

Students with a special interest in processing and applications are advised to include in their elective

courses MS&E 447, Applied Metallurgy; MS&E 337, Materials and Manufacturing Processes; and MS&E 338, Analysis of Manufacturing Processes.

## Master of Engineering (Materials)

Students who have completed a four-year undergraduate program in engineering or the physical sciences are eligible for consideration for admission to the M.Eng. (Materials) program, which includes the following:

1. A project qualifying for at least twelve credits and requiring individual effort and initiative. This project, carried out under the supervision of a member of the faculty, is usually experimental, although it can be analytical.

2. Six credits of courses in mathematics or applied mathematics. This requirement may be satisfied by courses T&AM 310 and 311; students who have previously completed these must select other courses acceptable to the faculty.

3. Courses in materials science and engineering selected from any of those offered at the graduate level, or other courses approved by the faculty, required to bring the total credits to thirty.

General admission and degree requirements are described in the introductory section under College of Engineering.

## Master of Science and Doctor of Philosophy

Graduate programs in materials science and engineering are described in the *Announcement of the Graduate School and Graduate Study in Engineering and Applied Science*.

## Description of Courses

The courses in materials science and engineering are listed under the following headings: *Undergraduate Courses*; *Graduate Program Courses*; and *Other Graduate Courses*.

### Undergraduate Courses

#### 201 Elements of Materials Science Spring, 3 credits.

Relations between atomic structure and macroscopic properties of such diverse materials as metals, ceramics, and polymers. Properties discussed include magnetism, superconductivity, insulation, semiconductivity, mechanical strength, and plasticity. Applications to microelectronics, desalination by reverse osmosis, superconducting power transmission lines, synthetic bones and joints, etc. Extensive use of modern educational techniques, including slides, audiotutorial systems, movies.

#### 261 Introduction to Mechanical Properties of Materials Fall or spring, 3 credits, 2 lec, 1 rec or lab.

See description under Division of Basic Studies.

#### 262 Introduction to Electrical Properties of Materials Spring, 3 credits, 2 lec, 1 rec or lab.

See description under Division of Basic Studies.

#### 331 Structure and Properties of Materials Fall, 4 credits, 1 lec and 1 lab.

The mostly widely used techniques to investigate materials such as metals, glasses, ceramics, and polymers; associated laboratory work teaches the use of the optical microscope and X-ray diffraction, and exposes the student to electron microscopy and the use and application of the scanning electron microscope. Discussion of how knowledge of microscopic structure obtained with these techniques can be used to predict and understand important engineering properties.

#### 333 Research Involvement I Fall, 3 credits.

Semi-independent research project in affiliation with faculty member and research group of the department. Approval of department required.

#### 334 Research Involvement II Spring, 3 credits.

May be a continuation of 333 or a one-term affiliation with a research group. Approval of department required.

#### 335 Thermodynamics of Condensed Systems Fall, 3 credits, 3 lec.

The various phases of materials and the changes that occur when temperatures and pressures change are considered by developing the laws of thermodynamics and applying them to different systems. The use of phase diagrams to predict the phase(s) of an alloy system at any given temperature and pressure in order to understand heat treatment such as the hardening of aluminum alloys and the quenching of steels. Phase transformations under conditions of quenching and their influence on hardness. Guidelines for heat treatment of steels.

#### 336 Kinetics, Diffusion, and Phase Transformations Spring, 3 credits, 3 lec.

Introduction to absolute rate theory, atomic motion, and diffusion. Applications to nucleation and growth of new phases in vapors, liquids, and solids; solidification, crystal growth, oxidation and corrosion, radiation damage, recrystallization, gas-metal reactions.

#### 337 Materials and Manufacturing Processes (also M&AE 311) Fall or spring, 3 credits, 2 lec, 1 lab.

May be taken in addition to 261. Prerequisite: T&AM 202, or permission of instructor. See M&AE 311 for course description.

#### 338 Analysis of Manufacturing Processes (also M&AE 612) Spring, 3 credits, 3 rec. Prerequisite: 337.

See M&AE 612 for course description.

#### 440 Macroprocessing of Materials Spring, 3 credits, 3 lec, occasional lab.

Control of chemical composition through smelting, reaction, and refining processes; applications to iron and steel, aluminum, refractories, etc. Shape control; casting and solidification, welding; mechanical shaping through rolling, drawing, etc. Deformation and annealing, textures; relation to material properties. Thermomechanical treatments for control of material properties.

#### 441 Microprocessing of Materials Fall, 3 credits, 3 lec, occasional lab.

The materials technology of electronic and magnetic devices; single crystals as well as thin films. Growth and purification (zone refining) of semiconducting crystals; doping procedures, including ion implantation; composition control; oxide growth; photoetching. Preparation of thin films by vapor deposition; sputtering; plating; evaluation of film geometry and composition. Material aspects of recent devices (superlattice growth, magnetic amorphous bubbles, etc.).

#### 443-444 Senior Materials Laboratory 443, fall; 444, spring, 3 credits.

Experiments are available in structural studies, properties of materials, deformation and plasticity, mechanical and chemical processing, phase transformation, surface physics, etc.

#### 445 Electrical and Magnetic Properties of Materials Fall, 3 credits, 3 lec.

An introduction to electrical and magnetic properties of materials with emphasis on structural aspects. Classification of solids, charge and heat transport in metals and alloys, semiconductors and insulators, principles of operation and fabrication of semiconductor devices, behavior of dielectric and magnetic materials, magnetic devices, phenomenological description of superconducting materials.

#### 446 Mechanical Properties of Materials Spring, 3 credits, 3 lec.

The mechanical properties of materials and how they can be understood and analyzed in terms of microscopic irregularities (lattice defects) in perfect regular crystals. The general relation between stress and strain; the concept of equivalent stresses and strains. How the concept of local defects can explain many aspects of plastic flow, creep, fatigue, and rupture in classical and new engineering materials. Application of these concepts to the development of improved materials.

#### 447 Applied Metallurgy (also M&AE 613) 3 credits, 2 lec, 1 lab. Prerequisite: 261 or M&AE 311 or permission of instructor.

W. W. Carson.

See M&AE 613 for course description.

#### 448 Current Topics in Materials Spring, 3 credits, 3 lec.

Coordinated lectures on topics of current interest, such as biomaterials, fuel cells, composite materials, materials problems in power generation and distribution systems, stress corrosion cracking.

#### 449 Introduction to Ceramics Fall, 3 credits, 3 lec. Prerequisite: 261 or permission of instructor.

Designed to develop an understanding of ceramic materials and processes for engineering applications. The crystallographic nature of some ceramics, and structural imperfections that can occur. Ionic motions in crystalline ceramics and their relation to properties and forming methods (such as sintering). Mechanical properties, such as cracking, in terms of microscopic mechanisms. The properties of some new ceramic materials, such as silicon nitride and barium titanate, in special applications.

### Graduate Program Courses

#### 701 Topics in Thermodynamics and Kinetics Fall, 3 credits.

The following topics are treated for condensed systems: free energy and phase equilibria; thermodynamics of solutions; interfaces; thermodynamics under applied fields; irreversible thermodynamics; reaction rate theory and diffusion.

#### 702 Phase Transformations Spring, 3 credits. Prerequisite: 701 or equivalent.

Nucleation theory. Growth theory. Formal theory of nucleation and growth transformation. Spinodal decomposition. Diffusionless transformations. Discussions of topics such as crystal growth from the vapor, solidification, eutectic transformations, solid state precipitation, eutectoid transformations, martensitic transformations with emphasis on the heat treatment of steels, and transformations in polymers and glasses. At the level of *Phase Transformations*, American Society of Metals, 1970.

#### 703 Elasticity and Physical Properties of Crystals Fall, 3 credits.

Elastic stress and strain, constitutive relations between stress and strain, elastic wave propagation in crystals, stress fields of dislocations, thermal stresses, stresses at cracks, generalized tensor representation of reversible physical properties of crystals, irreversible thermodynamics, the Onsager relations and transport phenomena in crystals. At the level of *Physical Properties of Crystals* by Nye.

#### 704 Plastic Flow and Fracture of Materials Spring, 3 credits. Prerequisite: 703 or equivalent.

Introduction to the theory of dislocations. Strain hardening. Dislocation treatment of yield and flow. Polycrystalline hardening. Interaction of interstitial solute atoms with dislocations. Solution hardening. Two-phase hardening. Time- and temperature-dependent deformation. Dislocation models for cleavage of crystals. Viscosity and visco-elastic behavior. Theories of rubber elasticity. Newtonian and nonlinear viscous flow. Creep and creep rupture. Ductile fracture and the fracture of rubber. Fatigue.

**706 Principles of Diffraction (also A&EP 711)**

Fall, 3 credits.

Introduction to diffraction phenomena as applied to solid-state problems. Scattering and adsorption of neutrons, electrons, and X-ray beams. Diffraction from two- and three-dimensional periodic lattices. Fourier representation of scattering centers, and the effect of thermal vibrations. Phonon information from diffuse X-ray and neutron scattering and Bragg reflections. Diffraction from almost-periodic structures, surface layers, gases, and amorphous structures. Survey of dynamical diffraction from perfect and imperfect lattices.

**Other Graduate Courses**

**553-554 Special Project** 553, fall; 554, spring. 6 credits per term.  
Research on a specific problem in the materials area.

**714 Electron Microscopy** Spring, 3 credits.

Electron optics Kinematical theory of diffraction with applications to the imaging of crystal defects. Dynamical theory of diffraction as applied to the calculation of images of various defects. Interpretation and analysis of electron diffraction patterns. Application of the stereographic projection to problems in microscopy. Applications of dark field microscopy. Instruction in the use of the microscope.

**716 The Effects of Radiation on Materials** Fall or spring, 3 credits, 3 lec.

Cross section for atom displacement; the atomic collision cascade; focusing of atomic collisions; mass transport along collision spectra within a cascade; range concepts; channeled particles and the effect of crystal imperfections; Rutherford scattering and channeling and their application to the lattice location of impurity atoms; sputtering of single and polycrystalline metals; recovery mechanisms for radiation damage; void formation in metals irradiated to high fluences and the problem of swelling in liquid metal fast breeder reactors.

**762 Physics of Solid Surfaces (also A&EP 762)**

Spring, 3 credits. Prerequisites: 701 and some knowledge of solid-state physics.  
See A&EP 762 for course description.

**765 Amorphous and Semicrystalline Materials**

Spring, 3 credits. Prerequisite: Phys 454 or equivalent.  
Topics related to the science of the amorphous state selected from within the following general areas: structure of liquids and polymers; rheology of elastomers and glasses; electrical, thermal, and optical properties of amorphous materials. Presented at the level of *Modern Aspects of the Vitreous State* by Mackenzie, "Glass Transitions" by Shen and Eisenberg in *Progress in Solid State Chemistry*, and *The Physics of Rubberlike Elasticity* by Treloar.

**767 Electrical and Magnetic Properties of Materials**

Spring, 3 credits. Prerequisite: Phys 454 or equivalent.  
Electronic transport properties of metals and semiconductors, semiconductor devices, optical and dielectric properties of insulators and semiconductors, laser materials, dielectric breakdown, structural aspects of superconducting materials, ferromagnetism and magnetic materials. At the level of *Physics of Semiconductor Devices* by Sze, *Ferromagnetism* by Bozworth, and current review articles.

**768 Theory of Crystal Defects** Fall, 3 credits.

Prerequisites: 701 and 703 or equivalent.  
The structure and properties of point, line, and planar crystal defects treated from a fundamental point of view. Thermodynamics and kinetics of point defects. Atomistic and continuum theories of dislocations. Thermodynamic treatment of grain boundaries. Structure of grain boundaries. Emphasis given throughout to interactions between the various types of defects and to their roles in important phenomena

such as diffusion, precipitation, plasticity, radiation damage.

**769 Ceramic Materials** Fall, 3 credits.

Prerequisites: 701 and some familiarity with crystal structures.  
Crystal structure and bonding of typical ceramic materials; structure of silicate and nonsilicate glasses; imperfections in oxides; point defects and point defect chemistry, line defects, extended defects; diffusion in stoichiometric and nonstoichiometric ceramics; phase transformations; equilibrium and nonequilibrium phases; grain growth and sintering; plastic deformation and creep; topics from research papers.

## Mechanical and Aerospace Engineering

E. L. Resler, Jr., director; A. R. George, assistant director; P. L. Auer, D. L. Bartel, J. F. Booker, W. W. Carson, D. A. Caughey, B. Conta, P. C. T. deBoer, F. C. Gouldin, S. Leibovich, W. J. McLean, F. K. Moore, R. M. Phelan, L. Phoenix, P. T. Radulovic, S. F. Shen, D. G. Shepherd, K. E. Torrance, K. K. Wang, R. L. Wehe. Members of the faculty of the graduate Fields of Aerospace Engineering and of Mechanical Engineering are listed in the *Announcement of the Graduate School*.

### Bachelor of Science

#### Mechanical Engineering

The upperclass Field Program in Mechanical Engineering is designed to provide a broad background in this basic branch of engineering, as well as an introduction to the many professional and technical areas with which mechanical engineering is particularly concerned. Two main areas of concentration, corresponding to the two major streams of mechanical engineering technology, are offered in the field program:

**Mechanical Systems and Design** is concerned with those aspects of mechanical engineering that involve the design, analysis, and manufacture of devices, machines, and systems. Particular areas of concentration that are available are mechanical design and analysis, vehicle engineering, and manufacturing engineering.

**Engineering of Energy and Fluid Systems** is concerned with (1) the conversion of energy for various requirements for electric power and transportation (terrestrial and aerospace); (2) the study of environmental modification, which involves such areas as pollution control, refrigeration and air conditioning, acoustics and noise, and combustion engines; and (3) theoretical and experimental aspects of fluid dynamics and heat transfer.

The field program is open to students who have taken the course T&AM 202, Mechanics of Solids, as one of the sophomore engineering core sciences. It is recommended that underclass students who definitely intend to major in mechanical engineering also take as engineering core sciences the courses T&AM 203, Dynamics, and M&AE 221, Thermodynamics, which are required for the field program. Another course required for the field program that can be taken as a sophomore core science is Elec E 210, Introduction to Electrical Systems. Also, a student who takes MS&E 261, Introduction to Mechanical Properties of Materials, as a core science in DBS need not necessarily take M&AE 311, Materials and Manufacturing Processes, which is normally part of the field program.

The courses required for the Field Program in Mechanical Engineering are included in the curriculum sample outlined below. It should be noted that if some of the field requirements are fulfilled in DBS, as recommended, released electives may be

substituted for them. It should also be noted that many courses may be taken in different terms than the ones indicated below.

	Credits
<i>Term 5</i>	
T&AM 203, Dynamics	3
M&AE 221, Thermodynamics	3
M&AE 311, Materials and Manufacturing Processes	3
Mathematics elective	3
Liberal studies elective	3
<i>Term 6</i>	
M&AE 325, Mechanical Design and Analysis	4
M&AE 323, Fluid Mechanics	4
Elec E 210, Introduction to Electrical Systems	3
Field elective	3
Liberal studies elective	3
<i>Term 7</i>	
M&AE 324, Heat Transfer and Transport Processes	3
M&AE 326, Systems Dynamics	4
M&AE 453, Mechanical Engineering Laboratory	4
Technical elective	3
Liberal studies elective	3
<i>Term 8</i>	
Field elective	3
Technical elective	3
Free elective	3
Free elective	3
Liberal studies elective	3

The mathematics elective is chosen from an approved list. The two field electives are selected from upperclass courses offered in mechanical and aerospace engineering.

#### Aerospace Engineering

Although there is no separate undergraduate program in aerospace engineering, students may prepare for graduate study in this area by majoring in mechanical engineering, or in other appropriate engineering specialties such as electrical engineering, engineering physics, or a physical science. Subjects recommended as preparation for graduate study in aerospace engineering are thermodynamics, fluid mechanics, applied mathematics, chemistry, and physics.

### Master of Engineering (Aerospace)

The Master of Engineering (Aerospace) program is designed to increase the student's facility in the application of the basic sciences to engineering problems of importance in this field. Because aerospace engineering is continually engaged in new areas, an essential guideline for the program is to reach beyond present-day practices and techniques. This is achieved by supplying the student with the fundamental background and the analytical techniques that will remain useful in all modern engineering developments.

General admission and degree requirements are described in the introductory section under College of Engineering.

Required courses for the M.Eng. (Aerospace) degree include four three-credit core courses in one of the following areas: (1) fluid mechanics, (2) aerodynamics, and (3) high-temperature gasdynamics. Active research is being carried out in these areas as well as in related areas such as chemical kinetics, aerodynamic noise, sonic boom, nonlinear waves, combustion processes in low-pollution engines, and solution of flow problems by finite element and numerical methods. The faculty may modify the core courses to suit the needs, interests, and background of an individual student; for example, course sequences can be arranged for specialization in energy conversion, aerophysics, or chemical kinetics. Available core courses are:

	Credits
M&AE 608, Physics of Fluids I	3
M&AE 643, Combustion Processes	3
M&AE 607, Dynamics of Flight Vehicles	3
M&AE 632, Fluid Mechanics I	3

M&AE 633, Fluid Mechanics II	Credits	3
M&AE 602, Aerodynamics I		3
M&AE 603, Aerodynamics II		3
M&AE 653, Experimental Methods in Fluid Mechanics and Combustion		3

Also required are six credits of elective subjects. A list of suggested electives is available from the Program Representative, M. Eng. (Aerospace), in Grumman Hall. Further requirements are six credits of mathematics (T&AM 610-611 or Math 415-416 or the equivalent), one advanced project (two credits), and attendance at the weekly colloquium (one credit per term) and one advanced seminar (two credits). This makes a total of thirty credits.

## Master of Engineering (Mechanical)

The one-year M.Eng. (Mechanical) degree program is design to be flexible so that candidates may concentrate on any of a variety of specialty areas within the field of mechanical engineering. These areas include bioengineering, machine dynamics and control, mechanical analysis and development, vehicles and propulsion, propulsion engines, energy systems, thermal environment, manufacturing engineering, and materials processing. Depending on the individual's preparation, at least half the course work is elective to some degree. The usual curriculum is as follows:

<i>Fall term</i>	Credits	
Mathematics		3
M&AE 770, Advanced Mechanical Analysis		3
M&AE 790, Mechanical Engineering Design Project		3
Engineering laboratory		3
Technical elective		3
<i>Spring term</i>		
Mathematics		3
Advanced energy and fluid systems course		3
M&AE 790, Mechanical Engineering Design Project		3
Mechanical engineering elective		3
Technical elective		3

It is recommended that the mathematics requirement be satisfied by Applied Mathematics, T&AM 310-311 or, on a more advanced level, by T&AM 610-611. Courses offered by the Department of Mathematics may be taken with the approval of the adviser. If the six-credit mathematics requirement has been satisfied in advance by courses taken during the undergraduate years, these credits may be taken in technical elective subjects.

The schedule may be arranged to accommodate the energy and fluid systems course either term. The course is to be selected from the following: M&AE 608, Physics of Fluids I (fall); M&AE 632, Fluid Mechanics I (fall); M&AE 650, Transport Processes I (fall); M&AE 609, Physics of Fluids II (spring); M&AE 633, Fluid Mechanics II (spring); M&AE 643, Combustion Processes (spring); M&AE 651, Transport Processes II (spring); M&AE 655, Energy Conversion (spring); M&AE 737, Numerical Methods in Fluid Flow and Heat Transfer (spring). If two or more of these courses have been satisfactorily completed before entry into the program, any graduate-level course in the fluid mechanics, heat transfer, or energy areas may be taken to satisfy the energy and fluid systems requirement.

The engineering laboratory course may be either M&AE 672, Experimental Methods in Machine Design (fall), or M&AE 653, Experimental Methods in Fluid Mechanics and Combustion (fall). Other laboratory courses given in the College of Engineering may be approved for qualified students if such courses are suitable for a particular objective.

For the design project, M&AE 790, some recent topics have been concerned with fly ash disposal, ocean current measurement, gas turbine load-test equipment, design of a tape splicer, planetary roving

vehicles, geothermal power plants, and assistive devices for hands and legs. Some projects are suggested, monitored, and reviewed by outside organizations, whose engineers work with the student groups and participate in a technical session when the project reports are presented at the end of the year.

General admission and degree requirements are described in the introductory section under College of Engineering.

## Master of Science and Doctor of Philosophy

Programs in the graduate Fields of Aerospace Engineering and of Mechanical Engineering are described in the *Announcement of the Graduate School and Graduate Study in Engineering and Applied Science*.

## Description of Courses

**101 Naval Ship Systems** Spring, 3 credits. Open to freshmen and sophomores only.

An introduction to primary ship systems and their interrelation. Basic principles of ship construction, stability, propulsion, control, internal communications, and other marine systems.

**208 The Role of Energy in Society** Spring, 3 credits. A seminar-format course including: patterns of energy consumption; United States and world comparisons; fuel resources; technology of fuel extraction, energy conversion, and utilization; energy policies and regulations; environmental conflict; limits to growth.

**221 Thermodynamics** Fall or spring, 3 credits. 3 rec. Prerequisites: Math 191 and 192, Phys 112. See description under Division of Basic Studies.

**302 Technology and Society—A Historical Perspective.** Spring, 3 credits. Prerequisite: upperclass standing or permission of instructor. B. J. Conta.

An introduction to the history of technology and its social consequences from the origin of man to the present. Emphasis will be on the nineteenth and twentieth centuries.

**305 Introduction to Aeronautics** Fall, 3 credits. Open to upperclass engineers and others by permission of instructor.

D. A. Caughey. Introduction to atmospheric flight vehicles. Principles of incompressible and compressible aerodynamics, boundary layers, and wing theory. Propulsion system characteristics. Static aircraft performance; range and endurance. Elements of stability and control.

**311 Materials and Manufacturing Processes (also MS&E 337)** Fall or spring, 3 credits. 2 lec, 1 lab. May be taken in addition to MS&E 261. Prerequisite: T&AM 202.

Material structures. Physical and metallurgical properties of materials and their control by mechanical and metallurgical means. Manufacturing processes. Emphasis on correlations among design, material properties, and processing methods.

**323 Fluid Mechanics** Fall or spring, 4 credits. 4 rec. Prerequisites: T&AM 202 and 203. Statics, kinematics, potential flow, dynamics, momentum and energy relations. Thermodynamics of compressible flow; dimensional analysis; real fluid phenomena, laminar and turbulent motion; boundary layer; lift and drag; supersonic flow.

**324 Heat Transfer and Transport Processes** Fall or spring, 3 credits. 1 lec, 2 rec. Prerequisite: 323. Conduction of heat in steady and unsteady situations. Fin surfaces and systems with heat sources. Emission and absorption of radiation, and radiative transfer between surfaces. Forced and natural

convection of heat owing to flow around bodies and through ducts. Combined modes of transfer and heat exchangers.

**325 Mechanical Design and Analysis** Fall or spring, 4 credits. 3 rec, 1 lab. Prerequisites: T&AM 202 and 203.

Application of the principles of mechanics and materials to problems of analysis and design of mechanical systems.

**326 Systems Dynamics** Fall or spring, 4 credits. Prerequisite: 325.

Dynamic behavior of mechanical systems, modeling, analysis techniques applications, digital- and analog-computer simulation, balancing of rotating and reciprocating machinery, vibrations of single and multi-degree-of-freedom systems, linear control systems, PDF control, stability analysis.

**389 Computer-Aided Design** Spring, 3 credits. 2 lec-rec, 1 computing lab. Open to juniors and seniors.

A broad introduction to computational methods in mechanical design. Term project.

**439 Acoustics and Noise** Spring, 3 credits.

Prerequisite: some knowledge of fluid mechanics or permission of instructor.

Vibration and wave motion. Sound transmission and absorption. Sound radiation by surfaces and flow. Loudspeakers. Hearing, noise, and noise control criteria. Architectural acoustics and noise control techniques.

**440 Thermodynamic Applications** Fall, 3 credits. Prerequisite: 221 or equivalent.

The Rankine cycle and its variations. The Brayton cycle and its variations. Other heat engine cycles. The Gibbs availability function as a criterion of maximum work for noncyclic energy conversion. Internal combustion engine processes and the open cycle gas turbine. An introduction to refrigeration and air-conditioning.

**[442 Pollution Control in Power and Propulsion**

Spring, 3 credits. Prerequisite: 323 concurrently, or permission of instructor. Not offered 1976-77.

Introduction to technical aspects of air, thermal, and noise pollution associated with power generation. Discussion of pollution generation mechanisms and methods of control, with emphasis on the underlying engineering sciences.]

**449 Combustion Engines** Fall, 3 credits. 3 rec. Prerequisite: 221.

Introduction to combustion engines, with emphasis on application of thermodynamics and fluid dynamics and on control of undesirable exhaust emissions. Emphasis on performance, efficiency, and emissions of current and future spark-ignited and diesel reciprocating engines. Discussion of alternative engines and fuels.

**453 Mechanical Engineering Laboratory** Fall,

4 credits. 1 lec, 2 labs. Prerequisites: 325, 323, and simultaneous registration in 326 and 324. Laboratory exercises in instrumentation, techniques, and methods in mechanical engineering. Measurement of pressure, temperature, heat flow, drag, flow rate, solar energy, thermoelectricity, displacement, force, stress, strain, vibrations, noise, etc.

**459 Plasmadynamics** Spring, 3 credits.

Prerequisite: Phys 214.

P. L. Auer.

An elementary treatment of principles on which the concepts of controlled thermonuclear reactors (fusion) are based. Comparisons between fission and fusion systems. Fundamental aspects of plasma physics; other plasma devices (e.g., MHD converters) as time permits.

**464 Design for Manufacture** Fall, 3 credits.

Prerequisite: 311 or permission of instructor. Design for casting, forging, stamping, welding, machining, heat treatment, and assembly; beneficial prestressing; improving the distribution of loads and deflections. Selection of materials; dimensioning and fits; joints, fasteners, and shaft mountings. Specifications for manufacturing and maintenance to minimize fatigue failures and improve reliability. Short design problems.

**483 Mechanical Reliability** Spring, 3 credits.

Prerequisite: OR&IE 260 or 270 or equivalent.

S. L. Phoenix. Classic system reliability, hazard function concepts, reliability bounds; static and time-dependent material strength models, static and dynamic fatigue, weakest flow models; structural system reliability, static and time-dependent parallel member models, Monte Carlo simulation of structural systems.

**486 Automotive Engineering** Spring, 3 credits.

Prerequisite: 325.

Selected topics in the analysis and design of vehicle components and vehicle systems. Emphasis is on automobiles, trucks, and related vehicles. Powerplant, driveline, brakes, suspension, and structure. Other vehicle types may be considered.

**602 Aerodynamics I** Fall, 3 credits. Prerequisite:

632-633 or equivalent. Intended for graduate students interested in fluid dynamics or aerodynamics research.

Basic equations, vorticity and flow development. Incompressible potential flow theory; singularity distributions, airfoil, wing, and slender body theory, complex-variable methods.

**603 Aerodynamics II** Spring, 3 credits.

Prerequisite: 632-633 or equivalent.

D. A. Caughey.

Basic conservation laws and fundamental theorems of compressible fluid flow. Shock waves, method of characteristics, wave interactions. Perturbation theories and similarity rules. Expansion procedures and singular perturbation problems. Linearized supersonic flow, wing theory, wave drag. Nonlinear theories of transonic and supersonic flow.

**606 Aerospace Propulsion Systems** Spring,

alternate years, 3 credits, 3 rec. Prerequisite: 323 or permission of instructor.

D. G. Shepherd.

Application of thermodynamics and fluid mechanics to design and performance of thermal-jet and rocket engines. Mission analysis in space. Auxiliary power supply; study of advanced methods of space propulsion.

**[607 Dynamics of Flight Vehicles** Spring,

alternate years. Not offered 1976-77. 3 credits.

Prerequisites: T&AM 203 and M&AE 305 or permission of instructor.

D. A. Caughey.

Introduction to stability and control of atmospheric flight vehicles. Review of aerodynamic forces and methods for analysis of linear systems. Static stability and control. Small disturbance equations of unsteady motion. Dynamic stability and transient control response. At the level of *Stability and Control of Airplanes and Helicopters* by Seckel.]

**608 Physics of Fluids I** Fall, 3 credits.

F. C. Gouldin.

Fundamental treatment of fluid properties, primarily from a microscopic viewpoint, providing an understanding necessary for advanced study of combustion, gas dynamics, and related areas. At the level of *Introduction to Physical Gas Dynamics* by Vincenti and Kruger, and *The Dynamics of Real Gases* by Clarke and McChesney.

**609 Physics of Fluids II** Spring, on demand,

3 credits.

Molecular structure bonding theory, heats of reaction. Atomic and molecular spectroscopy, applications to

pollution. Nonequilibrium statistical mechanics;

Boltzmann equation, H-theorem, review of Hilbert-Enskog-Chapman theory, fluctuations.

Onsager's relations. Radiative transfer; lasers. At the level of *The Dynamics of Real Gases* by Clarke and McChesney.

**610 Gasdynamics** Spring, on demand, 3 credits.

E. L. Resler, Jr.

Strong shock waves and their use in the production and study of high-temperature gases. High-temperature chemical kinetics and its application to hypersonic external flows, rocket internal flows, and other phenomena of current interest. Chemical relaxation effects of flow fields and the method of characteristics, including chemical reactions. Experimental techniques.

**612 Analysis of Manufacturing Processes**

(also MS&E 338) Spring, 3 credits, 3 rec.

Prerequisite: 311.

Analytical treatment of metal cutting and metal forming processes; conventional and nontraditional manufacturing methods; production systems and machine tool dynamics.

**613 Applied Metallurgy (also MS&E 447)** 3

credits, 2 lec, 1 lab. Prerequisite: 311 or MS&E 261 or permission of instructor.

W. W. Carson.

Designed to aid in the design, selection, and use of metals and alloys. Theory and practice of extractive, physical, and mechanical metallurgy. Corrosion principles and control, metallurgical failure analysis and prevention, nondestructive testing, metallurgical examination techniques, soldering, brazing, welding, powder metallurgy.

**614 Numerical Control in Manufacturing** Fall,

3 credits, 3 rec.

K. K. Wang.

Principles and the state of the art of numerical control (NC) technology; programming methods of NC machine tools; economic aspects and manufacturing systems.

**622 Introductory Magneto-hydrodynamics**

Spring, on demand, 3 credits.

Basic equations of magneto-hydrodynamics. Flow problems. Hydromagnetic shock waves. The pinch effect and instabilities. Tensor conductivity and excess electron temperature.

**632 Fluid Mechanics I** Fall, 3 credits.

Introduction to the mechanics of fluids. Derivation of the Navier-Stokes equations. Boundary conditions. Exact solutions. Vorticity theorems. Methods of solution of irrotational flows. Rotational flows. Boundary layer theory. Exact methods of solution of the boundary layer equations.

**633 Fluid Mechanics II** Spring, 3 credits.

Approximate methods in boundary layer theory. Heat transfer. Buoyancy-driven flows. Stability of fluid flow. Introduction to turbulent flows. Dynamics and thermodynamics of compressible flows. Sound waves. Subsonic and supersonic flow. One-dimensional steady flows. One-dimensional unsteady flows, method of characteristics, shock waves.

**636 Turbomachinery** Fall, 3 credits, 3 rec.

Prerequisite: 323 or permission of instructor.

D. G. Shepherd.

Aerothermodynamic design of turbomachines in general; energy transfer between fluid and rotor in specific types, axial and radial units, compressible flow, 3-D effects, surging. Outline design of high-performance compressor-turbine unit.

**643 Combustion Processes** Spring, 3 credits,

3 rec. Prerequisite: 323, 324.

An introduction to combustion and flame processes with emphasis on fundamental fluid dynamics, heat and mass transport, and reaction-kinetic processes

that govern combustion rates. Both premixed and diffusion flames are considered.

**648 Seminar on Combustion** Spring, 3 credits.

3 rec to be arranged. Prerequisite: permission of instructor.

F. C. Gouldin, W. J. McLean, K. E. Torrance.

Discussion of contemporary problems in combustion, such as efficiency and emissions considerations, destructive fires, and fuels of the future. Emphasis on modern experimental and analytical techniques required for analyzing chemical, thermal, and fluid dynamic effects in current combustion research.

**650 Transport Processes I** Fall, 3 credits.

Prerequisite: 323.

Intermediate-level treatment of heat and mass transfer. Analysis of heat conduction and mass diffusion. Radiative exchange, including participating gases and the diffusion approximation. Formulation of transport equations and thermal boundary layer regimes. Bouyancy flows, boiling, and condensation.

**651 Transport Processes II** Spring, 3 credits.

Prerequisite: 650.

Advanced convection heat transfer. Basic equations reasoned in detail. Natural convection boundary layers and freely-rising plumes. Forced convection boundary layers. Laminar, transitional, and turbulent flows. Thermal instabilities. Effects of variable properties, viscous dissipation, and compressibility.

**652 Seminar in Heat Transfer** Spring, 3 credits.

Two 2-hour meetings weekly to be arranged.

Prerequisite: permission of instructor.

Discussion of fields of active inquiry and current interest in heat transfer. Considerations of major recent contributions.

**653 Experimental Methods in Fluid Mechanics**

and Combustion Fall, 3 credits, 2 lec, 1 lab.

Study of experimental techniques and data analysis procedures for investigation of fluid and combustive systems, with emphasis on experimental capabilities, underlying principles, and statistical treatment of data. Topics include laser velocimetry, hot-wire anemometry, and spectroscopy.

**654 Environmental Control** Fall, 3 credits.

Prerequisites: thermodynamics, fluid mechanics.

D. G. Shepherd.

Environmental living systems; heating, cooling, air conditioning. Refrigeration, cryogenic systems, artificial environments and life-support systems for space and underwater. Environmental effects of technological thermal sources.

**655 Energy Conversion** Spring, 3 credits, 3 lec.

Prerequisite: 221 or equivalent.

Primarily a survey of methods for the direct conversion of heat into electrical energy, with emphasis on efficiency, maximum power, practical applications, and limitations. Thermoelectric generators and refrigerators. Thermionic generators. Solar cells. Magneto-fluid-dynamic generators. Fuel cells.

**656 Power Systems I** Fall, 3 credits. Prerequisite:

323 or equivalent.

A broad survey of methods of large-scale power generation, emphasizing energy sources, thermodynamic cycle considerations, and component description. Power industry, economic, and environmental factors. Trends and projections.

**657 Power Systems II** Spring, 3 credits.

F. K. Moore.

Options for future power generation: costs, feasibilities, benefits, impacts; hydrogen, solar, geothermal, wind, and MHD are examples. Environmental and siting issues. Problems of scale; "power parks." Uses of waste heat. Energy storage. Seminar format based on study projects reflecting student preparation and interests.

**663 Mechanical Components** Spring, 3 credits. Prerequisite: 325.

Advanced analysis of machine components and structures. Application to the design of new configurations and devices. Selected topics from the following: lubrication theory and bearing design, fluid drives, shells, thick cylinders, rotating disks, fits, elastic-plastic design, thermal stresses, creep, impact, indeterminate and curved beams, plates, contact stresses.

**665 Biomechanical Systems—Analysis and Design** Spring, 3 credits, 3 rec. Prerequisites: T&AM 202, 203.

D. L. Bartel.

Selected topics from the study of the human body as a mechanical system. Emphasis on the modeling, analysis, and design of biomechanical systems frequently encountered in orthopedic surgery and physical rehabilitation. Term project.

**672 Experimental Methods in Machine Design** Fall, 3 credits, 1 rec, 2 labs. Prerequisite: 325 or equivalent.

R. M. Phelan.

Investigation and evaluation of methods used to obtain design and performance data. Photoelasticity, strain measurement, photography, vibration and sound measurements, transducers.

**677 Mechanical Vibrations** Spring, 3 credits, 2 rec, 1 lab. Open to qualified undergraduates. Prerequisite: 326 or equivalent.

R. M. Phelan.

Further development of vibration phenomena in single-degree and multidegree of freedom linear and nonlinear systems, with emphasis on engineering problems involving analysis and design.

**678 Automatic Control Systems** Fall, 3 credits, 2 rec, 1 lab. Open to qualified undergraduates. Prerequisite: 326 or equivalent.

Further development of the theory and implementation of feedback control systems, with particular emphasis on the application of pseudo-derivative-feedback (PDF) control concepts to linear and nonlinear systems.

**679 Computer Simulation and Analysis of Dynamic Systems** Spring, 3 credits. Open to qualified undergraduates by permission of instructor. Some previous exposure to systems dynamics and digital programming areas is assumed.

Modeling and representation of physical systems by systems of ordinary differential equations in vector form. Applications from diverse fields. Simulation diagrams. Analog and digital simulation by direct integration. Problem-oriented digital-simulation languages (e.g., CSMP). Digital analysis of stability and response of large linear systems.

**680 Design of Complex Systems** Fall, on demand, 3 credits. Two 2-hour meetings. Prerequisite: permission of instructor.

R. L. Wehe.

A seminar course relying heavily on student participation in discussing frontier problems such as systems for space and underwater exploitation, salt water conversion, and transportation. Reports that set forth recommendations and the reasoning leading to them will be required.

**682 Hydrodynamic Lubrication** Spring, 3 credits. Designed to acquaint those having a general knowledge of solid and fluid mechanics with the special problems and literature currently of interest in various fields of hydrodynamic lubrication. General topics include equations of viscous flow in thin films, self-acting and externally pressurized bearings with liquid and gas lubricant films, bearing-system dynamics, and computational methods. Also selected special topics.

**685 Optimum Design of Mechanical Systems** Spring, 3 credits, 3 rec.

The formulation of design problems frequently encountered in mechanical systems as optimization problems. Theory and application of methods of mathematical programming for the solution of optimum design problems.

**687 Dynamics of Vehicles** Fall, 3 credits. Prerequisites: T&AM 202 and 203 or permission of instructor.

Intended as an introduction to the dynamics of automobiles and trucks. Emphasis is on the handling behavior of the automobile, tire theory, and suspension analysis.

**690 Special Investigations in Mechanical and Aerospace Engineering** Fall or spring. Credit arranged. Permission required for registration. Intended either for a student or small group of students wishing to pursue a particular analytical or experimental investigation outside of regular courses, or for informal instruction supplementing that given in regular courses.

**704 Theory of Viscous Flows** Spring, 3 credits. Prerequisite: 632 or equivalent.

S. F. Shen.

A systematic study of laminar flow phenomena and their methods of analysis. Exact solutions of the Navier-Stokes equations. The small Reynolds number approximation. Matched asymptotic expansion. The boundary layer approximation, general properties. Transformations for compressibility and axisymmetric effects. Approximate methods of calculation. Unsteady problems. Stability of laminar flows.

**706 Atmospheric Motions** On demand, 3 credits.

One-semester senior or graduate-level course, emphasizing a mathematical and physical understanding. The atmosphere; basic scales of synoptic motions. Equations of motion. Geostrophic flow, the Rossby number, hydrostatic approximation, prognostic equations, diagnostic equations, baroclinic motions. Sound, gravity, and Rossby waves. Analytical and numerical models.

**707 Aerodynamic Noise Theory** Spring, on demand, 3 credits. Prerequisite: 439 and 632–633 or permission of instructor.

Advanced topics in acoustics relevant to aerodynamic and transportation noise sources and control. Random processes. Geometrical acoustics in inhomogeneous moving media, Kirchhoff and Poisson formulas, diffraction, scattering. Lighthill-Curle formulations for sound generation. Absorption and transmission in fluid and at boundaries. Applications.

**723 Special Topics in Plasma Physics** Fall, on demand, 3 credits. Prerequisite: Elec E 681.

Advanced subjects of timely interest, at the level of current plasma physics literature or review articles. Recent topics have included radiation and scattering processes in plasmas, neoclassical transport theory, intense relativistic electron beam dynamics, and collision-free shock theory.

**734 Turbulence and Turbulent Flow** Fall, on demand, 3 credits.

Topics will include mathematical descriptions of turbulence and turbulent flow calculation methods. Reynolds stress, eddy viscosity, and mixing length; correlations and spectra, inertial and dissipation ranges, effects of shear and buoyancy, turbulent energy, and Reynolds stress equations.

**735 Dynamics of Rotating Fluids** Fall, on demand, 3 credits. Prerequisites: 632–633.

Review of classical fluid mechanics. Rotating coordinate systems. Linearized theory for rapidly rotating fluids. Inviscid regions, viscous layers. Spin-up. Motions past objects. Waves in rotating fluids. "Vortex breakdown" in swirling flows. Boundary layer interactions.

**737 Numerical Methods in Fluid Flow and Heat**

**Transfer** Spring, 3 credits. Prerequisites: fluid mechanics, heat transfer, and some Fortran programming.

K. E. Torrance.

Discretization procedures are developed for problems involving fluid motion and molecular diffusion. Consideration of finite differences, finite elements, numerical accuracy, stability, and convergence. Survey of current methods with applications. Course work requires use of digital computer.

**738 Nonlinear Wave Propagation** Spring, on demand, 3 credits.

Mathematical treatment of nonlinear effects associated with waves in continua. Examples are taken primarily from geophysical fluid dynamics and gas dynamics. Methods of averaging, variational methods, wave interactions, and exact solutions of nonlinear evolution equations.

**770 Advanced Mechanical Analysis** Fall, 3 credits.

Introduction to computational methods of mechanical analysis: basic concepts of engineering elasticity, finite elements, design optimization.

**771 Advanced Mechanical Analysis II** Spring, 3 credits. Prerequisite: 770 or permission of instructor.

Extensions of topics introduced in 770, with emphasis on systems dynamics and applications. (770–771 is a co-ordinated two-term sequence, though the first term is complete in itself and may be elected independently.)

**790 Mechanical Engineering Design Project**

Fall and spring, 3 credits per term. Intended for students in the M.Eng. (Mechanical) degree program. Design of an engineering system or a device of advanced nature. Projects by individuals or small groups, sometimes in collaboration with an external organization.

**791 Mechanical and Aerospace Engineering Research Conference** Fall and spring, 1 credit per term.

For graduate students involved in research projects. Short presentations on research in progress by students and staff.

**792 Seminar and Design Project in Aerospace Engineering** 2 credits. Prerequisite: approval of the director.

Study and discussion of topics of current research interest in aerospace engineering. Individual design projects.

**795 Special Topics in Aerospace**

**Engineering** Fall or spring. Credit arranged. Prerequisite: permission of instructor. Topics of current importance in aerospace engineering and research. Lecture or seminar format. More than one topic may be taken if offered.

**799 Mechanical and Aerospace Engineering Colloquium** Fall and spring, 1 credit a term. Credit limited to graduate students. All students and staff invited to attend.

Lectures by Cornell staff members, graduate students, and visiting scientists on topics of interest in mechanical and aerospace science, especially in connection with new research.

**890 Research in Mechanical and Aerospace**

**Engineering** Credit arranged. Prerequisite: candidacy for M.S. degree in mechanical or aerospace engineering, or approval of the director. Independent research in an area of mechanical and aerospace engineering under the guidance of a member of the staff.

**990 Research in Mechanical and Aerospace Engineering** Credit arranged. Prerequisite: candidacy for Ph.D. degree in mechanical or aerospace engineering or approval of the director.

Independent research in an area of mechanical and aerospace engineering under the guidance of a member of the staff.

## Nuclear Science and Engineering

Faculty members of the graduate Field of Nuclear Science and Engineering are listed in the *Announcement of the Graduate School*. Many of these professors are members of the School of Applied and Engineering Physics, which offers the course work in this area.

### Undergraduate Study

Although there is no special undergraduate field program in nuclear science and engineering, students who intend to enter graduate programs in this area are encouraged to begin specialization at the undergraduate level. This may be done by choice of electives within regular field programs (such as those in engineering physics, materials science and engineering, and civil, chemical, electrical, or mechanical engineering) or within the College Program.

### College Programs

The suggested curriculum for the College Program in Nuclear Engineering includes A&EP 201, Nuclear Energy and the Environment, and A&EP 303, Introduction to Nuclear Science, plus two of the four courses A&EP 612, A&EP 651, A&EP 633, and A&EP 609. Also available is the College Program in Energy Conversion, a synthesis of nuclear, thermal, and electrical engineering. See the introductory section under College of Engineering for a general description of the College Program.

### Master of Engineering (Nuclear)

The two-term curriculum leading to the degree of M.Eng. (Nuclear) is intended primarily for individuals who want a terminal professional degree, but it may also serve as preparation for doctoral study in nuclear science and engineering. The course of study covers the basic principles of nuclear reactor systems with a major emphasis on reactor safety and radiation protection and control. The special facilities of the Ward Laboratory of Nuclear Engineering are described in the *Announcement of the Graduate School*.

The interdisciplinary nature of nuclear engineering allows students to enter from a variety of undergraduate specializations. The recommended background is: (1) a baccalaureate degree in engineering, physics, or applied science; (2) physics, including atomic and nuclear physics; (3) mathematics, including advanced calculus; and (4) thermodynamics. Students should see that they fulfill these requirements before beginning the program. In some cases, deficiencies in preparatory work may be made up by informal study during the preceding summer. General admissions and degree requirements are described in the introductory section under College of Engineering.

The following courses are included in the thirty-credit program:

#### Fall term

A&EP 612, Nuclear Reactor Theory I  
A&EP 633, Nuclear Reactor Engineering  
A&EP 609, Low-Energy Nuclear Physics  
Technical elective

#### Spring term

A&EP 651, Nuclear Measurements Laboratory  
Technical elective  
Engineering design project  
Mathematics or physics elective

Available electives include a course in radiation biology and a seminar in physical biology. Engineering electives should be in a subject area relevant to nuclear engineering, such as energy conversion, radiation protection and control, feedback control systems, magnetohydrodynamics, controlled thermonuclear fusion, and environmental engineering. Typical examples are: Vet 751, Biological Effects of Radiation; M&AE 655, Energy Conversion; M&AE 651, Transport Processes II; Elec E 681, Introduction to Plasma Physics; Elec E 682, Advanced Plasma Physics; M&AE 622, Introductory Magnetohydrodynamics; and Elec E 671-672, Feedback Control Systems.

### Master of Science and Doctor of Philosophy

Programs in the graduate Field of Nuclear Science and Engineering are described in the *Announcement of the Graduate School* and *Graduate Study in Engineering and Applied Science*.

### Description of Courses

Courses in nuclear science and engineering are included in those listed under Applied and Engineering Physics.

## Operations Research and Industrial Engineering

R. E. Bechhofer, director; W. L. Maxwell, associate director; R. N. Allen, L. J. Billera, R. W. Conway, D. C. Heath, W. F. Lucas, J. A. Muckstadt, G. L. Nemhauser, N. U. Prabhu, T. J. Santner, B. W. Saunders, A. Schultz, Jr., M. S. Taqqu, H. M. Taylor, 3d., M. J. Todd, L. E. Trotter, Jr., B. W. Turnbull, L. I. Weiss.

### Bachelor of Science

During the sophomore year in the Division of Basic Studies, a student who plans to enter the Field Program in Operations Research and Industrial Engineering must elect, as one of the four engineering core sciences, OR&IE 260, Introductory Engineering Probability. Other recommended core sciences are Compr Sci 211, Elec E 210, and T&AM 202. Early consultation with an OR&IE faculty member or with the associate director can be helpful in making appropriate choices. In the junior year the following courses are required:

Term 5	Credits
OR&IE 320, Optimization I	4
OR&IE 350, Cost Accounting, Analysis, and Control	4
OR&IE 370, Introduction to Statistical Theory with Engineering Applications	4
Compr Sci 211, Computers and Programming*	3
Liberal studies elective	3
Term 6	
OR&IE 321, Optimization II	3
OR&IE 361, Introductory Engineering Stochastic Processes	4
OR&IE 383, Introduction to File Processing and Simulation	4
Behavioral science†	3
Liberal studies elective	3

\*If Compr Sci 211 is completed during the sophomore year, an appropriate three-credit technical elective may be substituted by agreement with the OR&IE adviser.

†The behavioral science requirement can be satisfied by any one of several courses of an advanced nature, including B&PA 540 (recommended for those contemplating the pursuit of a graduate business degree), B&PA 541, ILR 121, ILR 150, and ILR 151. The adviser must approve the selection in all cases.

The basic senior-year program, from which individualized programs are developed, comprises the following courses:

	Credits
Four courses consisting of two two-course sequences as described below	minimum of 12
Two technical electives (these need not be sequential)	6
Two liberal studies electives	6
Two free electives	6
Available OR&IE sequences are as follows:	
Industrial systems: OR&IE 410 and 421*	8
Information systems: OR&IE 682 and Compr Sci 414	8
Optimization methods: OR&IE 437 and 431 or 432 and 435	8
Applied statistics: OR&IE 471 or 462 and 570 or 472	7

\*This sequence must be selected by students who plan to participate in the cooperative program with the Graduate School of Business and Public Administration.

Students who have established specific career goals and wish to apply the OR&IE methodology in other technological areas may substitute a course sequence appropriate to the outside discipline for one of the required OR&IE sequences. Examples of possible sequences outside OR&IE are:

	Credits
Manufacturing systems: M&AE 311 and 612	6
Transportation systems: C&EE F621 and F624	7
Public systems: C&EE B617 and either F624 or H628	6
Electrical systems: Elec E 311 and 312	8
Numerical methods: Compr Sci 321 and 322	8
Information Systems: Compr Sci 613 and 635	8

Other sequences are possible and should be checked with the student's adviser.

These options, together with an appropriate choice of technical electives, enable a student to earn at least twelve credits in a technological field other than OR&IE. Through an appropriate choice of free electives also, as many as eighteen credits can be earned in the secondary discipline.

Scholastic requirements for the field are a passing grade in every course, maintenance of a grade-point average of at least 2.0, and satisfactory progress toward completion of the degree requirements. The student's performance is reviewed at the conclusion of each term.

### Master of Engineering (OR&IE)

This one-year professional degree program is application-oriented rather than research-oriented, and requires completion of a project. The course work centers on additional study of analytical techniques, with particular emphasis on engineering applications, especially in the design of new or improved man-machine systems, information systems, and control systems.

General admission and degree requirements are described in the introductory section under College of Engineering. The M.Eng. (OR&IE) program is integrated with the undergraduate degree program in OR&IE, and students who apply during their senior year will generally be admitted. Also welcome are requests for admission from Cornell undergraduates in engineering programs other than OR&IE, or from qualified non-Cornellians. To ensure completion of the program in one calendar year, the entering student should have completed courses in probability theory and basic probabilistic models and in computer programming, and should have acquired some fundamental knowledge of economic concepts required for decision making.

The two parallel course programs leading to the M. Eng. (OR&IE) degree are outlined below.

**I. For matriculants with preparation comparable to that provided by the undergraduate Field Program in OR&IE:**

Fall term	Credits
OR&IE 516, Mathematical Models—Development and Application	4
OR&IE 680, Digital Systems Simulation	4
OR&IE 893, Applied OR&IE Colloquium	1
OR&IE 898, Project Laboratory	1
Depth elective	minimum of 3
Breadth elective	minimum of 3
Spring term	Credits
OR&IE 551, Advanced Engineering Economic Analysis	4
OR&IE 894, Applied OR&IE Colloquium	1
OR&IE 899, Project	minimum of 4
Depth elective	minimum of 3
Breadth elective	minimum of 3

The electives specified above will normally be chosen from graduate courses offered by the School of Operations Research and Industrial Engineering. The depth elective will generally continue study in one of the topics elected to satisfy one of the fourth-year sequence requirements. The breadth elective will generally be one of these sequences available in the fourth year (see listing under Bachelor of Science) but not selected by the student for the undergraduate curriculum.

**II. For matriculants from other major fields of engineering who fulfill the basic prerequisite requirements but do not qualify for Program I:**

Fall term	Credits
OR&IE 370, Introduction to Statistical Theory with Engineering Applications	4
OR&IE 622, Operations Research I	3
OR&IE 516, Mathematical Models—Development and Application	4
OR&IE 893, Applied OR&IE Colloquium	1
OR&IE 898, Project Laboratory	1
Professional elective	minimum of 3
Spring term	Credits
OR&IE 383, Introduction to File Processing and Simulation	4
OR&IE 623, Operations Research II	3
OR&IE 551, Advanced Engineering Economic Analysis	4
OR&IE 894, Applied OR&IE Colloquium	1
OR&IE 899, Project	minimum of 4
Professional elective	minimum of 3

The M.Eng. (OR&IE) student fulfills the project requirement by working individually or as part of a group of no more than four students on an operational systems problem that actually exists in some organization. Appropriate problems are suggested by various operating organizations such as manufacturing firms, retailing organizations, service organizations, governmental agencies, and educational institutions.

**Cooperative Program with Business and Public Administration**

Of the three degree programs offered by the School of Business and Public Administration at Cornell, the Master of Business Administration program is of most interest to engineers. Because modern management is concerned with the operations of production and service systems, much of the analytical methodology required to deal with operating decisions is the same as that used by systems engineers in designing the systems. Therefore, there are several subjects required in the M.B.A. program which OR&IE students take as undergraduates, and an agreement between the School of Operations Research and Industrial Engineering and the Graduate School of Business and Public Administration provides an opportunity to complete the M.B.A. program in one additional year following completion of the M.Eng. degree requirements.

Essential aspects of this six-year M.Eng./M.B.A. program are:

1. that the OR&IE candidate have completed by course work, advanced standing, or exemption examinations, the core course work required for the M.B.A. degree, except for Business Policy, by the end of the fifth year;
2. that thirty credits, at most, of advanced standing will be awarded by the School of Business and Public Administration for work done before the start of the sixth year in the undergraduate B.S. program, in the M.Eng. program, and in Business and Public Administration;
3. that during the sixth year, over a period of two semesters, the candidate will earn twenty-six credits in elective courses approved by Business and Public Administration, plus four credits for Business Policy.

The candidate would qualify for the B. S. degree at the end of four years, the M.Eng. degree at the end of five years, and the M.B.A. degree at the end of six years.

Further details and applications forms for this special program may be obtained from the office of the School of Operations Research and Industrial Engineering, Upson Hall.

**Master of Science and Doctor of Philosophy**

Programs available in the Graduate Field of Operations Research are described in the *Announcement of the Graduate School and Graduate Study in Engineering and Applied Science*.

**Description of Courses**

**213 Systems Analysis and Design** Spring. 3 credits. 3 lec, 1 rec.  
See description under Division of Basic Studies.

**260 Introductory Engineering Probability** Fall or spring. 3 credits. 3 lec. Prerequisite: first-year calculus.  
See description under Division of Basic Studies.

**270 Basic Engineering Statistics** Fall or spring. 3 credits. 2 lec, 1 rec.  
See description under Division of Basic Studies.

**301 Introduction to Systems Engineering** Fall. 3 credits. 3 lec-rec.  
An introduction to modern industrial systems. Historical development of industrial engineering and operations research. Study of industrial organizations and their functions of production, marketing, and costing.

**320 Optimization I** Fall. 4 credits. 3 lec, 1 rec. Prerequisite: Math 293 or 221.  
Formulation of linear programming problems and solution by the simplex method. Related topics such as sensitivity analysis, two-person games, network and integer programming. Applications will include such models as resource allocation, production planning, and political districting.

**321 Optimization II** Spring. 3 credits. 2 lec, 1 rec. Prerequisite: 320.  
A variety of optimization methods, including nonlinear and dynamic programming, extensions of linear programming, and heuristic techniques. Formulation and modeling will be stressed, as well as the use of the computer in solving optimization problems.

**335 Introduction to Game Theory** Spring. 3 credits. 3 lec.  
A broad survey of the mathematical theory of games, including such topics as two-person matrix and bimatrix games; cooperative and noncooperative n-person games; games in extensive, normal, and characteristic function form. Economic market games. Structure theory for games arising from complex organizations.

**350 Cost Accounting, Analysis, and Control** Fall or spring. 4 credits. 3 lec, 1 computing-disc.

Principles of accounting, financial reports; job order and process cost systems—historical and standard costs; cost characteristics and concepts for control, analysis, and decision making.

**361 Introductory Engineering Stochastic Processes** Spring. 4 credits. 3 lec, 1 rec. Prerequisite: 260 or equivalent.  
Provides a working knowledge of random processes are used to construct models for a variety of problems of practical interest. Topics include the Poisson process, Markov chains, renewal theory, models for queueing and reliability.

**370 Introduction to Statistical Theory with Engineering Applications** Fall or spring. 4 credits. 3 lec, 1 rec. Prerequisite: 260 or equivalent.  
Provides a working knowledge of basic statistics as it is most often applied in engineering and a basis in statistical theory for continued study. Topics include a review of distributions of special interest in statistics; testing simple and composite hypotheses; point and interval estimation; correlation; linear regression; curve fitting.

**383 Introduction to File Processing and Simulation** Spring. 4 credits. 2 lec, 1 rec. Prerequisite: 260, 370, Compr Sci 211.  
The application of computers in the areas of management decision making. Design of large data bases and their retrieval and maintenance systems. Simulation methodology. Use of available program packages and special purpose languages. Considerable programming projects.

**410 Industrial Systems Analysis** Fall. 4 credits. 3 lec, 1 computing session. Prerequisite: 350 and 370.  
Engineering economic analysis, including engineering economy, replacement, taxation effects, decision making based on economic considerations. Operations analysis including process flow, process evaluation, procedural analysis, resource layout, methods analysis and design, work measurement, job evaluation, quality control elements. Project planning and control.

**421 Production Planning and Control** Spring. 4 credits. 3 lec. Prerequisite: 320 and 361 or permission.  
Planning and control of large-scale production operations. Inventory control. Leveling, smoothing, and scheduling of production. Job shop scheduling and dispatching. Demand forecasting. Economic and practical interpretation of planning and control procedures.

**431 Discrete Models** Spring. 3 credits. 3 lec-rec. Basic concepts about graphs, networks, and discrete optimization. The use of finite mathematical techniques to model contemporary problems selected from operations research, including voting procedures and decision making, efficient and equitable allocations, energy and environment, traffic and urban systems.

**432 Introductory Nonlinear Programming** Fall. 3 credits. 2 lec, 1 rec. Prerequisites: 320, Compr Sci 100.  
Optimization techniques involving nonlinear functions. Stress is on solution methods such as one-dimensional search, steepest-descent and second-order methods for unconstrained optimization; penalty, barrier, cutting-plane and feasible-direction methods for constrained optimization.

**435 Introduction to Game Theory** Spring. 4 credits. 3 lec, 1 rec. Prerequisite: 320 or 622.  
The same topics as in 335; lectures will be common for both courses. Registrants in 435 will have recitations requiring the indicated prerequisites.

**437 Introductory Dynamic Programming** Fall. 4 credits. 3 lec, 1 rec. Prerequisite: 320 or 622, and 260 or 660. Content similar to 637, though less intense. Stresses modeling and applications.

**462 Introductory Engineering Stochastic Processes II** Fall. 4 credits. 3 lec, 1 rec. Prerequisite: 361 or equivalent. A selection of topics from the following: Time series, Markov and semi-Markov processes, optimal stopping; examples and applications are drawn from several areas.

**471 Applications of Statistics to Engineering Problems** Fall. 4 credits. 3 lec, 1 rec. Prerequisite: 370 or equivalent. Sample size calculations for one- and two-sample *t* tests; theory of multiple linear regression and applications to problems in engineering and the sciences, including graphic and analytic techniques useful in model building; analysis of data from experiments with qualitative factors including one-way and two-way Anova models.

**472 Statistical Decision Theory** Spring. 3 credits. 3 lec. Prerequisite: 471 or equivalent. Same topics as 672, with emphasis on applications in sampling inspections, inventory control, estimation of parameters, testing hypotheses.

**516 Mathematical Models—Development and Application** Fall. 4 credits. 4 rec-labs. Prerequisite: 320 and 361 or permission. A laboratory course concerned with structuring problems and operational systems as mathematical models. A sequence of situations is considered, for which students must construct representative models. Models are examined for their usefulness in analysis, synthesis, and design.

**551 Advanced Engineering Economic Analysis** Spring. 4 credits. 2 lec-disc. Prerequisite: 350. Brief review of accounting bases of financial reporting, control, and decision making. Processes of definition of objectives and goals. Forecasting, pricing, planning, budgeting, and control. Product and market decisions; interdependence of organization, operations, and economic decisions. Cash flow, measurement and control of nonmanufacturing activities. Related topics of special interest to class.

**561 Queuing Theory and Its Applications** Fall. 3 credits. 3 lec. Prerequisite: 361 or permission. Basic queueing models. Design and control of queueing systems. Statistical inference from queueing processes. Solution techniques (including simulation). Scheduling and equipment maintenance. Highway and urban traffic networks. Analysis of computer systems.

**562 Inventory Theory** Fall. 4 credits. 2 lec, 1 rec. Prerequisite: 320 and 361. Discussion of the nature of inventory systems and their design and control. Periodic and continuous review policies for single-item and single-location problems. Multi-item and multi-echelon extensions. Dynamic and static models are discussed. Redistribution methods are analyzed. Applications are stressed.

**570 Statistical Methods in Quality and Reliability Control** Spring. 3 credits. 3 lec. Prerequisite: 370 or equivalent. Control concepts and methods for attributes and variables; process capability analysis; acceptance sampling plans; elementary procedures for variables; acceptance-rectification procedures. Reliability concepts; exponential and normal distributions in reliability; life and reliability analysis of components and systems; redundancy.

**614 Facilities Location and Design** Spring. 3

credits. 3 lec-rec. Prerequisite: 320 or 622 or permission. Formulation, analysis, and solution techniques for location and facility design problems. Applications in industrial, environmental, and regional arenas.

**622 Operations Research I** Fall. 3 credits. 3 lec-rec. Not open to students who have had 320. Survey of deterministic models. Models are drawn from linear, mixed-integer, nonlinear and dynamic programming, network theory, game theory, and deterministic inventory models. Modeling and applications will be stressed.

**623 Operations Research II** Spring. 3 credits. 3 lec-rec. Prerequisite: 260 or 270 or permission. Not open to students who have had 361. Models of inventory and production control, Markov decision models, queueing theory and its applications. Simulation. Illustrative examples and problems.

**625 Scheduling Theory** Spring. 3 credits. 3 lec-rec. Prerequisite: permission of instructor. Scheduling and sequencing problems. Single resource scheduling, parallel processing, flow shop scheduling. Methodology drawn from dynamic and integer programming; simulation techniques and heuristic methods.

**626 Advanced Production and Inventory Planning** Spring. 3 credits. 3 lec. Introduction to a variety of production and distribution planning problems; the development of mathematical models corresponding to these problems; a study of approaches for finding solutions.

**630 Linear Programming** Fall. 3 credits. 3 lec. Prerequisite: advanced calculus. Theory of polyhedral convex sets. Relationship to systems of linear equations and inequalities, including the Farkas lemma. Dual pairs of linear programming problems and the duality theorem. Simplex method and dual simplex method. Transportation problem. Decomposition principle. Introduction to integer and nonlinear programming.

**631 Integer Programming** Spring. 3 credits. 3 lec. Prerequisite: 630. Discrete optimization. Linear programming in which the variables are restricted to be integer-valued. Theory, algorithms, and applications. Cutting plane methods, enumerative methods, and group theoretic methods; additional topics drawn from recent research in this area.

**632 Nonlinear Programming** Fall. 3 credits. 3 lec. Prerequisite: 630. Necessary and sufficient conditions for unconstrained and constrained optima. Computational methods, including interior (e.g., penalty functions), boundary (e.g., gradient projection), and exterior (e.g., cutting plane) approaches.

**633 Combinatorial Analysis** Spring. 3 credits. 3 lec. Prerequisite: 640 or permission. A seminar in which students study and lecture on selected topics in combinatorics.

**634 Graph Theory** Spring. 3 credits. 3 lec-rec. Directed and undirected graphs. Bipartite graphs. Connectedness, planarity, and imbedding. Hamiltonian and Eulerian circuits. Enumeration, coloring and matching problems.

**635 Game Theory I** Fall. 3 credits. 3 lec. Prerequisite: Math 411 or permission. The minimax theorem for two-person zero-sum games. Two-person general sum games and noncooperative *n*-person games; Nash equilibrium points. Cooperative *n*-person games; the core, stable sets, Shapley value, bargaining set, kernel, nucleolus.

**637 Dynamic Programming** Fall. 3 credits. 3 lec. Prerequisite: concurrent registration in 660 and Math 411 or equivalent. Optimization of sequential decision processes. Deterministic and stochastic models, infinite horizon Markov decision models, policy iterations. Contraction mapping methods. Applications drawn from inventory theory, production control; discrete combinatorial examples.

**639 Convex Analysis** Spring. 3 credits. 3 lec. Prerequisite: Math 411 and Math 431 or permission. The theory of finite dimensional convex sets developed through the study of real valued convex functions and Fenchel duality. Separation of convex sets, polarity correspondences, recession cones, theorems of Helly and Carathéodory.

**640 Network Flows and Extremal Combinatorial Problems I** Fall. 3 credits. 3 lec. Prerequisite: permission. Theory of flows in capacity-constrained networks and related areas in applied combinatorial mathematics. Maximum flow, feasibility criteria, scheduling problems, set representatives, (0,1)-matrices, matchings, packing and covering problems, flows in infinite graphs, blocking systems.

**660 Applied Probability** Fall. 4 credits. 3 lec, 1 rec. Introduction to basic probability. The sample space; events; probability. Conditional probability. Independence. Product spaces. Random variables. Important distributions. Characteristic functions. Convergence concepts. Limit theorems.

**661 Applied Stochastic Processes** Spring. 4 credits. 3 lec, 1 rec. Prerequisite: 660 or equivalent. An introduction to stochastic processes which presents the basic theory together with a variety of applications. Topics include Markov processes, renewal theory, random walks, branching processes, Brownian motion, stationary processes.

**670 Applied Statistics** Spring. 4 credits. 3 lec, 1 rec. Prerequisite: 660 or equivalent. Review of distribution theory of special interest in statistics: normal, chi-square, binomial, Poisson, *t* and *F*; introduction to statistical decision theory; sufficient statistics; theory of minimum variance unbiased point estimation; maximum likelihood and Bayes estimation; basic principles of hypothesis testing, including Newman-Pearson lemma and likelihood ratio principle; confidence interval construction.

**671 Intermediate Applied Statistics** Fall. 4 credits. 3 lec, 1 rec. Prerequisite: 670 or equivalent. Distributions of random variables arising in statistical inferences based on the linear model, including the noncentral *t*, chi-square and *F* distributions; derivation of least squares estimators and their optimality properties; derivation of likelihood ratio tests and corresponding confidence regions; simultaneous inference, applications to regression analysis and various Anova models; simple, partial, and multiple correlation; robustness properties.

**672 Statistical Decision Theory** Spring. 3 credits. 3 lec. Prerequisite: 471 or 670 or equivalent. The general problem of statistical decision theory and its applications. Comparison of decision rules: Bayes, admissible, and minimax rules. Problems involving sequences of decisions over time. Use of the sample cdf and other simple nonparametric methods. Applications.

**674 Design of Experiments** Spring. 4 credits. 3 lec. Prerequisite: 671 or permission. Use and analysis of experimental designs such as randomized blocks and Latin squares; analysis of variance and covariance, factorial experiments; statistical problems associated with finding best operating conditions; response-surface analysis.

**680 Digital Systems Simulation** Fall, 4 credits. 2 lec, 1 rec. Prerequisites: Compr Sci 211 and OR&IE 370 or permission. Digital computer programs to simulate the operation of complex discrete systems in time. Modeling, program organization, random number and deviate generation, simulation languages, statistical considerations; applications to a variety of problem areas.

**682 File Processing (also Compr Sci 632)** Fall, 4 credits. 2 lec. Prerequisite: Compr Sci 211 or permission. See Compr Sci 632 for course description.

**736 Game Theory II** Spring, 3 credits. 3 lec. Prerequisite: 635. A continuation of 635, including in-depth treatment of some of the same topics plus such additional topics as games in extensive form, games without side payments, economic market games, and games with infinitely many players.

**738 Game Theory Seminar** Spring, 3 credits. Prerequisite: 736 or permission. A seminar in which students read and report on current papers of interest in game theory, primarily in the area of *n*-person cooperative theory.

**739 Selected Topics in Mathematical Programming** Fall or spring. Credit arranged. Current research topics in mathematical programming.

**741 Network Flows and Extremal Combinatorial Problems II** Spring, 3 credits. 3 lec. Prerequisite: 640. A continuation of 640. Topics include: minimum path, minimum cost flow, maximum dynamic flow, out-of-kilter algorithm, multiterminal flows, network synthesis, and project cost curves.

**761 Advanced Queuing Theory** Fall, 3 credits. 3 lec. Prerequisite: 660 or equivalent. A study of stochastic processes arising in a class of problems including congestion, storage, dams, and insurance. The treatment will be self-contained. Transient behavior of the processes will be emphasized. Heavy traffic situations will be investigated.

**762 Advanced Stochastic Processes** Fall, 3 credits. 3 lec. Prerequisite: 661 or equivalent. A selection of topics from the following: stationary processes, Levy processes, diffusion processes, point processes, martingales, regenerative phenomena, stochastic calculus, weak convergence.

**764 Deterministic and Stochastic Control** Spring, 3 credits, 3 lec. Prerequisite: 661 or equivalent. Topics include: elements of calculus of variations, Pontryagin's maximum principle, Markov decision processes, dynamic programming. Problems in filtering and prediction, production planning and inventory control, congestion phenomena, storage models, and environmental management will be discussed.

**769 Selected Topics in Applied Probability** Fall or spring. Credit arranged. Topics will be chosen from current literature and research areas of the staff.

**773 Statistical Multiple Decision Procedures** Fall, 3 credits. 3 lec. Prerequisite: 674 or permission. The study of multiple-decision problems in which a choice must be made among two or more courses of action; statistical formulation of the problems; fixed-sample size, two-stage, and sequential procedures; special emphasis on applications to selection problems involving choosing the "best" category where goodness is measured in terms of a particular parameter of interest; recent developments.

**774 Nonparametric Statistical Analysis** Spring, 3 credits. 3 lec. Prerequisite: 670 or permission. Estimation of quantiles, cdf's, and pdf's. Properties of order statistics and rank-order statistics. Hypothesis testing in one- and several-sample situations. Small and large sample properties of tests. Asymptotic distributions of test statistics. Testing goodness of fit.

**775 Quantitative Data Analysis** Spring, 3 credits. Prerequisite: 671. Varieties of categorical data; cross classifications and contingency tables; tests for independence; multidimensional tables and log-linear models; maximum likelihood and weighted least squares estimation; tests of goodness of fit; analysis of incomplete tables; life tables; paired comparison experiments.

**779 Selected Topics in Applied Statistics** Fall or spring. Credit arranged. Selected topics chosen from such fields as nonparametric statistical methods, sequential analysis, multivariate analysis.

**789 Selected Topics in Information Processing (also Compr Sci 733)** 4 credits. 2 lec, 1 computing session. Selected topics in the design and optimization of record storage and file accessing methodology using operations research techniques.

**890 Special Investigations in OR&IE** Fall or spring. Credit arranged. For individuals or small groups. Study, under faculty guidance, of special topics or problems.

**891 OR Graduate Colloquium** Fall or spring, 1 credit. A weekly 1½-hour meeting devoted to presentations by distinguished visitors, by faculty members, and by advanced graduate students, on topics of current research in the field of operations research.

**893-894 Applied OR&IE Colloquium** 893, fall; 894, spring, 1 credit per term. A weekly meeting for M. Eng. students. Discussion of assigned topics; presentations by practitioners in the field.

**898 Project Laboratory** Fall, 1 credit. A weekly meeting for M. Eng. students. Identification and description of engineering project proposals. Also a selection mechanism for projects to be done in 899.

**899 Project** Fall or spring. Credit variable. For M.Eng. students. Identification, analysis, design, and evaluation of feasible solutions to some applied problem within the OR&IE field. A formal report and oral defense of the approach and solution are required.

## Theoretical and Applied Mechanics

Y. H. Pao, chairman; H. D. Block, J. A. Burns, H. D. Conway, E. T. Cranch, J. T. Jenkins, R. H. Lance, G. S. S. Ludford, F. C. Moon, S. Mukherjee, R. H. Rand, W. H. Sachse.

### Undergraduate Study

The Department of Theoretical and Applied Mechanics is responsible for courses in engineering mechanics and engineering mathematics, some of which are part of the underclass engineering curriculum in the Division of Basic Studies.

### College Program in Engineering Science

Although no upperclass field program is offered in theoretical and applied mechanics, a student may

enroll in the College Program in Engineering Science, which is sponsored by the department. The College Program is described in the introductory section under College of Engineering.

### Master of Engineering (Engineering Mechanics)

Students who are interested in advanced study in mechanics and who intend to emphasize engineering practice rather than teaching or research may apply for admission to the M.Eng. (Engineering Mechanics) degree program. General admission and degree requirements are described in the introductory section under College of Engineering. Specific requirements for the M. Eng. (Engineering Mechanics) degree are:

1. Completion of a minimum of three credits of work on an individual project, either analytical or experimental, under the direction of a faculty member.
2. Satisfactory completion of six credits of 600-level courses in mathematics or applied mathematics.
3. Courses in or related to theoretical and applied mechanics, selected in consultation with the student's adviser from those offered at the graduate level, to bring the total credits to at least thirty.

### Master of Science and Doctor of Philosophy

The research-oriented degree programs offered by the graduate Field of Theoretical and Applied Mechanics are described in the *Announcement of the Graduate School and Graduate Study in Engineering and Applied Science*.

### Description of Courses

Courses are listed under the following headings: *Basics in Engineering Mathematics and Mechanics; Engineering Mathematics; Experimental Mechanics; Continuum Mechanics and Inelasticity; Elasticity and Waves; Dynamics and Space Mechanics; Biomechanics; and Special Courses, Projects, and Thesis Research.*

#### Basics in Engineering Mathematics and Mechanics

**105 Finite Mathematics for Biologists (also Math 105)** Offered by the Department of Theoretical and Applied Mechanics in 1976-77. Fall, 3 credits. 2 lec, 2 rec. Evening exams. Prerequisite: three years of high school mathematics, including trigonometry. Models, analytic geometry, difference equations, elementary linear algebra, probability. Examples from biology throughout the course.

**106 Calculus for Biologists (also Math 106)** Offered by the Department of Theoretical and Applied Mechanics in 1976-77. Spring, 3 credits. 2 lec, 2 rec. Evening exams. Prerequisite: Math 105 or three years of high school mathematics, including trigonometry and analytic geometry. Introduction to differential and integral calculus, partial derivatives, elementary differential equations. Examples from biology throughout the course.

**201 Introduction to Applied Mechanics** Spring, 3 credits. Prerequisite: registration in Math 293. See description under Division of Basic Studies.

**202 Mechanics of Solids** Fall or spring, 3 credits. 2 lec, 1 rec, 1 lab. Evening exams. Prerequisite: registration in Math 293. See description under Division of Basic Studies.

**203 Dynamics** Fall or spring, 3 credits, 2 lec, 1 rec, 1 lab. Evening exams. Prerequisite: registration in Math 294. See description under Division of Basic Studies.

**293 Engineering Mathematics (also Math 293)**

Fall or spring. 4 credits. Evening exams. Prerequisites: Math 192 or 194, computer programming equivalent to Engr. 105. Vectors and matrices, first-order differential equations, infinite series, complex numbers, applications. Problems for programming and running on the computer will be assigned.

**294 Engineering Mathematics (also Math 294)**

Fall or spring. 3 credits. Prerequisite: Math 293. Evening exams. Linear differential equations, quadratic forms and eigenvalues, differential vector calculus, applications.

**295 Engineering Mathematics (also Math 295)**

Honors section of 293. Fall. 4 credits. Prerequisite: Math 192 or 194. Follows the general plan and covers the material of 293 with substantially greater emphasis on fundamental unifying concepts. Additional topics may include the convergence in metric spaces, complex numbers in power series and linear transformation, invariance, the Jordan canonical form.

**296 Engineering Mathematics (also Math 296)**

Honors section of 294. Spring. 4 credits. Prerequisite: Math 295 or permission of instructor. Follows the general plan and covers the material of 294 with substantially greater emphasis on fundamental unifying concepts. Additional topics may include matrix solutions for ordinary differential equations, particular solutions by the superposition integral, and a project.

**Engineering Mathematics****310 Advanced Engineering Analysis I**

Fall. 3 credits. 3 lec. Prerequisite: Math 294 or equivalent. Applied ordinary differential equations in engineering context. Analytical and numerical methods. Special functions; initial value, boundary value, and eigenvalue problems in linear and nonlinear systems.

**311 Advanced Engineering Analysis II**

Spring. 3 credits. Prerequisite: 310 or equivalent. Continuation of 310. Applied partial differential equations. Topics from advanced calculus, functions of several variables, vector calculus, complex variables. Elliptic, hyperbolic, and parabolic equations. Analytical and numerical methods.

**610 Methods of Applied Mathematics I**

Fall. 3 credits. 3 lec. Open to undergraduates with permission of instructor. Intensive course for beginning graduate students in engineering and science, emphasizing applications. Linear algebra, ordinary differential equations, series, orthogonal functions and Sturm-Liouville theory, functions of several real variables, vector fields, and integral theorems.

**611 Methods of Applied Mathematics II**

Spring. 3 credits. 3 lec. Prerequisite: 610 or equivalent. Partial differential equations, Green's functions, Fourier and Laplace transforms, complex variables, calculus of variations, tensor analysis.

**613 Methods of Applied Mathematics IIIa**

First half of fall. 2 credits. Prerequisite: 611 or equivalent. First of an 8-credit sequence (613; 614, 615, 616) that develops advanced mathematical techniques for engineering problems. Review of complex variable theory; conformal mapping; complex integral calculus. Nonlinear partial differential equations; general theory of characteristics.

**614 Methods of Applied Mathematics IIIb**

Second half of fall. 2 credits. Prerequisite: 613 or equivalent. Integral transforms for partial differential equations; Green's function; asymptotics, including steepest descent and stationary phase. Wiener-Hopf technique. Problems drawn from vibrations and

acoustics, fluid mechanics and elasticity, heat transfer, and electromagnetics.

**615 Methods of Applied Mathematics IVa**

First half of spring. 2 credits. Prerequisite: 613 or equivalent.

In context of applications: regular and singular perturbation theory, method of matched asymptotic expansions, two timing (method of multiple scales), WKB approximation.

**616 Methods of Applied Mathematics IVb**

Second half of spring. 2 credits. Prerequisite: 614 or equivalent.

In context of applications: Hilbert-Schmidt and Fredholm theories of integral equations, Wiener-Hopf equations with application to finite interval, Carleman equation and its generalization, effective approximations.

**Experimental Mechanics****640-641 Experimental Mechanics**

640, fall; 641, spring. 3 credits. 1 lec. Each student is expected to perform six to ten experiments in mechanics, selected to meet his or her individual interests. Topics: elastic, viscoelastic, microplastic, and plastic response of materials; linear and nonlinear vibration of discrete and continuous systems; acoustic and elastic wave propagation and scattering phenomena; dynamical stability of rigid body; analog and digital simulation of dynamic systems; magnetoelastic interactions.

**Continuum Mechanics and Inelasticity****450 Introduction to Continuum Mechanics**

Fall. 3 credits. Provides a foundation for further studies in fluid and solid mechanics, materials science, and other branches of engineering. Vector and tensor analysis; kinematics of deformation; analysis of stress and strains; balance laws of physics; constitutive equations; examples of elasticity and fluid mechanics.

**651 Continuum Mechanics and Thermodynamics**

Fall, alternate years. 3 credits. Kinematics. Conservation laws. The entropy inequality. Constitutive equations. Frame indifference. Material symmetry. Simple materials and the position of classical theories in the framework of modern continuum mechanics.

**752 Topics in Continuum Mechanics**

Spring, alternate years. Prerequisite: 751. Theory of (nonlinear) elasticity and thermoelasticity; universal solutions, wave propagations, and stability theory. Nonlinear viscoelastic fluids and solids. Viscometric flows. Materials with continuum microstructure.

**757 Viscoelasticity, Creep, and Fracture**

Fall, alternate years. 3 credits. Linear viscoelasticity: constitutive equations, models, differential and integral operators, Laplace transforms, complex modulus, vibrations and wave propagation, boundary value problems. Thermoviscoelasticity. Creep: classical and modern theories, stress redistribution, boundary value problems. Fracture: criteria, stress singularities.

**758 Theory of Plasticity**

Fall, alternate years. 3 credits. Plastic stress-strain laws, yield, criteria, flow rules. Work hardening. Flexure and torsion of bars. Boundary value problems—thick cylinders and spheres. Residual stress. Limit analysis of structures. Plane strain—slip line theory.

**Elasticity and Waves****663 Applied Elasticity**

Fall. 3 credits. Two 1½-hour lec. Thin curved bars. Plane stress and strain in cylinders;

effects of pressure, rotation, and thermal stress. Small (and large) deflection theory of plates; classical, approximate, and strain-energy methods. Thin cylindrical shells. A first course in elastic deformable bodies with structural applications.

**664 Theory of Elasticity**

Spring. 3 credits. 3 lec. Analysis of stress and strain. Airy's stress function solutions using Fourier series and integrals. Torsion theory. Three-dimensional solutions. Bending of prismatical bars. Axially loaded circular cylinder and half space.

**765 Mathematical Theory of Elasticity**

Spring, alternate years. 3 credits. Prerequisites: 663 and 664. The basic equations of large-deformation elasticity; solution of certain large-deformation problems. Linearization. Boussinesq-Papkovich potentials and three-dimensional problems; plane stress by method of Muskhelishvili; conformal mapping; torsion problems.

**666 Fundamentals of Acoustics (also Elec E 499)**

Spring. 3 credits. 3 lec, biweekly lab. Introduction to the principles and theories of acoustics. The vibrations of strings, bars, membranes, and plates; plane and spherical acoustic waves; transmission phenomena; resonators and filters; waves in solids and fluids. Application is made to sonic and ultrasonic transducers, music and noise, and architectural acoustics. At the level of *Fundamentals of Acoustics* by Kinsler and Frey.

**667 Mechanical Waves and Vibrations**

Spring, alternate years. 4 credits. Two 1½-hour lec, 1 lab. An introduction to a unified treatment of waves and vibrations in elastic systems, including strings, rods, beams, membranes, and plates. Acoustic waves in air and solids, and seismic waves. Dispersion and group velocity. Transient waves and forced vibrations. Plane, cylindrical, and spherical waves. Huygen's principle. Radiation and scattering. Mechanical wave guides.

**768 Dynamic Theory of Elasticity**

Spring, alternate years. 3 credits. Two 1½-hour lec. An advanced course on dynamic stress analysis and wave propagation in elastic solids. Theory of elastodynamics. Waves in isotropic and anisotropic media. Reflection and refraction. Surface waves and waves in layered media. Transient waves and methods of Lamb-Cagniard-Pekeris. Thick plate theories. Vibration of spheres. Scattering of waves and dynamic concentration.

**Dynamics and Space Mechanics****670 Intermediate Dynamics**

Fall. 3 credits. Two 1½-hour lec. Newtonian mechanics for single particles and systems of particles, conservation laws, central-force motion; Eulerian mechanics for rigid bodies, tops, gyroscopes; generalized coordinates, D'Alembert's principle, Lagrangian equations, analytic mechanics for particles and rigid bodies.

**771 Advanced Dynamics**

Spring. 3 credits. Prerequisite: 670 or equivalent. Hamilton's principle, Lagrangian mechanics, principle of least constraint, principle of least action, Gibbs-Appell equations; Hamilton's equations, canonical transformations, Hamilton-Jacobi theory; differential geometry of geodesics; general theory of orbits; topological dynamics; principle of relativities.

**672 Space Flight Mechanics (also Astro 579)**

Fall, alternate years. 3 credits. Gravitational potential of planets, two-body problem, three-body problem, restricted three-body problem, Hill curves, libration points and stability, capture problems, virial theorem. Lagrange's planetary equations; effect of oblate earth, atmospheric drag, and solar radiation on satellite orbits; satellite attitude control; orbital maneuvers, rendezvous problems.

**673 Mechanics of the Solar System (also Astro**

**571)** Fall, alternate years. 3 credits. Prerequisite: 670 or permission.

Mechanics used to explain physical phenomena in the solar system. Seismic waves, free oscillations, free and forced rotation, collisions, gravitational potentials. Equilibrium tidal theory, tidal interactions, orbital evolution, spin-orbit coupling. Comets and asteroids. Dust dynamics; radiation pressure. Poynting-Robertson drag; Yarkovsky effect.

**775 Nonlinear Vibrations** Spring, alternate years. 3 credits. 3 lec. Prerequisite: 667 or equivalent.

Phase-plane techniques, singular points, conservative systems, limit cycles, Poincare-Bendixson theorem, method of isoclines, Lyapunov stability, perturbation methods, method of Krylov and Bogoliubov, applications.

**776 Stability of Motion** Spring, alternate years. 3 credits. 3 lec.

Physical notions of stability, Lyapunov stability, orbital stability, Lyapunov's second method, validity of linearized variational equations, stability of equilibrium points, stability of periodic motions. Floquet theory, perturbations.

**Biomechanics**

**681 Introduction to Biochemanics, Bioengineering, Bionics, and Robots (also Elec E 621)** Fall. 3 credits.

A survey, primarily for undergraduates; an introduction to 682, but not necessarily a prerequisite. Problems in the design of robots to operate in ways analogous to physiological and mental functions. Biomedical engineering, artificial intelligence, pattern recognition, natural languages, neural network and brain models. Students select individual or team projects and report on them.

**682 Current Research Problems in Bionics and Robots** Spring, alternate years. Offered 1976-77.

1-4 credits, as arranged. 681 is introductory but not necessarily prerequisite. A graduate-level seminar, concentrating on a few of the topics listed under 681. Faculty and students report on current research in problems of robotics, such as sensors, pattern recognition, perception, and language. Artificial intelligence, adaptive systems, neural networks; brain and behavior models.

**Special Courses, Projects and Thesis Research**

**491-492 Project in Engineering Science** 491, fall; 492, spring. Credit arranged.

Projects for undergraduates under the guidance of a faculty member.

**591-592 Project in Mechanics** 591, fall; 592, spring. Credit arranged.

A minimum of three credits must be completed by each candidate for the M.Eng. (Engineering Mechanics) degree.

**798-799 Selected Topics in Theoretical and Applied Mechanics** 798, fall; 799, spring. Credit arranged.

Special lectures or seminars on subjects of current interest. Topics will be announced when the course is offered.

**890-990 Research in Theoretical and Applied Mechanics** Fall or spring. Credit arranged.

Thesis or independent research at the M.S. (890) or Ph.D. (990) level on a subject of theoretical and applied mechanics. Research will be under the guidance of a faculty member.

Program on Science,  
Technology, and Society

## School of Hotel Administration

The opportunities for the student to achieve a fulfilling career in the lodging, food service, and travel industries are manifold. These industries have undergone tremendous change and development during the lifetime of the School and today are among the most challenging and rapidly expanding fields of human endeavor.

For more than fifty years, the School's graduates have found that their basic educational preparation has provided them with a desirable background to become leaders in these industries and to help shape industry development around the world. During the years since its founding, the School's curriculum has benefited from the close guidance of these industry leaders. Thus, the programs leading to the bachelor's degree represent the combined efforts of university educators and of those who are closely attuned to the educational needs of the industry.

As part of the degree requirements, each undergraduate enrolled in the School of Hotel Administration must complete a minimum of two summer periods of ten weeks each or their equivalent of full-time, supervised employment and file acceptable reports for each work period.

As many students displaying real promise and ability require financial aid, opportunities for scholarships are open to freshmen through the University's general scholarship program and to students who have successfully completed the freshman year through the School's extensive list of scholarships. For students who have established a good record, there are also loans, grants, and teaching assistantships. Attention is called to the fact, however, that the School can only supplement personal resources. (For further information, see the *Announcement of the School of Hotel Administration*.)

The School's programs for advanced degrees include those of Master of Professional Studies, Master of Science, and Doctor of Philosophy. For more complete information about undergraduate program requirements, see the *Announcement of the School of Hotel Administration*. For further information on graduate degree programs, the reader should consult the *Announcement of the Graduate School* or contact Professor Stanley W. Davis, Graduate Faculty Representative, School of Hotel Administration, Cornell University, Ithaca, New York 14853.

## Administration

**240 Personal Real Estate Investments** 2 credits. Open only to students outside the School of Hotel Administration.  
D. Sher.

A practical course in personal real estate investment. Lectures and case studies cover the advantages and disadvantages of real estate as an investment, and how to maximize gain and minimize risk and possible loss. Subject matter includes (1) the economics of real estate, tax shelters, financial leverage; (2) types of personal real estate investments; (3) risk analysis, cash flow, and return on investment; (4) sources of financing; (5) joint ventures and syndications; and (6) acquisition and development of real estate.

**340 Real Estate Feasibility Analysis** 2 credits. Open only to students outside the School of Hotel Administration. Prerequisite: H Adm 240 or equivalent or written permission of instructor.  
D. Sher.

Emphasis will be on determining market demand and potential of real estate projects, primarily from the private investor's viewpoint. Market demand and

market potential will be treated as part of the scope of the feasibility analysis. The course will review and apply concepts and theories of market stratification and segmentation, and location determination to specific case studies with attention to the impact of real estate feasibility on investment return. Specific areas will include retail/commercial real estate, offices, industrial parks, and housing.

## Economics

**241 Macroeconomics** 3 credits. Required.  
W. H. Kaven.

Modern economic problems are examined from the viewpoint of their historical perspective and as national issues after which aggregate economic system and the determinants of prosperity and recession are concentrated upon. Oriented toward the economic environment of business decisions and utilizes a text and case book for discussions along with current business publications.

**242 Microeconomics** 3 credits. Required.  
W. H. Kaven.

Centers on the use of economic analysis in formulating business decisions. Draws upon such concepts as demand, cost, profit, compensation, and pricing, and introduces managerial economics. In addition to text and cases, current business publications are utilized.

**243 Principles of Marketing** 2 credits. Hotel elective. Best taken after H Adm 241-242.  
W. H. Kaven.

Deals with the economic principles of marketing with special emphasis on the marketing of services. The course combines text, readings, and cases.

**244 Franchising in the Hospitality Industry** 2 credits. Hotel elective.  
D. E. Whitehead.

Designed to cover the specific steps involved in developing a franchise operation from the viewpoint of both the franchisor and the franchisee. Feasibility studies, real estate, plans and project costs, financing, project analysis, corporate structure, and operations are some of the topics to be studied.

**245 Tourism** 3 credits. Hotel elective.  
M. A. Noden.

A lecture course dealing with the primary characteristics of foreign and domestic tourism. Areas of concern include basic terminology, geographic considerations, development of infra- and superstructure in host countries, travel delivery systems, and the social and cultural aspects of tourism. Emphasis is placed on transportation and the travel service industries as well as the socioeconomic effects of tourism on developing countries. Consideration also is given to travel research and marketing.

**349 Development of a Hospitality Property** 3 credits. Hotel elective. Prerequisite: permission of instructor.  
D. E. Whitehead.

Students work in seminar groups of two to four to develop a hospitality project. All aspects of development will be covered, from the feasibility study through site acquisition, franchising, construction management, operational preopening, marketing, personnel training, and furniture and fixture installation to the actual opening of the hotel, motor inn, or restaurant.

**745 Graduate Seminar in Tourism** 2 credits. M.P.S. elective. Limit: 25 graduate students; seniors by permission.  
N. B. Rosenberg.

The components and dynamics of the international tourism industry, its postwar growth, and its economic impact on developed and underdeveloped countries will be reviewed. The integration of government and the private sector in planning, financing, and controlling the development of regional tourism in relation to market demand will be evaluated.

## Insurance

**246 General Insurance** 3 credits. Hotel elective. Open to upperclass and graduate students.  
K. McNeill.

Designed to provide the student with a comprehensive introduction to the insurance field. The emphasis is upon fire insurance, casualty insurance, and multiple peril policies. Such topics are covered as the law of contracts as it relates to insurance; the fire insurance policy and fire insurance forms; business interruption, marine, burglary and crime, and liability insurance; rates and rate making; bonds; negligence and torts; compensation; package policies; adjustment of losses; and the types of insurers.

## Law

**247 Law and the Women Employees** 3 credits. Hotel elective. Open to students in other divisions.  
J. E. H. Sherry.

Designed to enable management to deal with the legal problems of women employees as they affect the hospitality industry, and to provide the nonlaw student with information regarding the emerging legal rights of women generally. The practical needs of the industry and of women as co-equals are examined and treated. Emphasis is placed on an awareness of the psychological, social, and economic factors that operate in this area, and what legal changes are required to meet current and future needs. A combination of text, statutory, and case materials is used.

**341 Law of Business I** 3 credits. Required. Open to upperclass students.  
J. E. H. Sherry.

A basic course in business law. The student is introduced to the fundamental purposes, principles, and processes of the law as an agency of social control in relation to business activities. The topics treated include: the origin and development of common, statutory, and constitutional law; the organization and functioning of the judicial system; the formation, validity, enforcement, and breach of contracts; the laws of principal and agent, employer and employee; personal property; and partnerships and corporations. A combination of text and case materials is used.

**342 Law of Business II** 3 credits. Hotel elective. Open to upperclass and graduate students. Prerequisite: H Adm 341.  
J. E. H. Sherry.

A continuation of Hotel Administration 341 for those students who desire more extensive legal training to further their business careers. Emphasis is given to the laws pertaining to the Uniform Commercial Code (sales and negotiable instruments); bailments; trust and estates; transfers by will; unfair competition and trade regulation; bankruptcy and insurance.

**344 Law of Innkeeping** 3 credits. Required. Open to upperclass and graduate students and required of M. P. S. candidates.  
J. E. H. Sherry.

A study of the laws applicable to the ownership and operation of inns, hotels, motels, restaurants, and other places of public hospitality. Consideration of the host's duties to guests, lodgers, boarders, tenants, invitees, licensees, and trespassers; the exclusion and ejection of undesirable; liability for personal injuries on and off the premises; the concept of negligence; liability for damage or loss of property; statutory limitations of liability; lien rights; concession agreements; leases; credit and collection practices; arrest and detention of wrongdoers; and miscellaneous statutes and administrative rules and regulations applicable to public houses. The material is treated from the point of view of the executive who is responsible for policy and decision making.

**347-348 Real Estate Law** 347, fall; 348, spring. 2 credits per term. Hotel elective. Open to upperclass

and graduate students. Best taken after H Adm 341 or 241-242.

J. H. Sherry.

The student is introduced to laws governing the acquisition, ownership, and transfer of real estate, beginning with the purchase and sale of a family residence and leading to more complex transactions involving hotels, motels, condominiums, cooperatives, syndications, and real estate trusts. Actual transactions are analyzed to pinpoint the advantages and disadvantages to the parties involved. Financing aspects, including construction and building loans, mortgages, and mortgage foreclosures are treated from the viewpoint of lender and borrower. The legal relations of landlord and tenant are given special attention, and typical hotel and motel leases are dissected and scrutinized. Applicable tax considerations are focused on all transactions.

#### 444 Seminar in International Tourism Law

3 credits. Hotel elective. Open to upperclass and graduate students with permission of instructor. Prerequisites: H Adm 341 and 344, or the equivalent. J. E. H. Sherry.

A comparative analysis of the laws governing tourism as found in Anglo-American and civil law jurisdictions. The treatment includes immigration laws, travel agency responsibilities, the laws pertaining to passenger carriers as well as public hospitality laws. Emphasis is placed on case studies as well as textual material to enable management to apply legal theory to the practical resolution of current operational problems.

### Real Estate

#### 346 General Survey of Real Estate

2 credits. Hotel elective. Prerequisites: H Adm 241-242 or equivalent, or permission of instructor. D. Sher.

A practical survey of real estate as the capital investment decision in the hospitality industry and related retail industries. Lectures and case studies cover the role and importance of real estate environment, the relationship of real estate to the marketing strategy of a company and its investment decisions; the marketing and merchandising of real estate; the financing of real estate; and the effects of real estate financing on a company's overall corporate financial structure and on its future borrowing ability.

#### 441 Seminar in Real Estate

2 credits. Hotel elective. Prerequisite: H Adm 346 or equivalent, or permission of instructor. D. Sher.

This course develops the concepts introduced in Hotel Administration 346 with case studies and field projects.

#### 443 Site Selection Criteria and Computer Models

2 credits. Hotel elective. Prerequisite: H Adm 346. D. Sher.

Students develop a computer model for site selection for a hotel chain. During the fall term, the class makes a field study of the hotel chain's existing locations and analyzes the underlying marketing characteristics. During the spring term students cover regression analysis, evaluation and correlation of data, and the programming and testing of computer models.

### Directed Studies

#### 640 Undergraduate Independent Research in Administration

Credit to be arranged. Hotel elective. Prerequisite: written permission obtained before registration from the faculty member who is to direct the study.

Students are afforded an opportunity to pursue independent research projects under the direction of a faculty member. Only the first three credit hours of directed study may be credited toward hotel electives

during the student's undergraduate academic career. Additional directed study, if taken, will be credited toward free electives.

#### 740 Graduate Independent Research in Administration

Credit to be arranged. Graduate students only. As appropriate, graduate students may enroll in this course for thesis or monograph research, or for other directed study. The student must have in mind a project and in advance of registration for the term, obtain written agreement from a faculty member who will oversee and direct the study. Forms are available in the office of the graduate faculty representative.

## Financial Management

#### 120 Basic Principles of Accounting and Financial Management

2 credits. Not open to hotel students. D. Ferguson.

A survey course covering accounting principles, financial statement analysis, and income and payroll taxes. The course is designed for the student who desires a general knowledge of the language of business and finance. May be taken with Hotel Administration 322 to include the investment aspects of financial management.

### Required Courses

#### 121 Financial Accounting

3 credits. Required. J. J. Eyster, D. C. Dunn.

Reporting and measurement approaches for revenues, expenses, assets, liabilities, and owner's equity are studied. The focus is on the corporation rather than the sole proprietorship or the partnership. As a consequence, income taxes, dividends, earnings per share, capital stock, and the APB Opinions are encountered.

#### 122 Hospitality Accounting Systems

3 credits. Required. Prerequisite: H Adm 121 or equivalent. D. C. Dunn.

A course designed to expose the students to the accounting systems found in hotels, motels, and restaurants—as recommended by the American Hotel and Motel Association. Among the topics considered are hotel-motel front office accounting, the restaurant and other sales areas, the special journals and ledger accounts peculiar to hotel accounting systems, the flow of accounting transactions through the system, the preparation of hotel financial statements, and their interpretation.

#### 125 Finance

3 credits. Required. Prerequisite: H Adm 121 or equivalent. R. M. Chase.

An objective study of the financial function in a profit-oriented enterprise. Important concepts include cash flow, the time value of money, and capital budgeting. Emphasis is on the analysis of accounting information, problem solving, and decision making.

#### 221 Managerial Accounting

3 credits. Required. Prerequisite: H Adm 121 or equivalent. A. N. Geller.

The financial accounting process is reviewed and followed by the development of managerial accounting. The overall objective is the use of accounting information for managerial planning, control, and evaluation. Particular emphasis is placed on differential accounting and its role in extracting relevant decision variables. Other course topics are accounting systems, behavior of costs, budget preparation, standard costs, the analysis of variance from standard costs, and performance reports.

#### 222 Managerial Accounting in the Hospitality Industry

3 credits. Required. Prerequisites: H Adm 121, 122 and 221, or equivalent. J. J. Eyster.

The concepts and measurement techniques in Managerial Accounting (H Adm 221) are applied to hospitality industry situations and case studies.

Analyses of annual reports and cost-volume-profit ratios are undertaken. The analyses are summarized and reported in professional management letters written by the students. Other topics are internal control; operational budgeting, and capital budgeting in the hospitality industry. Emphasis is placed upon current issues between management and its auditors, and on a critical analysis of present practice.

### Elective Courses

#### 223 Front Office Machine Accounting

1 credit. Hotel elective. Prerequisite: H Adm 121 or equivalent. Best taken after H Adm 122. One two-hour practice period per week is individually scheduled. D. C. Dunn.

Students learn the operation of the NCR front-office posting machine by completing a series of practical exercises ranging from simple posting of charges and credits to error correction and the night audit.

#### 224 Food and Beverage Control

2 credits. Hotel elective. Prerequisites: H. Adm 122 and 132, or permission of instructor. T. C. Chevoor.

Essentials of food and beverage control from both the operational and accounting standpoints. Practice with typical methods and forms found in the hospitality industry.

#### 226 Hotel Accounting: The Hotel Ivy

3 credits. Hotel elective. Prerequisite: H Adm 122, or may be taken concurrently. D. C. Dunn.

A practice set involving the accounting records of a hypothetical 350-room hotel operated on the European plan and in accordance with the Uniform System of Accounts for Hotels. Among the topics considered are a review of front office accounting, including recording routine transactions and the completion of the night audit of accounts receivable; the income audit and the preparation of the controller's daily report; the entry of the day's business into the hotel's special journals; the use of the general journal for summarizing entries as well as for monthly and annual adjusting entries; the preparation of financial statements for the month and for the year; development of financial statement statistics, and their interpretation.

#### 322 Investment Management

2 credits. Hotel elective. Open only to juniors, seniors, graduate students. R. W. Farnsworth.

A survey of investment opportunities and the methods of analysis used by business and the individual to determine the best use of investment funds. Special emphasis is placed on the stock and bond markets, including security portfolio management.

#### 323 Financial Analysis and Planning I

3 credits. Hotel elective. Prerequisites: H Adm 222 and 225 or permission of instructor. Satisfies economics elective. J. J. Eyster.

After defining and describing the environment in which a business organization must design its strategy, an examination is made of the necessary techniques of financial analysis and planning. Discussion and case studies involve the following areas of financial management: profit planning and forecasting, capital budgeting techniques, cost-of-capital determination, working capital management, long-term financing, and valuation in mergers and corporate adjustments.

#### 325 Staff Planning and Operations Analysis

2 credits. Hotel elective. Prerequisites: H Adm 121, 122, 221, and 323, or permission of instructor. T. C. Chevoor.

Students obtain a working knowledge of the terminology, concepts, and procedures used by hotel management in developing information and making decisions relevant to forecasting and controlling

manpower requirements that are consistent with fluctuating business conditions. The approaches designed to maintain operational control and evaluate overall performance within the hotel also are covered. Major topics included are staff planning, budgeting, scheduling and payroll control, forecasting techniques and practices, considerations for operating within the guidelines of collective bargaining, analysis of financial statements and hotel case studies oriented toward productivity. A required field trip to a participating hotel is part of the study program, for which there is a nominal fee.

**326 Introduction to Statistical Analysis and Inference** 3 credits. Hotel elective. Open to juniors, seniors, and graduate students.

D. C. Dunn.

A first course, intended as an introduction to the basic techniques of statistical method, important both to the businessman and to the prospective researcher. Students with any previous exposure to statistics or probability should see the instructor before course registration.

**328 Cost Accounting** 3 credits. Hotel elective. Open to juniors, seniors, and graduate students. Prerequisite: H Adm 221 or equivalent.

A. N. Geller.

A study of the controller's function in decision making and analysis within the firm. The development of cost accounting systems and their use in the evaluation of operating performance and the setting of prices are explored. Other topics are cost accounting systems, cost-volume-profit relationships, budget preparation, systems design, standard costs, flexible budgets and various cost behavior patterns, cost allocation, transfer pricing, and responsibility accounting.

**421 Internal Control in Hotels** 2 credits. Hotel elective. Open to seniors and graduate students, or by permission of instructor. Prerequisite: H Adm 122.

A. N. Geller.

Discussion of the problems encountered in distributing the accounting and clerical work in hotels so as to provide a good system of internal control. Study of many actual cases on the failure of internal control and the analysis of the causes of the failure. Practical problems and actual techniques of functioning systems of internal control.

**422 Taxation: Personal and Corporate** 2 credits. Hotel elective.

R. M. Chase.

A series of lectures by a guest lecturer who is a member of the tax department of a leading CPA office. An overview and history of tax legislation initiates the course and documents the impact of taxation upon business and personal financial management. Specific topics will include personal income tax, corporate, federal, and state taxes, tax incentives, and tax "shelters."

**(B&PA) NBA 505 Auditing** 3 credits. Hotel elective. Prerequisites: H Adm 121, 122, and 221, or equivalent.

The work of the independent public accountant. Practice includes the preparation of audit work papers, internal control in general, and the preparation of the auditor's report.

**721 Graduate Financial Management I** 4 credits. Open to graduate students only.

R. M. Chase.

An intensive study of financial and managerial accounting. The course explores the accounting model and generally accepted accounting procedures. Report and measurement of revenues and expenses, assets, liabilities, and owner's equity, are studied. The analysis of financial statements is presented, and decision making from these data is emphasized. This course prepares the M.P.S. candidate for H Adm 222 and 722.

**722 Graduate Financial Management II** 4 credits. Required of M.P.S. candidates. Prerequisites:

H Adm 721 or equivalent, and H Adm 222.

A. N. Geller.

The course assumes knowledge of algebraic techniques and elementary statistics. While these quantitative areas are not prerequisites, those who have not recently had a statistics course are urged to purchase and study programmed review books in mathematics and elementary statistics. An introduction to the principles and practices of business finance including the development of theory and its application in case studies. Specific topics include types of securities and their uses, valuation concepts, capital budgeting, cost of capital, capital structure, dividend policy, long-term financing and bank relations, short- and intermediate-term financial management, mergers and consolidations, and the legal aspects of financial management.

**723 Interpretation and Analysis of Financial Statements** 3 credits. Graduate elective. Open to some seniors with written permission. Prerequisite: complete accounting curriculum.

A. N. Geller.

A seminar to discuss the financial accounting issues encountered in reporting the operations of corporate enterprises. The course emphasizes an outsider's view of the operation and decision making through interpretation of published statements. Generally accepted accounting principles as well as future extensions are explored. Financial statements are analyzed to see how and why they are reported and to determine their impact on the overall financial position of the firm and its acceptance in capital markets.

**724 Front Office Accounting Procedures**

1 credit. Required of M.P.S. candidates. Prerequisite: H Adm 121 or equivalent.

D. C. Dunn.

The lab work of H Adm 223 Front Office Machine Accounting is combined with several lectures on theory and procedures found in the accounting framework of the typical hotel front office. A brief introduction to the Uniform System of Accounts also is provided.

**725 Graduate Seminar in Hotel Operations**

2 credits. Hotel elective. Limited to 40 students. Prerequisites: H Adm 121, 122, 221, 222, and 323, or written permission of instructor.

T. C. Chevoor, P. L. Gaurnier.

A working knowledge of terminology, concepts, and procedures used by hotel management to develop information and make decisions relevant to forecasting and controlling manpower requirements consistent with fluctuating business conditions is the goal. The course will also pursue approaches to maintaining operational control and evaluating overall performance within the hotel. Major topics include staff planning, budgeting, scheduling and payroll control, forecasting technique and practice, the guidelines for collective bargaining, financial statement analysis, and productivity analysis through case studies. A required field trip to a participating hotel is an integral part of the program.

**726 Graduate Managerial Accounting in the Hospitality Industry** 3 credits. Required of MPS candidates. Prerequisite: H Adm 721 or equivalent.

J. J. Eyster.

Factors contributing to the gathering and presentation of accurate and reliable data for use by external parties are critically discussed and illustrated through the analysis of annual reports. Emphasis is placed upon current issues involving management and its auditors in the reporting and presentation of this data. Then, ratio, comparative, and cost-volume-profit analyses are studied and applied to individual operations to determine their strengths and weaknesses and the corrective action that will increase profitability. The analyses are summarized and reported in professional managerial letters written by the students. Other topics include internal control, operational budgeting, and the use of feasibility studies in making long-term capital budgeting decisions.

## Directed Studies

**620 Undergraduate Independent Research in Financial Management** Credit to be arranged. Hotel elective. Prerequisite: written permission obtained before registration from the faculty member who is to direct the study. Students are afforded an opportunity to pursue independent research projects under the direction of a faculty member. Only the first three credits of directed study may be credited toward hotel electives during the students undergraduate academic career. Additional directed study, if taken, will be credited toward free electives.

**720 Graduate Independent Research in Financial Management** Credit to be arranged. Graduate students only.

As appropriate, graduate students may enroll in this course for thesis or monograph research, or for other directed study. The student must have in mind a project and obtain written agreement in advance of registration for the term from a faculty member who will oversee and direct the study. Forms are available in the office of the graduate faculty representative.

## Food and Beverage Management

**330 Introduction to Wine and Spirits** 2 credits.

Open only to students in other divisions. Open to juniors, seniors, and graduate students for fall semester, and only to seniors and graduate students for spring semester.

V. A. Christian.

Covers the history of wine and spirits. The main focus is on flavor characteristics, fermentation processes, and brand specifications. Lectures also include purchasing, storage, wine tasting techniques, and drink formulas. Samples from a variety of countries, regions, and vineyards are evaluated. A \$4 fee is charged for tasting equipment.

## Required Courses

**131 Fundamentals of Managing Service**

3 credits. Required.

R. Goodman.

Restaurant service systems and management are presented and students participate as service managers and servers in the practical laboratory. Lectures, demonstrations, and practice sessions include American, French, Russian, and banquet service; beverage and table side service. Guest standards, the psychology of service, and training techniques also are discussed.

**132 Comcommercial Food Service Production**

3 credits. Required. Prerequisite: H Adm 131 or equivalent.

W. Herrmann and assistants.

Conducted in the Rathskeller cafeteria of the Statler Inn where faculty and their guests dine. In addition to the practical experience gained under these commercial conditions, students obtain further instruction from classroom lectures and demonstrations. This course deals with the current methods and principles of food production as practiced by the food service industry. Phases covered on a rotating basis include menu planning, requisitioning, pricing, preparation, serving, sanitation, performance evaluation, and scheduling.

**231 Meat Science and Management** 3 credits.

Required.

S. Mutkoski.

Deals with the major phases of meat, poultry, and fish from the hotel, restaurant, club, and institutional standpoints; nutritive value, structure and composition; sanitation; selection and purchasing; cutting; freezing; portion control and specifications; cooking, carving, and miscellaneous topics. Required

three-day field trip to visit purveyors in New York City, estimated fee for this trip, \$50 to \$60.

### 232 Operational Food Production Systems

3 credits. Required. Prerequisite: H Adm 132.

R. Cantwell, R. Whitaker, R. Johnson.  
Managing the food production and service of Statler cafeteria and dining room. Each student assumes complete managerial responsibility for the food production system which includes menu planning, purchasing, receiving, storing, preparation, and merchandising. Emphasis is placed on operational performance, stressing controls and guest satisfaction. Classroom presentations, demonstrations, and an in-depth managerial report are required.

## Elective Courses

### 234 Hospital Food Service Administration

2 credits. Hotel elective. Prerequisites: H Adm 131 and 132.

Lectures present an overview of health care food service: organizations, significance to hospital and community, management procedures and controls, role of the professional dietician, food production, sanitation, career opportunities, facilities layout and equipment, and utilization of food production systems. A field trip to inspect hospital food service is included.

### 235 Training Techniques—Service and Beverage

3 credits. Hotel elective. Prerequisites: H Adm 131 and permission of instructor.

V. A. Christian, R. Goodman.  
The principles and techniques of training service personnel. Each student is responsible for supervising the technical development of three or four people and for an in-depth research project.

### 331 Seminar in Convenience Foods

2 credits. Hotel elective. Prerequisites: H Adm 131, 132, 171, 172, 232, and permission of instructor.

P. Rainsford.  
A seminar designed to acquaint the student with the financial, managerial, and technological aspects of convenience foods. A class project allows the student the opportunity to compare a conventional food service system with a convenience food service system.

### 333 Restaurant and Beverage Management

4 credits. Hotel elective. Open to upperclass and graduate students. Prerequisite: H Adm 232.

V. A. Christian.  
Principles of modern restaurant and beverage management. Preparation for effective management by using case studies including such topics as the food and beverage service employee, menu planning, merchandising, production standards, purchasing standards, and control systems. A field trip to New York City to analyze restaurants is required; estimated fee, \$40.

### 336 Managerial Aspects of Purchasing

2 credits. Hotel elective. Open to juniors and seniors.

V. A. Christian, J. Durocher.  
Survey of the problems of purchasing meat, fish, poultry, canned products, fresh and frozen produce, dishes, and utilities. Speakers are leading managers and purveyors from the commercial food industry. In addition to lectures and class presentation, careful study is given to the writing of a purchasing manual and to a tour of current markets.

### 337 Survey of Beverages

2 credits. Hotel elective. Open only to hotel upperclass and graduate students.

V. A. Christian.  
This introductory course presents the fundamentals of wine identification, selection, storage, service, and evaluation. Lectures and tastings are conducted for American and international wines, spirits, and beers.

**338 Special Problems in Food** 1 credit. Hotel elective. Prerequisites: H Adm 131, 132, 231, 232, 233, 171, 172, 173, and permission of instructors.

V. A. Christian, J. C. White.  
A seminar course for upperclass and graduate students designed to examine in detail various aspects of food and food service in hotels, restaurants, clubs, and related fields.

### 634 Specialty Restaurants

3 credits. Hotel elective. Prerequisites: H Adm 232, or H Adm 732, or equivalent, and permission of instructors.

V. A. Christian, J. Durocher.  
This course covers a number of different specialty restaurant operations, including those titled Guest Chef, Pasta, Steaks, "Bar One," and Festival Night. The students supervise the planning, preparation and service of a broad range of specialty menus and are held responsible for the complete operational planning and financial accountability.

### 731 Restaurant and Beverage Management

3 credits. Required of graduate students.

V. A. Christian.  
The principles and techniques of planning, managing, operating, and evaluating a food and beverage operation. Special emphasis is placed on menu planning, wine list design, professional standards, and the managerial approach to purchasing, receiving, storing, issuing, preparation and service. A field trip is required at a cost of \$40 to \$60.

### 732 Food Production Systems

3 credits. Required for M.P.S. candidates. Prerequisite: H Adm 731 or equivalent.

J. Durocher.  
Students in the Saturday morning lab prepare and serve the breakfast and luncheon meals in the Statler Inn Rathskeller. Those in the Saturday afternoon lab prepare and serve the dinner for the Statler Inn main dining room and banquets. Students spend one half-term in each lab. The fundamentals of a food production system, from menu planning through service, are taught, and applied to give the student confidence in managing a commercial kitchen or dining room. The lecture demonstration provides further exposure to managerial and technical skills.

### 735 Graduate Meat Science and Management

3 credits. Graduate elective.

S. A. Mutkoski.  
Purchasing, receiving, storage, utilization, and cost analysis of meat, fish, and poultry, as well as meat extenders and analogs will be discussed from the standpoint of commercial food service. This will be done in a seminar-lab combination, with students also required to do independent research on current problems.

### 733 Graduate Operational Food Production Systems

3 credits. Open to graduate students only and required of M.P.S. candidates. Prerequisite: H Adm 732.

J. Durocher.  
Primarily designed to present commercial food production concepts, techniques, skills, and practical sessions. Lectures include menu planning, report writing, food cost and the operation of a commercial kitchen. Practical experience is provided in the planning and preparation of breakfast, luncheon, and dinner.

## Directed Studies

### 630 Undergraduate Independent Research in Food and Beverage Management

Credit to be arranged. Hotel elective. Prerequisite: written consent obtained before registration from the faculty member who is to direct the study. Students are afforded an opportunity to pursue independent research projects under the direction of a faculty member. Only the first three credits of directed study may be credited toward hotel electives during the student's undergraduate career. Additional

directed study, if taken, will be credited toward free electives.

### 730 Graduate Independent Research in Food and Beverage Management

Credit to be arranged. Graduate students only. As appropriate, graduate students may enroll in this course for thesis or monograph research, or for other directed study. The student must have in mind a project and obtain written agreement in advance of registration for the term from a faculty member who will oversee and direct the study. Forms are available in the office of the graduate faculty representative.

## Management

### Human Resources

#### 111 Introductory Psychology

3 credits. Required.  
S. W. Davis.  
An introductory study of basic psychological principles that are involved in understanding human behavior. The course is oriented toward the notion that such understanding is integral to successful hotel management and further applied study. Basic concepts of sensation, perception, learning, motivation, and development are discussed.

#### 211 Management of Personnel

3 credits. Required. Prerequisite: H Adm 111 or equivalent.

D. A. Dermody.  
A practically oriented approach to personnel management, including an introduction to organizational behavior, the selection and placement of personnel, the role of supervision, performance appraisal, wage and salary administration, employee motivation and union management relations. Class discussion is based on case studies drawn from industry. Lectures are augmented by use of case material and role playing.

#### 311 Union-Management Relations in Private Industry

3 credits. Hotel elective. Open to upperclass and graduate students, or by permission of instructor.

F. A. Hermann.  
Major areas of study will include: the development of the trade union movement in the United States, with emphasis on the history and structure of unions active in all phases of the hospitality industry; federal and state laws governing the bargaining relationship, including the role of the National Labor Relations Board; collective bargaining; contract administration; and the critical role of conciliation, procedures (for example, mediation, arbitration) in keeping industrial peace.

#### 313 Development of Training Programs

3 credits. Hotel elective. Open to upperclass and graduate students. Prerequisite: H Adm 211, or equivalent.

D. E. Whitehead.  
The development of training programs for employees and management. Thoroughly explores the construction and implementation of training programs and methods through case histories.

#### 314 Psychology in Business and Industry

3 credits. Hotel elective. Prerequisites: H Adm 111 and H Adm 211 or equivalent.

S. W. Davis.  
The principles of psychology applied to industrial and business systems: personnel selection; placement and training; problems of men at work including evaluation, motivation, efficiency, and fatigue; and the social psychology of the work organization. While Hotel Administration 314 is not a prerequisite for Hotel Administration 315, it is recommended that this course be taken first if the student plans to enroll in Hotel Administration 315.

**315 Seminar in Organizational Behavior and Administration** 3 credits. Hotel elective.

Prerequisites: H Adm 111 and 211 or equivalent; H Adm 314 recommended.

S. W. Davis.

Relation of current research in the behavioral sciences to practical problems of business as developed from actual cases. Particular emphasis is placed on leadership effectiveness and employee productivity. Each participant is responsible for an in-depth research project related to the course's subject matter.

**316 The Psychology of Advertising** 3 credits.

Hotel elective. Open to juniors, seniors, and graduate students. Prerequisites: three credits of psychology and three credits of marketing, or permission of instructor.

The principles of psychology and their potential application to advertising practices are examined. Areas emphasized include learning, perception, motivation, advertising research, consumer behavior, advertising strategy, and measurement. Visiting lecturers and audiovisual presentations constitute integral parts of the course. Students are required to prepare three short papers and to develop a campaign predicated on the principles discussed.

**416 Special Studies in the Management of Human Resources** 3 credits. Hotel elective. Open to upperclass and graduate students. Prerequisite: H Adm 211.

D. A. Dermody.

Students are afforded the opportunity to work in advanced areas of personnel administration. Cases will be presented by the individuals directly involved, and the students' suggested resolutions will be compared to the actual ones.

**711 Graduate Seminar in Organizational Behavior** 3 credits. Hotel elective. Limited to 20 graduate students, and seniors with written permission. Prerequisites: H Adm 111, 112 and 314 or equivalent.

S. W. Davis.

Applications of current thinking and research in organizational behavior and development to practical problems in the hotel-restaurant industry. Particular emphasis will be on group behavior, the leadership function, and employee productivity as they relate to the organizational setting. Each participant is responsible for an in-depth research project.

## General Management

### Required Courses

**112 Introduction to the Hospitality Industry** 1 credit. Required. For freshmen and transfer students with five or more terms of residence requirement.

Members of the faculty.

A survey of the hospitality industry in today's economy. Emphasis on industry growth and development, management problems, and principles of hotel, motel, and restaurant management. Lectures on the role of the School of Hotel Administration and its curriculum in the hospitality industry are included. Visual tour of hotels and other hospitality industry fields is conducted.

### Elective Courses

**115 Lectures in Hotel Management** 1 credit.

Hotel elective. May be taken for credit each semester.

R. A. Beck.

A series of lectures given by nonresident speakers prominent in the hotel, restaurant, and allied fields.

**213 Club Management** 2 credits. Hotel elective.

J. F. Tewey.

Managerial aspects of all types of clubs, from the

small city club to large multiple-activity organizations, are covered through lectures given by club managers, staff, and other authorities in the field. Different club structures are analyzed from the managerial viewpoint, including nonprofit, private, and institutional organizations.

**212 Housekeeping** 2 credits. Hotel elective.

D. A. Dermody, P. J. Starks.

Students become acquainted with the housekeeping function in the hospitality industry; the material, equipment, and techniques of housekeeping; and the managerial skills used in planning, organizing, directing, and controlling the housekeeping department. Discussion includes the duties of the executive housekeeper; staffing tables; purchasing; production standards; selection, care, and use of linens; maintenance of floors, walls, pool areas, and grounds.

**215 Resort and Condominium Management** 3 credits. Hotel elective.

M. A. Noden.

A lecture course in the operation of the resort hotel, including condominiums. Resorts of the various types, seasons, and economic levels are considered. Emphasis is given to the promotion of business, to the provision of facilities and services and guest entertainment, and to the selection, training, and direction of the employed staff. Terminology, rental pool agreements, and S.E.C. regulations, together with developer-management-owner contracts and relationships in condominiums are reviewed.

**319 Club Management Seminar** 1 credit. Hotel elective. Open to upperclass and graduate students. Prerequisite: H Adm 213.

J. F. Tewey.

A discussion class for students who are planning careers in club management that provides them with an opportunity to exchange ideas with leading authorities in club management.

**411 Hotel Management Seminar** 1 credit. Hotel elective. Limited to 20.

R. A. Beck.

Lecturers from industry who are leading executives in their fields will discuss with senior students important developments in the hospitality and travel industries.

**412 Principles of Management** 2 credits. Hotel elective. Open to seniors and graduate students only. Prerequisites: H Adm 211 or equivalent and permission of instructor.

P. L. Gaurier.

A seminar course designed to examine management processes, concepts, and principles; and to improve personal competence in decision making, problem solving, and communication. Each student prepares a comprehensive analytical report, based on previous work, for class discussion and analysis. Sufficient time is given during the first few weeks of the course to discuss management principles and concepts and thus give the student an understanding of the type of report to prepare.

**415 The Small Business** 2 credits. Hotel elective. Limited to 20 seniors with written permission.

R. Cantwell.

This course deals with managerial problems as related to small business operations. Emphasis will be placed on the acquisition of the new business or the takeover of an existing business. Preliminary investigation prior to decision making will be explored. Case studies will be used to illustrate relevant points. A team project will be required. Occasional presentations by guest lecturers.

## Marketing

**216 Marketing Management** 3 credits. Hotel elective. Prerequisite: H Adm 243.

W. H. Kaven.

The marketing function is studied as a management activity including: analysis of marketing opportunities;

organizing of marketing activity; planning the marketing program; and controlling the market effort. The course is oriented to the decision-making process in marketing. Text, cases, discussions, and visiting lecturers from the hotel industry in the areas of marketing research, pricing, and related subjects supplement instruction.

**317 Advertising and Public Relations** 2 credits. Hotel elective. Open to upperclass and graduate students.

H. V. Grohmann and staff.

Fundamentals of advertising, publicity, and public relations and the part each plays in a coordinated business promotion program for different types of hotels and restaurants. The lectures and visual displays depict various advertising techniques as well as current campaigns.

**413 Seminar in Advertising and Public Relations** 2 credits. Hotel elective. Open to seniors and graduate students. Prerequisite: H Adm 317.

H. V. Grohmann.

A seminar course dealing principally with case histories of the advertising, publicity, business promotion, and public relations of hotels, resorts, restaurants, and national travel attractions. Students have the opportunity to analyze and create their own advertising programs including names, logotypes, symbols, copy themes, complete marketing plans, and forecasts for properties of their choice.

**414 Hotel Sales** 2 credits. Hotel elective. Prerequisite: H Adm 216 or equivalent.

D. A. Dermody, T. Chevoor, M. Noden.

This course will take a practical approach to the selling of hotel space with particular emphasis on the solicitation and servicing of groups. Cases are used to develop the major points in the course and class discussion is encouraged in a seminar setting.

**417 Integrated Case Studies in the Hospitality Industry** 2 credits. Hotel elective. Limited to 12 seniors and graduate students, with written permission of instructor.

J. J. Eyster, W. H. Kaven.

An analysis of twelve integrated case studies involving issues in strategy, human relations, administration, marketing, finance, and ethics. The course affords an opportunity to synthesize material from other courses, practical experience, and the judgment of the students.

**712 Seminar in Marketing** 3 credits. Open to graduate students only. Required for M.P.S. candidates.

W. H. Kaven.

This discussion course in marketing management combines the lectures given in Hotel Administration 216 with case studies developed and presented by marketing authorities in the hospitality industry.

## Information Systems

**114 Information Systems I** 3 credits. Required.

D. H. Ferguson.

An introduction to information systems and computing machines. Students learn keypunching and programming skills for application to selected business problems. Use of preprogrammed routines augments and extends the student's own work. Projects involving the hospitality industry are executed on the University's computers.

**214 Hotel Computing Applications** 3 credits. Hotel elective. Prerequisite: H Adm 114.

R. G. Moore.

This course is planned to acquaint students with some of the diverse applications of computing technology within the hotel industry through case studies by lecturers drawn from industry. In addition to lectures, the students will work on a systems development project.

**714 Computers and Hotel Computing**

**Applications** 3 credits. Required for M.P.S. candidates.

R. G. Moore.

The introduction of the computing machine/information system to the hospitality industry is examined from several viewpoints: managerial impact, cost justifications, user reaction, and guest satisfaction. The various successes and failures to date of hotel computing will be analyzed in detail. Students will be given "hands-on" exposure to an actual hotel computing system.

**Directed Studies****610 Undergraduate Independent Research in Management**

Credit to be arranged. Prerequisite: written consent obtained before registration from the faculty member who is to direct the study.

Students are afforded the opportunity to pursue independent research projects under the direction of a faculty member. Only the first three credits of directed study may be credited toward hotel electives during the student's undergraduate academic career. Additional directed study, if taken, will be credited to free electives.

This course is part of the Work-Study Program when taken for twelve credits. Students who enroll in this program have the opportunity to combine managerial instruction with on-the-job management experience. Application for admission should be made one semester in advance. Instruction is provided by the School's faculty and by the organization participating in the work-study arrangements. Currently, work-study programs are in operation at several locations including Statler Inn on the University campus; the St. Francis and Mark Hopkins Hotels in San Francisco; Sea Pines Plantation, Hilton Head, South Carolina; Dobbs Houses, Inc., Atlanta, Georgia; TWA Dining and Catering in New York City; Inn on the Park in Toronto, Canada; and Sherburne Associates in Nantucket, Massachusetts. Other similar programs can be arranged. Students receive both academic credit and practice credit, and appropriate financial remuneration for the period of the program. The student is charged three-fourths of full tuition. All inquiries should be addressed to the Work-Study Coordinator, Statler Hall.

**700 Graduate Monograph or Thesis**

**Research** Credit to be arranged. Required of M.P.S. candidates. Registration must be approved by the graduate faculty member who is to direct the research.

**710 Graduate Independent Research in Management**

Credit to be arranged. Open to graduate students in Hotel Administration only. Designed specifically for graduate students working on theses or other research projects. Any member of the graduate faculty of the School of Hotel Administration, upon consultation with the student, may be selected to direct a particular problem of special interest to the student.

**Managerial Communications****Required Courses****265 Effective Communication** 3 credits.

Required. Limited to 25 students per section.

F. Herman.

This seminar is designed to help students 1) express themselves clearly and effectively orally and in writing and 2) acquire reading and listening skills to better understand the ideas of others. Principles of the communication process are explored, tested, and reinforced during the term through classroom interaction, case studies, debates, and individual and group videotaped presentations. Individual conferences arranged throughout the term.

**Elective Courses**

(Open also to students outside the School)

**161 Typewriting** 2 credits. Hotel elective.

E. C. Seaburg.

The personal needs of college students are met by this course in elementary typewriting.

**261 Report Typing** 2 credits. Hotel elective.

Prerequisite: H Adm 161 or equivalent.

E. C. Seaburg.

A course in electric typewriting designed for those students who can type but who wish to increase speed and accuracy. Special emphasis is placed upon the typewritten report as a form of communication. Business letters are typed in various styles and their effectiveness studied.

**262 Typewriting and Business Procedures**

3 credits. Hotel elective.

E. C. Seaburg.

Students who already know the keyboard develop sufficient speed and accuracy to meet business standards for an executive secretary. Instruction is provided in filing, duplication, and machine transcription.

**263 Shorthand Theory** 3 credits. Hotel elective.

Prerequisite: typing ability or taken concurrently with H Adm 161.

E. C. Seaburg, B. David.

The basic theory of Gregg shorthand is completed; dictation and transcription speed are developed to meet business standards for a stenographer.

**361 Shorthand Transcription** 2 credits. Hotel elective.

Prerequisite: H Adm 263 or equivalent.

E. C. Seaburg.

Students who already know the basic theory of Gregg shorthand develop sufficient skill in dictation speed and transcription to meet business standards for an executive secretary. Emphasis is placed on recording technical material rapidly and on transcribing it accurately.

**364 Managerial Letter Writing** 2 credits. Hotel elective.

Hotel elective.

E. C. Seaburg.

Students learn the techniques of good letter composition needed by an executive to achieve effective communication. Skill is developed in correct procedures for machine dictation and dictation to stenographers. Ability to type is not a prerequisite.

**Directed Studies****660 Undergraduate Independent Research in Managerial Communications**

Credit to be arranged. Hotel elective. Prerequisite: written permission obtained before registration from the faculty member who is to direct the study.

This course is designed for students engaged in the preparation of special reports and other communications projects. Only the first three credit hours of directed study may be credited toward hotel electives during the student's undergraduate academic career. Additional directed study, if taken, will be credited toward free electives.

**760 Graduate Independent Research in Managerial Communications**

Credit to be arranged. Graduate students only.

As appropriate, graduate students may enroll in this course for thesis or monograph research, or for other directed study. The student must have in mind a project and in advance of registration for the term obtain written agreement from a faculty member who will oversee and direct the study. Forms are available in the office of the graduate faculty representative.

**Properties Management****Required Courses****251 Property Management Graphics** 3 credits.

Required.

R. H. Penner.

Basic principles of graphic communication as a management tool for problem solving including drafting fundamentals and the interpretation of both presentation and technical drawings. Principles of site analysis and site planning, physical plant organization, and internal spatial relationships common to hotel and restaurant properties are stressed.

**351-352 Mechanical and Electrical Systems I and II** 3 credits each term. Required. Prerequisites: H Adm 251.

J. J. Clark, M. H. Redlin.

Investigation of management problems associated with the mechanical systems of the physical plant. The major systems of water, heating, refrigeration, air conditioning, lighting, and electricity are given primary emphasis. In addition, systems such as elevators, fire equipment, swimming pools, communications, data processing, laundry, and housekeeping equipment are discussed. The basic engineering theory associated with each of the mechanical systems is taught. Throughout the course the problems of capital expenditures, operating costs, and of repairs and maintenance are stressed.

**451 Physical Plant Planning and Construction**

3 credits. Required. Prerequisite: H Adm 352.

R. A. Compton.

The feasibility, planning, development, and construction of the physical plant of the hotel food facilities projects are considered and analyzed. Materials and methods of building construction, repair, and maintenance are covered. Emphasis is placed on trade practices, building codes, cost estimation, and management responsibility in working with professional planners.

**Elective Courses****255 Principles of Design** 3 credits. Hotel elective.

Prerequisites: H Adm 251 and permission of instructor.

R. H. Penner.

A studio course that provides a complete foundation in graphics techniques for, and concepts of, architectural design. Perspective, freehand sketching, and abstract design problems are used to describe and define three-dimensional space. Recommended for students considering a concentration in hotel/restaurant planning and food facilities engineering.

**353 Introductory Food Facilities Engineering**

3 credits. Hotel elective. Prerequisite: H Adm 251 or equivalent.

M. H. Redlin, R. A. Compton.

A course designed to familiarize the student with the basic concepts of food facilities design and planning. Studies are carried out to determine space allocation for kitchens, refrigeration, storage, waste disposal, and service areas. Development of basic production work flow in the preparation and service areas is emphasized. The basic requirements for the selection of equipment utilizing industry standards for production capability, quality of construction, and ease of maintenance are covered. Students utilize their laboratory time for the planning, design, and specification writing for a small to medium-size production kitchen.

**354 Food Facilities Equipment, Layout, and Design** 3 credits. Hotel elective. Prerequisite: H Adm 353 or permission of instructor.

H Adm 353 or permission of instructor.

M. H. Redlin, R. A. Compton.

Each student programs, plans, and develops a

complete project. This involves study: (1) to research the project program and draw up the prospectus; (2) to select and design equipment; (3) to develop layout studies and complete the master plan (preliminary renderings); (4) to develop working drawings (contract drawings), including equipment and architectural plans, mechanical plans, equipment schedules that are required for bidding, fabrication, construction, and installation; and (5) to budget-estimate and review feasibility studies. Large food service facilities in hotels are emphasized.

**355 Orientation in Safety of Personnel and Property** 1 credit. Hotel elective. Prerequisite: H Adm 352 or written permission of instructor before registration. Consideration of such subjects as fire prevention and control in public structures, fire insurance, and the training of personnel in the areas of first aid and disaster control. The first aid training program will include familiarization with safety equipment. Students successfully completing the course will receive senior Red Cross certification.

**452 Seminar in Interior Design** 3 credits. Hotel elective. Prerequisite: H Adm 251. R. H. Penner. A project course concerned with the problems related to interior design and renovation. The seminar is concerned primarily with the study of guest requirements in the different lodging types (hotel, motel, resort, etc.) and their influence on the design of the guest room unit, and other interiors.

**453 Seminar in Environmental Control** 3 credits. Hotel elective. Prerequisite: H Adm 352 and permission of the instructor. J. J. Clark.

Theory and application of light and color, acoustical design, noise suppression, control systems, temperature, humidity control, and ecological consideration. Topics will be examined via the assignment and discussion of projects.

**454 Seminar in Hotel Planning** 3 credits. Hotel elective. Open to seniors and graduate students. Prerequisite: H Adm 352. R. A. Compton. Through project assignments the design and layout for a proposed hotel, from feasibility study through plans and specifications, are covered. Emphasis is placed on site selection, floor plans, guest room layouts, and the selection and arrangement of equipment in all of the various departments.

**455 Seminar in Restaurant Planning** 3 credits. Hotel elective. Open to seniors and graduate students. Prerequisite: H Adm 352. R. A. Compton. A project course in the analysis and design of restaurant properties. The critical study of existing solutions and how they set the design criteria for both kitchen and dining areas. These guidelines serve as the basis for the student work which includes general programming, organization, spatial standards, layout, and equipment.

**456 Seminar in Destination Resort Planning** 3 credits. Hotel elective. Open to seniors and graduate students. Prerequisite: H Adm 352. R. H. Penner, M. A. Noden. A project course in the feasibility and planning of destination resort properties, with emphasis on the development of recreational facilities as well as the physical structure of the hotel.

## Graduate Courses

**751 Graduate Studies in Project Development and Construction** 3 credits. Open to graduate students only and required of M.P.S. candidates. M. H. Redlin. The major elements of the project development and construction process are presented and developed from an engineering management viewpoint. Topics

include feasibility studies, functional planning and design, financing techniques, the bidding process, construction contracts, project scheduling, and actual building construction. In addition, the techniques for effective graphic communication are developed and integrated into the design process.

**752 Graduate Studies in Electrical and Mechanical Systems** 3 credits. Open to graduate students only and required of M.P.S. candidates. Prerequisite: H Adm 751. J. J. Clark.

The major electromechanical systems of large buildings and hotels/motels are considered from a capital cost versus operating cost viewpoint. Systems considered include water, heating, refrigeration, air conditioning, lighting, communications, and elevators. Concepts of energy conservation and efficient utilities management, from the original selection of equipment through operating procedures, are emphasized. Students analyze and present case studies, criticize papers and reports, and suggest new systems.

**756 Resort Planning and Development** 3 credits. M.P.S. elective. Limit: 12. Upperclass students by permission. Prerequisite: H Adm 751. R. H. Penner, M. A. Noden.

The seminar will emphasize the economic, social, marketing, and legal aspects of new resort development as well as the planning of the physical and recreational facilities. Students can choose to develop an international or United States property, including in the formal presentations appropriate market research, applicable laws, economic proforma, regional and location analysis, environmental priorities, etc., in addition to design and engineering concepts.

## Directed Studies

**650 Undergraduate Independent Research in Properties Management** Credit to be arranged. Hotel elective. Prerequisite: written permission obtained before registration from the faculty member who is to direct the study. Students are afforded an opportunity to pursue independent research projects under the direction of a faculty member. Only the first three credits of directed study may be credited toward hotel electives during the student's undergraduate academic career. Additional directed study, if taken, will be credited toward free electives.

**750 Graduate Independent Research in Properties Management** Credit to be arranged. Graduate students only. As appropriate, graduate students may enroll in this course for thesis or monograph research, or for other directed study. The student must have in mind a project and in advance of registration for the term obtain written agreement from a faculty member who will oversee and direct the study. Forms are available in the office of the graduate faculty representative.

## Science

### Required Courses

**171 Food Chemistry I** 3 credits. Required. Prerequisite: high school chemistry. P. Rainsford and staff. Principles and concepts of inorganic chemistry and organic chemistry. The chemistry of fats, carbohydrates, and proteins is emphasized. Three lectures and one two-hour recitation weekly.

**172 Food Chemistry II** 4 credits. Required. Prerequisite: H Adm 171. P. Rainsford and staff. The chemistry of fats, carbohydrates, and proteins is emphasized in relation to food products and food

production techniques. The roles of additives in foodstuffs, colloidal phenomena, of food processing and reconstitution techniques are studied. Three lectures and one three-hour laboratory weekly.

**173 Sanitation in the Food Service Operation** 2 credits. Required of undergraduates and M.P.S. candidates. J. C. White.

The causes and prevention of food poisoning are stressed. Included are the aesthetic, moral, and legal responsibilities involved in presenting sanitary food to patrons. Emphasis is placed on the current problems confronting the industry with recent food developments as they relate to sanitation.

**771 Graduate Food Chemistry** 4 credits. Open to graduate students only and required of M.P.S. candidates. P. Rainsford.

Principles of inorganic and organic chemistry. The chemistry of fats, carbohydrates, and proteins is emphasized in relation to food products and food production techniques. The roles of additives in foodstuffs, colloidal phenomena, food processing, and reconstitution techniques are studied. Three lectures, one recitation, and two laboratories of two and one-half hours weekly.

## Directed Studies

**670 Undergraduate Independent Research in Science** Credit to be arranged. Hotel elective. Prerequisite: written permission obtained before registration from the faculty member who is to direct the study. This course is designed to study specific chemical processes involved in modern food preparation. Only the first three credits of directed study may be credited toward hotel electives during the student's undergraduate academic career. Additional directed study, if taken, will be credited toward free electives.

**770 Graduate Independent Research in Science** Credit to be arranged. Graduate students only. As appropriate graduate students may enroll in this course for thesis or monograph research, or for other directed study. The student must have in mind a project and in advance of registration for the term obtain written agreement from a faculty member who will oversee and direct the study. Forms are available in the office of the graduate faculty representative.

## New York State College of Human Ecology

### Field Study Office

K. D. Evans, director; B. Jablon, E. D. Kahn, J. M. Sokal

The Field Study Office came into being in 1972 as a result of the College's commitment to provide students with more opportunities to explore the human ecological approach in defining and solving social problems. Field study courses offered through the departments generally are related to specialized disciplines and emphasize professional exploration or training. The offerings of the Field Study Office, while they may provide opportunities to test career options, focus on an interdisciplinary approach. They are designed to help students develop a framework for thinking more systematically about the nature of social systems and the strategies for meeting human needs.

Field study means moving the learning environment from the classroom and library to places outside the University where students can experience the complexities of societal issues. Field study can provide opportunities for students to test out their classroom learning, to stand back from and develop a deeper understanding about their work setting, and to define the ways that the work and the theories clarify each other. It is the process of meshing theory and practice that distinguishes field study from job experience. This distinction is the basis of the College's rationale for granting field study credit. It is expected that students will acquire better understandings about the assumptions made by different groups with conflicting interests, as well as an appreciation of the variety of disciplines necessary to solve social problems.

The Field Study Office, in addition to developing and implementing collegewide courses and advising students about field study options, makes policy recommendations about field learning and evaluates current offerings. All students are encouraged to make contributions to these aspects of the program.

For information about specific possibilities, check with the Field Study Office, New York State College of Human Ecology, Cornell University, 159 Martha Van Rensselaer Hall, Ithaca, New York 14853.

### Interdepartmental Courses

Interdepartmental courses for human ecology students may count toward the fifteen credits outside the major but must be in addition to work in two departments with at least six credits or two courses in one department. In some cases these courses may be accepted by a department to fill a practicum or major requirement.

#### 200 Preparation for Fieldwork: Perspectives in Human Ecology

Fall or spring, 3 credits. S-U grades optional. Intended for students from all five human ecology departments interested in preparing themselves for field experience in departmental or interdepartmental courses, as well as in summer fieldwork. Limited to 20. Permission of instructor required.

M W 2:30-4:30. K. Evans.

This course focuses on developing skill in problem defining and problem solving. It includes a section on investigatory methods (interviewing, building and understanding communication, other participant-observer skills). Two simulated,

multimedia case studies will be presented that highlight issues in the delivery of human services and in the governmental regulation of the private sector. Students in groups will define problems, analyze data (including presentations by key participants, legislation, newspaper reports, census data, annual budgets, for example), and report to the group about resolutions to the problems.

**250 Introduction to Social Policy** Spring, 3 credits. S-U grades optional. Open to sophomores and upper-division students.

T Th 12:20-1:45. CSE and CEPP faculty. This course is intended to give students an appreciation of the significance of national policies as they affect social relations and levels of living. Although it will concentrate on governmental policies, the course also will consider the role of private initiatives. The course will examine questions about the distribution of social goods and services and the measurement of their contribution to particular objectives.

**402 Independent Field Learning** Fall or spring. Credit to be arranged. S-U grades optional. Registration with permission of department faculty sponsor(s) and approval of the director of the Field Study Program.

Hours to be arranged. Provides opportunity for student to develop an individual field-study experience within an interdisciplinary framework, usually under the supervision of faculty from other departments.

**408 Organizations in the Delivery of Goods and Human Services** Spring, 15 credits. Limited to 25. Intended for Human Ecology upperclass students. Prerequisites: background work in the social sciences and other subjects applicable to student's placement interest. Enrollment by permission of field faculty and Field Study Committee.

A full semester, off-campus field course in the New York City metropolitan area. Each student spends 3½ to 4 days per week in an organization that provides goods or human services, is consumer oriented, or is concerned with policymaking and regulation. Students meet weekly for a six-hour seminar. Equal weight given to the three parts of the course: organizational structure, skills development, and synthesis of theories of organization and field practice. Deadline for receipt of applications in the Field Study Office: October 25, 1976.

### Interdepartmental Major

See the Interdepartmental Major in Social Planning and Public Policy under the Departments of Community Service Education and Consumer Economics and Public Policy.

### Division of Academic Services

B. Morse, chairman; R. J. Babcock, E. Martire, H. J. Pape, M. Stout, V. Vanderslice, R. West, N. Yaghlian.

**320 Student Counseling and Advising** Fall or spring, 3 credits. S-U grades only. Limited to 15. Permission of the instructor required.

T 1:30-4:30. G. Vanderslice. The course work will include staffing the Peer Counseling Office for two to three hours a week—to answer questions and to provide counseling for other human ecology students concerning their academic pursuits—as well as attending a two-hour seminar each week. Seminars include supervised training in basic counseling skills, analysis and discussion of several different theories of counseling, analysis of organizational and functional issues of peer

counseling and its relation to this college, and the sharing of issues and concerns that arise from the actual peer counseling process. Outside reading that introduces students to various counseling theories will be required as preparation for the seminars.

**400-401-402 Special Studies for Undergraduates** Fall or spring. Credit to be arranged.

Hours to be arranged. Department faculty. For independent study by an individual student in advanced work not otherwise provided in the department; or for study, on an experimental basis, with a group of students in advanced work not otherwise provided in the department.

Students prepare a multicopy description of the study they wish to undertake. Forms are available from counselors in the Division of Academic Services. Students, in consultation with their supervisor, should register for one of the following subdivisions of independent study.

**400 Directed Readings** For study that predominantly involves library research and independent reading.

**401 Empirical Research** For study that predominantly involves data collection and analysis or laboratory or studio projects.

**402 Supervised Fieldwork** For study that predominantly involves participation in community or classroom settings.

**600 Special Problems for Graduate Students** Fall or spring. Credit to be arranged. For graduate students recommended by their chairperson and approved by the head of the department and the members of the staff in charge of the problem for independent, advance work. Hours to be arranged. Department faculty.

## Community Service Education

I. Lazar, chairman; H. Y. Nelson, graduate faculty representative; R. J. Babcock, D. J. Barr, L. Berg, S. Blackwell, N. Burwell, E. Conway, M. Dandridge, D. Deshler, C. Farris, H. Ford, J. L. Ford, W. W. Horne, E. Johnson, L. A. Kaeser, C. C. McClintock, M. Minot, B. J. Mueller, L. A. Noble, C. Reed, K. Rhodes, C. Shapiro, H. Shippee, L. Street, J. Wright, B. L. Yerka, T. Zimrat.

The Department of Community Service Education primarily is concerned with the education of human service professionals—people who can design innovative programs for effecting change, participate in the implementation of such programs, and analyze their impact on society. The department's undergraduate program includes options to prepare students to teach home economics (Option I), to serve as social workers (Option II), or to engage in educational work with adults in community settings (Option III). In addition, the department, in collaboration with the Department of Consumer Economics and Public Policy, offers an interdepartmental major in social planning and public policy. The department's graduate program is a part of the Field of Education in the Graduate School of the University.

**In Education**, (Option I) the curriculum focuses on human development, family, and decision making and resource management as a consumer. Students in this option select one of the following problem areas for concentrated study: consumer education and resource management; housing and design; family development and management; human nutrition and food; textiles, clothing, furnishing, and design; family and community health. A sequence of professional courses analyzes the teaching-learning

process. Facilities for student use include the instructional resource center, a workroom for preparing materials, and multimedia equipment. Students completing Option I are prepared for professional roles as teachers of youth and adults, educational consultants, and developers of educational materials. (New York State Provisional Certification for teaching home economics in K-12 grades is automatically received upon completion of the option.)

Students planning to transfer into this department from other colleges and departments in order to enter the teacher-education sequence (Option I) should be aware that the requirements of this curriculum are difficult to complete in only four semesters. Where the student has not completed at least some of the required courses (or their equivalents) prior to transfer, a summer session or an additional semester may be necessary.

**In Social Work**, (Option II) the undergraduate program, which is accredited by the Council on Social Work Education, prepares students for entry level employment in social work and other human services professions. In addition, students who complete this curriculum are eligible to apply to graduate schools of social work for an accelerated one-year M.S.W. program.

**Adult and Community Education**, (Option III) prepares students to appreciate the special learning needs, interests, and concerns of adults, and to acquire skills that will enable them to respond appropriately to the problems they identify. Each student selects an area of concentration within community planning and development, community health and nutrition, consumer economics and education, gerontology, parents and youth, or family resource management.

In the Interdepartmental Major in Social Planning and Public Policy, students have an opportunity to acquire knowledge and skills to assess local and regional needs and to develop, implement, and evaluate policies and plans for meeting these needs. Students learn to work as trained professionals to help state and local agencies implement social programs and develop public policy. The Department of Community Service Education participates in this major with the Department of Consumer Economics and Public Policy.

Students interested in any of the above areas should consult with department faculty members or members of the department council for current information about programs. Requirements for the department major are also available from the Division of Academic Services. Details of the field experience requirements will be available before preregistration.

The graduate program in community service education, a part of the Field of Education, focuses on the design, implementation, and analysis of human service programs with special emphasis on their relationship to human ecology. It offers two majors, home economics education and community service education, both of which provide for the study of program planning and development, program evaluation and evaluative research, and higher education for professionals in human services. For example, doctoral students in home economics education interested in college teaching may specialize in teacher education and supervision; similarly, doctoral candidates in community service education, with appropriate background, may specialize in teaching social work or adult education at the college level. The general degrees of M.S. and Ph.D. and the professional degrees of Master of Arts in Teaching, Master of Professional Studies, and Doctor of Education are offered.

Requirements for all graduate degrees in education, and the majors available in the department, are stated in the *Announcement of the Graduate School*. Applicants are required to submit scores on the aptitude test of the Graduate Record Examination or

on the Miller Analogies Test. In addition, applicants for master's degrees (other than the M.A.T.) are required to have had field experience. In general, applicants for the doctorate are expected to have had two years of paid professional experience in a human service agency such as a public school, a mental health clinic, a county extension association, or a United Fund agency.

A limited number of assistantships are available in the Department of Community Service Education to provide financial support as well as relevant professional experiences for many students. College and University fellowships are also available. In general, priority for assistantships is given to U. S. citizens.

Students seeking additional detailed information about the graduate program in this department should write Professor Helen Y. Nelson, Graduate Faculty Representative, Department of Community Service Education, Cornell University, New York State College of Human Ecology, Ithaca, New York 14853.

**202 Structure of Community Services** Fall or spring. 3 credits.

M W F 10:10. L. Street.

This lecture-discussion course is designed as an introduction to the community base of services. The presence or absence of educational, social, or planning services, as well as their place and performance are examined in the context of theoretical and empirical community dimensions. Examples of such dimensions include community complexity, differentiation, modernity, ethnicity, and community role.

**203 Groups and Organizations** Fall or spring. 3 credits. Should be taken after or concurrently with CSE 202.

M W F 9:05. C. McClintock.

A basic course in the social psychology of small groups and human service organizations. Study of group processes will include self- and inter-personal perception roles, norms, communication, power, and leadership. To attain a better grasp of group processes, students will participate in self-analytic groups during the semester. Students will apply what has been learned about small groups to the study of issues in human service organizations (for example, organization-environment interaction, management, service delivery, goals, interorganizational relations, and change).

**246 Ecological Determinants of Behavior** Fall. 3 credits. Limited to 30. Preference given to CSE majors. Prerequisites: introductory soc, introductory psych, HDFS 115.

Sec. 1: M 7:30-10:30 p.m.; sec. 2: M W F 2:30. B. J. Mueller.

A general consideration of the major determinants of human behavior presented from the perspective of social work practice and followed by a more detailed discussion of social and psychological determinants. Emphasis is given to ego psychology as developed by Erik Erikson and to role analysis as applied to social history data. Implications are drawn for the application of behavioral science knowledge in social work practice.

**292 Research Design and Analysis** Fall or spring. 3 credits. Limited to 50. Prerequisite: basic course in psych or soc.

T Th 2:20-3:45. S. Blackwell.

Students should develop skill in analyzing and evaluating research reports. Readings, exercises, and periodic assignments focus on stating hypotheses, designing studies to test hypotheses, measuring variables, and interpreting findings. Major project is a research proposal that is critiqued before the final draft is submitted.

**300 Special Studies for Undergraduates** Fall or spring. Credit to be arranged.

Hours to be arranged. Department faculty. For special arrangement of course work necessitated

because of nonequivalent training in a previous major or previous institution. Students prepare a multicopy of description of the study they wish to undertake. Forms are available from Counselors in academic services.

**325 Health-Care Services and the Consumer** Spring. 3 credits. S-U grades optional. Limited to 40; juniors and seniors only.

M W F 9:05. J. Ford.

Developments in the health field that affect the availability and kinds of health services. Emphasis is placed on interrelationships between institutions and agencies, and the part each can play in prevention, diagnosis, and treatment of disease and disability.

**330 Ecology and Epidemiology of Health** Spring. 3 credits. S-U grades optional.

T Th 12:20-1:35. J. Ford.

Ecological and epidemiological approaches to the problems of man in achieving health in interaction with his physical, social, and mental environment. The course will introduce the student to epidemiological methods and survey the epidemiology of specific diseases.

**340 Clinical Analysis of Teaching** Fall or spring. 1 credit. CSE majors in Option I have priority. Prerequisite or corequisite: Educ 411.

T 12:20-2:15, plus additional hours to be arranged. C. Farris.

This laboratory course provides students with theoretical frameworks for observation, analysis, and practice of various teaching behaviors and their effects on learners. Course content includes analysis of verbal and nonverbal behaviors, patterns of verbal interaction, motivational techniques, and planning and teaching for cognitive, affective, and psychomotor learning. Opportunity for observation, analysis, actual practice, self-evaluation, and improvement of various skills and strategies is provided in microteaching laboratories with small groups of junior and senior high pupils.

**370 Social Welfare as a Social Institution** Fall. 3 credits. Limited to 35. Preference given to students in social work option (Option II).

Sec 1: M W F 9:05; sec. 2: W 7:30-10:30. L. Berg. This course is designed to provide students with a philosophical and historical introduction to social welfare services. It reviews the social contexts from which programs and the profession of social work have evolved. From this background it discusses the political and ideological processes through which public policy is formed and how policies are translated into social welfare programs. Basic issues in welfare are discussed in the context of present program designs, public concerns, and the interrelationships and support of services in the community.

**400-401-402 Special Studies for Undergraduates** Fall or spring. Credit to be arranged. Limited to CSE, interdepartmental, and independent majors.

Hours to be arranged. Department faculty. For independent study by an individual student in advanced work in a field of CSE, not otherwise provided in the department or elsewhere at the University; or for study, on an experimental basis, with a group of students in advanced work not otherwise provided in the department or elsewhere at the University. Students prepare a multicopy description of the study they wish to undertake. Forms are available from counselors in academic services. Students, in consultation with their supervisor, should register for one of the following subdivisions of independent study.

**400 Directed Readings** For study that predominantly involves campus library research and independent readings.

**401 Empirical Research** For study that predominantly involves data collection and analysis

or laboratory or studio projects.

**402 Supervised Fieldwork** For study that predominantly involves participation in community or classroom settings.

**411 Introduction to Adult Education** Fall, 3 credits. S-U grades optional. Limited to 60. CSE majors have priority at preregistration.

T Th 10:10–11:25. D. Deshler, L. Noble.  
Focuses on the broad aspects of adult education, types and scope of adult education programs, philosophy and principles of adult education, and community and organizational factors affecting development of adult programs. Field trips will provide opportunities to observe adult education programs in community organizations and agencies.

**413 The Adult Learner in Microperspective** Spring, 3 credits.

T Th 2:30–3:45. D. Deshler.  
This course will examine a full range of adult learning activities through a study of individual learners in a variety of contexts. It will include an analysis of the interests, needs, and special problems of the adult learner in traditional and nontraditional learning situations. Members of the class will be required to conduct comprehensive interviews of adult learners in a variety of occupational and social roles as a part of a group research project.

**414 Practicum** Fall or spring, 6 credits. Section 1 open only to CSE Option III majors who have completed the prerequisites planned with their adviser; Section 2 open only to interdepartmental Option I majors. Consent of the option adviser and agency field preceptor required prior to registration.

Department Faculty.  
The practicum is an opportunity for a student to assume a professional role and responsibilities under the guidance of a preceptor in a community service organization. Conferences involving the student, field preceptor, and College supervisor will be arranged in a block, scheduled throughout the semester, or completed in the summer session depending on the nature and location of the experience planned.

**415 The Adult Learner in Macroperspective** Fall, 3 credits.

M 7:30–10:30. D. Deshler.  
This course will deal with four main areas. First, the implications for a long-range social planning of continuing education, recurrent education, and lifelong learning will be examined. Second, a close analysis will be made of adult education policies in selected regions outside the United States. Third, federal and state policies toward adult and continuing education in the United States will be examined. Finally, the literature on educational futures will be studied.

**416 The Helping Relationship** Fall or spring, 3 credits. S-U grades optional.

T 10:10–12:05, Th 10:10–11. D. Barr.  
The first half of the course focuses on theory, research, and experiential exercises in interpersonal relationships. The second half focuses on the political aspects of the helping relationship. The design of the course is based on the assumption that feelings and ideas can and should be taught together.

**440 Program Planning** Fall or spring, 2 credits. Teaching majors in Option I should schedule the semester prior to CSE 441–442.

T Th 8. Students need to have a block of approximately 3 hours (between 9 and 3) available during the week for several observations and/or participation in educational programs, unless the program of interest meets in the evening. M. Minot. The student will (1) analyze the factors that influence program planning and program change and (2) apply principles of program development to planning for a group and/or individuals in programs with different purposes and organizational structures. Plans will reflect a knowledge of clients, societal trends, issues

in the problem area, philosophy of the specific program and of education generally, psychology of learning, and organizational structures. Plans will be critiqued by a panel of professionals.

**441 The Art of Teaching** Fall or spring, 2 credits. To be scheduled concurrently with CSE 442 and CSE 443. This course is blocked during the first seven weeks of the term.

T Th 10:10–12:05. Additional hours are arranged during the week of independent study following student teaching. E. Conway.  
The course provides an orientation to student teaching and the development of selected materials for student teaching. Consideration is given to major concerns related to individual and program evaluation, supervision of paraprofessionals, department management, professionalism, philosophy, and other topics of interest.

**442 Teaching Practicum** Fall or spring, 6 credits. Student teaching full time for last seven weeks of term. To be scheduled concurrently with CSE 441 and 443. Prerequisite: CSE 440.

M. Minot, coordinator, and department faculty.  
Guided student teaching experience with student assigned to cooperating public schools. Student teachers are required to live in the school communities and work under the guidance of both local teachers and department faculty. Cooperating schools are located in different types of communities, represent a variety of organizational structures, and have comprehensive programs. Students should indicate their intent as early as possible to facilitate communication and scheduling.

**433 Critical Issues in Education** Fall or spring, 2 credits. Limited to 25. Priority to CSE Option I and HDFS N-K students. No students will be admitted to the class after the first session. This course is blocked during the first seven weeks of the term.

F 12:20–2:15. D. Barr, R. Babcock.  
An examination of current issues in education. Analysis of the historical, philosophical, social, and political factors that affect these issues.

**444 Career Environment and Individual Development** Spring, 2 credits. Limited to 25. No students will be admitted to the class after the first session. This course is blocked during the second seven weeks of the term.

F 12:20–2:15. R. Babcock.  
An analysis of the extent to which work, jobs, and careers relate to and shape the behavior of individuals. Topics considered are theories of occupational choice, job satisfaction, structure of the labor force, manpower projection, and career planning. The course provides opportunities for students to examine their own vocational aspirations. At the same time, emphasis is placed on how the helping professional deals with clients or students in preparing for, adjusting to, and maintaining jobs and careers.

**471–472 Social Work Practice I and II** An introduction to social work practice through an integrated field and methods course. Comparison and contrast of concepts and skills used in casework, group work, and community work. Field experience in problem-solving activities with individuals, families, groups, and/or communities. Examination of the value base of social work practice. The class meetings are combined with two days of field instruction each week. Supervised field placements are made in selected social agencies in Tompkins, Tioga, Chemung, and Steuben counties.

**471 Social Work Practice I** Fall, 9 credits. Enrollment by permission of instructor before preregistration. Limited to 25. Prerequisites: introductory psychology, introductory sociology, HDFS 115, CSE 246, and CSE 370.

Lec, M W 10:10–12:05; lab T Th 12:20–2:15. B. J. Mueller.

**472 Social Work Practice II** Spring, 9 credits. Enrollment by permission of instructor before preregistration. Limited to 25. Prerequisite: Grade of C or better in CSE 471.

M W 9:05–11. B. J. Mueller.

**473 Special Problems and Issues in Social Work** Fall, 3 credits. Limited to 25. Preference given to social work majors. Enrollment by permission of the instructor before preregistration.

M W F 3:35. Social work faculty.  
Building on the CSE core curriculum and the social work practice courses, this advanced seminar will integrate theoretical and practical considerations in the examination of special problems or policy issues germane to social work. The specific topic for fall 1976 will be announced before preregistration.

**474 Program Development in Social Work** Spring, 3 credits. Limited to 30. Preference given to students in social work option. Enrollment by permission of the instructor before preregistration. Social work majors must schedule concurrently with CSE 472.

M W F 2:30. Social work faculty.  
This seminar will coordinate with CSE 472 (Social Work Practice II) and teach program development in fields of practice represented by the settings in which students have their field placements.

**475 Organization and Structure for Delivery of Social Services** Spring, 3 credits. S-U grades optional. Limited to 35. Prerequisites: CSE 370 or ID 250 and permission of instructor.

1976–77.  
M 7:30–10:30 p.m. L. Berg.  
The course is designed to provide students with a framework for assessing and understanding the range of issues posed in the current organization and delivery of various social services. Concepts of social policy analysis will be utilized in the evaluation of different social service systems, new models of service delivery being developed, and proposals for change being made at national, state, and local levels. Students should have some field or work experience in human services before or concurrent with this course.

**600 Special Problems for Graduate Students** Fall or spring. Credits to be arranged. S-U grades optional. For students recommended by their chairperson and approved by the instructor in charge for independent, advanced work.

Hours to be arranged. Department faculty.

**601 Theories of Community Services** Fall, 4 credits.

T Th 2:30–4:25. J. Wright.  
An introductory graduate-level course encompassing theories of community services. The course considers the nature of values and goals in a social system, the nature of goods and services, and the supply and demand side of human services within an ecological framework. The course will allow the student—through readings and contact with local human services professionals and organizations—to experience both the theoretical and applied aspects of community services.

**607, 608 Professional Improvement I and II** Fall, spring, or summer. Variable credits. S-U grades optional. Enrollment will be determined by various factors including nature of content, funding/resources/facilities, and instructor. Primarily designed for extramural (evening) and off-campus instruction.

Department faculty.  
Series of special problem seminars/classes/activities designed for inservice and continuing education of practitioners in helping professions, such as home economics teachers, social workers, public health planners, and adult educators. Specific content of each course will vary with group being served, but will include amount of work and class time appropriate to number of credits. May be repeated with the permission of the instructor.

**610 Seminar in Adult Education** Spring. 3 credits. S-U grades optional.

M 7:30-10:30 p.m. J. Wright.  
Designed to deal with significant problem areas in adult education. Implications of theory and research on the topic will be important considerations. One specific problem area will be considered each term the seminar is offered, the particular area to be announced at preregistration. The seminar may be repeated with permission of the instructor.

**621 Alcohol: Problems and Community Services** Fall. 3 credits. S-U grades optional.

T Th 12:20-1:35. J. Ford.  
The course will focus on the nature and extent of various alcohol problems and delivery of services for alcoholics. Special attention will be given to effects of alcohol on the body, drinking trends and patterns, special problem drinking groups, legal approaches to the control of alcohol problems, and an overview of treatment and rehabilitation programs in various organizational settings.

**631 Paraprofessionals in Human Services** Spring. 3 credits. S-U grades optional. Previous experience as a professional in a human service setting required.

W 7:30-10:30 p.m. J. Wright.  
For persons who anticipate working with paraprofessionals in a community service setting. The course will focus on the responsibilities of the professional as a social analyst, developing alternative staffing patterns as social needs change and emerge; as a member of an organization, taking responsibility for establishing and implementing appropriate personnel policies and practices; and as a team member, working with paraprofessionals to provide high-quality service and job satisfaction.

**[650 Comparative Studies of Educational Services for Rural Families** Fall. 3 credits. S-U grades optional. Not offered in 1976-77.

K. Rhodes.  
Factors related to planning educational human service programs for rural families in developing countries. Methods of need assessment and program development, and evaluation appropriate to rural programs.]

**651 Seminar on Women's Role in International Rural Development (also Women's Studies 651)** Fall. 3 credits. S-U grades optional.

M W 2:30-3:45. K. Rhodes.  
An examination of the status of rural women in developing countries and their potential role in raising local productivity and living levels. Focus will be on evidence of status change in the context of social, economic, and political change.

**660-661 Internship in Planning and Program Development** 660, fall; 661, spring. Enrollment by written permission of instructor only. Credit to be arranged.

T 4-5:30. I. Lazar.  
Application of planning and program development skills to current problems in state and regional planning. May involve fieldwork outside the Ithaca community.

**[670 Seminar in Higher Education** Fall. 3 credits. S-U grades optional. Not offered in 1976-77.

K. Rhodes.  
Study of selected current problems in higher education. Topics will focus on the development of innovative approaches to professional education.]

**671-672 The Teacher Educator in Home Economics** 671, fall; 672, spring. Fall, 3 credits; spring, 4 credits. Class hours, observations, and field experiences to be arranged.

Fall, H. Nelson. Spring, C. Farris.  
**671** Opportunity is provided for graduate students to develop understanding of teacher education practices by observing and participating in the

undergraduate program. Participation involves teaching and individual work with students. Additional experiences include observation of student teachers and the supervisory conferences in student teaching centers.

**672** Seminar is concerned with basic principles of supervision and their application to the preservice education of home economics teachers. Opportunity is provided for observation and participation in CSE 340, CSE 441, and CSE 442, including some teaching in the courses and the supervision of a student teacher.

**673 Belief and Practice in Educational Interventions** Spring. 3 credits.

T Th 3:35-5. M. Minot.  
Professional educators bring a set of beliefs and values and a preferred theoretical orientation to their work in schools and other agencies. They may find, however, that the agency has institutionalized values and practices at variance with those they bring. This seminar will consider implications for practice of several prevalent belief systems in education and the problems of discordance between individual beliefs and institutional policies related to educational practice.

**679 The Teaching of Home Management in College** Spring. 1-3 credits. S-U grades optional. Permission of instructor required.

T 10:10-12:05. A. Davey.  
An examination of the ways home management concepts are being taught and the exploration of new teaching approaches.

**680 Seminar in Community Service Education** Fall. 1 credit. S-U grades only.

M 3:35. Department faculty.  
An informal seminar for graduate students and faculty. One or two major topics are considered each term. May be repeated for credit with permission of instructor.

**681 Current Issues in Home Economics Education** Fall or spring. 2 credits.

W 7:30-9:25. Home economics education faculty.  
Different topics and issues related to home economics education are considered each semester. May be repeated for credit with permission of instructor.

**684 Bases for Instructional Program Planning** Spring. 3 credits. For professionals concerned with educational programs. Students without professional experience are admitted by permission of the instructor.

Th 10:10-11:10. K. Rhodes.  
Basic strategies for planning instructional programs. Concepts of structure, function, and process in program planning and their relation to individual learning and ecological variables. Opportunity provided for students to work on projects related to their special interests.

**690 Evaluation** Fall. 3 credits. For professionals concerned with behavioral change: extension agents, social workers, educational program directors, high school and college teachers and administrators, and research workers. Students without experience in any of these professional positions are admitted by permission of the instructor.

T Th 10:10-11:25. H. Nelson.  
Basic principles of evaluation studies in relation to specific methods of appraising progress toward objectives of behavioral change. Opportunities will be given for constructing and using evaluation instruments.

**691 Community Ethnography** Spring. 3 credits. Limited to graduate students or exceptionally well-qualified seniors with permission of instructor.

W 1:25-4:25. L. Street.  
Community ethnographies are examined for methods of investigation, substantive results, social theory,

orientation of the analyst to setting and subjects, and related issues. The seminar is focused on practicalities such as preparing for the fieldwork, entering and withdrawing from the field, note taking, relating observations to registry or other kinds of data, interning in the field, problems of analysis, and report routine with special reference to all-black towns. Students should be familiar with race and ethnic relations theory, engaged in an ethnographic study, or have the consent of the instructor.

**[692 Survey Research Methods** Spring. 3 credits. Prerequisite: at least one course in statistics or permission of instructor. Not offered in 1976-77.

C. McClintock.  
This is a practicum course in which students will be presented with a research problem and then design, implement, and analyze the results of an appropriate data collection effort. The course will cover survey design, planning and management, instrument design, sampling, interviewing and other means of data gathering, field quality control, coding and data processing, and analysis. Selected problems and topics will be given special emphasis: confidentiality and informed consent, assessment of bias due to nonresponse in sampling and data collection, omnibus surveys, and others.]

**693 Analysis and Critique of Survey Data** Fall. 3 credits. S-U grades optional. Prerequisite: statistics or field research design.

T 1:25-4:25. C. McClintock.  
An intermediate-level course focusing on the analysis and reporting of survey projects with emphasis on research related to planning, design, and evaluation of human services. Relevant to needs assessment, program evaluation, social indicators. Course work will include analyses of data and critiques of reported research. In addition to discussing students' research, topics to be covered include secondary analysis, small sample techniques, multiple method research.

**694 Research Design and Analysis** Fall. 2-3 credits. Students taking CSE 690 or its equivalent may register for two hours with permission of instructor. S-U grades only.

M 2:30-5:15. S. Blackwell.  
Intended for graduate students with little or no research experience. Parallels CSE 292 in purpose and content. Requirements include development of a research proposal and a final examination. Other written requirements of CSE 292 are optional for CSE 694.

**718 Designing Human Service Programs** Fall. 3 credits. Permission of the instructor required.

M 7:30-10:30 p.m. I. Lazar.  
This course will explore methods of translating human services research into programs for service to communities and individuals. Operational design, staffing, budget preparation, fund raising, and community auspices development, as well as evaluation, administration, and program change will be discussed. Students will be expected to fully design a local service program.

**719 Developing Systems for the Delivery of Human Services** Spring. 3 credits. Permission of the instructor required.

W 3:35-6:30. I. Lazar.  
This seminar will describe various attempts to build consolidated systems for the delivery of human services at local, state, and federal levels. An assessment of these efforts will be followed by an examination of new system designs and of the specification criteria for the measurement of system effectiveness. It will be assumed that students in this course are familiar with the present service structure of typical communities.

**773 Internship and Fieldwork in Teacher Education** Fall or spring. 2 credits. S-U grades optional. Prerequisites: CSE 671 and CSE 672.

Hours to be arranged. M. Minot, H. Nelson.

Involves supervision of student teachers and conferences as needed with college supervisor and cooperating teachers in the schools. Provision made for a follow-up visit to a first-year teacher.

### 775 Administration and Supervision

**Practicum** Spring. 2 credits. S-U grades optional. Permission of instructor required.

F 2:30-4:25. K. Rhodes.

Analysis of concepts of administration and supervision in agencies and institutions concerned with educational aspects of human services through directed observation of state, local, and college programs. Approximate costs of field trips, \$35.

**790 Seminar in Evaluation** Spring. 3 credits. S-U grades optional. Prerequisite: CSE 690 or equivalent and at least one course in statistics.

T 10:10-1:10. S. Blackwell.

Emphasis on methodological problems of evaluative research. Consideration given to alternative design choices appropriate to particular evaluation models and to compromises that take into account the constraints imposed on the researcher by the real world context of program evaluation.

**899 Master's Thesis and Research** Fall or spring. Credit to be arranged. S-U grades optional. Registration with permission of the chairperson of the graduate committee and the instructor.

Hours to be arranged. Department graduate faculty.

**999 Doctoral Thesis and Research** Fall or spring. Credit to be arranged. S-U grades optional. Registration with permission of the chairperson of the graduate committee and the instructor.

Hours to be arranged. Department graduate faculty.

## Consumer Economics and Public Policy

E. S. Maynes, chairman; E. Wiegand, graduate faculty representative; C. T. Babb, H. B. Biesdorf, L. L. Bower, W. K. Bryant, G. J. Byrners, P. Chi, S. Clemhout, A. J. Davey, K. Evans, M. S. Galenson, W. H. Gauger, J. Gerner, M. Griffin, A. J. Hahn, C. Meeks, J. Robinson, N. C. Salford, J. Swanson, I. Telling, K. E. Walker.

Increasing concern with the welfare of the consumer in society is evident at all levels of government and in private industry. The Department of Consumer Economics and Public Policy (CEPP) offers students an opportunity to study in this developing field. Programs for students majoring in the department are focused on social and economic policies as they affect individuals and families; an understanding of economics and sociology, particularly those aspects that relate to consumption and to housing problems, is basic. Students who complete their undergraduate work in this department are well prepared for a variety of positions within an expanding field of consumer-related work.

Faculty members in the department represent a broad range of special interests within the field and provide depth through a diversity of backgrounds and experiences. In addition to teaching undergraduate courses, most are involved in research and in teaching at the graduate level. Several teach in the College's public service/extension program operating throughout the state and serve on numerous committees, at both the state and national level, that deal directly with current issues affecting society.

At the undergraduate level, the student is offered two options within the Department of Consumer Economics and Public Policy: consumer economics and housing.

**Consumer Economics** is concerned with the economic behavior and welfare of consumers in the private, public, and mixed sectors of the economy. Emphasis is placed on how consumers allocate their scarce resources, which include time and money. This option requires a strong foundation in those subjects that contribute to an understanding of the market economy and of consumers' rights and responsibilities. Many graduates from the consumer economics option find careers in government agencies providing consumer services, while others choose to work in business and industry in consumer relations divisions or in consumer-related community programs.

**Housing**, a major societal problem, is studied through an interdisciplinary approach that includes the methods and models of sociology, economics, and political science. This option focuses on housing consumption and production in the context of the housing market. In addition, the social implications of housing related to household preferences, mobility, and involvement in neighborhood change are emphasized. Attention is placed on the development of social science research skills for the analysis and evaluation of housing policies and programs. Recent graduates have taken positions with local, state, and federal agencies dealing with housing problems.

In the **Interdepartmental Major** in Social Planning and Public Policy, students have an opportunity to acquire knowledge and skills to assess local and regional needs and to develop, implement, and evaluate policies and plans for meeting these needs. Students learn to work as trained professionals to help state and local agencies implement social programs and develop public policy. The Department of Consumer Economics and Public Policy participates in this major with the Department of Community Service Education. The department offers programs leading to bachelor's, master's, and doctoral degrees. Students seeking additional detailed information about graduate programs in this department should write: Graduate Faculty Representative, Department of Consumer Economics and Public Policy, Cornell University, New York State College of Human Ecology, Ithaca, New York 14853.

**100 Introduction to Consumer Economics and Public Policy** Fall or spring. 3 credits. S-U grades optional. Students who have taken Economics 101 or another introductory macroeconomics course should not register. Enrollment limited to 120.

Fall: M W F 10:10; spring: M W F 11:15.

J. Robinson, M. Galenson.

An introductory course designed to provide a basic understanding of macroeconomics with particular concern for those areas having an impact on families. The course will cover national income accounting, income distribution, prices, and monetary and fiscal policy. This will serve as a basis for the study of income redistribution programs and other areas of government action.

**147 Housing and Society** Fall or spring. 3 credits. S-U grades optional. Enrollment limited to 20 students per section, 5 sections. Information regarding special section hours will be available at preregistration.

Lec, T Th 11:15. P. Chi.

A survey of contemporary American housing issues as related to the individual, the family, and the community. The course focuses on the current problems of the individual housing consumer, the implications of the problems for housing the American population, and governmental actions undertaken to alleviate housing problems.

**148 Sociological Perspectives on Housing** Spring. 3 credits. S-U grades optional. Prerequisite: CEPP 147 or equivalent. Enrollment limited to 12 students per section, 5 sections. Information regarding section hours will be available at preregistration.

Lec, T Th 10:10. M. Griffin.

A theoretical and empirical analysis of housing patterns in the United States from a sociological perspective. Topics include migration patterns of the population, residential mobility, suburbanization, and the structure and function of neighborhoods. Emphasis is placed on explaining the widespread patterns of segregation in the United States by race, ethnicity, and social class.

**230 Problems in Providing Consumer Goods** Fall. 3 credits. S-U grades optional. Econ 101-102 recommended.

M W F 8. G. Byrners.

The basis for a better understanding of the market economy as it is concerned with the distribution of consumer goods. Emphasis is on the common interest of industry, consumers, and the government in an efficient distribution system. Areas covered include identification of the consumer interest, sources of consumer information and protection, and a discussion of current consumer issues. Students who have taken CEPP 233 should not register for this course.

**233 Marketing and the Consumer** Spring. 3 credits. S-U grades optional. Prerequisite: microeconomics.

M W F 8. Department faculty.

A study of marketing functions, institutions, policies, and practices with emphasis on their roles in creating consumer satisfaction. Current problems are identified for concentrated study. A field trip to New York City to study selected marketing operations is arranged when feasible. Students who have taken CEPP 230 should not register for this course.

**248 Housing Controls and Standards** Fall. 3 credits. S-U grades optional. Prerequisite: CEPP 147 or permission of instructor.

T Th 12:20-1:55. L. Bower.

An analysis of institutional-legal controls governing production, finance, distribution, and consumption of housing and establishment of housing standards. Emphasis is on those controls having impact on availability, use, and quality of housing in local communities. Controls deriving from property, as well as those resulting from the interface of legislative, judicial, and administrative control of housing assistance programs, also are covered.

**300 Special Studies for Undergraduates** Fall or spring. Credit to be arranged.

Hours to be arranged. Department faculty.

For special arrangement of course work necessitated because of nonequivalent training in a previous major or previous institution. Students prepare a multicopy description of the study they wish to undertake. Forms are available from counselors in academic services.

**312 Decision Making in the Family** Fall or spring. 3 credits. S-U grades optional. Enrollment limited to 28; preference given human ecology juniors and seniors. Not open to freshmen.

T Th 1:25-3:20, other hours to be arranged.

A. Davey.

Decision making is studied in relation to goal formation and goal attainment within the economic and social context of the family. Factors that expand as well as limit alternatives are examined. Field trips are included. Students elect a practical application that may include a field experience with a family, a live-in experience in Apartment A, or an independent exploration of some phase of family decision making. Course fee is \$20 per week for the live-in experience (average time is three weeks).

**325 Economic Organization of the Household** Fall. 3 credits. S-U grades optional. Prerequisite: Econ 102 or equivalent.

M W F 9:05. K. Bryant.

Theories and empirical evidence on how households spend their resources are used to investigate how households alter the amounts and proportions of time and money spent in various activities, their size, and

their form in response to changing economic forces.

**330 Management in Relation to Personal Finances** Spring. 3 credits. S-U grades optional. Preference given to juniors and seniors.

M W F 9:05. J. Robinson.

The study of personal financial management at various income levels and during different stages of the family life cycle. Topics covered will include the use of budgets and record keeping in achieving family economic goals; the role of credit and the need for financial counseling; economic risks and available protection; and alternative forms of saving and investment.

**332 Consumer Decision Making** Fall. 3 credits. Prerequisite: Econ 101-102 or permission of instructor.

M W F 2:30. S. Maynes.

This course is devoted to help students make more effective choices as consumers through an understanding of the economy and the use of relevant economic and statistical principles. The course is normative, stressing how consumers should act in order to achieve their goals. The latter part of the course is devoted to an appraisal of the functioning of the economy from the viewpoint of consumers.

**341 Fundamentals of Housing Economics** Fall. 3 credits. S-U grades optional. Prerequisite: Econ 101-102 or equivalent.

M W F 1:25. J. Gerner.

Designed to give the student a basic understanding of the structure and operation of the housing market. The economic determinants of housing supply and demand are related to (1) levels of housing consumption and housing standards, (2) the composition of the housing inventory, and (3) levels of and fluctuations in housing production.

**349 Housing Policy and Housing Programs** Spring. 3 credits. S-U grades optional.

Prerequisites: Econ 101 or equivalent and CEPP 147.

T Th 10:10-11:25. L. Bower.

Critical examination of the development and current state of federal and selected state housing policies and policy-related questions and problems. Assessment of the operation of housing programs together with consideration of strategies devised to further their effective functioning. Considerable attention will be devoted to the structure and operations of both primary and secondary mortgage markets.

**355 Economic Conditions in Relation to the Welfare of Families** Spring. 3 credits. S-U grades optional for nonmajors. Open to sophomores, juniors, and seniors. Graduate students may elect to audit and write a research paper for one to two credits under CEPP 600. Prerequisite: Econ 101-102 or equivalent.

M W F 10:10. J. Gerner.

Examination of contemporary economic problems that affect the welfare of families in the United States. Examples are affluence and poverty; monetary and fiscal policies as these affect families; and efficacy of the delivery of public services in the areas of health, education, and subsidized housing. Where relevant, the historical origin of these problems will be studied.

**400-401-402 Special Studies for Undergraduates** Fall or spring. Credits to be arranged.

Hours to be arranged. Department faculty.

For independent study by an individual student in advanced work not otherwise provided in the department; or for study, on an experimental basis, with a group of students in advanced work not otherwise provided in the department. Students prepare a multicopy description of the study they wish to undertake. Forms are available from counselors in academic services. Students, in consultation with their supervisor, should register for one of the following subdivisions of independent study.

**400 Directed Reading** For study that predominantly involves library research and independent reading.

**401 Empirical Research** For study that predominantly involves data collection and analysis or laboratory or studio projects.

**402 Supervised Fieldwork** For study that predominantly involves participation in community or classroom settings.

**411 Time-Use Decisions in Families** Fall. 3 credits. S-U grades optional. Prerequisites: one course in sociology; one course in microeconomics recommended.

T Th 12:20-2:15. K. Walker.

Seminar on time as a human resource in a consumption-oriented society with emphasis on decision making and alternative time uses in households. The meaning of time and implications for its use for society and families as work roles of people change. Review of research in use of time. Individual projects applied to special professional interests of students.

**413 Exceptional Families: An Ecological Approach to Their Resource Management** Spring. 2 credits. Field experience option, one additional credit hour. Prerequisite: CEPP 312 recommended but not required. Consult instructor before registering. Enrollment limited to 20.

M W 12:20-2:15. K. Walker or A. Davey.

Examination of managerial problems faced by families with exceptional imbalances in resources. Analysis of techniques of compensating for resource limitation of families in poverty, with health handicaps, with young mothers in labor force, one-parent families, student couples, and retired couples. Suggested for students preparing to work with families in health and rehabilitation programs, social work, geriatrics, secondary and adult education, and financial counseling.

**425 Economics of Recreation and Leisure** Spring. 3 credits. S-U grades optional.

Prerequisite: microeconomics; a course in sociology also recommended.

T Th 8-9:15. W. Gauger.

The course focuses on leisure time use and views recreational activities as consumer goods that are subject to economic decisions on the allocation of time and money. Empirical observations and data will be examined for theoretical insights.

**443 The Social Effects of the Housing Environment** Fall. 3 credits. S-U grades optional. Prerequisite: CEPP 147 or CEPP 148.

T Th 10:10-11:25. M. Griffin.

A seminar dealing with the interplay of housing and human behavior. Physical and social deterministic viewpoints are considered. Discussion of substantive issues including the effect of housing on crime rates, health, racial attitudes, and satisfaction. Research skills to analyze and evaluate critically the literature in the field are developed.

**465 Consumer and the Law** Fall. 3 credits. S-U grades optional. Prerequisite: CEPP 230 or permission of the instructor before preregistration.

T Th 2:30-3:45. M. Galenson.

The emphasis will be on the work of federal agencies and on court decisions as these affect consumers in the market. Topics covered will include liability for injury from consumer products; laws covering safety of drugs, labeling, and advertising; and consumer problems arising from ignorance and poverty.

**472 Community Decision Making** Spring. 3 credits. S-U grades optional. Prerequisite: Govt 111 or 112 or equivalent.

T Th 8-9:55. A. Hahn.

Identification and discussion of factors that influence the outcomes of community issues. Topics include political participation, decision-making processes, the interests and resources of key decision makers,

and community change. Concurrent participation in community activities is desirable but not required.

**[480 Welfare Economics** Fall. 3 or 4 credits. S-U grades optional. Prerequisite: permission of instructor before preregistration. Not offered 1976-77.

M W F 11:15. S. Clemhout.

A study of the social desirability of alternative allocation of resources. Topics include Pareto Optimality, external effects in production and consumption with applications to problems of environmental quality, public expenditure decisions, measurement of welfare, and evaluation of relevant public policy issues.]

**485 Public and Private Decision Making** Spring. 3 credits. Prerequisite: an intermediate microeconomic theory course or equivalent.

T Th 12:20-1:35. C. Babb.

Starting with the free-rider problem and the theory of public goods, the ideas of efficiency, equity, and consistency are applied to the collective choice problem. Constitutional choice is handled in general terms and in the context of the contract doctrine. Efficiency in legislative and bureaucratic institutions is studied and the economic implication of certain judicial principles is investigated. Cost benefit studies of several institutions and programs are examined.

**600 Special Problems for Graduate Students** Fall or spring. S-U grades optional.

Hours to be arranged. Department faculty. For graduate students recommended by their chairpersons and approved by the head of the department and the instructor in charge for independent, advanced work.

**601 Research Design and Analysis in the Social Sciences** Spring. 3 credits. S-U grades optional.

Prerequisites: introductory statistics course and permission of instructor.

T 2:30-5. S. Maynes.

The course is an introduction to the design and analysis of research, emphasizing research methods for social and economic studies. The meaning of science and patterns of social science investigation are studied in relation to selected concepts in the department's area of inquiry. Planned for first- or second-year graduate students, the course aims to help students make critical evaluations of research findings and to design sound studies.

**619 Seminar in Family Decision Making** Fall. 3 credits. S-U grades optional. Consult instructor before registering.

M W F 10:10. A. Davey.

Decision-making processes in relation to family goals and goal implementation are studied. Situational factors that place constraints on decision making and resource allocation are investigated. Emphasis is placed on studying the totality of the decision event.

**620 Consumption Theory** Spring. 3 credits. S-U grades optional. Prerequisite: intermediate economics theory or permission of instructor.

M W F 2:30. K. Bryant.

Major developments in the theory of household behavior with applications to consumption, saving; physical asset, debt, and liquid asset positions of households; demand and expenditure analyses; economics of consumer information; market work and housework activities of households; economics of household size and form.

**621 Explorations in Consumer Economics** Spring. 3 credits. S-U grades optional. Prerequisite: permission of instructor.

Hours to be arranged. G. Byrners.

With the guidance of the instructor students will select and independently investigate a substantive current consumer issue. Topic selected must be one that can be studied within both an economic and an institutional framework. Students will present status reports of their investigation to the group regularly for criticism and feedback. A substantive term paper is required.

**630 Family Financial Management** Spring, 3 credits. S-U grades optional. Prerequisite: CEPP 330 or equivalent.

Th 12:20-2:15. E. Wiegand.

Family financial management is studied with emphasis on role of financial consultant. Each student works with one or more families on an individual basis. Course is designed to increase awareness and knowledge of characteristics of persons in serious financial difficulties, complexity of factors affecting such situations, desirable relationships between helper and helped, and community agencies and organizations having appropriate resources.

**640 Fundamentals of Housing** Fall, 2 credits. S-U grades optional.

W 3:35-5:15. L. Bower.

An introductory survey of housing as a field of graduate study. Consideration of the spatial context and institutional setting of housing; the structure, operations, and performance of the housing market and the house-building industry; housing finance; the nature, operations, impact, and policy of government housing programs; contemporary housing problems and issues.

**642 Advanced Housing Market Analysis** Fall, 3 credits. S-U grades optional. Permission of instructor required.

Th 2:30-4:25. C. Babb.

The interaction of housing supply and demand in the housing market is studied from a spatial perspective involving urban structure and neighborhood change, and from a time perspective involving new construction and residential filtering. Quantitative methods are used to evaluate the impacts of zoning, property taxes, urban renewal, public housing, rent control, housing allowances, and housing finance subsidies.

**648 Social Demography of Housing** Spring, 3 credits. S-U grades optional.

Th 2:30-4:25. M. Griffin.

This course is concerned with the dynamic relationship between population and the housing market. The size and composition of the population, components of population growth, migration and mobility of the population, and population projections will be analyzed in light of the amount and quality of the housing stock. Students will become familiar with the data available in the U. S. Census of Population and Housing.

**649 Production of Housing** Spring, 2 credits. S-U grades optional. Prerequisite: CEPP 640 or permission of instructor.

T 3:35-5:15. L. Bower.

Examination of the system of producing shelter in the United States, its structure, and major processes. Focus will be on decision making within existing institutional constraints. Description and evaluation of major subsystems including contractual and speculative home building, the prefabrication industry, and the production of mobile homes and rental units. Attention is given to "new towns" and to a number of special-purpose government programs.

**655 Allocation of Time to Nonhousehold**

**Activities** Fall, 3 credits. S-U grades optional. Prerequisite: intermediate economic theory or permission of instructor; CEPP 411 recommended but not required.

M 2:30-4:25. J. Gerner.

This course examines the public sector policies that influence family time allocation decisions. Particular attention will be given to the time allocated by female family members to nonhousehold activities and how these activities are influenced by outside economic forces and by internal family characteristics.

**665 Seminar on Consumer Law**

**Problems** Spring, 3 credits. S-U grades optional. Open to CEPP graduate students and to others with permission of instructor. Enrollment limited to 20.

T 10:10-12:05. M. Galenson.

A study of areas of current interest to consumers that involve the law as developed by regulatory commissions and the courts with the emphasis on the institutional and economic background. The aim is to encourage critical examination of policy issues and their social and economic effects on families.

**[671 Intergovernmental Relations and Local Community Change** Spring, 3 credits. S-U grades optional. Prerequisite: CEPP 472, equivalent course in local government and politics, or permission of instructor. Not offered 1976-77.

T Th 8-9:55. A. Hahn.

Description and analysis of the intergovernmental system with special attention to the relationships between local communities and state and federal governments.]

**[680 Applied Welfare Economics-Policy Issues** Spring, 3 credits. S-U grades optional. Permission of instructor required. Not offered in 1976-77.

M W F 11:15. S. Clemhout.

Topics vary from year to year. The objective of the course is to evaluate the economic impact of various policies in conjunction with the efficiency of existing institutions. Policy issues covered relate to education (effects of automation and so forth), health, and environmental problems (urban development or transportation, for example). Attention is given to the interrelationship of policy and planning within the larger economic-sociopolitical framework.]

**697 Seminar** Fall or spring. Noncredit course. M 4-5. Department faculty.

Planned to orient students to graduate work in the field, to keep students and faculty abreast of new developments and research findings, to acquaint them with topics in related areas, and to provide opportunity to examine and discuss problems of the field.

**720 Economics of Consumption** Spring, 3 credits. S-U grades optional. Consult instructor before registering.

T 2:30-4:25. Department faculty.

A review of theories of the consumption function and of the recent literature on family consumption, including demand elasticities; family saving and investment, including investment in human capital; and the economic determinants of the participation of women in the labor force. Particular attention will be paid to the analytical techniques used on empirical data and the problems involved in research in this field.

**740 Seminar in Current Housing Issues** Spring, 3 credits. S-U grades optional. Permission of instructor required.

F 9:05-11. Department housing faculty. Focuses on a selected group of national issues related to housing. The issues evaluated vary from year to year based on current importance and student interest. When possible, this course presents studies in the context of present or recent research, with emphasis on both subject content and methodology.

**743 Readings in Housing** Spring, 2 credits. S-U grades optional. Registration with permission of instructor.

Hours for discussion of readings to be arranged. Department housing faculty.

**758 Seminar for Doctoral Candidates** Fall, 2 credits. S-U grades optional.

Department staff. Review of critical issues and thought in consumer economics and public policy questions.

**899 Master's Thesis and Research** Fall or spring. S-U grades optional. Registration with permission of the chairperson of graduate committee and the instructor.

Department graduate faculty.

**999 Doctoral Thesis and Research** Fall or spring. S-U grades optional. Registration with permission of the chairperson of graduate committee and the instructor.

Department graduate staff.

## Design and Environmental Analysis

R. Steidl, chairman; G. C. Millican, graduate faculty representative; C. Adams, F. D. Becker, M. Boyd, D. Buchanan, A. Bushnell, G. J. Coates, J. Carreiro, T. Engelland, L. Gallup, C. E. Garner, J. H. Hanna, K. Houck, C. Johnson, B. A. Lewis, W. J. McLean, S. H. Mensch, E. R. Ostrander, E. Peters, M. Purchase, A. Racine, R. Rector, N. C. Salford, J. Sirlin, C. Straight, M. A. Warner, S. S. Watkins, M. V. White

The Department of Design and Environmental Analysis is concerned with the creation, change, and quality of our near environment. The near environment begins with our clothing and reaches into all the areas we occupy as we move in our work and leisure activities, at home and away from home. The program of the department emphasizes the interaction between environments and people; the needs of individuals, families, and other groups as they affect and are affected by the space, objects, and materials around them.

The department draws its strength from the multidisciplinary nature of its faculty, whose education has been in such areas as chemistry, physics, psychology, sociology, economics, architecture, engineering, fine arts, and design. The diverse faculty backgrounds and teaching approaches lead to multidisciplinary problem solving and development of students' creative abilities, aesthetic judgment, and analytical thinking.

The department offers flexibility to all its majors, after first introducing them to basic subject matter in three areas: *Design*—an introduction to visual language including the elements and principles of two- and three-dimensional design, color theory, and drawing; *Physical science*—the chemical, physical, and structural properties of such materials as textiles, wood, clay, and plastics; and *Social science*—psychological, sociological, and managerial analysis of our relationship to the physical environment.

A major in design and environmental analysis prepares a student to be a qualified professional in one of several areas. As soon as possible each student should select an area in which to concentrate and should indicate one of the following major options.

**Design, Interior or Product** (Option 1a) prepares students who are interested in the design of objects and the spaces in which they are used. Students learn to seek and to apply knowledge about materials and human needs to the design of the man-made environment. Because it emphasizes studio work, this option specifies more hours in the major field than do any of the others. Careers are available in consumer product design, interior space planning, aspects of housing design and technology, and (after graduate study) in teaching.

**Design, Apparel** (Option 1b) involves students with both aesthetic and functional considerations in the design of body coverings. The program emphasizes a problem approach that enables the student to integrate knowledge of design, textiles, and other materials, human and social factors, and technical processes. Careers are available in industry, government, institutions, and education.

**Materials/Textiles** (Option II) permits students to explore the chemical and physical structures and properties of textiles, textile products, and of some other materials, and to consider the requirements for using these materials in the near environment. This option is planned to give students the flexibility to select a series of strongly supporting courses in either physical sciences, design, human and social factors, and/or consumer economics. Careers are available in the fiber and textile industries, government, and education. Recent graduates are active in process and product research, development, and evaluation; consumer information programs; consumer product safety; technical marketing services; Cooperative Extension; and teaching.

**Human and Social Factors** (Option III) encourages students to analyze existing and proposed environments, to study sociological and psychological factors as they seek to understand the interaction between people and their behavior settings, and to establish criteria for improving the quality of physical solutions to human needs. Professional careers include working with designers, architects, interior space planners, and government agencies in creating and evaluating environments for families, children, the handicapped, the ill, or the elderly; serving as liaison between consumer and producer; and working with communication specialists. Graduate study is generally necessary for careers in teaching and research.

**The department does not offer an option in either retailing or graphics.**

Facilities for study and research include textile laboratories; household equipment laboratories; design studios including those for woodwork, textile printing, and weaving; a laboratory for studying human and social factors; and two galleries that exhibit current work by students, faculty, professional designers, artists, and craftsmen. In addition, the extensive Cornell Costume Collection, a unique historic and cultural resource, is available for class and student use. Field study involving actual experience in the community, business, or government is an increasingly important aspect of many students' programs.

Courses in other departments of the College of Human Ecology and in other colleges of the University supplement work in design and environmental analysis. Appropriate areas include architecture, city planning, landscape architecture, engineering, hotel administration, sculpture, painting, history of art, theater, communication arts, marketing, statistics, mathematics, physics, chemistry, anatomy, physiology, psychology, anthropology, sociology, and education.

**Transfer Students.** The department welcomes transfers. Students intending to specialize in design should have completed some of the required design courses (or their equivalent) before transfer, or should expect to spend additional time to complete their programs here, since the basic language of design is an essential prerequisite for successful work. Transfer students specializing in textiles or in human and social factors who have completed most of the natural and social science requirements usually can complete the major within the normal four years.

**Graduate Study.** The increasingly complex demands being made on professionals suggest the growing importance of work beyond the bachelor's degree for many students. In the Field of Design and Environmental Analysis, graduate study offers a multidisciplinary program individually tailored to the background and interests of the student and leading to a Master of Arts or Master of Science degree. Candidates for the doctoral degree in other fields may minor in either design or environmental analysis. Graduate study may be directed toward empirical problem solving or toward theoretical research into a facet of a problem. Financial aid is provided by

teaching and research assistantships for about two-thirds of the graduate students; others may compete for available University and college fellowships (see *Announcement of the Graduate School*).

Students seeking additional detailed information about the graduate programs in the department should write: Graduate Faculty Representative, Department of Design and Environmental Analysis, Cornell University, New York State College of Human Ecology, Ithaca, New York 14853.

**044 Workshop in Elementary Clothing Construction** Fall or spring. Noncredit. S-U grades only. (This S-U grade will not be counted as one of the four courses a human ecology student may take for S-U.) Enrollment limited to DEA majors or human ecology students with approval of adviser. Students who wish to enroll in this course should contact the instructor, S. Watkins, 325 MVR.

A series of autotutorial laboratories teaching the basic sewing skills needed to execute design ideas in apparel design courses. Topics include using the sewing machine; using a commercial pattern; layout and cutting of fabric; sewing darts, seams, and gathers; inserting a zipper, facing a neckline; setting in a sleeve; and hemming. A blouse or shift dress will be constructed. Approximate cost of materials and supplies, \$20.

**101 Design I: Fundamentals A** Fall or spring, 3 credits. Each section limited to 23.  
T Th 8-11 or 1:25-4:25; M W 1:25-4:25 or 7:30-10:30 p.m. M. Boyd, C. Straight.

A studio course introducing the fundamental vocabulary and principles of design and involving experimentation with the development of form through problem-solving approaches. Average cost of materials, \$25.

**102 Design I: Fundamentals B** Fall or spring, 3 credits. Each section limited to 23. Prerequisite: DEA 101.

Fall, M W 10:10-1:10, T Th 8-11; spring, M W or T Th 8-11, M W 1:25-4:25. M. Boyd, A. Bushnell, C. Straight.

A study of visual organization including problems dealing with color and visual perception. Emphasis on the development of visual sensitivity, imagination, and problem structuring, utilizing simple materials to produce abstract solutions. Approximate cost of materials, \$25.

**111 Theory of Design** Fall, 3 credits. Enrollment limited to 120; DEA majors given priority. Recommended to precede or parallel DEA 101 and 115. Required for majors in DEA, preferably in the first year.

M W F 12:20. J. Carreiro.  
Introduction to the field of design for the student in any academic area. The course reviews the spectrum of design activities, examining various movements in the visual arts and differences among designers in philosophical premises, social and functional roles, and cultural positions. Also examined are requirements in the man-made environment as affected by the interaction of people, design, and materials. Lectures and visual material are presented by DEA faculty and visiting design professionals.

**115 Drawing** Fall and spring, 3 credits. Each section limited to 25.

M W 1:25-4:25, or 7:30-10:30 p.m.; T Th 1:25-4:25. T. Engelland, J. Hanna, S. Mensch.  
A studio drawing course. Short demonstrations or lectures on the ideas and techniques of drawing are presented every week. The student is introduced to the functions of line, shape, and value as they apply to design. Drawing from the figure and from inanimate objects, perspective, and conceptual drawing are emphasized. Course may be repeated for credit with consent of instructor. Minimum cost of materials, \$15.

**116 Design Drawing** Spring, 3 credits. Limited to 23. Prerequisite: DEA 115.

M W 8-11. A. Bushnell, J. Hanna, S. Mensch.  
Teaches the formal schemata of drawing communication: natural perspective, parallel and axonometric drawing, orthography, presentation layout and techniques, and basic drafting. Drawing schemata are used to communicate solutions for applied design problems that encompass interiors, products, small shelters, and public spaces. Minimum cost of materials, \$25.

**117 Drawing the Clothed Figure** Fall, 3 credits. S-U grades optional. Enrollment limited to 25. Prerequisites: DEA 115 or equivalent.

M W 7:30-10:30 p.m. T. Engelland.  
Intended to improve students' ability to illustrate two-dimensionally the interaction of draped fabric with the human form and to develop awareness of clothing as a design medium. Emphasis is on development of techniques and skills in selected media necessary for professional communication of design ideas.

**135 Textiles I** Fall or spring, 3 credits. Chem 103-104 or 107-108 may be taken concurrently.

Fall: lec, T Th 11:15; lab, T or W 2:30-4:25 or Th 8-9:55. Spring: lec, T Th 11:15; lab, W 8-9:55 or 2:30-4:25 or Th 8-9:55. D. Buchanan.

An introduction to the basic properties of textile materials, with consideration of their technology, consumer uses, and economic importance. Behavior of textile materials is observed in a variety of environmental conditions that influence esthetics, comfort, and performance. This course is designed to provide a basis for further study in textiles, but it also contains sufficiently broad coverage of the subject to be used as an elective course.

**145 Apparel Design I** Fall or spring, 4 credits. Each lab section limited to 25. Recommended: DEA 044 or equivalent personal experience. Those with formal course work in pattern design may take an exemption exam by contacting instructor (E425 MVR) the first day of registration.

Lec, T Th 10:10; lab, T Th 11:15-1:05 or 2:30-4:25. A. Racine.

An intensive study of the principles and processes of flat pattern design and fitting techniques. Various design problems using flat pattern concepts and techniques are undertaken. Emphasis is placed on the development of creative expression. Sewing skills are not taught (see DEA 044). Approximate cost of supplies, \$30 plus fabric for final project.

**150 Environmental Analysis: Human and Social Factors** Spring, 3 credits. Required for DEA majors who must complete the course in the freshman or sophomore year. Not open to juniors (except transfers), seniors, or graduate students.

M W F 12:20. F. Becker, G. Coates, E. Ostrander, R. Steidl.

Introduction to study of relations between physical environment and behavior of individuals and groups. Perception of space and effects of spatial arrangements on interactions between persons. Significance of human capabilities and limitations as factors to be considered when designing person-environment systems. Guidelines for analyzing environmental conditions.

**201-202 Design II** 201, fall; 202, spring, 6 credits per term. Prerequisites: DEA 101 or permission of instructor; recommended: DEA 102, 111, 115.

M T W Th 1:25-4:25. A. Bushnell, J. Hanna, and department faculty.  
A team-taught studio course emphasizing the conceptualization of form as a function of the theory and handling of materials. Included are basic drafting, model building, and presentation drawing. The course is structured around a series of design problems, three to five weeks in length, encompassing a basic understanding of wood, plastic, metal, glass, ceramics, concrete, and textiles. Where possible, problems include the handling of the

actual materials. Minimum cost of materials, \$60.

**230 Science for Consumers** Fall. 3 credits. S-U grades optional. Limited to 20 students per section. Prerequisite: high school or college chemistry or physics. Not open to students who have taken DEA 434.

Lec, T Th 9:05; lab, 12:20-2:15 or 2:30-4:25. M. Purchase.

Principles of science applied to household equipment and supplies. Topics include the chemistry of cleaning agents, chemical characteristics of surfaces to be cleaned, electricity in dwellings, heat transfer, control of environmental conditions in dwellings, and mechanics of equipment. Particularly valuable for environmental designers and analysts and students planning to work with consumers as teachers, extension workers, home service personnel, or consumer consultants.

**235 Textiles II: Manufacturing Processes; Textile Testing and Evaluation** Fall or spring. 3 credits. Enrollment limited to 16. Prerequisites: DEA 135 and 2 semesters of chemistry.

M W 9:05 and F 8-9:55. E. Peters.

A descriptive study of current fiber, yarn, and fabric forming; dyeing, printing, and finishing processes; and machinery. Scope and limitations of test methods, especially those that relate to durability and flammability of fabrics, and operation of certain testing instruments will be the focus in the laboratory. Approximate cost of materials, \$20.

**250 Environmental Psychology: Perspectives and Methods** Fall. 3 credits. Prerequisite: DEA 150, or permission of instructor.

T Th 10:10-11:30. F. Becker.

Course focuses on issues central to study of person-environment relationships and the uses of evaluation research in the design process. Graduate students should enroll in DEA 660 concurrently with 250.

**251 Historic Design I: Furniture and Interior Design** Spring (for 1977 only). 3 credits.

Prerequisites: DEA 101 and 111. Recommended sequence: DEA 251, 252, and 353.

M W F 11:15. G. C. Millican.

A study of the patterns of historical development and change in furniture and interiors from man's earliest expressions through the eighteenth century as they reflect the changing cultural framework of Western civilization, excluding America.

**252 Historic Design II: Furniture and Interior Design** Spring. 3 credits. Prerequisites: DEA 101 and 111. Recommended sequence: DEA 251, 252, and 353.

M W F 8. G. C. Millican.

A study of the patterns of historical development and change as revealed through American furniture and interiors, 1650-1885. Design forms are considered individually, collectively, and in their overall historical context as they express the efforts, values, and ideals of American civilization.

**[261 Fundamentals of Interior Design for Nonmajors** Fall. 3 credits. Enrollment limited to 20. Prerequisite: DEA 101 (not open to DEA Option Ia students). Not offered 1976-77.

T Th 1:25-4:25. G. C. Millican.

A studio course that emphasizes the fundamental principles of design as applied to the planning of residential interiors and coordinated with an understanding of family and individual needs. Studio problems explore choices of materials, space planning, selection and arrangement of furniture, lighting, and color. Illustrated lectures, readings, and introductory drafting and rendering techniques are presented. Minimum cost of materials, \$20.]

**263 Apparel Design II: Problems in Apparel Design** Fall. 3 credits. Prerequisites: DEA 101, 111, 135, and 145; recommended DEA 115.

T Th 10:10-1:10. C. Johnson.

Studio problems are designed to involve students in creative experiences that will increase understanding of design concepts and principles related to body coverings. Problems focus on the aesthetic nature of dress. Problem solving requires exploration of sources of apparel design ideas, experimentation with materials and techniques, and innovation. The Cornell Costume Collection is used for illustration and inspiration. Approximate cost of materials, \$25.

**300 Special Studies for Undergraduates** Fall or spring. Credit to be arranged.

Hours to be arranged. Department faculty.

For special arrangement of course work necessitated because of nonequivalent training in a previous major or previous institution or a change in department's major requirements. Students prepare a multicopy description of the study they wish to undertake. Forms are available from counselors in academic services.

**301-302 Design III** 301, fall; 302, spring. 6 credits per term. Prerequisite: DEA 201-202.

M T W Th 1:25-4:25. S. Mensch, J. Sirlin, and department faculty.

A team-taught studio course emphasizing the conceptualization of form as a function of human and social factors. Environmental analysis concepts and techniques are studied to provide design students with enough understanding to begin a behaviorally-based design project. Several short-term problems are explored with the intention of identifying a significant project to be undertaken in the spring semester. Minimum cost of materials, \$60.

**317 Issues in Design Methods and Planning Strategies** Spring. 3 credits. Limited to 20.

Prerequisites: DEA 111, 150, and 250, or permission of instructor.

T Th 10:10-11:30. G. Coates.

A critical and historical evaluation of the methods, tools, and techniques of the design process. Issues to be covered include the role of the designer in a technological society; psychology of consciousness and the design process; and effects of sociocultural, economic, political, and technological factors on the design activity. Particular emphasis placed on examination and development of alternatives.

**330 Household Equipment Principles** Spring. 3 credits. S-U grades optional. Prerequisite: either DNS 146 or DEA 135 or DEA 230.

M W 2:30-4:25. M. Purchase.

Principles of operation of appliances for food preparation and preservation, cleaning, laundering, temperature and humidity control, and lighting. Evaluation of features in relation to the functions they are designed to serve and to their cost. Selection, use, and care of household equipment. Individual problems related to the student's background and interests.

**335 Textiles III; Structure and Properties** Spring.

4 credits. Prerequisites: DEA 235.

Lec, M W 12:20; lab, T 1:25-4:25. D. Buchanan.

An in-depth study of the structures of textile materials and their component parts, from polymer molecules through fibers and yarns to fabrics, and the techniques of controlling structure to achieve desirable end-use properties. Particular emphasis is placed on properties important to the consumer, including easy care, elasticity, durability, comfort, and aesthetics. Laboratory experimentation illustrates the important interrelationships among structures and properties of polymers, fibers, yarns, and fabrics.

**338 Textiles for Interiors and Exteriors** Spring. 3 credits. S-U grades optional. Prerequisites: DEA 235 or permission of instructor.

T Th 8-9:55. V. White.

Through lectures, seminars, and laboratory experiences, students will examine interior and exterior environments and their interaction with

textiles. Physical and chemical properties of fiber, yarn, and fabric will be studied relative to product requirements, for example, product reliability, safety, performance, and aesthetics. Communication at consumer/government/industry interfaces will be considered.

**[340 Form Study** Spring. 3 credits. Prerequisite: DEA 201. Not offered 1976-77.

T Th 8-11.

Work with basic plastic form utilizing the design possibilities of moldable materials. Minimum cost of materials, \$35.]

**342 Design: Weaving** Fall or spring. 3 credits. Limited to 12. Prerequisite: DEA 101; recommended: DEA 102, 115, 135.

T Th 10:10-1:10. K. Houck.

A studio course encompassing the basics of weaving and the functioning of a loom. Using a variety of fibers, yarns, and other materials, students are introduced to design possibilities on the loom. The relationship among color, design technique, and function is considered in weaving a number of experimental samples, as well as several more complicated woven projects. Minimum cost of materials, \$45.

**343 Design: Introductory Textile Printing** Fall. 3 credits. Each section limited to 15. Prerequisites: DEA 101 and at least one other studio design course.

M W 1:25-4:25; T Th 10:10-1:10. C. Straight.

A studio course exploring the print as a design form. Silk-screen printing is the basic process used, but opportunities are provided for designing with other processes. Minimum cost of materials, \$40.

**344 Intermediate Textile Design: Silk-Screen Printing** Fall. 3 credits. Enrollment limited to 12.

Prerequisite: DEA 343 or equivalent course in silk screening and permission of instructor.

Hours to be arranged. N. Brotman.

A studio course emphasizing the development of professional printing skills and techniques. Students work on a larger scale and are expected to develop a more individual and sophisticated approach to their designs than in DEA 343. Approximate cost of materials, \$60.

**349 Graphic Design** Fall or spring. 3 credits. Enrollment limited to 18. Prerequisite: DEA 201 or permission of instructor.

M W 7:30-10:30 p.m. M. Boyd.

The fundamentals of lettering, typography, layout, and presentation techniques. Printing processes and the use of photography and illustration also are covered. Consideration is given to graphics in product and interior design applications and to packaging, exhibit design, and informational systems.

**350 Environmental Analysis: Person, Activity, Space** Spring. 3 credits. Prerequisite: introductory psychology; recommended: DEA 150 and a course in human physiology.

T Th 12:20-2:15.

Study of ways in which physical aspects of the near environment affect a person's effort and characteristics of activities. Various sources of ergonomic or human-factors data are used. Human costs of work (effort, energy, time, cognitions, preferences) provide guides for reducing amount of adaptation to man-made objects and environments. Implications for design and organization of products, interior spaces, and activities, and for choice of products for efficient, safe, and comfortable human use. Field trips.

**[353 Historic Design II: Contemporary**

**Design** Spring. 3 credits. Recommended sequence: DEA 251, 252, and 253. Not offered 1976-77.

M W F 11:15. G. C. Millican.

A historical study of the emergence and development of contemporary design, 1885 to present. An

examination of the social, economic, technical, and style forces that shape the design forms of the present. Also a critical analysis of selected works of furniture, fabrics and interiors.]

**[361 Residential Design** Fall, 3 credits. Prerequisite: DEA 201-202 or permission of instructor; recommended: DEA 235 and 350. Not open to DEA Option Ia majors. Not offered 1976-77. T Th 8-11. G. C. Millican.

An introduction to residential architectural design. Through the design solution for specific occupant needs, the student is involved with site, orientation, climate, and materials. Drafting room work consists of plans, elevations, perspectives, and studies in the presentation of solutions. Lectures, discussions, and required readings.]

**366 Apparel Design III: Design Approaches** Spring, 3 credits. Prerequisites: DEA 115, 150, 263.

M W 1:25-4:25. C. Johnson. The course is intended to give the student an understanding of the interrelationships of two techniques for designing apparel: draping and flat pattern. Advanced flat pattern techniques are studied. Problems require the student to make judgments regarding the design process, nature of the materials, body structure, and function. Minimum cost of materials, \$25.

**400-401-402 Special Studies for Undergraduates** Fall or spring. Credit to be arranged.

Hours to be arranged. Department faculty. For independent study by an individual student in advanced work not otherwise provided in the department, or for study, on an experimental basis, with a group of students in advanced work not otherwise provided in the department. Students prepare a multicopy description of the study they wish to undertake. Forms are available from counselors in academic services. Students, in consultation with their supervisor, should register for one of the following subdivisions of independent study.

**400 Directed Readings** For study that predominantly involves library research and independent reading.

**401 Empirical Research** For study that predominantly involves data collection and analysis or laboratory or studio projects.

**402 Supervised Fieldwork** For study that predominantly involves participation in community or classroom settings.

**417 Workshop in Environmental Design** Fall, 4 credits. S-U grades optional. Enrollment limited to 25. Prerequisite: DEA 301-302 or permission of instructor.

M W F 10:10-12:05. G. Coates. A problem-focused course aimed at integrating learning, research, design, and public service. Projects selected allow students to confront pressing issues in design and management of the near environment, user preference research, environmental education, and systematic evaluation of existing settings. Minimum cost of materials, \$15.

**430 The Textile and Apparel Industries** Fall and one week of intersession. 3 credits. Prerequisites: CEPP 233, DEA 135, or permission of instructor. T Th 12:20-2:15. N. Saltford.

A critical review of the textile and apparel industries: trends in production and marketing and factors affecting output, price, and location; the role of unions; and the effects of international trade, trade barriers, integration, and automation. A field experience in the textile regions of the Carolinas is planned for January intersession. Students are responsible for field experience expenses.

**434 Refurbishing Textiles** Spring, 2 credits. Enrollment limited to 16. Not open to students who have taken DEA 230.

Lec, M 8-8:50; lab, W 8-9:55. M. Purchase. The course will center on the interaction of soils and stains with textiles and with cleaning agents and laundry equipment. Topics will include characteristics of soils, mechanisms for bonding soils to substrates, textile properties and changes in properties related to refurbishing processes, functional finishes, wet- and dry-cleaning processes, the supplies and techniques used in cleaning, and instructions for refurbishing.

**436 Textiles IV: Textile Chemistry** Fall, 4 credits. Prerequisite: DEA 235.

Lec, T Th 9:05; lab, T Th 10:10-12:05. B. A. Lewis. An introduction to the chemistry of the major classes of natural and man-made fibers, including their structure, properties, and reactions. Laboratory work will include the qualitative identification of textile fibers, and a consideration of chemical damage to fabrics, finishes, and dyes.

**438 Apparel Textiles** Fall, 3 credits. S-U grades optional. Prerequisites: DEA 235, 263, or permission of instructor.

T Th 2:30-4:25. V. White. A study of the complex interrelationships of aesthetics, fashion and function, and other trade-offs of concern to the consumer. Consideration of the use of standards, specifications, and other means of communication at consumer/government/industry interfaces. Individual or team projects. Seminars and lectures with required readings. Lab experiences will include evaluation of articles bearing attached care labels.

**[444 Advanced Textile Design: Silk-Screen Printing** Spring. Credit variable depending on the amount of work done; minimum of 3 credits. Enrollment limited to 12. Prerequisite: DEA 344 and/or permission of instructor. Not offered 1976-77.

T Th 1:25-4:25. C. Straight. Advanced design problems in textile printing are posed. Emphasis is placed on professional practice in both solutions and presentations. Approximate cost of materials, \$40.]

**445 Apparel Design IV: Theory of Functional Clothing** Fall, 3 credits. Prerequisites: DEA 235, 366 (DEA 235 and 445 may be taken concurrently).

M W 10:10-11:40. S. Watkins. Application of physical science theory to problems in clothing design. Approach to problems studied requires the student to relate three aspects of apparel design: needs and functions of the human body, structural properties of materials, and apparel forms. Information gained by study and testing of textiles and garment forms is applied to the problems of movement, warmth, impact protection in active sports equipment, and other topics relating to comfort and function of clothing.

**451 History of Costume** Fall, 3 credits. Recommended: courses in history of art or in cultural history.

T Th 2:30-4:25. Department faculty. A comparative study of dress of selected cultures from antiquity through fifteenth century, stressing (1) relationship of social, economic, and political factors affecting dress, and the mores as expressed through dress; (2) contribution of ancient cultures to apparel arts of the Western world. Illustrated lectures, readings, term problems, and direct study of basic forms of dress as exemplified in the Cornell Costume Collection. Field trip at student expense to museum in New York City arranged when feasible.

**452 History of Costume** Spring, 3 credits. Recommended: courses in history of art or in cultural history.

T Th 2:30-4:25. G. C. Millican. A comparative study of dress of selected cultures from sixteenth through twentieth centuries. Emphasis on development of apparel arts of Western civilization

and factors that brought about change. Illustrated lectures, readings, and term problems bring students into direct contact with the Cornell Costume Collection and other primary sources such as the Regional History Collection.

**[455 Psychology of the Near Environment** Fall, 3 credits. Prerequisites: DEA 150, Psych 101, and either Psych 128 (102), HDFS 115, or an equivalent second course; recommended: a stat course. Not offered 1976-77.

M W F 9:05. E. Ostrander. An exploration of the interaction of human beings and the immediate nonsocial environment. Interaction is considered in terms of basic psychological processes, including perception, learning, and motivation. Applications of psychological principles are made to consumer products such as clothing and appliances and the settings in which we live, work, and play.]

**[463 Product Design** Fall, 3 credits. Prerequisite: DEA 301-302. Not offered 1976-77. T Th 8-11. A. Bushnell, J. Carreiro.

The development and analysis of a series of products for use in either homes or institutional settings. The emphasis of the course is on design related to materials and production methods.]

**465 Apparel Design V: Product Development and Presentation** Spring, 3 credits. Prerequisite or corequisite: DEA 117. Prerequisite: DEA 102 and 366; recommended: Econ 102, CEPP 233, DEA 430.

M W 10:10-1:25. A. Racine, C. Johnson. Through studio and field problems students examine the influence of manufacturing technology and cost on the designer. Projects developed to various stages of completion from sketch to finished prototype. Students are responsible for field trip expenses.

**[466 Interior Space Planning I** Fall, 3 credits. Prerequisite: DEA 301-302 or permission of instructor. Not offered 1976-77.

T Th 8-11. Designing of interior environments with an emphasis on programming, spatial organization, materials, furnishings, and lighting. Student projects emphasize professional-level presentations of materials, drawings, and models.]

**[467 Interior Space Planning II** Spring, 3 credits. Prerequisite: DEA 466 or permission of instructor. Not offered 1976-77.

T Th 8-11. Advanced exploration of a specific complex interior environment project.]

**477 Photo/Graphic Communication in Design** Spring, 3 credits. Limited to 12. Prerequisites: DEA 150, 301, and one additional environmental analysis technique course; or permission of instructor.

M W 10:10-12:05. J. Sirlin. The application of photographic and other graphic design processes to environmental design. Students explore studio design problems of varying scales including interior and community design, plus specific technical problems such as lighting and color. Special projection and copy equipment used to investigate local environmental design. Open to advanced design students with knowledge of photography and access to 35mm camera. Minimum cost of materials, \$40.

**499 Design IV** Fall or spring, 4 credits. (A 4-credit senior project is required for the DEA Option Ia major. Credits may be taken in 1 or 2 semesters. In addition, students may elect additional credits in DEA 499, up to a total of 8 credits.) Prerequisite: DEA 301-302.

Hours to be arranged. J. Carreiro and department faculty. A senior thesis, essentially a problem-solving experience with the problem area to be selected by the student and approved by the department faculty.

Most projects will be within product design or interior design. However, other interests may be pursued if the department approves the proposal and if the student can find a DEA instructor who will be responsible for the program.

**600 Special Problems for Graduate Students** Fall or spring. Credit to be arranged. For graduate students recommended by their chairpersons and approved by the head of the department and instructor in charge for independent, advanced work.

Hours to be arranged. Department faculty.

**617 Workshop in Environmental Design** Spring. 4 credits. S-U grades optional. Limited to 25. Prerequisite: DEA 301-302, 417, or permission of instructor; recommended: DEA 317.

M W 10:10-12:05. G. Coates.

A problem-focused course aimed at integrating, research, design, and public service. Projects selected allow students to confront pressing issues in design and management of the near environment. Experiences include conceptualization, design programming and development, user preference research, environmental education, and systematic evaluation of existing settings. Minimum cost of materials, \$15.

**620 Instrumental Analysis** Fall. 2 credits.

Prerequisite: organic chemistry.

Th 1:25-4:25 or by arrangement. B. A. Lewis.

An introduction to the theoretical and practical aspects of instrumentation including spectroscopy, chromatography, electrophoresis, and other selected techniques.

**630 Physical Science in the Home** Fall. 2 or 3 credits. S-U grades optional. Prerequisite: college chemistry. 3 credits require laboratory attendance.

Consult instructor before registering.

Lec. T Th 10:10; lab. W 2:30-4:25. M. Purchase.

Selected principles from mechanics, electricity, heat, sound, and light are applied to household equipment. Considers chemical characteristics of soil, of surfaces to be cleaned, and of supplies used for cleaning and protecting surfaces, and the laundry process and supplies. Gives background information in physical science for professionals working with equipment in teaching, extension, and home service as well as information essential to the environmental analyst and technically informed designer.

**635 Special Topics in Textiles** Spring. 3 credits.

Prerequisite: DEA 235 or permission of instructor.

Lec. M W 10:10; lab. F 10:10-12:05. E. Peters.

An in-depth study of one or more selected topics, for example, comfort, formed fabrics, flammability. Relationships of fabric properties and end-use performance as well as test method development will be the focus in the laboratory. Approximate cost of materials, \$20.

**[636 Advanced Textile Chemistry** Spring. 4 credits. Prerequisite: DEA 436. Offered in alternate years. Not offered 1976-77.

B. Lewis.

The chemistry and physicochemical properties of natural and synthetic rubbers, polyurethanes and other elastomeric materials, high-temperature polymers, and inorganic materials used as textile fibers, and the relationship between their chemistry and functional properties as textile materials. Other topics will include polymerization processes, textile finishing processes, dyes and dyeing, and degradation of textile materials under environmental conditions.]

**637 Textile Seminar** Fall or spring. 1 credit. S-U grades only. Required of all graduate students in textiles.

T 4:30-5:45. E. Peters.

Discussion of research progress and other textile topics of interest by faculty, students, and invited guest speakers.

**650 Person-Activity-Environment**

**Relationships** Spring. 3 credits. Recommended: DEA 350 and 455. Consult instructor before registering.

T Th 9:05.

Human requirements, capabilities, and limitations are studied with reference to design and organization of consumer products, interior spaces, and work. Literature concerns ergonomic or human-factors data and the description and measurement of work and other activities. Projects coordinate with DEA 350. Field trips.

**652 Research Practicum in Environmental**

**Psychology** Spring. 4 hours. S-U grades only. Permission of instructor required.

M 1:25-4:25. F. Becker.

This seminar is for students preparing or doing graduate-level research (generally thesis projects) in the area of environmental psychology. Discussions focus on problem definition, research design, methodology, and data analysis as applied to environmental psychology.

**655 Social Psychology of the Near**

**Environment** Spring. 3 credits. Prerequisites:

elementary psychology; and DEA 250 or 317 or 350 or 417 or 455; or permission of instructor.

T Th 2:30-4:05. E. Ostrander.

The impact of the near environment on our behavior as social animals. Ways our environment facilitates or hinders effective functioning, individually or in groups, considered in terms of sociopsychological theory. Frameworks developed for analyzing our social behavior in varied settings in which we function. Methodological problems are considered.

**660 Environmental Psychology: Perspectives**

**and Methods** Fall. 1 credit. Permission of instructor required.

Hours to be arranged. F. Becker.

Course focuses on issues central to study of person-environment relationships and the uses of evaluation research in the design process. Graduate students should register for DEA 250 concurrently with 660.

**740 Design: Research and Planning**

**Procedures** Spring. 3 to 5 credits. S-U grades optional. Enrollment limited to 12.

Lecture-discussion W 10:10-1:10; additional time to be arranged. J. Carreiro.

An examination of specific methods and procedures in thesis development, writing, and presentation. Focus is on problems related to theses in design and environmental analysis. Included are techniques in problem isolation and development; organizing, writing, and presenting design and research proposals. Of primary concern is development of a common language combining verbal and visual methods of planning our near environment.

**899 Master's Thesis and Research** Fall or

spring. Credit to be arranged. S-U grades optional.

Registration with permission of the chairperson of the graduate committee and the instructor.

Hours to be arranged. Department graduate faculty.

## Human Development and Family Studies

J. P. Hill, chairman; J. L. Doris, graduate faculty representative; E. R. Bard, F. Barry, H. T. M. Bayer, J. Birkmayer, R. Bookman, W. L. Brittain, U. Bronfenbrenner, M. Cochran, J. Condry, Jr., E. C. Devereux, H. Feldman, P. Fender, H. Ginsburg, S. Hamilton, J. Harding, P. G. Hatwood, B. Koslowski, L. C. Lee, R. Linton, G. McCord, G. Miller, B. Muhs, M. A. Nunno, M. H. Potts, J. A. Provan, R. Raimon, H. N. Ricciuti, B. Richardson, D. Roy, B. Sagan, M. Shea, G. Suci, M. Taietz, S. Wahl, J. R. Weisz, A. Willis.

The Department of Human Development and Family Studies is a center for education, training, and research in this field. The size and combination of its programs of instruction, public service, and research provide diverse opportunities for students to prepare for careers requiring bachelor's degrees or to acquire the bases for additional study at the graduate level. Those whose career interests are in the areas of university teaching and research, social work, medicine, law, and clinical psychology need to pursue graduate education. Others who seek positions as research technicians, mental health assistants, youth counselors, and preschool teachers may be able to meet their career objectives with the bachelor's degree. The department does not offer teacher certification for elementary teaching, and is no longer accepting new students for the Nursery School-Kindergarten Certification Program.

During their first semesters, students who major in HDFS are expected to obtain a broad base in the liberal arts on which to build their majors. This foundation is acquired through a range of courses in natural and social sciences and the humanities, often in departments and academic units other than HDFS. Courses within the department vary widely in type and substance. In addition to lectures and discussions, students have the opportunity for research and independent study. All students also are required to observe and to participate in a laboratory or a field setting.

Courses are grouped into three areas: cognitive development, personality-social development, and family and society. A student majoring in the department takes at least one basic course in each area. These courses deal with language and learning; individual, social, personality, and cognitive development; the family in its traditional and contemporary forms; and the consideration of various settings for human development outside the home, particularly day care and nursery school environments. Study deals with people at all levels and stages of life, with special emphasis on the years from infancy through adolescence.

**Graduate Study.** The Department of Human Development and Family Studies offers a number of graduate programs leading to both master's and doctoral degrees. The principal areas of specialization within the department are (1) early childhood education, (2) child development, (3) cognitive development, (4) personality and social development, (5) research in childhood psychopathology, and (6) family relationships. Students seeking additional detailed information about the graduate programs in this department should write the Graduate Faculty Representative, Department of Human Development and Family Studies, Cornell University, New York State College of Human Ecology, Ithaca, New York 14853.

**111 Observation** Fall or spring. 3 credits. Limited to 100.

M W F 12:20. H. Bayer.

Provides opportunities for observation of people and settings in which they behave in order to (a) develop observational skills, (b) increase understanding of behavior and its development, and (c) acquaint students with basic methodological concepts underlying the scientific study of behavioral development. Following an orientation period, students observe in field settings. Discussion groups accompany the observation experience.

**115 Human Development: Infancy and Childhood** Fall. 3 credits.

M W F 11:15. H. Ricciuti, J. Weisz.

Provides a systematic analysis of the forces affecting human development from infancy through childhood. Attention is focused on the interplay of biological factors, interpersonal relationships, social structure, and cultural values in changing behavior and shaping the individual. Special emphasis is given to the social implications of existing knowledge.

**116 Human Development: Adolescence and Adulthood** Spring. 3 credits. Limited to freshmen and sophomores except by permission of instructor.

M W F 11:15. J. Hill.

Provides a systematic analysis of the forces affecting human development from early adolescence through late adulthood. Attention is focused on the interplay of biological factors, interpersonal relationships, social structure, and cultural values in changing behavior and shaping the individual. Familial, peer group, educational, and work contexts for development are discussed. Special emphasis is given to the social implications of existing knowledge.

**141 Introduction to Expressive Materials**

Spring. 3 credits. Limited to 20 freshmen and sophomore students.

T Th 2:30-4:25. W. L. Brittain.

Designed to explore the means and materials suitable for creative expression for children of different ages, as well as for adults. Students are expected to acquire competence in evaluating and utilizing various media and in understanding the creative process. Experimentation in paint, clay, chalk, crayon, paper, wire, plaster, wood, and other materials.

**150 (162) The Family in Modern Society** Spring. 3 credits. Limited to freshman and sophomores except by permission of instructor.

M W 1:25 plus sections. B. Richardson.

Contemporary family roles and functions are considered as they are illuminated by United States history, as they change over the life cycle, and as they are influenced by the locales in which families live and the social forces that impinge on them.

**[240 (230) Educational Models and Settings for Young Children** Fall. 2-4 credits. Limited to 50.

Prerequisite: HDFS 111 or permission of instructor. Not open to freshmen or to students taking HDFS 242. Not offered 1976-77.

Lec, W 1:25-3:20 plus one-half day a week for fieldwork for 3 credits, two half-days for 4 credits. Lectures and discussion on the implications of different educational settings for the development of children's behavior and learning. Practical experience in both early and middle childhood.]

**[241 (212) Effecting Behavioral Change in Early Childhood Settings** Spring. 4 credits. Limited to 40. Prerequisite: HDFS 115. Not offered 1976-77.

W 10:10-12:05. J. Provan.

Relates development of preschool children to observable behavior in classrooms; observation and interpretation of behavior while teaching in a classroom; thorough study of theory and methods of dealing with behavior, including other cultures. Two hours of lecture and discussion, plus two mornings or afternoons of participation in nursery school, day care center, or kindergarten.]

**[242 (230) Participation of Groups of School-Aged Children** Spring. 3-4 credits. Limited to 35. Not open to freshmen or to students who take HDFS 240. Prerequisite: HDFS 111 or permission of the instructor. Not offered 1976-77.

Lec, W 1:25-3:20 plus one-half day a week for fieldwork for 3 credits; two half-days for 4 credits. The focus is on the behavior and learning of children from five to twelve in different educational settings. Practical experience in elementary school classrooms.]

**[270 (205) Processes of Adaptation and Atypical Development** Spring. 3 credits. Prerequisites: HDFS 115, Psych 101, or Educ 110. Not offered 1976-77.

M W F 1:25. J. Weisz.

An introduction to atypical development through the study of environmental sources of stress on the growing person. Attention is focused such as the family, the neighborhood, peer groups, and school as a means of understanding atypical adaptations and development.]

**300 Special Studies for Undergraduates** Fall or spring. Credit to be arranged.

Hours to be arranged. Department faculty.

For special arrangement of course work necessitated because of nonequivalent training in a previous major or previous institution. Students prepare a multicopy description of the study they wish to undertake. Forms are available from counselors in academic services.

**302 Family and Community Health** Fall or spring. 3 credits. Limited to 60.

T Th 9:05 plus additional section; sec 1, T

10:10-11; sec 2, Th 10:10-11. M. Taietz.

Health concepts from world concern to individual and community responsibility for healthful living and disease prevention. Foundations of health science, mental and emotional functioning, chemical alteration of behavior, family health, personal health care, health and disease, health care in America, and world health problems. Laboratory sections devoted to discussion and demonstration of emergency childbirth, physical needs of infant and preschool child, and first aid. Additional six hours of arranged laboratory practice during first aid section.

**315 Human Sexuality: A Psychosocial**

**Perspective** Fall. 3 credits. Limited to 100 juniors and seniors. Prerequisite: introductory course in HDFS, psychology, or sociology, or equivalent social science course.

W 12:20-1:45 plus section; sec 1, F 12:20-1:45;

sec 2, F 1:55-3:10.

The aim of this course is to delineate the major psychological and sociological components of human sexual attitudes and behavior. Two central themes will be addressed: the development of sexual orientation over the life cycle and the evolution of sexual norms and customs within changing social systems. An underlying issue will be the role of moral assumptions and contemporary ethics in generating research and theory on human sexuality in the social sciences. Materials will be drawn from interdisciplinary sources including biology, history, and anthropology.

**[317 Adolescent Development in Modern**

**Society** Spring. 4 credits. S-U grades optional. Not open to freshmen and first-term sophomores. Limited to 100. Prerequisite: HDFS 115 or 116 or Psych 101 or equivalent. Not offered 1976-77.

T 2:30-4:25 and 1 hour disc to be arranged, plus a block of 3 or 4 hours available for fieldwork each week. Department staff.

General introduction to the adolescent phase of human development with concern for the biological, cultural, social, and psychological influences on adolescent behavior. Special attention will be given to problems of youth in modern society. Will provide a comprehensive background for students interested in further study of or work with adolescents.]

**318 Social Problems and the Problems of**

**Youth** Fall. 4 credits. Limited to 25. Prerequisite: HDFS 317 and permission of instructor.

T Th 2:30-4:25. D. Roy.

Analysis of factors that contribute to delinquency, drug abuse, unemployment of young people, and social policy programs designed to deal with these problems. Particular emphasis on (1) law and organization of the juvenile justice system; (2) policies, practices, and performance of institutions dealing with problems of young people; (3) use of theory and research in planning and evaluation; and (4) strategies for implementing programs and policies. Students do field research and a report on a selected issue.

**319 Practicum in Working with Adolescents in**

**Trouble** Fall. 5 credits. Limited to 24. Prerequisites: HDFS 317 and permission of instructor; HDFS 318 strongly recommended. Preregistration in 319 does not assure admission. During required three-day field trip, students provide their own food.

T Th 10:10-12:05 plus 8 hours available each week

for fieldwork and related meetings. D. Roy. An advanced fieldwork opportunity for students wanting experience with adolescents whose behavior has brought them to the attention of local legal and treatment facilities. Students attend a series of weekly workshops dealing with the etiology of delinquent behavior, the juvenile justice system, probation work, and theories and methods of treatment. Field placement in local agency that works with young people.

**333 (323) Cognitive Processes** Spring. 3 credits.

Prerequisite: HDFS 115 or equivalent.

M W F 11:05. G. Suci.

A survey of theories and problems in the development of selected cognitive processes; attention, perception, mediation processes, and language.

**338 (342) The Development of Creative**

**Thinking** Spring. 3 credits. Prerequisites: HDFS 115, Psych 101, or Educ 110. Limited to 40.

M W F 9:05-10:10. W. L. Brittain.

A study of various theories of creativity and a review of the research on creative behavior. Emphasis is placed on the conditions and antecedents of creative thinking.

**[344 Infant Behavior and Development** Spring. 3 credits. Prerequisite: HDFS 115 or equivalent. Not offered 1976-77.

M W F 11:15-12:05. H. Ricciuti.

Nature and determinants of major developmental changes in infant behavior from birth to two years. Special attention directed to role of major environmental influences on perceptual-cognitive and social-emotional development and to recent attempts to modify the infants' experience in the interest of facilitating optimal psychological development. Physical growth with reference to biological influences (malnutrition and low birth weight) as they react to the social environment.]

**345 (334) Advanced Participation in Community**

**Groups** Fall or spring. 4-6 credits. S-U grades optional. Prerequisite: HDFS 240 or 242. Limited to 15.

W 2:30-4:25 plus approximately 10 hours per week of field participation. J. Harding.

In 1976-77, field placements will be in an Ithaca elementary school with an innovative program. Each student will work under the supervision of a classroom teacher. Students will have responsibility for developing projects with groups of children and for some remedial work with individual children.

**347 Human Growth and Development; Biological and Social Psychological Considerations (also**

**Nutritional Sciences 347)** Spring. 3 credits. Prerequisites: Bio Sci 101 or 109 or equivalent; HDFS 115 or Psych 101, and NS 115 or equivalent.

M W F 1:25. J. Haas. H. Ricciuti.

A review of major patterns of physical growth from the fetal period through adolescence, with consideration given to biological and socio-environmental determinants of growth, as well as to physical and psychological consequences of variations in growth patterns. Normal patterns of growth will be examined, followed by an analysis of major sources of variations in growth, both normal and atypical.

**352 Contemporary Family Forms in the United States** Fall. 3 credits. Limited to 20 students in each section.

Sec 1, Th 2-4:25; sec 2, W 7:30-9:20 p.m.

H. Feldman.

Variations in family formation, organization, and functioning will be investigated with an emphasis on research findings about each of the family types. Family forms will range from the rural extended family to the more contemporary. The functions of each family form will be considered as they are germane to the individual, the family, and to the society. Students must complete a case study.

**353 The Family as a Context for Adult**

**Development** Spring. 3 credits. Prerequisites: HDFS 150, Soc 101, or R Soc 100.

Th 2-4:25. H. Feldman.

Describes development within the family from late adolescence through late adulthood. Emphasizes intrafamilial experiences and relates them to external social forces (particularly occupational experiences) affecting adults and families. Stresses the ways that family settings influence adult development.

**354 (362) The Family in Cross-Cultural**

**Perspective** Fall. 3 credits. S-U grades optional. Prerequisites: HDFS 115 or 116, Psych 101 or Educ 110, and HDFS 150 or R Soc 100, or equivalent.

M W F 10:10. E. Devereux.

The sociological study of the family, with particular reference to the relationships between the family and society and between the family and its individual members. Special emphasis is placed on the role of the family in child development. Extensive use will be made of cross-cultural and comparative materials.

**[358 Theories of Adult Interpersonal**

**Relationships** Spring. 3 credits. S-U grades optional. Not offered 1976-77.

Th 2-4:25. H. Feldman.

Selective theories of the basic disciplines in social psychology, sociology, and psychology will be reviewed and their pertinence to understanding of the marital dyad examined. Students will generate hypotheses about these theories and test one of them through either a library or empirical paper. A notebook-journal will be kept to interrelate the concepts and to suggest practical applications. Students must complete a case study.]

**360 Personality Development in**

**Childhood** Spring. 3 credits. Prerequisites: HDFS 115 or Psych 101, plus one other course in HDFS or Psychology.

M W F 9:05. L. Lee.

Study of relevant theoretical approaches and empirical findings regarding the development of the child's personality. The influence of parents and other environmental factors on the child will be examined. Topics to be covered will be attachment, autonomy, identification, moral development, and social behavior.

**361 (321) The Development of Social**

**Behavior** Spring. 3 credits. Limited to 100. Prerequisite: HDFS 115 or Psych 128 (102).

M W F 10:10. J. Condry.

Issues in the development of social behavior are viewed from the perspective of both theory and research. An attempt is made to apply our understanding of social behavior to practical problems in areas such as education, childbearing, and group behavior. Likely topics include bases of social behavior in early childhood, the role of peers, the development of aggressive behavior, the development and functioning of attitude and value systems, conformity and deviation, and the function and limits of experimental research in the study of social development.

**371 (325) Functional Disorders of**

**Childhood** Fall. 3 credits. Prerequisites: HDFS 115, Psych 101, or Educ 110, and a course in personality development (270 or other).

M W F 12:20. J. Weisz.

Considers major functional disorders of childhood, ranging from transient and adjustment reactions through the psychoses, with reference to problems of development, prevention, and remediation in settings including families and schools.

**[372 (325) Intellectual Deviations in**

**Development** Fall. 3 credits. Prerequisites: HDFS 115, Psych 101, or Educ 110, and a personality course (270 or other). Not offered 1976-77.

M W F 12:20. J. Doris.

Considers major forms of organic and familial retardations, perceptual and motor handicaps, and

learning disabilities with reference to problems of development, prevention, and remediation in settings including families and schools.]

**[397 Experimental Child Psychology** Fall. 4 credits. Prerequisites: one course in statistics and permission of the instructor. Not offered 1976-77.

T Th 10:10-11:40 plus additional hours for laboratory work. L. Lee.

Students will carry out empirical research projects with class discussion devoted to techniques and problems arising in the projects. The focus will be on experimental studies of children, intended primarily for students interested in entering graduate programs involving further research training.]

**400-401-402 Special Studies for**

**Undergraduates** Fall or spring. Credits to be arranged. S-U grades optional.

Hours to be arranged. Department faculty.

For independent study by an individual student in advanced work not otherwise provided in the department; or for study, on an experimental basis, with a group of students in advanced work not otherwise provided by the department. Students prepare a multicopy description of the study they wish to undertake. Forms are available from counselors in academic services. Students, in consultation with their supervisor, should register for one of the following subdivisions of independent study.

**400 Directed Readings** For study that predominantly involves library research and independent study.

**401 Empirical Research** For study that predominantly involves data collection and analysis or laboratory or studio projects.

**402 Supervised Fieldwork** For study that predominantly involves participation in community or classroom settings.

**[410 (420) Field Study in Adolescence** Fall or spring. 12-15 credits. Prerequisites: HDFS 319 and permission of the instructor. Number of students limited. Not offered 1976-77.

Hours to be arranged. Department staff.

Serves as the final course in the adolescent field study sequence. Provides opportunity for a full-time placement at an agency or institution concerned with the welfare of youth. Interested students should contact instructor for more information.]

**437 (343) Creative Expression and Child**

**Growth** Fall. 4 credits. Limited to 25. Saturday morning should be free in order to provide 15 clock hours of participation with children. Not to be taken concurrently with HDFS 141.

T Th 10:10-11:30. W. L. Brittain.

Aimed at an appreciation and understanding of the creative process as seen in art, music, dance, and drama in relation to the development of children.

**440 (415) Internship in Preschool Teaching** Fall or spring. 10 credits. To be scheduled concurrently with Professional Seminar (HDFS 441). Open only to students accepted for the Nursery-Kindergarten Certification Program. Prerequisites: HDFS 241, 340, and 341.

P. Fender.

Clinical internship under the guidance of University faculty and cooperating centers. Placements at the nursery and kindergarten levels: in public schools, day care centers, experimental programs, and community schools. To get opportunity to assess approaches to early education, students will intern in two diverse situations, working one-half semester in each.

**441 (416) Professional Seminar** Fall or spring. 2 credits. Open only to students accepted for the Nursery-Kindergarten Certification Program. To be scheduled concurrently with HDFS 440.

P. Fender.

Seminar in analysis of comparative approaches to early education with focus on the diverse programs experienced in the internship. Programs are examined considering the political problems of schools and communities, parent involvement, training and supervision of staff, and administration of educational centers for young children.

**[450 (350) Case Studies of Intrafamily**

**Interactions** Spring. 3 credits. S-U grades optional. Limited to 15. Prerequisites: HDFS 115 or 116, Psych 101 or Educ 110, and HDFS 150 (162), or R Soc 100. Not offered 1976-77.

T 12:20-2:15 and a half-day of field work per week. H. Feldman.

Emphasis on the understanding of human interactions. Influence of experiences with significant others, social setting variables, and social support systems will be examined as they influence the interpersonal relationships of family members. Structured and unstructured observations and interviews of cases drawn from a variety of sources including unmarried welfare clients, upper-income families, commune members, married and divorced couples, and homosexuals. Ethical problems inherent in the case study will be discussed.]

**[451 (465) Innovative Programs of Parent**

**Intervention and Community Action** Spring. 3 credits. Permission of the instructor required before preregistration. Limited to 10. Not offered 1976-77.

T 2:30-4:25. Additional laboratory and field experiences to be individually arranged. H. Bayer.

Consideration of the theoretical bases and the empirical consequences of programs intended to change styles of parental behavior, whether by manipulation of individual action or of societal alternatives; parent intervention, social action.]

**[454 Public Policy Related to Children and**

**Families** Fall. 3 credits. Limited to 60. Open to undergraduates and graduate students with permission of instructor. Not offered 1976-77.

M W F 9:05. M. Cochran.

Will examine the relationship between children, their families, and American public policy. Issues affecting family life include the parental role in childrearing; peer group socialization; the world of work, housing, and transportation; the relationship between childrearing and education; the role of the social network in childrearing; cultural variations in American childrearing patterns.]

**470 (336) Field Experience in Atypical**

**Development** Fall. 1-3 credits. S-U grades only. Open only to students concurrently registered for HDFS 371.

Hours to be arranged. J. Weisz.

Students in HDFS 371 may elect to spend at least one-half day working with a group of exceptional children or with an individual child.

**499 Senior Honors Thesis** Fall or spring. Credit to be arranged. S-U grades only. Registration with permission of thesis adviser.

Department Faculty.

**Topics Courses**

**415 Topics in Adolescent Development**

**435 Topics in Cognitive Development**

**445 Topics in Early Childhood Education and Development**

**455 Topics in Family Studies**

**465 Topics in Social and Personality Development**

**475 Topics in Atypical Development**

**485 Topics in the Ecology of Human**

**Development** Fall or spring. 3 credits. Prerequisites and enrollment limits vary with topic being considered in any particular term. Permission of the instructor required.

Days and hours to be arranged. Department faculty.

This series of courses provides an opportunity for advanced undergraduates to explore thoroughly an issue, theme, or body of research in the areas of departmental concentration. Some courses in the series are offered each year. A given topic is explored in each course; topics vary each time the course is offered. Descriptions of each semester's topics are available at the time of preregistration. Although the courses are usually taught as seminars, from time to time a subject may lend itself to lecture, practicum, or other format.

**The Graduate Program**

Human Development and Family Studies graduate courses are open to undergraduates only with instructor's permission.

*These courses will be taught annually.*

**600 Special Problems for Graduate**

**Students** Spring. Credit to be arranged. S-U grades optional. For graduate students recommended by their chairpersons and approved by the head of the department and the instructor in charge for independent, advanced work.

Hours to be arranged. Department faculty.

**601 Research Design and Methodology** Spring. 3 credits.

T Th 2:30-4:25. B. Koslowski.

Seminar will consist of three components: (1) discussion of representative literature on problems of research design, methodology, and data collection; (2) analysis of methodological issues involved in empirical studies employing different kinds of research designs and methods, both in laboratory and field settings; and (3) a practicum component in which students will formulate research designs for their own problems, to be evaluated and critiqued at each stage of development and pretesting.

**602 Research Design and Data Analysis** Fall. 3 credits. Prerequisite: HDFS 601.

Hours to be arranged. Department faculty.

Students will carry out research projects designed in HDFS 601. While working with individual faculty members on these projects, the seminar will meet as a group to review and critique progress reports on each other's research. The seminar also will discuss, through appropriate literature, problems involved in data analysis, interpretation, explanation, causal imputation, and the strategies of writing up research findings in publishable form.

**603 Development in Context** Fall. 3 credits.

T Th 2:30-4:25. U. Bronfenbrenner.

This seminar examines selected problems dealing with processes of human development as they take place in the actual contexts in which people live. Emphasis is placed on the interaction of processes (biological, psychological, and social) and social systems in the course of development in a variety of settings. The seminar is recommended for graduate students entering the field.

**700 Practicum in Human Development and**

**Family Studies** Fall or spring. 2-4 credits. S-U grades optional.

Department faculty.

Field experiences in settings serving children and families. Will be given in conjunction with appropriate course or seminar and arranged on an individual basis by student and instructor of the associated course or seminar.

**899 Master's Thesis and Research** Fall or spring. Credit to be arranged. S-U grades only.

Registration with permission of thesis adviser. Department graduate faculty.

**999 Doctoral Thesis and Research** Fall or spring. Credit to be arranged. S-U grades only. Registration with permission of thesis adviser. Department graduate faculty.

*These courses will be taught every other year.*

**[617 Adolescence** Spring. 3 credits. Not offered 1976-77.

T Th 8-9:55. J. Hill.

Current issues in the theoretical and empirical literature on adolescent development.]

**631 Cognitive Development** Fall. 3 credits.

T Th 12:20-2:15. B. Koslowski, H. Ginsburg.

Overview of cognitive development, with special emphasis on current research and theoretical issues in language, perceptual, and thought processes.

**640 Infancy** Spring. 3 credits.

T 2-4:25. H. Ricciuti.

Major theoretical issues and relevant empirical research on perceptual-motor, cognitive, and affective development in the first two years of life.

**641 Early Childhood Education** Fall. 3 credits.

T Th 10:10-12:05. M. Potts.

In-depth study of specific issues in the theoretical and empirical literature of early childhood education.

**650 Family** Spring. 3 credits.

T Th 12:20-2:15. E. Devereux.

Focuses on the uses of sociological theories and research in the study of the family, with particular reference to the relationship between the family and society and between the family and its individual members.

**[660 Personality and Socialization** Spring. 3 credits. Not offered 1976-77.

W 2:30-4:25.

Major issues in personality development and socialization, with special emphasis on theoretical models and empirical issues.]

**670 Atypical Development** Fall. 3 credits.

M W 12:20-2:15. J. Doris.

Overview of current theories and empirical research on functional and organic disorders in childhood.

*Topical Seminars.* Graduate seminars with changing topics and instructors offered irregularly, with content, times, credit, and instructors to be announced. Seminars offer concentrated study of specific theoretical and research issues.

**618 Seminar in Adolescence** Illustrative topics include peer relations or parent-child relationships in adolescence.

**633 Seminar on Language** Illustrative topics include acquisition of meaning in infancy, precursors of language in early infancy, or language development in bilingual children.

**635 Seminar in Cognitive Development** Illustrative topics include language development in infancy, mathematical thought in childhood, or cognitive development in the context of early childhood education.

**645 Seminar on Infancy** Illustrative topics include Bowlby's attachment model, the premature infant, or the use of infant test in developmental research.

**646 Seminar in Early Childhood Education** A process approach to learning involvement techniques and strategies for teaching cognitive development and early childhood education, problem solving, and so on.

**655 Seminar in Family Studies** Illustrative topics include the marital dyad, the family in poverty, or the single-parent family.

**665 Seminar in Personality and Social Development** Illustrative topics include socialization in infancy, peer relations, or sex role development.

**675 Seminar in Atypical Development** Illustrative topics include learning disabilities, therapeutic interventions in atypical development, child abuse and maltreatment, or family factors in the etiology of functional disorders.

**685 Seminar in Human Development and Family Studies** Illustrative topics include development of self-concept, sex-role identity, observational methods, or play interviews in developmental research.

**690 Seminar on Ecology of Human Development** Illustrative topics include the institutional setting as a determinant of behavior, the family in poverty, or the identification and measurement of ecological variables.

**Nutritional Sciences**

See p. 204.

## Independent Interdisciplinary Centers and Programs

### Africana Studies and Research Center

See p. 118.

### Center for International Studies

The Center for International Studies supports and coordinates Cornell's programs of international and comparative studies. By serving as a focal point for ideas, information, and advice about the University's wide range of international offerings, the center contributes to their further development. The center places particular emphasis on strengthening inquiry into issues that cut across disciplinary, professional, and regional concerns, and on providing a continuing source of innovation and experimentation in international studies. The center and its constituent programs promote interdisciplinary teaching and research in international and comparative studies. These programs are:

#### Area Programs

- China-Japan Program (140 Uris Hall).
- Committee on Soviet Studies (140A Uris Hall).  
See p. 124.
- Latin American Studies Program (190 Uris Hall).  
See p. 122.
- South Asia Program (130 Uris Hall). See p. 125.
- Southeast Asia Program (120 Uris Hall). See p. 53.

#### Problem-Oriented Programs

- International Population Program (372 Uris Hall)
- Participation and Labor-Managed Systems (490 Uris Hall)
- Peace Studies Program (164 Uris Hall)
- Policies for Science and Technology in Developing Nations (180 Uris Hall)
- Rural Development Committee (170C Uris Hall)
- Structural Change Committee (170 Uris Hall)
- Western Societies Program (170 Uris Hall)

#### Professional School Programs

- International Agriculture (261 Roberts Hall)
- International Business and Public Administration (526 Malott Hall)
- International and Comparative Labor Relations (294 Ives Hall)
- International Legal Studies (404 Myron Taylor Hall)
- International Nutrition (127 Savage Hall)
- International Studies in Regional Planning (200 West Sibley Hall)

## Program on Science, Technology, and Society

R. Bowers, director; S. M. Brown, Jr., associate director

The STS Program, in conjunction with Cornell academic departments, cosponsors a wide range of interdisciplinary courses which are open to qualified students from all colleges and schools of the University. All STS-cosponsored courses deal with some aspect of the interaction of science and technology with society. Some topics of concern to the program are: public policies for science and technology; legal and moral implications of modern

biology and medicine; technology assessment; the sociology of science; the scope and limits of rational decision making; arms control and national defense policies; and the ecological impact of emerging technologies.

The titles and numbers of STS-cosponsored courses are listed below. For course descriptions and details, refer to the entries located in the listings of the respective cosponsoring departments. Further information on these courses and the STS Program, as well as a list of STS-related courses offered throughout the University and information on opportunities for individualized courses of study in the STS area, are contained in a booklet available from the program office, 628 Clark Hall (256-3810).

#### Biological Sciences 205 and Philosophy 245 Biomedical Ethics

#### Biological Sciences 206 and Philosophy 246 Environmental Ethics

[Business and Public Administration NCE 510 and Government 630 Science, Technology, and Development. Not offered 1976-77.]

[Business and Public Administration NCE 513 and Government 683 Science, Technology, and International Relations. Not offered 1976-77.]

#### Business and Public Administration NPA 504 and Government 626 United States Public Policies and Programs for Science and Technology

#### Business and Public Administration NPA 513, City and Regional Planning 533, and Government 629 The Politics of Technical Decisions

#### City and Regional Planning 434, Government 302, and Economics 302 The Impact and Control of Technological Change

#### Computer Science 305 The Computerized Society

#### Engineering C&EE B305 Social Implications of Technology

#### Engineering C&EE B615 The Law and Environmental Control

#### Engineering C&EE B616 Seminar in Technology Assessment

#### Engineering M&AE 302 Technology and Society—An Historical Perspective

#### Government 312 Urban Affairs Laboratory

#### Government 484 Defense Policies and Arms Control

#### History 280 Freshman Seminar in the History of Technology

[History 386 and Philosophy 386 Problems in the History and Philosophy of Biology. Not offered 1976-77.]

#### Industrial and Labor Relations 677 Theoretical and Research Problems Relating to the Study of Technology

#### Law 575 Science, Technology, and Law

#### Philosophy 383 Philosophy of Choice and Decision

#### Sociology 403 Sociology of Science and Technology

#### Sociology 529 Demographic and Ecological Models of Science

## New York State School of Industrial and Labor Relations

### Collective Bargaining, Labor Law, and Labor History

J. Morris, chairman; G. Brooks, D. Cullen, C. Daniel, R. Doherty, R. Donovan, H. Finch, J. Gross, K. Hanslowe, G. Hildebrand, V. Jensen, R. Keeran, M. Kelly, T. Kochan, G. Korman, D. Lipsky, J. McKelvey, R. McKersie, M. Neufeld, P. Ross, A. Smith, J. Windmuller.

#### 100 History of Industrial Relations in the United States

Fall or spring, 3 credits.  
C. Daniel, R. Keeran, G. Korman, J. Morris.  
This review of the history of industrial relations in the United States emphasizes developments in the twentieth century. The course concentrates on the American worker, both union and nonunion, labor movements, and the environmental forces that have shaped industrial relations in the United States. Readings will be selected from scholarly accounts and original sources.

#### 200 Special Studies in the History of Industrial Relations in the United States

Spring, 3 credits. Prerequisite: 100 for ILR students; no prerequisite for out-of-college students.  
C. Daniel, H. Finch, R. Keeran, G. Korman, or J. Morris.  
Several instructors will offer undergraduate classes; each on a particular aspect of the history of industrial relations in the United States. Students will choose among classes that may vary from year to year and include such topics as the following: industrial relations in the Age of Jackson and in other periods of American History such as the Gilded Age, the two World Wars, or the Great Depression; the role of industry and organized labor in politics; and radicalism and dissent in the American labor movement.

#### 201 Labor Relations Law and Legislation

Fall, 3 credits.  
K. Hanslowe, A. Smith.  
A survey of the law governing labor relations. The legal framework in which the collective bargaining relationship is established and takes place is analyzed. Problems of the administration and enforcement of collective agreements are considered, as are problems of protecting individual employee rights in the collective labor relations context. Also serves as an introduction to the legal system and method, and to legal and constitutional problems of governmental regulation of industrial and labor relations.

#### 300 Collective Bargaining

Fall or spring, 3 credits.  
D. Cullen, M. Kelly, T. Kochan, D. Lipsky, P. Ross.  
A comprehensive study of collective bargaining, the negotiation and scope of contracts, the day-to-day administration of contracts, the major substantive issues in bargaining, including their implication for public policy, and the problem of dealing with industrial conflict.

#### 301 Labor Union Administration

Fall or spring, 3 credits. Prerequisites: 100 and 201.  
G. Brooks, C. Daniel, R. Keeran, G. Korman, J. Morris.  
A review of the operations of American unions, including a general theoretical framework, but with major emphasis on practical operating experience. The course will consider the formal government of unions; organizational or institutional purposes and

objectives and how these are achieved; underlying structure and relationship among members, locals, and national organizations; the performance of the primary functions of organizing; negotiating; contract administration; and the effect of the Landrum-Griffin Act.

#### 302 History of American Industrial Civilization Since 1750

Fall, 4 credits.  
G. Korman.  
The interaction between industrial life and American nationalism since 1750 will be examined. Special attention will be given to the changes in nationalism and their consequences for ethnic group behavior and such other elements of American industrial life in the nineteenth and twentieth centuries as changes in production, transportation, organization, techniques of manipulation, and in oligarchy, paternalism, fraternalism, professionalization, and quantification. Readings will be selected from original sources and scholarly accounts.

#### 303 Research Seminar in the Social History of American Workers

Fall, 4 credits. Open, with permission of instructor, to upperclass students who have demonstrated their ability to undertake independent work.  
G. Korman.  
An examination of a different subject each year.

#### 304 Seminar in the History, Administration, and Theories of Industrial Relations in the United States

Spring, 3 credits. Prerequisite: permission of instructor.  
C. Daniel, R. Keeran, G. Korman, J. Morris.  
Designed to explore the social, economic, and political background of industrial relations in the history of the United States. Examines a different subject each year.

#### 306 Research Seminar in the American Labor Movement and Politics

Spring, 3 credits. Open, with permission of instructor, to upperclass students who have demonstrated ability to undertake independent work and who have taken 200.  
J. Morris.  
Students will be free to choose any research topic, via any disciplinary approach (such as law, history, behavioral or political science) within the subject matter area. Group meetings will be devoted to (1) discussion in depth of special problems such as compulsory membership and union political spending, the adequacy of the law governing union political action, and labor's partisan ties with the Democratic party, and (2) exchange of research problems and reports. Some time normally devoted to group meetings will be scheduled for individual consultations.

#### 307 Industrial Relations Biographies

Fall, 4 credits. Open to juniors and seniors. Prerequisite: 100.  
J. Morris.  
The objective of this reading course is to study American industrial relations history through the lives of some of the outstanding men who have helped make it—men of business, government, and the law as well as leaders of labor and their allies among the intellectuals. While economic forces, institutional developments, and social values are important in shaping history, so also is the role of individual personality. The class will read and discuss biographies and autobiographies. In some cases the written record will be supplemented with tapes and films. There will be written assignments but emphasis will be on the weekly discussion.

#### 380 Famous Trials in American Labor History

Spring, 3 credits. Open to juniors and seniors. Prerequisite: 100.  
J. Morris.  
A course on some of the famous criminal trials involving union leaders, radicals, and ordinary workmen who were unknown before they faced the bar. Among the defendants or cases from which

selection will be made with charges that range from fraud to murder, are Jimmy Hoffa, Sacco and Vanzetti, Mooney and Billings, the Centralia tragedy and trial, the great IWW trials of World War I, the case of Joe Hill, the Haymarket anarchists, the trial and execution of the Molly Maguire leaders, and the triple case of Moyer, Haywood, and Pettibone.

#### 381 Jewish Workers in Europe and America, 1789-1948

Spring, 4 credits. Open to sophomores, juniors, and seniors.  
G. Korman.  
This course in comparative history examines the complex experiences of the Yiddish speaking immigrant workers and their families. A special subject of interest will be the extraordinary history of the Jewish working class between 1924 and 1948.

#### 401 Collective Bargaining Structures

Fall, 3 credits. Prerequisite: 300.  
D. Lipsky.  
An examination of the conduct of collective bargaining with emphasis on the size and scope of the bargaining unit and the locus of decision making in collective negotiations. The relation between bargaining structure and product market structure, public policy, and union structure will be studied. Industry and case studies of various bargaining structures, including pattern bargaining, coalition bargaining, and multiemployer bargaining will be used to illustrate general principles. Wage patterns and the economic effects of bargaining structures also will be examined. A seminar course.

#### 406 History of the Black Worker in the United States

Fall, 3 credits. Prerequisite: 100.  
J. Gross.  
The course is intended to introduce the student to the history of the black worker in the United States through a review and analysis of the existing literature of black labor history and through source documents from the National Archives. Discussions will center around the black worker in agriculture, industry, and government; black worker migrations; black workers and organized labor; and black workers, discrimination, and the law.

**499 Directed Studies** Fall or spring, 3 credits. For individual research, conducted under the direction of a member of the faculty, in a special area of labor relations not covered by regular course offerings. Registration normally limited to seniors who have demonstrated ability to undertake independent work. Eligible students should consult with a counselor in the Office of Resident Instruction at the time of preregistration to arrange for formal submission of their projects for approval by the Academic Standards Committee.

#### 600 Advanced Seminar in Labor Arbitration

Spring, 3 credits. Open to juniors, seniors and graduate students who have taken 602 or equivalent.  
J. Gross.  
An advanced seminar in labor arbitration emphasizing the practical aspects of current labor arbitration techniques and problems. Subjects considered will range from laboratory exercises in the presentation of an arbitration case, the preparation of prehearing and posthearing briefs, and the writing of an arbitration opinion and award, to the investigation and evaluation of the experience of labor arbitrators with selected case problems arising in state and federal employment and public education as well as in the private sector.

#### 601 Integration of Industrial Relations Theories

Fall or spring, 3 credits. Open to second-year graduate students and seniors with permission of instructor.  
T. Kochan.  
The major purpose of this course is to explore the similarities and differences among the (1) normative premises, (2) theoretical frameworks, (3) substantive issues, and (4) methodological approaches found in

the various areas of study in industrial relations. The areas that will be studied include (1) collective bargaining and union-management relations, (2) organizational behavior and personnel, and (3) labor economics and manpower policy. An effort will be made to explore the potential for integration among these various areas by discussing some issues or problems that cut across the traditional lines of study.

**602 Arbitration** Fall or spring, 4 credits. Prerequisite: for undergraduates, 300; for graduates, 700.

J. Gross.

A study of the place and function of arbitration in the field of labor-management relations, including an analysis of principles and practices, the law of arbitration, the handling of materials in briefs or oral presentation, the conduct of an arbitration hearing, and the preparation of an arbitration opinion.

**603 Governmental Adjustment of Labor Disputes** Fall or spring, 3 credits. Prerequisites: for undergraduates, 300; for graduates, 700; and permission of instructor.

D. Cullen, J. Gross, or A. Smith.

An examination of the various governmental techniques for dealing with labor disputes in both the private and public sectors, including mediation, fact-finding, arbitration (both voluntary and compulsory), the use of injunctions, and seizure. The course will also examine the application of these techniques under the Railway Labor Act, Taft-Hartley Act, and various state acts.

**604 Readings in the Literature of American Radicalism and Dissent** Fall or spring, 3 credits.

Open only to seniors and graduate students with permission of instructor.

R. Keeran.

Each term concentration will be on a different historical aspect of American radicalism and dissent. Some examples of areas and writers who might be selected for study are: agrarian reform—Thomas Skidmore, George Henry Evans, and Ignatius Donnelly; anarchism—Josiah Warren, William D. Haywood, Emma Goldman, and Paul Goodman; communism—John Reed, Jay Lovestone, and William Z. Foster; economic dissent—Henry George, Thorstein Veblen, and Francis Everett Townsend; equal rights for Negroes and black nationalism—William E. B. DuBois and Marcus Garvey.

**605 Readings in the History of Industrial Relations in the United States** Fall, 3 credits.

Open only to seniors and graduate students.

Prerequisites: for seniors, 100 and 200; for graduates, 702.

C. Daniel, R. Keeran, G. Korman, J. Morris.

A seminar covering, intensively and in historical sequence, key documents, studies, legislative investigations, and memoirs concerning American industrial relations systems. Primarily designed to aid students in orienting themselves systematically and thoroughly in the field. Among the authors and reports covered are E. P. Thompson, John R. Commons, Norman Ware, Lloyd Ulman, the Abram Hewitt hearings, the Henry W. Blair hearings, the United States Industrial Commission, Philip Taft, Paul F. Brissenden, and the United States Commission on Industrial Relations.

**606 Theories of Industrial Relations Systems** Spring, 3 credits. Open only to seniors and graduate students. Prerequisites: for seniors, 100 and 200; for graduates, 702.

C. Daniel, R. Keeran, G. Korman, or J. Morris.

An examination of the leading theories concerning the origins, forms, organization, administration, aims, functions, and methods of industrial relations systems. Among the theories studied are those formulated by Karl Marx, Mikhail Bakunin, Georges Sorel, Vladimir Lenin, Lujo Brentano, Beatrice and Sidney Webb, Herbert Croly, Antonio Gramsci, Selig Perlman, Frank Tannenbaum, the Guild Socialists,

Karl Polanyi, Clark Kerr, Frederick Harbison, John Dunlop, and Charles A. Myers.

**607 Administrative Tribunals** Spring, 3 credits. Open to seniors with permission of instructor.

K. Hanslowe.

An examination of the law controlling administrative agencies, including executive departments, in their complex tasks of carrying out various governmental programs. Legislative bodies determine general programs, and administrative tribunals make then more specific through making rules, deciding cases, investigating, prosecuting, and supervising. The general quest is for understanding principles of exertion of governmental authority and principles of justice that cut across functions of federal, state, and local tribunals and their relation with reviewing courts and with legislative and executive bodies.

**608 Black Labor: Directed Research in the History of the Black Worker** Spring, 3 credits.

Open to juniors, seniors, and graduate students by permission of instructor.

J. Gross.

Intended to review the history of the black worker in the United States through an analysis of the existing literature of black labor history and through source documents from the National Archives, such as records and correspondence from the Division of Negro Economics 1919–21; the papers of Lawrence A. Oxley, Chief of the Division of Negro Labor of the Bureau of Labor Statistics, 1933–42; the papers of Karl Phillips, U. S. Commissioner of Conciliation for Negro Labor, 1925–33; and the records of the President's Committee on Fair Employment Practice, 1941–45.

**609 Public Policy and Labor Relations** Fall, 3 credits. Prerequisites: One term of labor law and some course work in statistics; open to upperclass students with permission of instructor.

D. Lipsky, J. Drotning.

This seminar examines the application of public policy in labor relations, with particular emphasis on the empirical, nonlegal analysis of the impact of national and state laws on the behavior of managements, unions, and workers. Several important public policy questions will be examined in the course: What is the real impact of duty to bargain requirements on the behavior of the parties in negotiations? How effective are NLRB remedies in actually changing the behavior of the parties? What are the determinants of certification election outcomes? What evidence is there on the impact of right-to-work laws on union organizing and bargaining?

**680 Problems in Union Democracy** Fall or spring, 3 credits.

P. Ross, A. Smith.

Unions are considered as an example of private government, and union democracy is examined by standards and customary practices in both public and private governments. Included are such elements as elections, self-government by majority, rights of minorities, the judicial process including impartial review, local-national relationships, constituency and representation, the legislative process, and executive power and functions. The regulation of private government by the state will be considered.

**681 Labor Relations Law** Spring, 3 credits. Prerequisite: 201 or 701 or equivalent.

K. Hanslowe or A. Smith.

An advanced course in labor law, covering such topics as emergency labor disputes, legal problems of labor relations in public employment, labor and the antitrust laws, civil rights legislation, rights of individual employees and union members, and legal problems of union administration.

**682 Seminar in Labor Relations Law and Legislation** Fall or spring, 3 credits. Permission of instructor required.

K. Hanslowe or A. Smith.

The seminar will emphasize legal problems in public employment and other areas of labor relations affecting the public interest.

**683 Seminar in the History, Administration, and Theories of Industrial Relations in the United States** Fall or spring, 3 credits. Prerequisite: for undergraduates, 100 and 200; for graduates, 702.

C. Daniel, R. Keeran, G. Gorman, or J. Morris. Intensive studies in theories of industrial relations, the social and political history of workers in urbanizing and industrializing communities, the history of ideas that impelled the labor movement, the history and government of individual unions and confederations of unions, the development of ideas in the management of personnel, and comparative studies of American, European, and non-European industrial relations systems. The areas of study will be determined each semester by the instructor offering the seminar.

**684 Employment Discrimination and the Law** Fall or spring, 4 credits. Prerequisite: 201 or 701 or equivalent. Open to upperclass and graduate students.

A. Smith.

An examination of legal problems involving employment discrimination based upon race, color, religion, sex, national origin, or age. The impact of developing principles of law on pre-employment inquiries and testing, seniority and promotions, and other personnel policies, practices, and procedures will be discussed. The requirements of affirmative action under Executive Order 11246, as amended, will be analyzed. Special attention will be given to the role of state law in resolving employment discrimination claims and the procedural framework for raising and adjudicating such claims before administrative agencies and the courts.

**685 Collective Bargaining in Public Education** Spring, 3 credits. Permission of the instructor required.

R. Doherty.

The seminar will consist of a study of the legal, financial, administrative, and educational problems raised by collective bargaining in the public schools. Major attention will be directed at existing statutes covering the employment arrangement for public school employees, the content and administration of collective agreements, the ideological postures of teacher organizations, and the resolution of negotiating impasses. Individual and group research projects will be required.

**686 Collective Bargaining in the Public Sector** Fall or spring, 3 credits. Prerequisites: 201 and 300 for undergraduates; 700 and 701 for graduate students.

R. Donovan, T. Kochan, P. Ross.

An examination of the development, practice, and extent of collective bargaining between federal, state, and local governments and their employees. The variety of legislative approaches to such matters as representation rights, unfair practices, scope of bargaining, impasse procedures, and the strike against government are considered along with implications of collective bargaining for public policy and its formulation.

**687 Current Issues in Collective Bargaining** Spring, 4 credits. Open to upperclass and graduate students. Prerequisite: 300 or 700.

D. Cullen, R. Donovan, D. Lipsky, R. McKersie, P. Ross.

An intensive study of the most significant current issues and problems facing employers and unions in their relations with each other, with particular emphasis on the substantive matters in contract negotiations and administration of the provisions of collective bargaining agreements. A major research paper is usually required.

**688 Scholarship in the History of Industrial Relations** Spring, alternate years. 4 credits.

G. Korman.  
This seminar examines the quality of books and articles written by selected labor historians and others working in the domain of arbitration, collective bargaining, and labor law.

**689 Seminar in the History of Agricultural Labor** Spring, alternate years.

C. Daniel.  
An extensive examination of the history of farm workers in the United States, with particular focus on the nature and structure of industrial agriculture in America; the cultural and racial makeup of the farm labor force; conditions of employment in agriculture; farm worker organization; the relationship of farm labor to the American labor movement; and the dynamics of social, economic, and political assimilation in American life with special reference to farm workers.

**700 Collective Bargaining** Fall or spring. 3 credits. Open to graduate students.

D. Cullen, G. Hildebrand, T. Kochan, D. Lipsky.  
A comprehensive study of collective bargaining with special emphasis on philosophy, structures, process of negotiations, and administration of agreements. Attention also will be given to problems of handling and settling industrial controversy, the various substantive issues, and important developments and trends in collective bargaining. It is recommended that ILR 701, Labor Relations Law and Legislation be taken prior to or concurrently with ILR 700.

**701 Labor Relations Law and Legislation** Fall or spring. 3 credits.

K. Hanslowe, A. Smith.  
A survey and analysis of the labor relations law in which an examination is made of the extent to which the law protects and regulates concerted action by employees in the labor market. The legal framework within which the collective bargaining takes place is considered and analyzed. Problems of the administration and enforcement of the collective agreement are considered as are problems of protecting the individual member-employee rights with the union.

**702 Labor Union History and Administration** Fall or spring. 3 credits.

C. Daniel, R. Keeran, G. Korman, J. Morris, or M. Neufeld.  
A presentation of the history of labor in America with emphasis upon post-Civil War trade union development. Includes an analysis of the structure and functions of the various units of labor organization, ranging from the national federation to the local union, and some consideration of special problems and activities, such as democracy in trade unions and health and welfare plans, as well as of various types of unions, such as those in construction, maritime trades, entertainment, transportation, and basic industry.

**703 Theory and Research in Collective Bargaining** Spring. 3 credits. Open to graduate students who have had 700 and 723 or their equivalents. A statistics course beyond the level of 710 would be desirable.

T. Kochan, D. Lipsky.  
This is a second-level course in collective bargaining that builds on the institutional research covered in ILR 700. The existing literature in the area of collective bargaining is appraised for its theoretical and empirical content. Efforts are made to explore the appropriate role for theory and empirical analysis in moving research in collective bargaining toward a more analytical perspective. Efforts are made to identify and appraise the underlying paradigms used to study collective bargaining related issues.

**707 Research Seminar in Public Sector Collective Bargaining** Spring. 3 credits. Prerequisites: basic familiarity with statistical analysis

(correlational and multivariate techniques) and interest in theoretical and empirical research on issues related to public sector labor relations.

T. Kochan, P. Ross.  
(1) Discussion of the role of theory in collective bargaining research. Issues such as what is a theory, how is a theory constructed and made operationally testable, and what kinds of theoretical frameworks have been used in public sector research will be addressed. (2) Determination of what alternative research strategies have been used and might be used in collective bargaining research. (3) Evaluation of existing theoretical and empirical research in the public sector. (4) Analysis of current and future research needs. Each student will be required to submit a seminar paper.

**708 Industrial Relations in Health Care Institutions** Spring. 3 credits.

G. Brooks, P. Ross.  
A study of the laws, institutions, and practices that characterize this rapidly changing field, and of the special complexities of the nonprofit sector as they appear in health care. Attention will be given to the character of the unions in the industry, to the problems of collective bargaining that flow from the nature of the industry and its work force, and to the contractual relations that have developed. The principal economic problems that have complicated the collective bargaining relationship also will be discussed. Where appropriate, distinctions will be made among public, nonprofit, and proprietary institutions.

**799 Directed Studies** Fall or spring. Credit to be arranged. For individual research conducted under the direction of a member of the faculty.

## Economic and Social Statistics

P. McCarthy, chairman; I. Blumen, I. Francis, P. Velleman.

**210 Statistics I (Statistical Reasoning)** Fall or spring. 3 credits.

An introduction to the basic concepts of statistics: description of frequency distributions (averages, dispersion, and simple correlation) and introduction to statistical inference. Prerequisite to certain of the specialized courses on applications of statistics offered in various departments.

**211 Economic and Social Statistics** Spring. 3 credits. Prerequisite: 210

Application of statistical techniques to the quantitative aspects of the social sciences and industrial and labor relations. Topics to be covered include construction and use of index numbers, time-series analysis, elements of the design of sample surveys, multiple regression and correlation, and a brief introduction to automatic data processing.

**310 Design of Sample Surveys** Spring. 3 credits. Prerequisite: one term of statistics.

Application of statistical methods to the sampling of human populations. A thorough treatment of the concepts and problems of sample design with respect to cost, procedures of estimation, and measurement of sampling error. Analysis of nonsampling errors and their effects on survey results (for example, interviewer bias and response error). Illustrative materials will be drawn from such fields as market research and attitude and opinion research.

**311 Statistics II** Fall. 4 credits. Prerequisite: 210 or permission of instructor.

An intermediate nonmathematical statistics course emphasizing the concepts associated with statistical methods. Includes a treatment of estimation and tests of hypotheses with reasons for choice of various methods and models. Application to problems involving percentages, means, variances, and correlation coefficients with an introduction to

nonparametric methods, analysis of variance, and multiple regression and correlation.

**410 Techniques of Multivariate Analysis** Fall. 3 credits. Prerequisite: 311.

The techniques of multivariate statistical analysis, the associated assumptions, the rationale for choices among techniques, and illustrative applications. No mathematical prerequisite but some matrix algebra and related mathematics will be introduced. Includes regression, correlation, principle components, multivariate tests on means, variances and covariances, relations between sets of variates, and discriminatory analysis.

**411 Statistical Analysis of Qualitative Data** Spring. 3 credits. Prerequisites: 311 and permission of instructor.

I. Blumen.  
An advanced undergraduate and beginning graduate course. Includes treatment of association between qualitative variates, paired comparisons, rank-order methods, and other nonparametric statistical techniques, including those related to chi-squared.

**499 Directed Studies** For course description, see p. 194.**610 Seminar in Modern Data Analysis** Fall. 3 credits. Prerequisite: 311 or equivalent.

P. Velleman.  
A survey of modern data analysis methods concentrating on analysis of "badly behaved" data. Topics will depend upon the interests of those present, but will probably include: exploratory data analysis methods, use, and foundations; robust methods (measures of location and scale, robust regression, data smoothing); computer as a data analysis tool. The course will cover many practical methods. Data of interest to participants will be used to demonstrate applications.

**710 Introductory Statistics for the Social Sciences** Fall or spring. 3 credits.

P. Velleman.  
A nonmathematical course for graduate students in the social sciences without previous training in statistical method. Emphasis will be placed on discussion of technical aspects of statistical analysis and on initiative in selecting and applying statistical methods to research problems. The subjects ordinarily covered will include analysis of frequency distributions, regression and correlation analysis, and selected topics from the area of statistical inference.

**711 Seminar in Statistical Methods** Fall. 3 credits. Prerequisite: 311 or equivalent.

The analysis of experiments and observational studies. Topics to be included are: a) philosophy of statistical science; b) role of models, experiments, randomization; c) limitation of experiments in the social sciences and the role of observational studies; d) an appreciation of experimental designs common in the social sciences; e) statistical program packages for the analysis of the General Linear Model—analysis of variance and covariance, regression, and multidimensional contingency tables.

**712 Theory of Sampling** Fall. 3 credits. Prerequisite: calculus and at least one semester of mathematical statistics.

A companion course to ILR 310, Design of Sample Surveys, stressing the development of the fundamentals of sampling theory. Attention will be paid to recent progress in the field. Occasional illustrative material will be given to indicate the application of the theory.

**799 Directed Studies** For course description, see p. 196.

## International and Comparative Labor Relations

J. Windmuller, chairman; M. Clark, W. Galenson, G. Hildebrand, M. Neufeld, W. Whyte.

**330 Comparative Industrial Relations Systems I** Fall or spring. 3 or 4 credits. Prerequisite: for non-ILR students, ILR 150 or permission of instructor.

W. Galenson or J. Windmuller.  
An introductory course concerned with the history, structure, institutional arrangements, and philosophy of the labor relations systems of several countries in advanced stages of industrialization. Countries to be examined include Great Britain, France, Germany, Sweden, and others.

**331 Comparative Industrial Relations Systems II** Spring. 3 or 4 credits.

W. Galenson or J. Windmuller.  
A comparative study of labor problems in the less developed nations. Among the subjects included are the relationship of different patterns of development to employment; the role of government and trade unions in industrial relations; the problem of income inequality; technological choice and employment; and the role of transnational companies and foreign investment.

**430 European Labor History** Fall. 3 credits.

J. Windmuller.  
The development of trade unions in major European countries, especially Great Britain, France, Germany, and Russia. Different patterns of labor organization, the main ideological currents, political party-trade union links, the growth of industrial relations systems, and the evolution of public policies toward labor will be emphasized. Some attention may also be devoted to the emergence of international labor movements.

**499 Directed Studies** For course description, see p. 194.

**630 Seminar in International and Comparative Labor Relations** Spring. 3 credits. Open to ILR juniors, seniors, and graduate students; others with permission of instructor.

J. Windmuller.  
Students will examine selected problems in labor relations in the light of international and comparative experience and will be expected to prepare, discuss, and defend individual research papers. Seminar topics will vary from year to year according to student and faculty interests.

**635 Working Women in Nine Countries (also Women's Studies 635)** Fall. 3 or 4 credits.

Prerequisite: one course in labor relations, economics, comparative government, or women's studies.

A. Cook.  
The course will draw on materials from various countries, with particular attention to factors bringing women into the labor market. Emphasis will be placed on the contrast between Communist and non-Communist countries. Students will develop individual studies on such topics as occupational selection, training, promotion, wage classification systems, maternity and child care leave; on community support programs for working mothers including child care, transportation, health and recreation programs, housing, housekeeping, and time use.

**730 Comparative Industrial Relations Systems I** Fall or spring. 3 credits. Prerequisite: for non-ILR graduate students, permission of instructor.

W. Galenson or J. Windmuller.  
Students in this course will be expected to attend the lectures in ILR 330 (see course description above). In addition, they will meet separately to consider current labor market problems in industrial nations, including

various forms of incomes policy, methods of dealing with unemployment, the relationship between fiscal policy and collective bargaining, the movement toward labor participation in management decision making, new schemes for worker participation in corporate equity, the changing political role of trade unions, and innovations in shop floor authority.

**731 Comparative Industrial Relations Systems II** Spring. 3 credits. Open to graduate students.

W. Galenson or J. Windmuller.  
A comparative study of labor problems in the less developed nations. Among the subjects included are the relationship of different patterns of development to employment; the role of government and trade unions in industrial relations; the problem of income inequality; technological choice and employment; and the role of transnational companies and foreign investment.

**799 Directed Studies** For course description, see p. 196.

## Labor Economics and Income Security

G. Clark, chairman; R. Aronson, R. Ehrenberg, R. Ferguson, W. Galenson, G. Hildebrand, R. Hutchens, F. Slavick, R. Smith, V. Stoikov.

**140 Development of Economic Institutions** Spring. 3 credits. Permission of instructor required non-ILR students.

G. Clark.  
Designed to give the student an understanding of the historical development of our economic institutions and the nature of the problems incident to economic change and development as part of the background for understanding and analysis of important present-day issues. Attention is focused on the agricultural, commercial, and industrial revolutions, tracing their development from their beginnings in Western Europe to the present.

**240 Economics of Wages and Employment** Fall or spring. 3 credits. Prerequisite: Econ 101-102 or equivalent.

An introduction to the characteristics of the labor market and to analysis of wage and employment problems. Among topics studied are the composition of the labor force, job-seeking and employment practices, methods of wage determinations, theories of wages and employment, economic effects of unions, the nature and causes of unemployment, and programs to combat joblessness and poverty.

**340 Economic Security** Fall. 3 credits.

R. Hutchins, F. Slavick.  
History, philosophies, and the economic and social effects of social security measures. Analysis of programs offering protection against economic loss due to industrial accident, temporary and permanent disability, illness, old age, premature death, and unemployment, as well as private and voluntary efforts to provide security, and the problems of integrating public and private programs. An examination is made of proposals for amending or modifying economic security measures, including guaranteed income proposals.

**341 Protective Labor Legislation** Spring. 3 credits. Open to juniors and seniors.

F. Slavick.  
A survey of the nature of the problems and the basis for state and federal legislation in fields such as discrimination in employment, migratory labor, industrial health and safety, minimum wages and maximum hours, and child labor. Special attention is given to the problem of maintaining a proper balance among the efforts of industry, organized labor, and government in the development of labor standards.

Proposals for amending existing legislation will be discussed.

**343 Problems in Labor Economics** Spring. 4 credits. Prerequisite: Econ 101-102; ILR 240 recommended.

G. Hildebrand.  
An advanced course concerning the institutional organization of labor markets, economic analysis of their operation, and major policy questions involved. Principal topics include wage and employment theory, determinants of wage level and structure, technological change, unemployment, income distribution, inflation, and incomes policy.

**344 Comparative Economic Systems: Soviet Russia** Spring. 4 credits.

G. Clark.  
A comparative analysis of the principles, structure and performance of the economy of Soviet Russia. Special attention will be devoted to industry and labor.

**346 Economics of Collective Bargaining** Spring. 3 credits. Open only to upperclass students with permission of instructor.

R. Ferguson.  
Economic aspects of contract negotiation; management and union goals, nature of bargaining power, strategy and tactics of negotiation, use of economic criteria in deciding term of employment. Students participate in a series of simulated contract negotiations.

**347 Capitalism and Socialism** Fall. 4 credits. Limited to juniors and seniors.

G. Hildebrand.  
Capitalism as a type of economic organization and idea system. Smith's view and Marx's critique. The achievements of capitalism. Some current issues: stability, inflation, monopoly, distribution, cost of growth, and industrial relations. Socialist criticisms. Types of socialist thought. Some problems of socialism; the place of the state and the question of scarcity. Central planning. Recent appraisals of capitalism and socialism: Schumpeter, von Mises, Sweezy, Pigou, Galbraith, and Friedman.

**441 Income Distribution** Fall. 3 credits. Open to upperclass and graduate students.

R. Ferguson.  
The sources and distribution of income in the United States. Examination of theories, facts, and value judgments regarding labor, entrepreneurial, and capital shares, personal incomes, and policies influencing their distribution.

**499 Directed Studies** For course description, see p. 194.

**640 Economics of Manpower** Fall. 3 credits. Prerequisite: 740 or equivalent; open to undergraduates only by permission of instructor.

R. Aronson.  
Survey of the economic background and selected issues in manpower policy and planning. Labor market processes and behavior involved in the development and implementation of manpower programs are treated systematically. Special topics will be arranged in accordance with student interests.

**641 Comparative Economic Systems: Soviet Russia** Fall or spring. 3 credits. Open to undergraduates with permission of instructor.

Prerequisite: 344.  
G. Clark.  
Preparation and discussion of individual papers on selected topics concerning the Soviet economy.

**643 Special Topics in Labor Economics** Fall or spring. 3 credits. Prerequisite: graduate standing or permission of instructor.  
Devoted to new policy issues and to recent literature in the field. The specific content and emphasis will

vary from year to year and in response to interests of the faculty member teaching the course.

**644 The Economics of Occupational Safety and Health** Spring. 3 credits. Permission of instructor required.

R. Smith.

The course analyzes the problem of occupational injuries and illnesses in the United States. The first section concentrates on the legal requirements, judicial interpretations, and legal implications of the Occupational Safety and Health Act. Focus will then shift to such questions as the need for, and appropriate goals of, the Act; the stringency of safety standards considered in a benefit-cost framework; the difficulties in enforcing the Act; and estimates of the impact of the Act.

**645 Economics of the American System of Private Enterprise (also Economics 355/555)** Fall. 4 credits.

G. Hildebrand.

A critical examination of the private sector of the United States economy: its history, some leading current relevant issues, and its relation to theoretical and philosophical interpretations of the market economy.

**646 Professional and College-Trained Manpower: Labor Market Issues and Analysis** Spring. 3 credits. Open to upperclass students with permission.

R. Aronson.

Explores the nature and behavior of labor markets for highly qualified manpower, including the principal human service and technological professions. Focuses on the supply-demand relationships in these markets and the social, political, and economic institutions affecting the compensation, development, and utilization of professional and technical workers.

**647 The Economics of Evaluation** Spring. 4 credits.

R. Ehrenberg.

An introduction to the methodologies used by economists in their evaluation of the impacts of social action programs and legislation. Initially discussions of general evaluation methodology, cost-benefit analysis, and econometrics are presented. Case studies are then considered to illustrate the uses of these techniques, to acquaint the student with major current governmental programs and legislation, and to estimate these programs' economic impacts. Throughout, the analytic framework used by the instructor in conceptualizing the expected program effects is primarily elementary microeconomics.

**648 Economics of the American System of Private Enterprise (also Economics 356/556)** Spring. 4 credits.

Continuation of 645, although 645 not prerequisite to 648.

**740 Labor Economics** Fall or spring. 3 credits. Required of graduate students majoring or minoring in labor economics and income security and M.I.L.R. candidates. Prerequisite: Econ 101-102 or equivalent.

R. Aronson.

Economic issues in the employment and compensation of labor. Topics discussed include labor force growth and composition, structure and functioning of labor markets, unemployment, wage theories, wage levels and structures, the economic influence of unions, income distribution, and the problem of poverty.

**741 Social Security and Protective Labor Legislation** Fall. 3 credits. Normally required of graduate students majoring or minoring in labor economics and income security and required of M.I.L.R. candidates.

F. Slavick.

The fundamental aspects of employee protection and income security. Emphasis will be placed upon state

and federal minimum wage and hour laws, antidiscrimination legislation, employee benefit programs, social insurances, and public welfare programs. The underlying causes of the legislation, the legislative history, the administrative problems and procedures, and the social and economic impact of the legislation will be studied.

**742 Seminar on Investment in Man** Spring. 3 credits. Prerequisite: 740 or equivalent.

V. Stoikov.

This seminar will cover activities that influence future monetary and psychic income by improving the resources in people. The investments covered include schooling, on-the-job training, medical care, migration, and the search for information on prices and incomes, with main emphasis on education and health. A last section covers educational planning.

**744 Seminar in Labor Economics (also Economics 641)** Fall. 3 credits.

Reading and discussion of selected topics in labor economics.

**745 Seminar in Labor Economics (also Economics 642)** Spring. 3 credits.

Reading and discussion of selected topics in labor economics in the fields of theory, institutions, and policy.

**799 Directed Studies** For course description, see p. 196.

**940 Workshop in Labor Economics** Fall or spring. 3 credits. Designed for Ph.D. students at the dissertation-writing stage. Concern primarily will be with the formulation, design and execution of dissertations. Preliminary plans and portions of completed work will be presented to the workshop for discussion.

## Manpower Studies

F. Foltman, chairman; T. DeCotiis, L. Dyer, J. Farley, W. Frank, F. Miller, R. Risley, V. Stoikov, W. Wasmuth, W. Wolf.

**260 Urban Problems and Manpower Programs** Fall. 4 credits. Upperclass students with permission of instructor.

R. Risley.

A seminar concerned with selected urban problems and manpower service programs developed to cope with them. Consideration is given to both public and private programs: their organization and comparative methods of operation. Each student is required to conduct a field study of a selected organization.

**261 Manpower and Public Policy** Spring 3 credits. Open to sophomores, juniors, and seniors.

F. Foltman.

The course concentrates on the macroeconomic facets of the United States manpower policies and programs: their history, development, implementation, evaluation, impact, theoretical foundation, and future.

**360 Manpower and Organization Management** Fall or spring. 3 credits.

T. DeCotiis, L. Dyer.

Focuses on the management of personnel in organizations. Deals with manpower planning, recruiting, selection, wage and salary administration, training, performance appraisal, organizational development, and the administration of personnel department activities. Special attention is paid to government manpower policy and its implications for personnel management.

**363 Techniques and Theories of Training in Organizations** Fall. 3 credits.

F. Foltman or W. Frank.

A course directed toward 1) examination of basic psychological formulations of learning relevant to the training of personnel in organizations; 2) review of the methods available for use in organizational training.

**364 Communication in Organizations** Fall. 3 credits.

W. Frank.

Devoted primarily to the study and analysis of organizational communication. Emphasis will be placed on the examination of the communication process, models, meaning and language, channels and networks, and interpersonal and intergroup issues.

**365 The Management of Complex Organizations** Fall. 3 credits. Open to juniors and seniors.

W. Wolf.

A case-study seminar exploring the practices and problems of the management of multiindustry, multinational firms. Emphasis is on management practices and their implications for manpower utilization.

**366 Women at Work (also Women's Studies 366)** Spring. 4 credits.

J. Farley, F. Miller.

This course examines various aspects of female occupational roles in twentieth-century United States. Historical, social, and legal factors that influence women's choice of careers, work socialization and training, and subsequent labor market experience are considered. Working women's entry-level jobs, opportunities for advancement, and income are compared to men's.

**367 Organization Development: Strategy and Practice** Fall. 3 credits. Open to graduate students.

F. Foltman.

The study of models, theories, and methods used in changing entire organizations or major organizational subunits. Consideration will be given to current methods and strategies for improving individual or group performance including laboratory training, consultancy, sensitivity training, grid training, and other planned interventions. Organization development approaches are compared and contrasted with classical individual training models.

**368 Manpower and State Legislative Process** Spring. 4 credits. Upperclass students with permission of instructor.

R. Risley.

This course is designed to provide students with an understanding of the legislative process in New York State and current issues in the area of manpower and related topics being considered by the legislature. Each student will be required to work with a legislator to research an assigned topic and prepare appropriate legislative memoranda as a major part of the course work.

**461 Field Studies in the Development of Management Training Programs** Spring. 3 credits. Open to upperclass students by permission of instructor.

W. Frank.

Provides direct field experience and training needs within different organizations and will involve the design and construction of actual training programs. Each student will conduct interviews, observe work activity, study past training activity, and attempt to gain a general understanding of the basic operation of the particular organization to which he or she is assigned. The student will then develop a detailed proposal for subsequent training activity within the organization.

**462 Occupational Analysis and Manpower Planning** Spring. 3 credits. Prerequisite: 360 for undergraduates; 760 for graduates; 151 for non-ILR students.

F. Miller.

The course combines a practicum aspect—intensive

practice in job analysis observations and interviews—with systematic study of how occupational information so obtained can be used in manpower planning at the level of the community or the work organization.

**499 Directed Studies** For course description, see p. 194.

**660 Seminar in Manpower Studies and Organization Management** Fall or spring, 3 credits. Prerequisite: for undergraduates 261, 667, or equivalent.

F. Miller.  
A strategy of federal revenue-sharing has moved responsibility for planning and implementing remedial manpower training and employment programs to states and localities (along with funds to support them). The seminar will study certain system problems growing out of this decentralized "prime sponsor" strategy, as each student develops an appropriate manpower game plan for an individual unit of local government. We will focus on New York State and its less populous counties for our main examples.

**661 Public Policy and Development of Human Resources** Fall, 3 credits.

F. Foltman.  
Analysis of the need for development of human resources, trends in work force requirements and implications for public policy, the role of government and educational institutions in providing development programs, and the effectiveness of such programs. Examination of the rationale, organization, and administration of specific programs, such as apprenticeship, vocational and technical schools, technical institutes, university programs, and others.

**662 Management Training Simulation: Public Policy Issues in Social Agencies** Fall, 3 credits.

Open to seniors and graduate students with permission of instructor.  
W. Wasmuth.  
The seminar will be conducted through the technique of simulation applied to a rehabilitation workshop and a hospital. Although the substantive material relates to health services management, simulation as an approach to training managers has wider and growing importance to all types of organizations. Students are provided with realistic problem-solving situations involving boards of directors, community resources, public policy issues, and state and federal agencies.

**663 History of Contemporary Management Thought** Fall, 3 credits.

W. Wolf.  
A critical review of the works of the major contributors in terms of the development of their ideas and their impact. Tape recorded interviews with Barnard, Simon, Drucker, Urwick, and others will be studied.

**664 Management and Leadership Development** Fall, 3 credits. Permission of instructor required.

T. DeCotiis, L. Dyer.  
Consideration is given to both individual and organizational determinants of managerial effectiveness and methods used to influence these. Topics include defining and measuring managerial effectiveness, motivation theory, staffing at the managerial level, individual training and development, and organization analysis and development.

**665 Case Studies in Personnel Administration** Fall, 3 credits.

T. DeCotiis, W. Wasmuth.  
A seminar devoted to an analysis of personnel management activities and their impact on organizational objectives and administration. Cases, incidents, and field data, derived from a variety of institutional settings, will provide a framework for examining and explaining the various roles played by

personnel managers. When it is appropriate, attention will be given to the evolution and formalization of personnel activities within growing small business organizations.

**666 Administrative Theory and Practice** Spring, 3 credits. Prerequisites: for advanced undergraduates, 120-121 or its equivalent and permission of instructor; for graduate students, 720 or permission of instructor.

W. Wolf.  
A general survey of the theory and practice of administration. Attention focuses on organizational differentiation and its implication for managerial practices. Taught around cases and field studies. Topics include theories and approaches to administration, organizational diagnosis, managerial practices, and organizational dynamics.

**667 Current Issues and Research in Human Resources Development** Fall or spring, 3 credits.

A graduate seminar centering on selected issues and relevant research involved in the development of managerial and work-force skills (particular emphasis to be determined with the seminar group). Papers and class discussions might concentrate on such topics as management development, impact of technological change on training programs, development of scientific and professional personnel, or labor union education.

**668 Manpower Planning, Selection, and Utilization** Fall, 3 credits. Prerequisite: one course in statistics.

T. DeCotiis, L. Dyer.  
An analysis of the staffing process as applied to employing organizations. Topics examined include manpower planning, sources of manpower, methods used to assess individual differences, methods used to assess organizational job requirements, problems associated with man-job matching, and the relationship between the staffing process and other organizational processes.

**669 Administration of Compensation** Spring, 3 credits. Permission of instructor required.

L. Dyer.  
The development and administration of wage and salary programs. Major emphasis is given to the role of compensation in attracting, retaining, and motivating employees. Topics investigated include motivation theory, factors influencing compensation levels, job evaluation, forms of compensation, including incentive plans and fringe benefits, special issues of managerial compensation, and problems of compensation control.

**692 The Appraisal and Diagnosis of Organizations** Fall, 3 credits. Permission of instructor required.

W. Wolf.  
This seminar focuses upon the understanding of organizations in a holistic framework. It deals with the process of diagnosis, techniques for gathering data, analysis of the functional areas of management, and interpretation and synthesis of findings. Field study and laboratory training are emphasized. The point of view taken is that of the administrator and/or consultant.

**693 Design and Administration of Training Programs** Fall, 3 credits.

F. Foltman.  
An analysis and exploration of the training and retraining function as applied in business, government, and industrial organizations. Consideration is given to the conceptual framework and practical approaches with which learning activities are developed at the workplace at all levels.

**695 Local Government Manpower Planning and Administration** Spring, 4 credits. Permission of instructor required. Students should have previous academic courses and/or experience in local government or manpower programs.

R. Risley.

A seminar devoted to the study of local government manpower planning and administration. Students will study federal and state functions and the activities of local governments, particularly counties in New York State, in the implementation of manpower programs.

**696 Personnel Administration and Government Regulations** Fall, 3 credits. Open to juniors, seniors, and graduate students concerned with manpower management and personnel administration.

R. Risley.  
A survey and analysis of government regulations affecting manpower administration and personnel management in nongovernment organizations, examining the framework within which management must operate. Governmental agencies' methods of enforcement of such regulations and the firm's responsibilities for failure to comply with these legal requirements will be considered.

**697 Sex Roles and Career Patterns (also Women's Studies 666)** Spring, 3 or 4 credits.

Prerequisite: Graduate standing or six hours of manpower studies or women studies, or permission of instructor.

J. Farley.  
The purpose of this course is to examine the extent to which sex-role expectations affect career patterns of women and men in twentieth-century United States.

**760 Manpower and Organization Management** Fall, 3 credits.

L. Dyer.  
A basic graduate course covering the major areas of manpower and organizational management as they relate to human behavior in work organizations. Consideration is given to such aspects of personnel work as job attitudes, motivation, task design, leadership, manpower planning, recruitment and selection, training, management development, and compensation. Emphasis is on the application of theory and research to the solution of personnel problems.

**761 Occupational Aspects of Manpower Studies** Spring, 3 credits.

F. Miller.  
After learning how job analysis is done and how it contributes to conventional personnel practices, the seminar goes on to consider individual and community needs for systematic information about occupations. Special attention will go to problems experienced by youth, especially minority youth, and women of all ages in getting information about and access to rewarding careers in organization and professions.

**762 Design and Administration of Training Programs** Spring, 3 credits.

F. Foltman.  
The development of education and training programs in government, business, labor, and voluntary organizations. Attention will be given to the role of line and staff and to problems and techniques in policy determination, the identification of training needs, and the design, implementation, and evaluation of programs. Case studies will focus on the philosophy and administration of selected training programs.

**799 Directed Studies** For course description, see p. 196.

## Organizational Behavior

G. Gordon, chairman; H. Aldrich, S. Bacharach, L. Gruenfeld, T. Hammer, N. Rosen, R. Stern, H. Trice, W. Whyte, L. Williams.

**120 Society, Industry, and the Individual I** Fall, 3 credits.  
R. Stern.

Deals with the relationship between industry and the economy as a whole and its implications for other social institutions in American society such as stratification, politics, and American values. It also deals with the nature of industrial organizations and of complex organizations in general, emphasizing authority relations, goals, the division of labor, and bureaucracy.

### 121 Society, Industry, and the Individual II

Spring, 3 credits.

L. Williams.

Deals with the relationship between the individual and the organization and such basic psychological processes as need satisfaction, perception, attitude formation, and decision making. It describes and examines the individual as a formal and informal group member. Within this area, particular emphasis is placed on leadership, problem solving, and conflict resolution.

### 221 Social Issues and Social Theory in Industrial Society

Spring, 3 credits. Permission of instructor required.

G. Gordon.

Experimental course. Explores the viability of concepts developed in course 120 in order to increase our understanding of problems resulting from living in an industrial society.

### 222 Studies in Organizational Behavior

Spring 3 credits. This course is intended as a sequel to 120 and 121. Open to sophomores, juniors, and seniors.

R. Stern.

Various types of organizations—voluntary associations, business firms, and government agencies—will be discussed in light of some contemporary theories of organizations. The theories will be critically reappraised in relation to the case material presented.

### 322 Cross-cultural Studies of Organizational Behavior

Fall, 3 credits. Prerequisite: 120–121 or equivalent introductory courses to the behavioral sciences including sociology and social psychology. Comparisons of organizations in terms of cultural similarities and differences. Organizational processes in both industrially advanced and developing societies will be examined. Varying attitudes toward work, achievement, and authority will be compared. The implications of these differences for the transfer of technological and organizational change will be highlighted. Sociological and social-psychological theories and constructs provide the framework for discussion.

### 323 Introduction to the Study of Attitudes

Fall, 4 credits. Open to juniors and seniors.

T. Hammer.

Designed to acquaint the student with what is known about (1) origins of human attitudes, (2) the determinants of attitude change, and (3) the measurement of attitude differences. Studies employing clinical, experimental, and survey techniques will be discussed. Each student will design, execute, and analyze an independent research study.

### 324 Organizations and Deviant Behavior

Spring, 3 credits. Open to juniors, seniors, and graduate students. Prerequisite: one or more courses in both sociology and psychology.

H. Trice.

Focus is on the relationships between organizations and deviant behavior. Covers (1) the nature and etiology of psychiatric disorders, particularly schizophrenia, the psychoneuroses, and psychosomatic disorders; (2) organizational factors related to these disorders and to the more general phenomena of role conflict and stress; (3) an examination of alcoholism as a sample pathology, in terms of personality characteristics and precipitating organizational factors; (4) evaluation of organizational responses to deviance; (5) the nature of self-help

organizations such as Alcoholics Anonymous; and (6) the structure and functioning of the mental hospital.

### 325 Field Research in Community

Organization Spring, 3 credits. Permission of the instructor required.

H. Aldrich.

A seminar for students interested in pursuing field research projects on which a substantial amount of work has already been completed. Some previous training in field methods required. Emphasis will be placed on integrating field research with theories of the urban community.

### 326 Sociology of Occupations

Spring, 3 credits. Open to juniors, seniors, and graduate students and to sophomores with permission of instructor.

Prerequisite: one or more courses in sociology or permission of the instructor.

H. Trice.

Focuses on (1) the changing character of American occupations within the context of social change; (2) occupational status—differences in income, prestige, and power and the resultant general phenomenon of social stratification; (3) vertical and horizontal occupational mobility; (4) recruitment and socialization into occupational roles; (5) the process of professionalization; and (6) comparison of personnel occupations with the career and organizational patterns of other occupations.

### 327 Psychology of Industrial Conflict

Fall, 3 credits. Open to juniors, seniors, and graduate students. Permission of instructor required.

An application of frustration theory to the analysis of conflict and stress in organizations and society. Comparisons are made between industrial relations, race relations, international relations, and other settings. Readings include behavioral research findings from a variety of studies in industry. Relevant contributions from experimental, social, and clinical psychology also are considered.

### 328 Cooperation, Competition, and Conflict

Resolution Spring, 4 credits. Prerequisite: two courses in social psychology or equivalent. Permission of instructor required.

An examination of theory and empirical evidence relating to the resolution of interpersonal, intergroup, and international conflict. Specific attention will be devoted to studying factors that contribute to the development of cooperative or competitive bonds between parties to a conflict. The following topics will be studied: the availability and use of threat; the credibility, intensity, and costs of threat; fractionating and escalating conflict. Personality and situational factors that regulate conflict intensification will be stressed.

### 371 Individual Differences and Organizational Behavior

Fall, 4 credits. There are no formal prerequisites for this course. However, some acquaintance with the substance and methods of behavioral or social science will be helpful.

L. Gruenfeld.

This is a course in personality, culture, and organizational behavior. A framework for the study of personality in culture is presented and differences in age, sex, social class, and national character are examined. The relationship between culture and personality is examined to illustrate the influence of the ecological, technological, and economic environments on the formation of personality.

### 420 Group Processes

Fall, 3 credits. Preference given to seniors and graduate students. Permission of instructor required.

An advanced undergraduate and beginning graduate course emphasizing group development. Readings and discussion will be concerned with interpersonal attraction, conformity, interaction process, leadership, group effectiveness, norms, etc. Laboratory experiences in group tasks will be provided.

### 421 Social Organization of the Urban Community

Fall, 3 credits.

H. Aldrich.

An examination of the social organization of the urban community, focusing on ethnic and racial ghettos, the police and organized crime, business and industrial organizations, and political and educational organizations. The urban community will be treated as a group of specialized activity systems, with a view toward studying the interrelation among the various systems. Special attention will be given to community conflict in such areas as civil disorder, community control of schools, and urban renewal. Students will be expected to take part in a research project dealing with an urban issue.

### 423 Evaluation of Social Action Programs

Fall, 3 credits. Permission of instructor required.

H. Trice.

A consideration of the principles and strategies involved in "evaluation research." A look at objective research designs whose aim is to determine the extent to which change agents in fields such as training and therapy accomplish their goals. Consideration of the adaptation of these strategies to large social contexts, for example, child guidance clinics, mental health clinics, and programs in the poverty areas such as Head Start.

### 425 Sociology of Industrial Conflict

Spring, 3 credits.

R. Stern.

The focus will be on the variety of theoretical and empirical evidence available concerning social, economic, and political causes of industrial conflict. The manifestations of conflict such as strikes, labor turnover, absenteeism, and sabotage, and the influence of the environments in which they occur will be emphasized.

### 499 Directed Studies

For course description, see p. 194.

### 620 Theories and Methods of Organizational Change

Spring, 4 credits. This seminar will explore the notion that organizations can be seen as political entities and, further, that the dynamics of social stability are perhaps stronger than pressures for change. The seminar will try to develop a political conceptual framework with which to evaluate the organizational change literature. Several case studies of significant structural changes in organizations (unions, universities, hospitals, and government) will be examined.

### 621 Management of Science

Spring, 3 credits. Open to undergraduates with permission of instructor.

G. Gordon.

Treats the management of science on both the micro and macro levels. It will examine empirical findings as they bear on national policy with respect to science, and environmental settings that inhibit or stimulate accomplishment. Emphasis will be placed on current problems such as freedom and control of science, scientific secrecy, bureaucracy and creativity, financial and political underpinnings of research, and the emerging social structures in scientific organizations.

### 622 The Organization and Its Environment

Spring, 3 credits. Permission of the instructor required.

H. Aldrich.

A survey of the literature on organization-environment and interorganizational relationships. Emphasis will be on two tasks: developing typologies of interorganizational relations, and exploring methods of measuring or quantifying such relations. Students in the seminar will be expected to write a research paper in which they apply an organization-environment or interorganizational perspective to a particular set of organizations.

### 627 Leadership in Organizations

Spring, 3 credits. Permission of the instructor required.

A seminar designed to examine theories and

research findings from the behavioral sciences that are relevant to leadership and the influence process in groups and organizations. Personality, situational factors, intergroup processes, interpersonal perception, as well as motivation to lead and to follow, will be discussed. The implications for leadership training, organization development, and action research will be explored.

**628 Cross-cultural Studies of Organizational Behavior** Fall or spring, 3 credits. Prerequisite: 720 or 721 or equivalent. Open to graduate students and upperclass students with permission of the instructor.  
G. Gordon, L. Gruenfeld.

An advanced seminar that will deal with cross-cultural studies in values, interpersonal relations, and organizational structure. The appropriateness of various organizational strategies to certain cultural and subcultural contexts will be considered. Problems relating to authority, decision making, achievement motivation, and change will be highlighted.

**629 Seminar on Personality and Organization** Spring, 3 credits. Prerequisite: 720 and 721 or permission of instructor.  
L. Williams.

A seminar that attempts to integrate available research and focuses on both personality and organizational variables. Investigations in the field of culture and personality will be examined for their utility in the understanding of organizational functioning. The relationship of personality to economic development also will be examined. Each participant will be encouraged to write a term paper on the interrelationship of technology and values.

**670 Sociological Study of Power** Fall, 3 credits. Open to graduate students and seniors with permission of instructor.  
S. Bacharach.

This course will come to grips with the empirical, conceptual, and theoretical issues involved in the study of power. Power will be analyzed within the context of an interaction paradigm and thus, while the major emphasis of this course will be on the examination of power dispersion in organizations and communities, relevant social-psychological literature also will be drawn upon. Among the various works to be considered are those of Gamson, Blau, and Dahl.

**671 Government Bureaucracies in Social and Economic Development** Fall, 4 credits.  
W. Whyte.

The course focuses on the dynamics of behavior within governmental organizations and between government officials and the public, with special emphasis upon government programs designed to improve the condition of poor people. Readings will deal with developing nations and with the United States. Special attention will be given to manpower and rural and urban community development programs.

**672 Urban Politics and Public Policy** Fall, 3 credits. Permission of instructor required.  
S. Bacharach.

Deals with the relationship between community processes and structures and public policy outputs. Specifically, it will focus on such issues as the limitations of the classic elitist/pluralist debate and the recent controversy concerning centralization/decentralization of local government and the delivery of social services. Treatment of these issues will stress the value of applying sociological theory to questions of public policy. A primary concern will be the integration of organizational and community theory.

**673 Cross-cultural Explorations of Individual Differences** Fall, 3 credits.

A data-bank analysis of the relationship between socioeconomic status, socialization values, ethnicity, and various indices of individual differences such as interpersonal trust, propensity to take risks, self-concept, cognitive style, and job preferences.

**674 Social Regulation and Control of Institutions** Fall, 3 credits.

R. Stern.

Interorganizational relations will be examined in terms of networks of control agents and target objects. The dynamics of control relationships based on political bargaining, the distribution of power, economic rewards and costs, and historical circumstances will be examined in the context of their evolution through organizational adaptation to the environment. Subject matter will include theories of organizational change and application of a control perspective to the institutions of American business, government regulation, athletics, and others.

**675 Theories of Industrial Society: A Sociological Perspective** Fall, 3 credits.

The goal of this course will be to provide the student with a working knowledge of the major works of both classical and contemporary sociology. An effort will be made to integrate the various perspectives around the theme of theories of industrial society.

**676 Systems of Labor Participation in Management** Fall, 4 credits. Open to upperclass and graduate students.

W. Whyte.

The course examines the theory and practice of labor participation in systems ranging from informal shop level participation to self-management. Attention also is given to projects involving the restructuring of work and efforts to improve the quality of working life. Readings and lectures will cover cases drawn from various countries, with emphasis upon the United States, Europe, and Latin America.

**677 Theoretical and Research Problems Relating to the Study of Technological Organizations** Fall, 4 credits. Open to seniors with permission.

G. Gordon.

An examination of theory and research methodology as they apply to the understanding and study of technological organizations such as universities, research and development organizations, computing and electronic firms, and hospitals. Emphasis will be placed on social context variables, interorganizational variables, as well as the study of internal organizational variables.

**678 Theories of Work Motivation** Spring, 3 credits.

T. Hammer.

Theories of motivation will be studied as these relate to the design of work settings. The focus of the course will be two-fold: to increase the students understanding of the theoretical and empirical bases of work motivation and to analyze the applications of the theories to the issues of task design, job enrichment, reward systems, and organizational structure.

**720 Organizational Behavior I** Fall, 3 credits.

T. Hammer.

Survey of concepts, theories, and research from the fields of organizational and social psychology as these relate to the behavior of individuals and groups in organizations. Job attitudes, motivation, performance, leadership and power, group formation, perception, and organizational climate. A preliminary course for advanced work in organizational behavior.

**721 Organizational Behavior II** Spring, 3 credits.

G. Gordon.

Formal organizations will be studied from the perspectives of classical organization theory, human relations theory, and comparative and cross-cultural analysis. Also consideration in some detail of the contemporary theories and quantitative approaches to organizational structure. Intended to be preliminary to more intensive work in organizational behavior.

**722 Theories of Organization** Fall or spring, 3 credits, graduate; 4 credits, undergraduate. Open to undergraduates who have had 371 with permission, and graduates who have had 720 and 721.

L. Gruenfeld.

Deals with a set of readings in two subject areas discussed by the professor in previous courses: 1) organizations as political systems, and 2) conceptions of organizations, societies, and individuals in terms of a conceptual framework which distinguishes between community and society. The theme that holds these two sets of readings together focuses on behavior in coercive and utilitarian organizations as distinguished from behavior in communal and voluntary organizations.

**723 Behavioral Research Theory, Strategy, and Methods I** Fall. Credit variable. Designed to meet the needs of M.S. and Ph.D. candidates majoring in organizational behavior, but other graduate students may enroll. Permission of instructor required.

S. Bacharach.

Material to be included in ILR 723 and ILR 724 are (1) theoretical, conceptual, and ethical questions; (2) survey research and attitude scaling procedures; (3) laboratory research methods; (4) participant observation and interview methods; (5) use of documents and qualitative data analysis. Will provide students with important philosophical background for doing research and expose them to a well-balanced, interdisciplinary set of quantitative and qualitative research tools.

**724 Behavioral Research Theory, Strategy, and Methods II** Spring. Credit variable. Permission of the Instructor required.

L. Gruenfeld.

Must be taken in sequence with ILR 723 except by petition. Designed to meet the needs of M.S. and Ph.D. candidates majoring in organizational behavior, but other graduate students may enroll.

**725 Analysis of Published Research in Organizational Behavior** Fall, 3 credits. Prerequisites: 720-721, and one year of statistics.

N. Rosen.

An advanced research methods course which examines critically published research papers in terms of research design and method as well as theory in the field of organizational behavior.

**726 Organizational Behavior III** Fall or spring, 3 credits. Prerequisite: 720-721 or equivalent.

S. Bacharach.

A team-taught comparison of different disciplinary approaches to organizational analysis and models. Emphasis will be placed on integrating different disciplinary approaches to selected organizational phenomena such as change and innovation, decision making and information processing, reward structures, conflict resolution, and others.

**728 Seminar on Work Motivation** Spring, 4 credits. Prerequisite: 720-721.

T. Hammer.

The course will provide an overview of basic concepts of human motivation with the implications for theory and research. The purpose will be to gain a basic understanding of theoretical issues involved in work motivation and knowledge of basic research approaches and results as these apply to individuals and groups in formal organizations.

**799 Directed Studies** For course description, see p. 196.

## Interdepartmental Courses

**150 Labor Problems in American Society** Fall or spring, 3 credits.

F. Slavick.

A survey for students in other divisions of the University. An analysis of the major problems in industrial and labor relations; labor union history, organization, and operation; labor market analysis and employment practices; industrial and labor legislation and social security; personnel management and human relations in industry; collective bargaining and the settlement of industrial

disputes; and the rights and responsibilities of employers and employees.

**151 Personnel Management for Managers**

Fall or spring. 3 credits. Not open to ILR students.

F. Miller.

A study of the personnel function in work organizations with special emphasis on the responsibilities of managers/supervisors. After reviewing evidence from behavioral science research on factors affecting work behavior, we look at such major personnel areas as recruitment, selection and placement; training; compensation and benefits; and discipline.

**155 Practicum in Employer-Employee**

**Relations** Spring. 3 credits. Open only to freshmen.

J. Drotning.

An elective course, offered on an experimental basis, which focuses on employer-employee relations with particular emphasis on matters of personnel administration and collective bargaining. Its objective is to acquaint students, through direct involvement in small problem-solving groups, with some of the dilemmas dealt with by practitioners and the information and skills necessary for resolving them. Four different organizational case settings will be presented, covering such topics as union-management negotiation, grievance handling, employment practices, and training and development.

**650 Manpower and Collective Bargaining**

**Problems in the Construction Industry** Spring. 3 credits. Open to seniors and graduate students, and non-ILR students with permission of the instructor.

D. Cullen, F. Foltman.

The seminar will examine selected manpower and collective bargaining problems in the construction industry, such as supply and demand of construction manpower; the Negro and the building trades; skilled manpower forecasting and planning; skill requirements; education and training; personnel management policies and practices; the wage-price issue; the closed shop; featherbedding; jurisdictional disputes; and problems of bargaining structure. Individual research is required.

# Law School

## First-Year Courses

- 500 Civil Litigation and Professional Responsibility
- 501 Constitutional Law
- 502 Contracts
- 503 Criminal Justice
- 504 Practice Training I
- 505 Practice Training II
- 506 Property
- 507 Torts

## Second- and Third-Year Elective Courses

- 510 Administrative Law
- 511 Antidiscrimination Law
- 512 Antitrust Law
- 513 Arbitration
- 514 Business Enterprises I
- 515 Business Enterprises II
- 516 Business Planning
- 517 Commercial Law
- 518 Commercial Paper and Banking Transactions
- 519 Comparative Law
- 520 Conflict of Laws
- 521 Criminal Procedure
- 522 Debtor-Creditor Law
- 523 Economics for the Lawyer
- 524 Enterprise Organization
- 525 Environmental Law
- 526 Estate and Gift Tax
- 527 Estate Planning Problems
- 528 Evidence
- 529 Family Law
- 530 Federal Courts
- 531 Federal Income Taxation
- 532 History of Legal Institutions
- 533 Insurance
- 534 International Law
- 535 International Private Trade
- 536 Jurisprudence and the Legal Process
- 537 Labor Law

- 538 Land Financing
- 539 Land-Use Planning
- 540 Law, Society, and Morality
- 541 Law Practice Dynamics
- 542 Legal Accounting
- 543 Legislation
- 544 Local Government
- 545 New York Practice
- 546 The Process of Property Transmission
- 547 Regulated Industries
- 548 Remedies
- 549 Securities Regulation
- 550 Trial Techniques
- 551 Trusts and Estates I
- 552 Trusts and Estates II
- 553 Welfare Law

## Problem Courses and Seminars

- 554 Antitrust Law Seminar
- 555 Computers and the Law
- 556 Copyright, Trademark, and Patent Law
- 557 Corporate Morality and Legal Ethics
- 558 Corporate Practice
- 559 Economic Foundations of Private Law
- 560 Emerging Constitutional Problems
- 561 Environmental Law Problems
- 562 Experimentation on Human Subjects
- 563 Fiduciary Administration
- 564 Financial Regulation in Times of Change
- 565 Income Maintenance Law
- 566 Institutional Investors
- 567 International Tax Planning
- 568 Labor Relations Law Seminar
- 569 Legal Aid Seminar I
- 570 Legal Aid Seminar II
- 571 Organized Crime Control
- 572 Problems in Environmental Planning
- 573 Problems in Legislation
- 574 Problems of Urban Development
- 575 Science, Technology, and Law
- 576 Socialist Law
- 577 United Nations Law

## Division of Nutritional Sciences

M. C. Nesheim, director; E. E. Hester, graduate faculty representative; J. Appgar, G. Armbruster, R. E. Austic, R. H. Barnes, A. Bensadoun, C. A. Bisogni, J. Bowering, T. C. Campbell, K. Clancy, M. Devine, J. L. Gaylor, J. D. Haas, L. R. Hackler, R. Klippstein, L. P. Krook, M. C. Latham, D. A. Levitsky, B. A. Lewis, D. B. McCormick, N. Mondy, M. A. Morrison, C. Olson, M. Pimentel, W. G. Pond, J. M. Rivers, D. A. Roe, D. Sanjur, R. Schwartz, M. L. Scott, C. P. Timmer, D. Treadwell, C. VanCampen, K. Visnyei, M. B. Washbon, R. H. Wasserman, E. K. Woodruff, L. D. Wright, R. J. Young, D. B. Zilversmit.

The Division of Nutritional Sciences is an intercollege unit, administered jointly by the Colleges of Human Ecology and Agriculture and Life Sciences. The division was established to coordinate and unify undergraduate teaching, graduate training, research, and extension activities related to nutritional sciences. Presently, students are admitted to the undergraduate major through the College of Human Ecology. Courses in the division may be used to meet graduation requirements in both the College of Human Ecology and the College of Agriculture and Life Sciences.

Nutritional sciences constitutes a broad area of study drawing from many diverse disciplines to develop an understanding of the interrelationships among food, nutrition, and health. Division programs concentrate on the generation of new knowledge through research and the utilization of knowledge to alleviate human problems. Major areas of study within the division involve: (1) nutrition: physiological and biochemical dimensions of nutrition in relation to human health; (2) food science: quality, acceptability, and utilization of food for human beings; and (3) applied nutrition: application of knowledge of nutrition, dietetics and food science to the nutritional well-being of individuals from all age groups and socioeconomic levels.

The division offers programs leading to the bachelor's, master's, and doctoral degrees. Graduate study in nutritional sciences is administered by the Graduate Field of Nutrition.

### Programs for Undergraduate Majors in the Division

The core of the undergraduate major is preparation in appropriate areas of physical and biological sciences and professional courses in nutritional sciences. Basic course work in chemical and biological sciences and mathematics or statistics and appropriate areas of social sciences is taken by all majors. Some choice is possible among required basic sciences. This common core of basic disciplines provides the foundation for concentration of professional courses in the options of nutrition, food, or community nutrition described below. Further, a nutritional science major may be combined with other majors in the two colleges.

**The nutrition option** builds on the basic science core to give a solid foundation in theoretical and some applied aspects of nutrition. Strong emphasis is placed on laboratory work. This option is designed for students who are highly motivated in the biological sciences and who wish, with further training, to enter careers in nutrition research, nutrition service professions, or medical sciences.

**The food option** provides students with a background in basic and applied sciences to aid in the understanding of the composition and treatment of food that affect its quality, acceptability, and use.

Students completing this option may enter graduate programs related to the science of food or nutrition; or they may enter first-level positions in government, quality control, and educational programs in industry or industry-supported organizations.

**The community nutrition option** provides a strong background in basic and nutritional sciences that, in combination with carefully selected courses in the social sciences, enables the professional nutritionist to help people translate knowledge about nutrition and food into practice. This option is designed for students whose interests are directed toward public service professions. Students may continue study in graduate school or enter first-level positions in extension teaching, community nutrition programs, food regulatory agencies, or government and business information services.

By appropriate selection of electives, students wishing to specialize in **dietetics** may meet the academic requirements of the American Dietetic Association (ADA). These are similar but not identical to the major requirements.

Details of the requirements for the major, various concentrations, and ADA requirements may be obtained from the division's Undergraduate Office, 335 Van Rensselaer Hall, or from the Division of Academic Services, New York State College of Human Ecology, N-101 Van Rensselaer Hall.

Students majoring in the division should consult with a division faculty member about concentrations and selection of courses for particular career interests. In general, more work will be necessary in the sciences or division courses for specific career goals than the minimum listed for a major.

**An honors program** is offered by the division leading to a B.S. degree with honors in nutritional sciences. Students in the honors program are given the opportunity to do independent study. Criteria for selection of students include scholastic achievement in the sciences and professional courses, cumulative grade point average, and motivation for independent study. Decisions on admission to the program are made by a faculty committee near the end of the spring semester of the sophomore year. Other students, including students transferring into the division major at the junior level, will be considered for admission on written request. The deadline for entry into the program is the beginning of the second semester of the junior year. A description of the program can be obtained from the division's Undergraduate Office or from the division's honors representative.

**Courses Recommended for Nonmajors.** Courses are open to all students of the University. For nonmajors, nutritional science courses strengthen preparation for careers in biological sciences, medicine, agriculture, and food science, as well as those related to human services such as education and social service. Introductory courses in nutrition (NS 115) and food (NS 146) are available to the nonmajor as well as special interest courses NS 222, NS 325, NS 347, NS 457. Students with college courses in chemistry, biological sciences, and nutritional sciences may elect advanced courses such as NS 231, 246, 431 and 446. Graduate students in other fields who want basic work in nutrition should consult with a faculty member for appropriate courses.

**Graduate Program.** The breadth and depth of faculty interests make it possible for students with a wide variety of interests to be accommodated. Graduate students may concentrate in human nutrition, general nutrition, animal nutrition, international nutrition, food, and nutritional biochemistry. Research or teaching assistantships and fellowships are available to qualified graduate students. Students who want detailed information about graduate programs in the division should write to Graduate Faculty Representative, Cornell University, Division of Nutritional Sciences, Ithaca, New York 14853.

### 115 Ecology of Human Nutrition and Food

Fall or spring, 3 credits. S-U grades optional.

Fall, M W F 1:25; spring, M W F 9:05. M. Devine. Introduction to the field of human nutrition and food focused on the mutual relationships between man and his biological and physical environment. Includes study of human nutritional needs; problems encountered in providing food to meet nutritional needs; relationships among man's physiological needs, his sociocultural system, his food, and the significance of these relationships to the attainment of health.

### 146 Introductory Foods

Fall or spring, 3 credits. S-U grades optional. Prerequisite or concurrent registration in NS 115.

Lec, M 10:10; lab, W F 10:10-12:05, T Th 10:10-12:05, or 2:30-4:25, M. Pimentel.

Criteria for evaluating man's practice of the science of food and nutrition. Laboratory includes an introduction to the physicochemical properties of food and the relationship of these properties to preparation techniques and food quality. Some meal preparation, focused on man's nutritional needs and the management of money and time, is included.

### 222 Maternal and Child Nutrition

Fall, 3 credits. S-U grades optional. Prerequisites: NS 115 and a college biology course.

M W F 12:20, K. Clancy.

Involves a study of the nutritional requirements in pregnancy, lactation, and growth through adolescence. Topics include the relationship between maternal diet and pregnancy outcome; analysis of different methods of infant feedings; nutritional status of pregnant women, children, and adolescents in the United States; and the interrelationships between nutrition and mental development.

### 231 Physiological Bases of Human Nutrition

Fall, 3 credits. S-U grades optional. Prerequisites: NS 115, Chem 103-104 or equivalent, and Bio Sci 101-103. Course not open to freshmen.

M W F 9:05, J. Bowering.

Nutritional needs of humans throughout the life cycle. Emphasis placed on organ system function and physiological processes as they relate to human nutrition.

### 232 Laboratory in Nutrition

Fall or spring, 1 credit. Enrollment limited to 18 in each section. Prerequisite or concurrent registration in NS 231.

Fall, M 1:25-4:25 or T 1:25-4:25; spring, T 1:25-4:25, Th 1:25-4:25, or F 1:25-4:25.

J. Bowering.

An introduction to principles and procedures used in nutritional assessment. Emphasis is on human nutrition although principles may be illustrated with small animal experiments. Includes analysis of biological materials, determination of body composition and energy expenditure, food analysis, and dietary assessment.

### 246 Introduction to Physicochemical Aspects of Food

Fall or spring, 4 credits. S-U grades optional. Prerequisites: NS 146 and a college course in organic chemistry or biochemistry.

Lec, T Th 9:05; lab, T Th 10:10-12:35 or M W 2-4:25, E. Hester.

A study of (a) the colligative properties of solutions; (b) colloidal systems—sols, gels, foams, and emulsions; (c) physical and chemical properties of the major groups of foods, the effect of basic methods of food preparation and preservation on these properties, and their relation to food quality (especially color, flavor, and texture). Laboratory experience in comparative cookery provides an introduction to the experimental study of food and illustrates the functions of ingredients and effect of treatment on food quality.

### 300 Special Studies for Undergraduates

Fall or spring. Credit to be arranged.

Hours to be arranged. Division faculty.

For special arrangement of course work necessitated because of nonequivalent training in a previous major or previous institution. Students prepare a multicopy description of the study they wish to undertake. Forms are available from counselors in academic services.

**302 Orientation of Field Study in Extension** Fall. 2 credits. S-U grades only. Enrollment limited to 5. Prerequisites: NS 231 and permission of the instructors.

F 1:25-3:25 plus hours to be arranged for three field trips to nearby extension counties as students schedules permit. R. Klippstein, M. Mapes. Working closely with two extension faculty members each participant will prepare and test an educational tool suitable for a selected lay audience in a county extension program setting. Experiences will include visits to field sites, determination of the characteristics and needs of the selected audience, preparation of program materials using a variety of media. Opportunity to use the materials in a county extension program will be arranged. Self and group evaluation will be practiced.

**325 A Sociological Approach to Food and Nutrition** Spring. 3 credits. S-U grades optional. Prerequisites: NS 115 and a college course in anthropology or sociology.

M W F 12:20. D. Sanjur. A study of sociological and cultural variables influencing human behavior in relation to food. Emphasis on recent national and international food habits research and the implications of this knowledge in designing and implementing effective nutrition action programs.

**347 Human Growth and Development; Biological and Social Psychological Considerations (also HDFS 347)** Spring. 3 credits. Prerequisites: Bio Sci 101 or 109 or equivalent; HDFS 115 or Psych 101 and NS 115 or equivalent.

M W F 1:25. J. Haas, H. Ricciuti. A review of major patterns of physical growth from the fetal period through adolescence, with consideration given to biological and socio-environmental determinants of growth, as well as to physical and psychological consequences of variations in growth patterns. Normal patterns of growth will be examined, followed by an analysis of major sources of variations in growth, both normal and atypical.

**361 Drugs and Behavior (also Psych 361)** Fall. 3 credits. Prerequisites: Bio Sci 101-102, Chem 103-104, Psych 123, or permission of instructor.

M W F 11:15. D. Levitsky. This course is intended to survey the scientific literature on the role of brain and body biochemical changes as determinants of human behavior. The topics covered will include action and effects of psychopharmacologic agents, biochemical determinants of mental retardation, biochemical theories of psychosis, effects of nutrition on behavior. A fundamental knowledge of human biology and chemistry is essential.

**378 Management Principles in Food Service Operations** Spring. 4 credits. S-U grades optional. Prerequisites: NS 246 and Ag Ec 220, or NCE (BPA) 540 or equivalent, or by permission of instructor.

T Th 12:20-2:15. D. Treadwell. Application of management principles to food service operations involved in production, distribution, and service of quality food in quantity; includes layout, design, and food cost control. Estimated cost of field trips, \$5.

**398 Honors in Nutritional Sciences** Fall. 1 credit. S-U grades only. Open only to students admitted to the division honors program.

Th 2:30. Division faculty. Coordinated by chairman of honors committee. Research design. Delineation of honor's research problem planned individually in consultation with the faculty adviser.

**400-401-402 Special Studies for Undergraduates** Fall or spring. Credit to be arranged.

Hours to be arranged. Division faculty. For independent study by an individual student in advanced work not otherwise provided in the division; or for study, on an experimental basis, with a group of students in advanced work not otherwise provided in the division. Students prepare a multicopy description of the study they wish to undertake. Forms are available from counselors in academic services.

Students, in consultation with their supervisor, should register for one of the following subdivisions of independent study.

**400 Directed Readings** For study that predominantly involves library research and independent reading.

**401 Empirical Research** For study that predominantly involves data collection and analysis or laboratory or studio products.

**402 Supervised Fieldwork** For study that predominantly involves participation in community or classroom settings.

**431 Human Nutrition** Spring. 3 credits. S-U grades optional. Prerequisites: NS 231, Bio Sci 431, or equivalent.

M W F 10:10. C. Campbell. The biochemistry of human nutrition will be covered in the context of physiological systems. Emphasis will be on interrelationships among nutrients in metabolism, effect of diet on biochemical and physiological processes, and environmental factors that may alter nutrient requirements.

**441 Nutrition and Disease** Fall. 3 credits. S-U grades optional. Prerequisites: NS 431 and a physiology course.

M W F 10:10. J. Rivers. Study of the physiological and biochemical anomalies in certain diseases and the principles underlying nutritional therapy. Independent survey of the technical literature in this field.

**445 Community Nutrition and Health** Spring. 3 credits. S-U grades optional. Prerequisites: NS 431; beginning course in sociology recommended.

Lec, M F 1:25; disc, W 1:25-4:25. K. Clancy. Study of biochemical, environmental, and political dimensions of human nutrition and health problems; applications of concepts of food and nutrition to the improvement of health status; and evaluation of federal, state, and community programs focused on improving nutrition status.

**446 Physiochemical Aspects of Food** Fall. 3 credits. S-U grades optional. Prerequisites: NS 246 and a college course in biochemistry, which may be taken concurrently.

M W F 9:05. G. Armbruster. The relation to food quality of (a) rheological properties of food systems, (b) oxidation and reduction reactions, and (c) enzymatic and nonenzymatic browning. Physical and chemical factors accounting for the color, flavor, and texture of natural and processed foods.

**447 Physiochemical Aspects of Food, Laboratory** Fall. 1 credit. S-U grades optional. Enrollment limited to 16. Prerequisite or concurrent: NS 46.

T 1:25-4:25. G. Armbruster. Laboratory experiments designed to illustrate the effect of varying ingredients and treatment on the quality characteristics of food products. Objective testing methods are used to determine food quality characteristics.

**448 Physiochemical Aspects of Food, Laboratory** Fall. 1 credit. S-U grades optional.

Enrollment limited to 16. Prerequisite or concurrent: NS 446.

Th 1:25-4:25. G. Armbruster. Laboratory experiments designed to illustrate (a) the physicochemical behavior of colloidal systems, (b) chemical reactions of some food components, and (c) effects of temperature, pH, moisture, inorganic salts, and enzymes on physicochemical changes in natural foods, food components, and food mixtures.

**456 Experimental Foods Methods** Spring. 3 credits. Enrollment limited to 16. Prerequisites: NS 446 and NS 448; a course in statistics is desirable but not required.

Lab, T Th 1:25-4:25. G. Armbruster. Application of the scientific method in the design and performance of experimental food problems and in the interpretation and evaluation of results. Evaluation of the use of instruments, chemical, and sensory methods in the measurement of food properties. Independent laboratory problems.

**457 National and International Food Economics** Fall. 3 credits. S-U grades optional. Prerequisites: college course in economics and junior standing or permission of the instructor.

T Th 10:10-11:40. P. Timmer. Examination of individual components essential for a macro understanding of the United States and world food economies. Bioenergetic and economic principles of food production needed to explain the potential for food supplies. Consideration of nutritional, social, and economic factors that influence the consumption of major food groups. Examination and evaluation of the effectiveness of various food policies and programs in altering food consumption patterns. Analysis of the world food economy in global perspective.

**488 Applied Dietetics in Food Service Systems** Fall or spring. 3 credits. S-U grades optional. Prerequisite or concurrent: NS 378 and permission of instructor before preregistration.

Lec, M 8; lab, M-F 2:30-8 p.m. K. Woodruff, D. Treadwell. Laboratory will be arranged through Cornell Dining Services. Students will gain experience in care and use of institutional equipment, job analysis, volume food production, applied sanitation, and recipe development and evaluation, as well as other management skills required to effectively operate a food service program. Estimated cost, \$10.

**498 Honors in Nutritional Sciences** Spring. 1 credit. S-U grades optional. Open only to students admitted to the division honors program.

Th 9:05. Division faculty. Coordinated by chairman of the honors committee. Informal presentation and discussion of current topics in food and nutrition in which all members participate. Written reports on topics discussed may be requested. Students may register for NS 499 concurrently.

**499 Honors Problem** Fall or spring. Open only to students in the division honors program.

Hours to be arranged. Division faculty. An independent literature, laboratory, or field investigation. The work should be spread over two semesters.

**600 Special Problems for Graduate Students** Fall or spring. Credit to be arranged.

Hours to be arranged. Division faculty. For graduate students recommended by their chairperson and approved by the instructor in charge for independent, advanced work. Experience in research laboratories in the division may be arranged.

**601-604 Advanced Nutrition Series**

A series of nutrition courses offered jointly by the Division of Nutritional Sciences and the Departments of Animal Science and Poultry Science. Prerequisites:

courses in nutrition, physiology, and biochemistry to include intermediary metabolism, or with permission of instructor.

**601 Proteins and Amino Acids** Fall. 2 credits. Prerequisites: courses in physiology, biochemistry, and nutrition.

W F 11:15. M. Morrison.

Discussion includes: role of gastrointestinal tract in nitrogen utilization, dietary and nutrition regulation of protein metabolism, alternate amino acids metabolic pathways, interrelationships, effects on amino acid requirements and selected current topics.

**602 Lipids** Fall. 2 credits.

T Th 11:15. A. Bensadoun.

Advanced course on biochemical, metabolic, and nutritional aspects of lipids. Emphasis is placed on critical analysis of current topics on: lipid methodology; lipid absorption; lipoprotein secretion, structure, and catabolism; mechanism of hormonal regulation of lipolysis and fatty acid synthesis; and cholesterol metabolism and atherosclerosis.

**603 Nutritional Energetics** Spring. 2 credits.

Register in Anim Sci 503.

M W 10:10. J. T. Reid.

**604 Minerals and Vitamins** Fall. 2 credits.

Register in Anim Sci 504.

T Th 11:15. M. Scott.

**606 Carbohydrate Chemistry** Spring. 2 credits. S-U grades optional. Prerequisite: organic chemistry; biochemistry recommended.

W F 11:15. B. Lewis.

The chemistry and physicochemical properties of carbohydrates, including sugars, polysaccharides, and their complexes with lipids, proteins, and other food components. The functional role of the carbohydrates in food systems and their nutritional implications will be discussed as well as applications of carbohydrates in food processing.

**611 Molecular Toxicology** Fall. 2 credits. S-U grades optional. Prerequisite: 1 year 400-level biochemistry or equivalent.

T Th 10:10. C. Campbell.

A study of fundamental biochemical mechanisms of absorption, transport, metabolism, and excretion of drugs, carcinogens, and toxicants. Emphasis on oxidative and conjugative pathways of metabolism and of environmental and nutritional factors that influence toxicant metabolism and disposition. Methods of evaluation of *in vivo* and *in vitro* metabolism. About one-half formal lectures, one-half study sessions of current research papers.

**612 Methods of Assessing Physical Growth in Children** Spring. 3 credits. S-U grades optional.

Graduate standing or permission of instructor required.

Lec, T 1:25; lab, Th 1:25-4:25. J. Haas.

This laboratory course is designed to train students in methods and techniques used to assess the physical growth and development of growing children. The methods explored will be those which are applicable for field or community studies and will cover anthropometry, body composition, skeletal age, maturity indicators, physical fitness, and physiological responses to environmental stress.

**616 Readings in Food** Fall. 2 credits.

Prerequisites: 446 or permission of instructor.

F 11:15 or time may be arranged. N. Mondy.

Critical review of selected topics in the current literature. Emphasis on experimental data and basic scientific principles underlying modern theory and practice relative to food quality. May be repeated for credit with permission of instructor.

**619 Field of Nutrition Seminar (also Anim Sci 619)** Fall or spring. Noncredit.

M 4:30.

Lectures on current research in nutrition presented by visitors and faculty.

**621 General Nutrition** Spring. 4 credits.

Prerequisites: NS 431, Bio Sci 431 and Vet Med 346. Students with equivalent course work may enroll with permission of instructor.

M W Th F 10:10. D. Roe.

The course is intended for graduate students with a major or minor in nutrition and undergraduate nutrition majors with the necessary background of course work. The aim is to present an in-depth treatment of nutritional science with human application. Subject matter will include historical perspectives, nutritional physiology, assessment of nutritional status, human nutritional requirements, and nutritional disease due to diet, disease, or drugs.

**624 Research Methods in Human Metabolic Studies** Spring. 3 credits. Prerequisites: NS 431 or equivalent, laboratory experience in biochemistry or quantitative analysis, or permission of instructor.

Lec and lab, M W 1:25-4:25. R. Schwartz and division faculty.

Principles of human metabolic research, experimental design of human studies, dietary considerations, methods of collecting and analyzing biological material, and evaluation. Laboratory will include planning and management of a metabolic study; collection and the appropriate analyses of blood, urine, and feces.

**625 Seminar in a Sociological Approach to Food and Nutrition.** Spring. 3 credits. S-U grades optional. Enrollment limited to graduate students.

M W F 12:20 and additional discussion to be arranged. D. Sanjur.

The seminar utilizes the lectures of NS 325 as a basis for critical review of selected topics in the current literature. Emphasis will be given to the development of a research proposal utilizing sociological conceptual frameworks, methods, and techniques as applied to nutritional data.

**626 Special Topics in Food** Spring. 2 credits.

W F 8. G. Armbruster, E. Hester, B. Lewis.

Current research related to food will be reviewed in the context of basic principles and their application to the quality of food.

**627 Special Topics in Food** Spring. 2 credits.

Hours to be arranged. N. Mondy.

**634 Vitamins and Coenzymes (also Bio Sci 634)** Spring. 2 credits. Offered in alternate years.

Prerequisites: Chem 353 and Bio Sci 431 or 432, or their equivalents.

T Th 10:10. D. B. McCormick.

The chemical, biochemical, and nutritional aspects of the vitamins and coenzymes.

**646 Seminar in Physicochemical Aspects of Food** Spring. 3 credits. S-U grades optional.

Prerequisite: a college course in organic chemistry or biochemistry.

T Th 9:05 with an additional discussion period to be arranged. E. Hester.

An introduction to physicochemical aspects of food for graduate students who have had limited or no work in this area. The seminar utilizes the lectures of NS 246 as a basis for supplementary readings and critical reviews of research on selected topics.

**650 Clinical and Public Health Nutrition** Spring. 3 credits. Prerequisites: NS 431 or equivalent level course.

M W F 9:05. D. Roe.

The course is for graduate students with a major or minor in nutrition and undergraduate majors in nutrition in their senior year. Lectures will cover social, environmental, and disease variables that influence the nutrition of infants, children, and adults. Endemic nutritional problems such as obesity, dental caries, and anemias, of public health importance in the United States will be discussed. Student presentations will be made in class.

**651 Nutrition and the Chemical Environment** Fall. 3 credits.

M W F 11:15. D. Roe.

The course discusses the relationship between nutrition and the effects of foreign chemicals. Students are offered an overall view of compounds to which we are exposed, including natural food toxicants, food additives, water pollutants, pesticide residues, and radioactive wastes as well as medications and illegal drugs. A factual and scientific background will be developed so that students can interpret information and misinformation circulated in the news media.

**660 Special Topics in Nutrition** Fall or spring. 3 credits maximum each term. Registration by permission of the instructor.

Division faculty.

Designed for the student who wishes to become well informed in any specific topic he or she selects that is related directly or indirectly to nutrition. The course may include individual tutorial study, experience in research laboratories, a lecture series on a special topic selected by a professor or a group of students, and/or selected lectures of a course already offered. Topics can be changed so that the course may be repeated for credit.

**680 International Nutrition Problems, Policy, and Programs** Fall. 3 credits. Registration by permission.

T Th 11:15-12:30. M. Latham.

The course is designed for graduate students who wish to learn about the important nutritional problems of developing countries. The major forms of malnutrition related to poverty and their underlying causes will be discussed. Emphasis will be placed on programs and policies that can assist poor countries and communities to improve their nutritional and health status.

**690 Seminar in Nutrition and Behavior** Spring. 3 credits. Registration by permission.

Hours to be arranged. D. Levitsky.

Selected topics in the area of nutrition and behavior are discussed. Such topics include the effect of diet on the developing brain and its effect on behavior, physiological basis of feeding and drinking behavior, and control of obesity. Students should have at least one course in psychology, physiology, and nutrition.

**695 Seminar in International Nutrition and Development Policy** Spring. 2 credits. S-U option. Prerequisite: NS 680 or equivalent.

Hours to be arranged. M. Latham and division faculty.

The seminar is designed to allow the student to consider the role of nutrition in national development. The emphasis will be on the interdisciplinary nature of the programs and policies needed to solve the food and nutrition problems of low-income countries and communities. The planning of programs and the evaluation of alternate strategies designed to improve nutrition will be discussed using examples from particular countries.

**699 Special Topics in International Nutrition** Fall. 2 credits. S-U grades optional.

**703 Seminar in Nutritional Science** Fall or spring. 1 credit. S-U grades only.

Hours to be arranged. Division faculty.

**899 Master's Thesis and Research** Fall or spring. Credit to be arranged. S-U grades optional. Registration with permission of the chairperson of the graduate committee and the instructor.

Hours to be arranged. Division graduate faculty.

**999 Doctoral Thesis and Research** Fall or spring. Credit to be arranged. S-U grades optional. Registration with permission of the chairperson of the graduate committee and the instructor.

Hours to be arranged. Division graduate faculty.

## Officer Education

### Aerospace Studies Courses

#### Freshman Year

**AS 161 United States Military Forces in the Contemporary World** Fall and spring. 1 credit.  
1 class each week. W. C. McPeck

An introductory study of current United States military forces with emphasis on the analysis of the doctrine, mission, and organization of the United States Air Force. The Air Force's Strategic Air Command and the Navy's Fleet Ballistic Missile System are explored as elements of strategic offensive forces. Aircraft and missile defense is studied. A field trip to an Air Force SAGE Center is included.

**AS 162 United States Military Forces in the Contemporary World** Fall and spring. 1 credit.  
1 class each week. W. C. McPeck.

A study of the general purpose of the aerospace support forces of the United States, with emphasis on the mission, resources, and operation of tactical air forces. Included is an overview of defense organization and sources of power.

#### Sophomore Year

**AS 211 Development of Air Power** Fall and spring. 1 credit.  
1 class each week. W. C. McPeck.

The factors leading to the development of air power and the concepts and doctrine for the employment of air power studied. The course reviews the history of manned flight. The effects of World War I on the employment of airpower are studied and the struggle for the development of an independent air arm is analyzed. The course also examines the employment of airpower in World War II, including such topics as strategic bombing, tactical airpower, and the role of air superiority in warfare.

**AS 212 Development of Air Power** Fall and spring. 1 credit.

1 class each week. W. C. McPeck.  
The employment of the Air Force since World War II in military and nonmilitary operations to support national objectives is studied. The effects of technology on defense policy and strategy are analyzed. Quasi-military employment of the air arm in such activities as the Berlin Airlift and national and international relief missions in Asia, Africa, and the Americas is discussed. The role of airpower in the Korean conflict, the Cuban and Middle East crises, and the Vietnam War is examined from the viewpoint of technology and tactical doctrine.

#### Junior Year

**AS 361 National Security Forces in Contemporary American Society** Fall and spring. 3 credits.

3 classes each week. W. R. Williamson.  
The course will examine the functions and roles of the professional officer in a democratic society and how they relate to the socialization processes, prevailing public attitudes, and value orientations associated with professional military service. Throughout the course the students will make oral presentations on topics of contemporary military interest. The course will move to the study of the formulation of defense policy and will address political, economic, and social constraints. It will explore the requisites for maintaining adequate national security forces and assess the impact of technological and international developments upon strategic preparedness and the overall defense policymaking process.

**AS 362 National Security Forces in Contemporary American Society** Fall and spring. 3 credits.

3 classes each week. W. R. Williamson.  
This course will investigate basic contemporary nuclear strategy; its evolution, control, and future. It will examine alternatives to nuclear war including arms control, limited wars, wars of revolution, and insurgency. It will conclude by examining governmental processes and relationships that determine the contemporary military environment and provide a perspective for the future of defense policymaking in the United States.

#### Senior Year

**AS 431 Management and Leadership** Fall and spring. 3 credits.

3 classes each week. J. S. Levisky.  
Air Force management at the junior officer level is studied with the goal of understanding the basic concepts of management and the decision-making process in relation to the duties of the Air Force junior officer. Management fundamentals as they apply to the role of the Air Force junior officer are emphasized, including human motivation, individual and group behavior, organizational structure, planning and policymaking, communicating, and controlling. Case studies relating to military situations are used. Cadets are required to present oral and written reports.

**AS 432 Management and Leadership** Fall and spring. 3 credits.

3 classes each week. J. S. Levisky.  
Air Force leadership responsibilities at the junior officer level are studied in order to understand the responsibility, authority, and functions of the Air Force commander and his staff. Leadership research is emphasized covering the Trait Approach, the Situational Approach, the Interactional Approach, the Leader Variable, the Likert Leadership Model, the 3-D Leadership Model, and the Contingency Leadership Model. The function of the military law system as contained in the Uniform Code of Military Justice is covered, examining its similarities to and differences from civil law as they apply to the Air Force junior officer. Case study exercises are used to strengthen classroom learning for both the leadership and military law studies.

## Military Science Courses

#### Freshman Year (MS I)

**MS 101 United States Organization for Defense** Fall. 1 credit.

AROTC staff.  
This course allows the student an opportunity to examine the United States defense apparatus in terms of organization, mission, personnel, and interrelationships among military forces and between the military forces and various branches and departments of the government. The United States Army force structure is examined from the policymaking level in Washington to the role of the officer education programs on college and university campuses. The complexities and magnitude of operating the defense organization are dealt with, providing a framework for subsequent instruction.

**MS 131 Social and Organizational Psychology in the Military Environment** Spring. 1 credit.

AROTC staff.  
This course allows the student to develop a basic understanding and appreciation of the theories of social and organizational psychology and behavior as they apply to the military setting. Attention is given to leader types, the source and exercise of authority, and the impact of varying styles of leadership on motivation and organizational effectiveness. The student is introduced to the concepts of integrity, ethics, and professionalism. Demands upon

organizational leaders are discussed in terms of individual behavior, responsibility, self-discipline, span of control, and effective relationships with peers, superiors, and subordinates.

#### Sophomore Year (MS II)

**MS 211 Armed Conflict and Society** Fall. 3 credits.

Army and Navy ROTC staff and guest lecturers.  
A study of modern warfare that examines the relationship of military strategy to geography, economics, sociology, technology, and national political realities and values; the evolution of warfare including principles of war, weapons and associated equipment, and the effect of nuclear weapons and guerilla warfare on traditional concepts of national strategy.

**MS 221 Mapping: Theory and Practice** Spring. 2 credits.

Staff.  
The course provides the student with a practical knowledge of the various forms of topographic representation. The student develops, interprets, and utilizes maps in terrain association and land navigation. The student's knowledge of topography is complemented with an orientation on significant environmental influences from political, social, and climatic factors. Portions of the course emphasize practical experiences in land navigation and orienteering.

#### Junior Year (MS III)

**MS 332 Theory and Dynamics of the Military Team** Fall. 2 credits.

AROTC staff.  
After an initial introduction to techniques of presenting briefings, the student is provided with a broad understanding of the principles, fundamentals, and applications of team concept of military organizations. Particular emphasis is given to leadership responsibilities of the commander as the team coordinator. Additionally, the student is given an opportunity to develop an understanding of the roles and contributions of the various branches of the Army in support of the military team.

**MS 322 Leadership in Small Unit Operations** Spring. 2 credits.

AROTC staff.  
This course provides the student with an understanding of the nature of decision making and the tactical application of the military team. Through the use of conferences and extensive practical exercises, the student develops a familiarity with the factors influencing the leader's decisions, the processes of planning, coordinating, and directing the operations of military units to include troop-leading procedures, and development of operation plans and orders.

#### Senior Year (MS IV)

**MS 423 The Military as a Factor in United States World and Domestic Affairs** Fall. 1 credit.

AROTC staff and guest lecturers.  
Through lectures, seminars, and special research projects, the student is provided an overview of the various considerations and aspects of the military role in current United States foreign and domestic policy. Civilian and military lecturers will analyze the potential roles of the military in the United States' interaction with the nations of the world, the role of the military in American society, and society's influence on the military. This course constitutes the first portion of the semester's work and the student is required to register for both MS 423 and 424 (see below) during the fall.

**MS 424 Contemporary Military Environment** Fall. 2 credits.

AROTC staff.  
A detailed examination of the functions and activities

of military organizations, their commanders, and their staff. Discussion focuses on students' past experiences and future expectations in examining such aspects of the military environment as the chain of command, decision making, command and staff relations/actions, and the various elements of small unit administration. The AROTC student will register for both MS 423 and MS 424 during this semester.

#### **MS 461 Contemporary Military**

**Environment** Spring. 2 credits. Prerequisite: MS 424. AROTC staff.

As a continuation of the material presented in MS 424, the student is provided the opportunity to examine carefully the leadership environment he will enter as an Army officer. Conferences and seminars are used to examine the techniques of effective military leadership, the sociological and psychological environment of the present military, the nature of military law, and above all, the professional ethics, responsibilities, and obligations of an Army officer.

## Naval Science Courses

### Freshman year

**NS 101 Fundamentals of Naval Science** Fall. Noncredit.

1 class each week. Navy staff.

A study of fundamental aspects of naval science including its conceptual contributions to sea power, factors involved in the physical development of naval forces, resources which must be managed, and prospects for the future.

**M&AE 101 Naval Ship Systems** Spring. 3 credits. 3 classes each week. R. L. Wehe.

The course is an introduction to primary ship systems and their interrelationship. Basic principles of propulsion, control, internal communications, structure, and other marine systems are considered.

### Sophomore Year

**MS 211 Armed Conflict and Society** Fall. 3 credits.

Joint presentation by army and navy staffs with guest lecturers from government and history departments.

A study of modern warfare which examines the relationship of military strategy to geography, economics, sociology, technology, and national political realities and values; the evolution of warfare including principles of war, weapons and associated equipment, and the effects of nuclear weapons and guerilla warfare on traditional concepts of national strategy.

**NS 201 Seapower-Maritime Affairs** Spring. 1 credit.

1 seminar weekly. Navy staff.

The seminar discussions explore the meaning and modern applicability of seapower concepts, including such components as naval power, ocean science, ocean industry, ocean commerce, and international law.

### Junior Year (Navy)

**C&EE 153 Principles of Navigation** Fall. 4 credits.

4 classes each week (lecture recitation-project work).

The course covers coordinate systems, chart projections, navigational aids, instruments, compass observations, tides and currents, and soundings. It also includes celestial navigation, time, spherical trigonometry, motion of the stars and sun, star identification, position fixing, use of the nautical almanac, and electronic navigation.

**NS 321 Naval Operations Analysis** Spring. 3 credits.

3 classes each week. Navy staff.

The course covers processes of planning and executing naval operations and review of the principles of probability, two-person zero-sum game theory, and mathematical models of detection theory. It also includes examination of sensors, weapons, and supportive elements and their application in naval operations. Practical work in planning and coordination of operations is given, and the course concludes with a problem in which opposing student teams plan a typical naval operation and write an operation order.

### Senior Year (Navy)

**NS 451 Naval Weapons System** Fall. 3 credits. 3 classes each week (lecture-recitation). Navy staff.

A primarily descriptive course dealing with the function, importance, capabilities, design, and development of naval weapons systems. Subject material covers such topics as military capabilities of major political powers, arms limitation, Department of Defense budgetary considerations, and a detailed analysis of representative naval fire control systems including detection and evaluation systems, weapons command and control, delivery systems, and ordnance.

**NS 431 Naval Organization and Management** Spring. Noncredit.

1 class each week. Navy staff.

Discussions cover organizational theory and functions of management pertinent to the naval environment and the structure of naval organization. Theories and findings from the behavioral sciences relevant to leadership are explored, with particular emphasis on self-development and individual responsibility.

### Senior Year (Marine Corps)

**NS 311 Amphibious Warfare** Spring. 3 credits. 3 classes each week (lecture-recitation). Marine Corps staff.

The course covers the development, theory, techniques, and conduct of amphibious operations beginning with Gallipoli in 1915. Special emphasis is placed upon amphibious operations conducted in the central Pacific during World War II.

# New York State College of Veterinary Medicine

## Anatomy

- 500 Gross Anatomy (fall)
- 501 Gross Anatomy (spring)
- 502 Developmental and Microscopic Anatomy
- 503 Microscopic Anatomy
- 504 Neuroanatomy
- 505 Applied Anatomy (fall)
- 506 Applied Anatomy (spring)
- 600 Special Projects in Anatomy
- 601 Advanced Anatomy
- 602 Advanced Clinical Neurology
- 700 Vertebrate Morphology
- 701 Comparative Anatomy of the Digestive System

## Avian and Aquatic Animal Medicine

- 255 Poultry Hygiene and Disease
- 555 Avian Diseases
- 670 Special problems in Avian Diseases
- 671 Diseases of Aquatic Animals
- 770 Advanced Work in Avian Diseases

## Clinical Courses

- 568 Veterinary Medical Orientation (fall)
- 569 Veterinary Medical Orientation (spring)
- 571 Clinical Pathology
- 572 Senior Seminar
- 573 Large Animal Clinic (fall)
- 574 Large Animal Clinic (spring)
- 575 Ambulatory Clinic (fall)
- 576 Ambulatory Clinic (spring)
- 577 Ancillary Clinics (fall)
- 578 Ancillary Clinics (spring)
- 579 General Medicine
- 589 Small Animal Medical Clinic (fall)
- 590 Small Animal Medical Clinic (spring)
- 591 Small Animal Surgical Clinic (fall)
- 592 Small Animal Surgical Clinic (spring)
- 593 Ophthalmology, Anesthesiology, and Neurology Clinic
- 594 Large Animal Medical Clinic
- 595 Rotation Clinic

## Large Animal Medicine, Obstetrics, and Surgery

- 475 Health and Diseases of Animals
- 560 Clinical Methods
- 561 Obstetrics and Reproductive Diseases (spring)
- 562 Obstetrics and Reproductive Diseases (fall)
- 563 Large Animal Medicine (fall)
- 564 Large Animal Medicine (spring)
- 565 Large Animal Surgery
- 566 Radiology
- 567 Clinical Nutrition
- 675 Special Problems in Large Animal Medicine
- 676 Special Problems in Large Animal Surgery
- 677 Special Problems in Large Animal Obstetrics
- 678 Mechanics of Biological Material and Systems
- 679 Dairy Herd Health
- 680 Poisonous Plants
- 681 Horse Health Management
- 682 Large Animal Internal Medicine
- 683 Veterinary Practice Management
- 684 Horse Lameness
- 685 Equine Locomotion and Lameness
- 775 Advanced Work
- 776 Urogenital Surgery of the Horse
- 777 Surgery of the Digestive System of the Horse
- 778 Gastroenterology Conference
- 779 Veterinary Gastroenterology
- 780 Veterinary Research Methods

## Microbiology

- 315 Basic Immunology Lectures
- 316 Pathogenic Microbiology
- 317 Pathogenic Microbiology Laboratory
- 515 Veterinary Immunology
- 516 Veterinary Bacteriology
- 517 Veterinary Virology
- 518 Veterinary Mycology and Protozoology
- 519 Epidemiology and Infectious Diseases
- 520 Applied Microbiology and Preventive Medicine
- 605 Special Projects in Microbiology
- 606 Small Animal Infectious Diseases
- 607 Virus Diseases of Cattle

- 608 Advanced Epidemiology
- 705 Advanced Immunology Lectures
- 706 Advanced Immunology Laboratory
- 707 Advanced Work in Bacteriology, Virology, or Immunology
- 708 Advanced Animal Virology Lectures
- 709 Advanced Animal Virology Laboratory
- 710 Microbiology Seminar
- 711 Laboratory Methods of Diagnosis
- 712 Immunopathology and Clinical Immunology

## Pathology

- 330 Introductory Parasitology and Symbiology
  - 440 Parasitic Helminthology
  - 535 General Pathology
  - 536 Special Pathology
  - 537 Veterinary Parasitology
  - 538 Applied Parasitology
  - 539 Introduction to Laboratory Animal Medicine
  - 635 Special Problems in Pathology
  - 636 Wildlife Pathology
  - 637 Postmortem Pathology
  - 638 Microscopy
  - 735 Pathology Seminar
  - 736 Pathology of Nutritional Diseases
  - 737 Advanced Work in Animal Parasitology
  - 738 Laboratory Methods of Diagnosis
  - 739 Advanced Work in Pathology
  - 740 Reproductive Pathology
  - 741 Care and Management of Laboratory Animals
  - 742 Ultrastructural Pathology
  - 743 Gastroenteric Pathology
  - 744 Diseases of Laboratory Rodents and Rabbits
  - 745 Diseases of Nonhuman Primates
  - 746 Comparative Pathology
  - 747 Laboratory Animal Genetics
  - 748 Laboratory Animal Seminar
  - 749 Laboratory Animal Clinical Rotation
- ## Physical Biology
- 345 Elementary Animal Physiology
  - 346 Introductory Animal Physiology
  - 347 Introductory Physical Biology
  - 348 Introductory Animal Physiology Laboratory
  - 445 Sensory Function

## 210 Veterinary Medicine

- 446 Sensory Function Laboratory
- 550 Applied Radiation Biology and Veterinary Nuclear Medicine
- 650 Special Projects in Physical Biology
- 651 Veterinary Statistics
- 652 Applied Electrophysiology
- 653 Clinical and Research Techniques in Veterinary Nuclear Medicine
- 654 Special Topics in Mineralized Tissues
- 750 Radioisotopes in Biological Research
- 751 Biological Effects of Radiation
- 752 Biological Membranes and Nutrient Transfer
- 753 Functional Organization of the Mammalian Nervous System
- 755 Physical Biology Graduate Seminar
- 756 Seminar—Special Topics in Physical and Radiation Biology
- 757 Experimental Physiology for Graduate Students
- 758 Graduate Seminar—Molecular Mechanisms of Hormone Action

### Physiology, Biochemistry, and Pharmacology

- 525 Vertebrate Biochemistry
- 526 Physiology for Veterinary Students (spring)
- 527 Physiology for Veterinary Students (fall)
- 528 Basic Pharmacology
- 529 Clinical Pharmacology
- 620 Special Projects in Physiology
- 621 Toxicology
- 622 Special Projects in Pharmacology
- 625 Vertebrate Biochemistry Lectures
- 626 Veterinary Animal Behavior
- 627 Acid-Base Relations
- 720 Special Problems in Physiology
- 721 Research
- 722 Methods in Gastroenterological Research
- 723 Comparative Gastroenterology
- 724 Physiologic Disposition of Drugs and Poisons
- 725 Basic Concepts in Pharmacokinetics
- 726 Physiology (spring)
- 727 Physiology (fall)

### Small Animal Medicine and Surgery

- 583 Small Animal Medicine (fall)
- 584 Small Animal Medicine (spring)
- 585 Small Animal Surgery

- 586 Small Animal Surgical Exercises
- 587 General Surgery
- 588 Small Animal Ophthalmology
- 688 Special Problems in Small Animal Medicine
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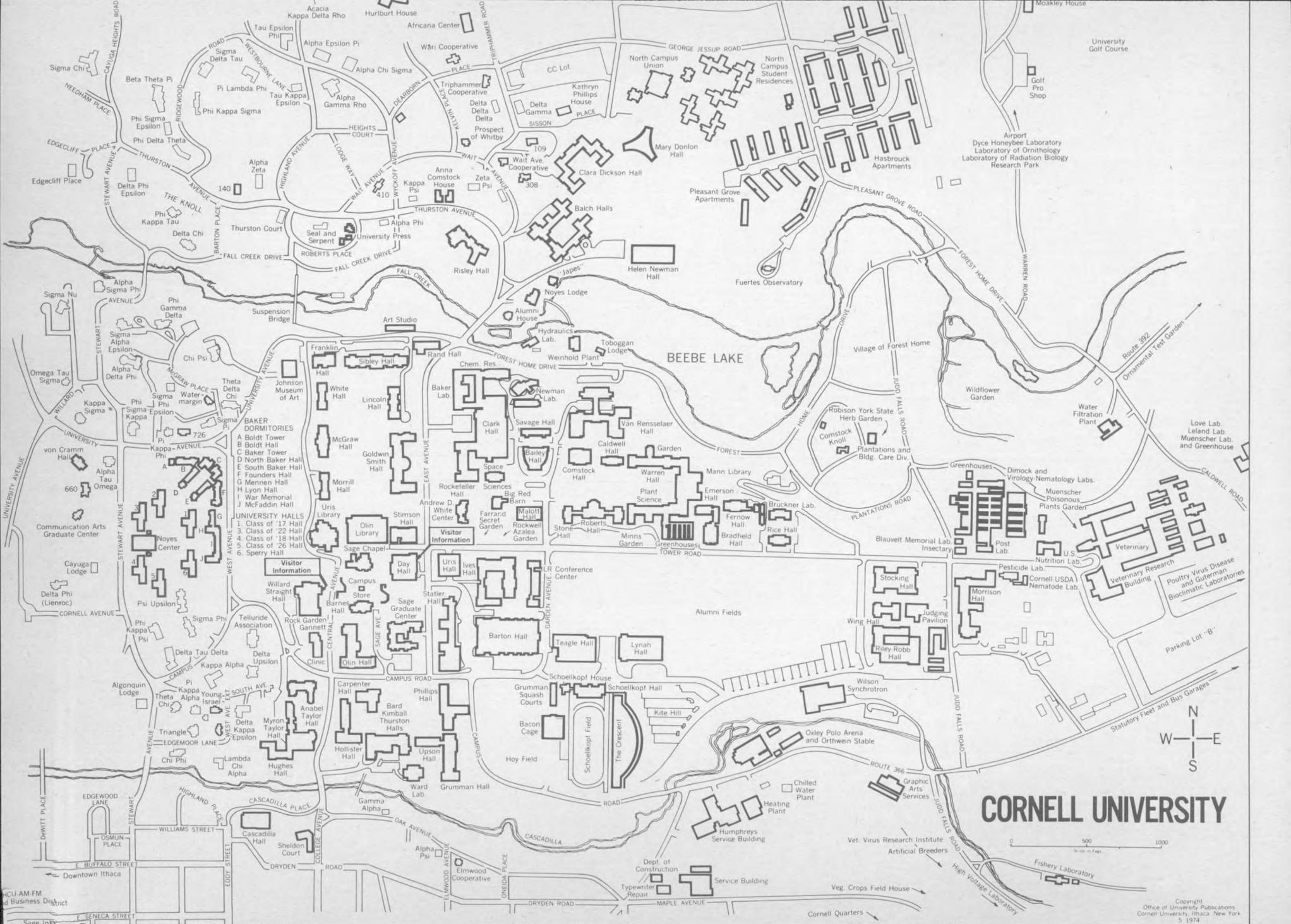
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