

**Perspectives on Agriculture and the Environment ..... 13**

- Plant Sciences 1 ..... 3
- Plant Sciences 2 ..... 4
- Applied Biological Systems Technology 49 ..... 2
- Animal Science 1 or 2 ..... 4

**Preparatory Subject Matter ..... 41-43**

- Biological Sciences 1A-1B ..... 10
- Chemistry 2A-2B ..... 10
- Physics 1A-1B or Physics 7A-7B ..... 6-8
- Mathematics 16A ..... 3
- Plant Sciences 21 ..... 3
- Plant Sciences 120 or Statistics 13 or 102 ..... 4
- Economics 1A ..... 5

**Breadth/General Education ..... 24**

See General Education requirement.

**Depth Subject Matter ..... 17-18**

- Plant Sciences 150 or Environmental Science and Policy 100 or Plant Biology 117 or 142 ..... 4
- Agricultural and Resource Economics 112 or 113 or 140 ..... 4-5
- Plant Sciences 101 ..... 3
- Plant Sciences 92, 99, or 137, or Applied Biological Systems Technology 145, or International Agricultural Development 195A, 195B ..... 3
- Plant Sciences 192, 199 ..... 3

**Area of Specialization (choose one):**

**Sustainable Production Systems ..... 54-58**

Includes food and agricultural production, agroecology, crop improvement, propagation, and pest management. Students may choose between a broad education in sustainable agriculture or focus on one or two areas of agriculture (e.g., agricultural management, agronomy, crop improvement, environmental horticulture, pest management, pomology, vegetable crops, viticulture).

Crop biology and ecology depth requirement must be met with Plant Biology 142.

- Plant Biology 152 or Biological Sciences 101 ..... 4
- Chemistry 8A, 8B ..... 6
- Plant Sciences 105 ..... 3
- Soil Science 100 ..... 5
- Select courses from Plant Sciences 107, 110A, 110B, 110C, 112, 134, 135, 150, 160, 170A, 170B; Environmental Horticulture 120, 125, 130, 133; Plant Biology 173, 174; Viticulture and Enology 101A, 101B, 101C, 111, 115 ..... 12-16
- Restricted elective courses chosen from the following groups with approval of the academic adviser ..... (minimum 24 units)
- Plant improvement and propagation*  
(Plant Sciences 118; Biotechnology 171; Plant Biology 143, 152, 153, 154, 160, 171)
- Plant physiology or plant nutrition*  
(Environmental Horticulture 102; Plant Biology 111, 146, 157, 158, 172; Viticulture and Enology 110)
- Atmospheric, soil or water science*  
(Atmospheric Science 133; Environmental and Resource Sciences 100; Hydrologic Science 110, 124; Soil Science 107, 109, 111)
- Pest ecology and management*  
(Plant Biology 176; Entomology 110, 135; Nematology 100; Plant Pathology 120; Viticulture and Enology 118)
- Agricultural economics*  
(Agricultural and Resource Economics 100A, 120, 130, 147; International Agricultural Development 110)
- Agricultural management*  
(Agricultural and Resource Economics 100B, 140, 145, 150, 157; Applied

- Biological Systems Technology 142, 147; Plant Sciences 121)

*Animal production*

- (Animal Science 41, 41L, 104)
- Policy, social science and ethics*  
(Agricultural and Resource Economics 147, 176; Plant Sciences 121; Environmental Science and Policy 161, 175; International Agricultural Development 103, 104; Plant Pathology 140; Political Science 107)
- Unrestricted Electives ..... 12-23

**Range and Natural Resources ..... 49-54**

This specialization brings together courses that provide a unified understanding of the interaction between livestock production and environmental quality in rangelands.

- Plant Sciences 112, 121, 130, 131, 134, 135, Plant Biology 102 or 145 ..... 21-23
- Soil Science 100 ..... 5
- Environmental and Resource Sciences 100 or 121 or Hydrologic Science 141 or 143 ..... 4
- Wildlife, Fish, and Conservation Biology 110, 111, 120, 151 ..... 6-7
- Animal Science 41, Nutrition 115 ..... 6
- Plant Sciences 180, Applied Biological Systems Technology 180, 182, Environmental and Resource Sciences 186, or Hydrologic Science 182 ..... 3-5
- Environmental Science and Policy 172 ..... 4
- Unrestricted Electives ..... 17-29

**Total Units for the Major ..... 180**

**Major Adviser.** T. Foin (*Plant Sciences*)

**Advising Center** located in 1220A Plant and Environmental Sciences (530) 752-1715.

**Minor Program Requirements:**

UNITS

**Agricultural Systems and Environment ..... 18-19**

- Preparatory material: Statistics 13, 32, Plant Sciences 120 or Sociology 42B, or the equivalent.
- Select one of the two following tracks:
- Sustainable Agriculture track*  
Plant Sciences 105, 150, Plant Biology 142, Soil Science 100 ..... 16
- Minimum of three units from the following:  
Plant Sciences 107, 110A, 110B, 110C, 112, 170A, 170B ..... 3
- Range and Natural Resources track*  
Plant Sciences 121, 130 ..... 7
- Minimum of 11 units from the following:  
Plant Sciences 131, 134, 135, 150, Environmental Science and Policy 123, 172 ..... 11

**Minor Advisers.** T.C. Foin (*Plant Sciences*), K.J. Rice (*Plant Sciences*)

**Advising Center** is located in 1220A Plant and Environmental Sciences (530) 752-1715.

**Honors.** The Senior Honors Thesis (Plant Sciences 194H) includes two or three successive quarters of guided, scientific and/or scholarly research on an agricultural and/or environmental subject of special interest to the student. With adviser approval, the Senior Thesis can satisfy up to 12 units of restricted electives in the major.

**Courses.** See Plant Sciences, on page 419.

## Agricultural and Managerial Economics

**See Managerial Economics, on page 338.**

## Agricultural and Resource Economics

(College of Agricultural and Environmental Sciences)

Richard E. Howitt, Ph.D., Chairperson of the Department

**Department Office.** 2118 Social Sciences and Humanities Building (530) 752-1517

Undergraduate Student Information, 1176 Social Sciences and Humanities Building (530) 754-9536; <http://www.agecon.ucdavis.edu>

Graduate Student Information, 1176 Social Sciences and Humanities Building (530) 752-6185; <http://www.agecon.ucdavis.edu>

### Faculty

- Julian M. Alston, Ph.D., Professor
- Stephen R. Boucher, Ph.D., Assistant Professor
- Hoy F. Carman, Ph.D., Professor
- Colin A. Carter, Ph.D., Professor
- James A. Chalfant, Ph.D., Professor
- Y. Hossein Farzin, Ph.D., Professor
- Rachael Goodhue, Ph.D., Associate Professor
- Richard D. Green, Ph.D., Professor
- Arthur Havenner, Ph.D., Professor
- Richard E. Howitt, Ph.D., Professor
- Lovell S. Jarvis, Ph.D., Professor
- Douglas M. Larson, Ph.D., Professor
- Philip L. Martin, Ph.D., Professor
- Catherine J. Morrison Paul, Ph.D., Professor
- Quirino Paris, Ph.D., Professor
- Scott Rozelle, Ph.D., Professor
- Richard J. Sexton, Ph.D., Professor
- Aaron D. Smith, Ph.D., Assistant Professor
- Daniel A. Sumner, Ph.D., Professor
- J. Edward Taylor, Ph.D., Professor
- James E. Wilen, Ph.D., Professor
- Jeffrey Williams, Ph.D., Professor

### Emeriti Faculty

- Oscar R. Burt, Ph.D., Professor Emeritus
- Harold O. Carter, Ph.D., Professor Emeritus
- Benjamin C. French, Ph.D., Professor Emeritus
- B. Delworth Gardner, Ph.D., Professor Emeritus
- Dale M. Heien, Ph.D., Professor Emeritus
- Warren E. Johnston, Ph.D., Professor Emeritus
- Gordon A. King, Ph.D., Professor Emeritus
- Sylvia Lane, Ph.D., Professor Emerita
- Elmer W. Learn, Ph.D., Professor Emeritus
- Samuel H. Logan, Ph.D., Professor Emeritus
- Alexander F. McCalla, Ph.D., Professor Emeritus
- Chester O. McCorkle, Jr., Ph.D., Professor Emeritus
- Refugio I. Rochin, Ph.D., Professor Emeritus
- Lawrence E. Shepard, Ph.D., Senior Lecturer SOE Emeritus
- Stephen H. Sosnick, Ph.D., Professor Emeritus

### Affiliated Faculty

- Richard Alcauskas, J.D., Lecturer
- Steven Blank, Ph.D., Lecturer
- Garland L. Brinkley, Ph.D., Lecturer
- Bayford D. Butler, M.S., Lecturer
- Leslie J. Butler, Ph.D., Lecturer
- John Constantine, Ph.D., Lecturer
- Roberta L. Cook, Ph.D., Lecturer
- Shermain Hardesty, Ph.D., Lecturer
- Desmond A. Jolly, Ph.D., Lecturer
- Karen Klonsky, Ph.D., Lecturer
- Richard Kleeberg, J.D., Lecturer
- Hyunok Lee, Ph.D., Lecturer
- Ralph Pavey, B.S., Lecturer
- Stephen A. Vosti, Ph.D., Adjunct Professor
- Marilyn Whitney, Ph.D., Lecturer

**Major Program and Graduate Study.** See the major in Managerial Economics, on page 338; and for graduate study, see Graduate Studies, on page 97 in this catalog.

**Major Advisers.** Contact Student Services office in 1176 Social Sciences and Humanities Building for a complete listing.

**Related Courses.** See Environmental Biology and Management 110; Environmental Science and Policy 160, 168A, 168B, 173; and courses in Economics.

## Courses in Agricultural and Resource Economics (ARE)

### Lower Division Courses

#### 1. Economic Basis of the Agricultural Industry (4)

Lecture—4 hours. Agriculture and man; the agricultural industry in U.S. and world economies; production and supply, marketing and demand; agricultural land, capital and labor markets; economic and social problems of agriculture in an urban and industrialized economy emphasizing California. GE credit: SocSci.

#### 15. Economic Basis of the Agricultural Industry (4)

Lecture—4 hours. Agriculture and man; the agricultural industry in Australia and world economies; production and supply, marketing and demand; agricultural land, capital and labor markets; economic and social problems of agriculture in an urban and industrialized economy emphasizing Australia. Taught in Australia under the supervision of a UC Davis faculty member. Not open for credit to students who have completed course 1. Not offered every year.—Alston

#### 15. Population, Environment and World Agriculture (4)

Lecture—3 hours; discussion—1 hour. Economic analysis of interactions among population, environment, natural resources and development of world agriculture. Introduces students to economic thinking about population growth, its causes and consequences for world food demand, and environmental and technological limits to increasing food supplies. GE credit: SocSci, Div, Wrt.—III. (I.)

#### 18. Business Law (4)

Lecture—4 hours. Prerequisite: sophomore standing. General principles of business law in the areas of contracts, business organization, real property, uniform commercial code, sales, commercial paper, employment relations, and creditor-debtor against a background of the history and functioning of our present legal system.—I, II, III, IV. (I, II, III, IV.)

#### 98. Directed Group Study (1-5)

Prerequisite: consent of instructor. (P/NP grading only.)

#### 99. Special Study for Undergraduates (1-5)

Prerequisite: consent of instructor. (P/NP grading only.)

### Upper Division Courses

#### 100A. Intermediate Microeconomics: Theory of Production and Consumption (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: Economics 1A, 1B; Mathematics 16B. Theory of individual consumer and market demand; theory of production and supply of agricultural products, with particular reference to the individual firm; pricing, output determination, and employment of resources under pure competition. (Not open for credit to students who have completed Economics 100 or the equivalent; however, Economics 100 will not serve as prerequisite to course 100B.)—I, II, III. (I, II, III.)

#### 100B. Intermediate Microeconomics: Imperfect Competition, Markets and Welfare Economics (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: course 100A. Pricing, output determination, and employment of resources under conditions of monopoly, oligopoly, and monopolistic competition.—I, II, III. (I, II, III.)

#### 106. Quantitative Methods in Agricultural Economics (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: course 100A, Statistics 103. Statistical methods for analyzing quantitative agricultural economics data: linear and multiple correlation and regression analysis.—I, II, III. (I, II, III.)

#### 112. Fundamentals of Business Organization (4)

Lecture—2 hours; discussion—2 hours. Prerequisite: upper division standing or consent of instructor. The role of organizational design and behavior in business and public agencies. Principles of planning, decision making; individual behavior, motivation, leadership; informal groups; conflict and change in the organization.—I, III. (I, III.)

#### 113. Fundamentals of Marketing Management (4)

Lecture—4 hours. Prerequisite: Economics 1A. For non-majors only. Nature of product marketing by the business firm. Customer-product relationships, pricing and demand; new product development and marketing strategy; promotion and advertising; product life cycles; the distribution system; manufacturing, wholesaling, retailing. Government regulation and restraints. (Not open for credit to students who have completed course 136.)—I. (I.)

#### 115A. Economic Development (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: Economics 1A and 1B. Major issues encountered in emerging from international poverty, problems of growth and structural change, human welfare, population growth and health, labor markets and internal migration. Important issues of policy concerning international trade and industrialization. (Same course as Economics 115A.) GE credit: SocSci, Div.—I, II, III. (I, II, III.)

#### 115B. Economic Development (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: Economics 1A and 1B. Macroeconomic issues of developing countries. Issues include problems in generating capital, conduct of monetary and fiscal policies, foreign aid and investment. Important issues of policy concerning international borrowing and external debt of developing countries. (Same course as Economics 115B.) GE credit: SocSci.—II, III. (II, III.)

#### 118. Tax Accounting (4)

Lecture—4 hours. Prerequisite: Management 11A, 11B; course 18 recommended. Development and application of a framework to understand the tax effects of typical management decisions on both entities and their owners. Impacts that different methods of taxation have on business entities with emphasis on tax planning, using income and deduction strategies, retirement plans, and choice of business entity for tax minimization.—III. (III.)

#### 120. Agricultural Policy (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: course 100A or the equivalent. Analytical treatment of historical and current economic problems and governmental policies influencing American agriculture. Uses of economic theory to develop historical and conceptual understanding of the economics of agriculture; how public policy influences the nature and performance of American agriculture. GE credit: SocSci.—III. (III.)

#### 120S. Agricultural Policy (4)

Lecture—4 hours. Prerequisite: course 100A or consent of instructor. Analytical treatment of historical and current economic problems and governmental policies influencing agriculture. Uses of economic theory to develop historical and conceptual understanding of the economics of agriculture; how public policy influences the nature and performance of agriculture. Taught in Australia under the supervision of a UC Davis faculty member. Not open for credit to students who have completed course 120. Not offered every year.—Alston

#### 130. Agricultural Markets (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: course 100A. The nature, function, organizational structure, and operation of agricultural markets; prices, costs, and margins; market information, regulation, and controls; cooperative marketing.—III. (III.)

#### 132. Cooperative Business Enterprises (3)

Lecture—3 hours. Prerequisite: Economics 1A. Study of cooperative business enterprise in the United States and elsewhere; economic theories of behavior, principles of operation, finance, decision-making, and taxation.—III. (III.)

#### 135. Agribusiness Marketing Plan Development (2)

Lecture/discussion—2 hours. Prerequisite: upper division standing. Fundamental components required to develop a marketing plan. Appreciation of the concept of a marketing plan, appropriate research required, including the use of library and Internet, survey and interview instruments, government documents, market analysis, business proposition, action planning, financial evaluation and monitoring. (P/NP grading only.)—I. (I.)

#### 136. Managerial Marketing (4)

Lecture—4 hours. Prerequisite: course 100A; Statistics 103. Application of economic theory and statistics in the study of marketing. Marketing measurement and forecasting, market planning, market segmentation, determination of optimal product market mix, sales and cost analysis, conduct of marketing research, marketing models and systems.—II, III. (II, III.)

#### 138. International Commodity and Resource Markets (3)

Lecture—3 hours. Prerequisite: course 100A, Economics 100 or 104. Basic nature and scope of international trade in agricultural commodities, agricultural inputs, and natural resources. Market dimensions and policy institutions. Case studies to illustrate import and export problems associated with different regions and commodities.—II. (II.)

#### 139. Futures and Options Markets (3)

Lecture—3 hours. Prerequisite: course 100A; Statistics 103. History, mechanics, and economic functions of futures and options markets; hedging; theory of intertemporal price formation and behavior of futures and options prices; price forecasting; futures and options as policy tools.—I. (I, III.)

#### 140. Farm Management (5)

Lecture—5 hours. Prerequisite: Economics 1A. Farm organization and resources; economic and technological principles in decision making; analytical techniques and management control; problems in organizing and managing the farm business.

#### 142. Personal Finance (3)

Lecture—3 hours. Prerequisite: Economics 1B. Management of income and expenditures by the household. Use of consumer credit, savings, and insurance by households. Principles of tax, retirement, and estate planning.—I, II, IV. (I, II, IV.)

#### 143. Investments (3)

Lecture—3 hours. Prerequisite: course 142 or consent of instructor. Survey of investment institutions, sources of investment information, and portfolio theory. Analysis of the stock, bond and real estate markets from the perspective of the investor.—II. (II.)

#### 144. Real Estate Economics (3)

Lecture—3 hours. Prerequisite: course 100A. The economic theory, analysis, and institutions of real estate markets and related financial markets. Case studies drawn from the raw land, single family, multi-family, industrial and office real estate markets.—III. (III.)

#### 145. Farm and Rural Resources Appraisal (4)

Lecture/discussion—4 hours. Principles, procedures, and practice of the valuation process with specific emphasis placed on farm real estate. Concepts of value, description of land, identification of the major physical and economic determinants of value, the three primary appraisal approaches to valuation, discussion of appraisal activity and practice.—II. (II.)

#### 146. Government Regulation of Business (3)

Lecture—3 hours. Prerequisite: course 100A or the equivalent. Variety, nature and impact of government regulation: anti-trust laws and economic and

social regulation. Nature of the legislative process, promulgation of regulations, and their impact, especially as analyzed by economists. GE credit: SocSci.—I. (I.)

#### 147. Resource and Environmental Policy Analysis (3)

Lecture—3 hours. Prerequisite: Economics 1A; enrollment open to non-majors only. Natural resource use problems with emphasis on past and current policies and institutions affecting resource use; determinants, principles, and patterns of natural resource use; property rights; conservation; private and public resource use problems; and public issues. (Students who have had or are taking course 100A, Economics 100, or the equivalent, may receive only 2 units of credit, so must enroll in course 147M instead.) GE credit: SocSci.—III. (III.)

#### 147M. Resource and Environmental Policy Analysis (2)

Lecture—3 hours. Prerequisite: Economics 1A; enrollment open to non-majors only. Natural resource use problems with emphasis on past and current policies and institutions affecting resource use; determinants, principles, and patterns of natural resource use; property rights; conservation; private and public resource use problems; and public issues. (Students who have had or are taking course 100A, Economics 100, or the equivalent, must enroll in this course (for 2 units) rather than course 147.)—III. (III.)

#### 150. Agricultural Labor (4)

Lecture—3 hours; discussion—1 hour. Importance of family and hired labor in agriculture; farm labor market; unions and collective bargaining in California agriculture; simulated collective bargaining exercise; effects of unions on farm wages and earnings. GE credit: SocSci, Div, Wrt.—I. (I.)

#### 155. Quantitative Analysis for Business Decisions (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: course 100A; Statistics 103. Introduction to selected topics in management science and operations research: decision analysis for management, mathematical programming, competitive analysis, and others.—I, II, III. (I, II, III.)

#### 156. Introduction to Mathematical Economics (4)

Lecture—4 hours. Prerequisite: courses 100A and 155; Mathematics 16C or 21C recommended (students should note that the formal mathematical content of this course is higher than other courses in the curriculum). Linear algebra for economists; necessary and sufficient conditions in static optimization problems; implicit function theorem; economic methodology and mathematics; comparative statics; envelope theorem; Le Chatelier principle; applications to production and consumer models.—I. (I.)

#### 157. Analysis for Production Management (4)

Lecture—4 hours. Prerequisite: course 100A; Statistics 103. Application of economic theory and quantitative methods in analyzing production management problems including inventory control, production scheduling, quality control, simulation, systems approach, and work measurement.—II, III. (II, III.)

#### 171A. Financial Management of the Firm (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: course 106; Management 11A-11B. Financial analysis at the firm level: methods of depreciation; influence of the tax structure; inventory, cash, and accounts receivable management; sources of short-term and long-term financing, and financial problem solving using a computer spreadsheet program. Not open for credit to students who have completed Economics 134.—I, II. (I, II.)

#### 171B. Financial Management of the Firm (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: course 171A. Financial analysis at the firm level: methods of capital budgeting; calculating the cost of capital; dividend policies; mergers and acquisitions; and special current topics in finance.—II, III. (II, III.)

#### 175. Natural Resource Economics (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: course 100B or Economics 100 or the equivalent. Economic concepts and policy issues associated with natural resources, renewable resources, (ground water, forests, fisheries, and wildlife populations) and non-renewable resources (minerals and energy resources, soil). (Same course as Environmental Science and Policy 175.) GE Credit: SocSci.—I. (I.)

#### 176. Environmental Economics (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: course 100B or Economics 100. Role of the environment in economic activity and methods for protecting and enhancing environmental quality; implications of market failures for public policy; design of environmental policy; theory of welfare measurement; measuring the benefits of environmental improvement. GE credit: SocSci.—II. (II.)

#### 192. Internship (1-6)

Internship—3-18 hours. Internship experience off and on campus in all subject areas offered in the Department of Agricultural and Resource Economics. Internships are supervised by a member of the staff. (P/NP grading only.)

#### 194HA-194HB. Special Study for Honors Students (4-4)

Independent Study—3 hours; seminar—1 hour. Prerequisite: Minimum GPA of 3.500; course 100B; courses 106 and 155 (may be taken concurrently); major in Agricultural and Managerial Economics or Managerial Economics; senior standing. A program of research culminating in the writing of a senior honors thesis under the direction of a faculty adviser. (Deferred grading only, pending completion of sequence.)—I, II. (I, II.)

#### 197T. Tutoring in Agricultural Economics (1-3)

Hours and duties will vary depending upon the course being tutored. Prerequisite: senior standing in Agricultural and Resource Economics and consent of Department Chairperson. Tutor will lead small discussion groups affiliated with one of the department's regular courses, under the supervision of, and at the option of the instructor in charge of the course. (P/NP grading only.)

#### 198. Directed Group Study (1-5)

Prerequisite: consent of instructor. (P/NP grading only.)

#### 199. Special Study for Advanced Undergraduates (1-5)

Prerequisite: consent of instructor. (P/NP grading only.)

### Graduate Courses

#### 200A. Microeconomic Theory (5)

Lecture—4 hours; discussion—1 hour. Prerequisite: graduate standing. Linear and non-linear optimization theory applied to develop the theory of the profit-maximizing firm and the utility-maximizing consumer. (Same course as Economics 200A.)—I. (I.)

#### 200B. Microeconomic Theory (5)

Lecture—4 hours; discussion—1 hour. Prerequisite: course 200A. Characteristics of market equilibrium under perfect competition, simple monopoly and monopsony. Emphasis on general equilibrium and welfare economics; the sources of market success and market failures. (Same course as Economics 200B.)—II. (II.)

#### 200C. Microeconomic Theory (5)

Lecture—4 hours; discussion—1 hour. Prerequisite: course 200B. Uncertainty and information economics. Individual decision making under uncertainty. Introduction to game theory, with emphasis on applications to markets with firms that are imperfect competitors or consumers that are imperfectly informed. (Same course as Economics 200C.)—III. (III.)

#### 202A. Introduction to Applied Research Methods (3)

Lecture/discussion—3 hours. Prerequisite: courses 204A and 256, or the equivalent; course 200A concurrently. Study of philosophy and methodology of

applied research in agricultural economics. Methods of conceptualization of researchable topics. Method of communication and constructive criticism.—I. (I.)

#### 202B. Applied Microeconomics I: Consumer and Producer Behavior (3)

Lecture/discussion—3 hours. Prerequisite: courses 200A and 202A; course 200B concurrently. Application of consumer and producer theory in models of individual behavior and market-level phenomena. Implications of consumer and producer theory for specification of empirical models of supply and demand for inputs and outputs and market equilibrium displacement models.—II. (II.)

#### 202C. Applied Microeconomics II: Welfare Analysis and Imperfect Competition (3)

Lecture/discussion—3 hours. Prerequisite: course 202B; course 200C concurrently. Methods of applied welfare economics with emphasis on problems arising in agriculture and the environment. Models of imperfectly competitive markets and their application to industries and institutions in the agricultural sector.—III. (III.)

#### 204A. Microeconomic Analysis I (4)

Lecture—4 hours. Prerequisite: course 100B or Economics 100; advanced undergraduates with consent of instructor. Behavior of consumers and producers and their interactions; tools and methods needed to analyze economic behavior in the marketplace. Application of those methods to real-world problems.—I. (I.) Paul

#### 204B. Microeconomic Analysis II (4)

Lecture—4 hours. Prerequisite: course 204A or consent of instructor. Behavior in imperfectly competitive markets—monopoly and price discrimination; oligopoly. Introduction to noncooperative game theory. Analysis of decisions made under risk and uncertainty and imperfect information. The economics of externalities and public goods.—II. (II.) Sexton

#### 214. Development Economics (4)

Lecture—4 hours. Prerequisite: course 100A, 100B, Economics 101; course 204A and Economics 160A, 160B recommended. Review of the principal theoretical and empirical issues whose analysis has formed development economics. Analysis of economic development theories and development strategies and their application to specific policy issues in developing country contexts. (Same course as Economics 214.)—II. (II.)

#### 215A. Microdevelopment Theory and Methods I (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: course 200A or 204A; course 240A recommended. Agricultural development theory, with a focus on microeconomics. Agricultural household behavior with and without imperfections and uncertainty. Analysis of rural land, labor, credit and insurance markets, institutions, and contracts. (Same course as Economics 215A.)—I. (I.)

#### 215B. Open Macroeconomics of Development (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: courses 200A or 204A; 200D or 205, and 214 or 215A. Models and policy approaches regarding trade, monetary and fiscal issues, capital flows and debt are discussed in the macroeconomic framework of an open developing country. The basic analytical focus is real exchange rate and its impact on sectoral allocation of resources. (Same course as Economics 215B.)—II. (II.)

#### 215C. Microdevelopment Theory and Methods II (4)

Lecture—3 hours; discussion—1 hour. Prerequisite: course 215A. Extension of development theory and microeconomic methods. Agricultural growth and technological change; poverty and income inequality; multisectoral, including village and regional models. Computable general equilibrium methods and applications. (Same course as Economics 215C.)—III. (III.)

**215D. Environment and Economic Development (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: course 200A, 204A or 275. Interdisciplinary course drawing on theoretical and empirical research on interactions between environmental resource use and economic development processes. Analysis of issues emerging at the interface of environmental and development economics. (Same course as Economics 215D.)—III. (III.)

**222. International Agricultural Trade and Policy (3)**

Lecture—3 hours. Prerequisite: course 100B or 204A; Economics 160A or the equivalent. Analysis of country interdependence through world agricultural markets. Partial equilibrium analysis is used to study the impacts of national intervention on world markets, national policy choice in an open economy and multinational policy issues. Offered in alternate years.—I. (I.)

**231. Supply and Demand for Agricultural Products (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: courses 200A, 202A, and 240A or consent of instructor. Analysis of supply and demand for agricultural commodities emphasizing the effective use of microeconomic theory with econometric methods, and other empirical procedures, in conducting applied analysis of supply and demand at the firm and industry level.—II. (II.)

**232. Agricultural Commodity Markets (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: courses 200A, 202A, and 240A or consent of instructor. Economic analysis of industries that produce, market, transport, store, and process basic commodities. Analysis of market equilibrium under perfect and imperfect competition, with and without government involvement.—I. (I.)

**233. Agricultural Policy (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: courses 200A, 202A, and 240A or consent of instructor. Nature, formation, evolution, and institutions of economic policy applied to food, agricultural, and rural issues. Examples for detailed consideration include food security, commodity issues, and trade policy. Analytical approaches include static and dynamic welfare analysis, policy design, and political-economic analysis.—III. (III.)

**239. Econometric Foundations (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: one course in undergraduate-level econometrics. The course will prepare students for econometric theory and empirical work by examining the statistical foundation of econometrics. Special attention is paid to problems specific to non-experimental data common to social sciences. Topics from matrix algebra are also covered. (Same course as Economics 239.)—I. (I.) Green

**240A. Econometric Methods (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: Statistics 133 and a course in linear algebra or the equivalent. Least squares, instrumental variables, and maximum likelihood estimation and inference for single equation linear regression model; linear restrictions; heteroskedasticity; autocorrelation; lagged dependent variables. (Same course as Economics 240A.)—II. (II.)

**240B. Econometric Methods (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: course 240A. Topics include asymptotic theory and instrumental variables, pooled time-series cross-section estimation, seemingly unrelated regression, classical hypothesis tests, identification and estimation of simultaneous equation models, cointegration, error-correction models, and qualitative and limited dependent variable models. (Same course as Economics 240B.)—III. (III.)

**240C. Time Series Econometrics (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: course 240B. Probability theory; estimation, inference and forecasting of time series models; trends and non-standard asymptotic theory; vector time

series methods and cointegration; time series models for higher order moments and transition data; state-space modeling; the Kalman filter. (Same course as Economics 240C.)—II. (II.) Jorda

**240D. Cross Section Econometrics (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: course 240B. Estimation and inference for nonlinear regression models for cross-section data; models for discrete data and for limited dependent variables; models for panel data; additional topics such as bootstrap and semiparametric regression. (Same course as Economics 240D.)—I. (I.) Cameron

**240E. Topics in Applied Econometrics (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: courses 240A and 240B. Examination of modern econometric techniques used in applied fields of economic research, such as demand analysis, environmental economics, macroeconomics/finance, etc. Emphasis on selection of appropriate tools for individual fields. Course focus will expand topics covered in courses 240A and 240B. (Same course as Economics 240E.)—III. (III.)

**252. Applied Linear Programming (4)**

Lecture—3 hours; discussion—1 hour. Applied linear programming methods emphasizing uses for business decisions: production, diet, blending, network and related problems.—II. (II.)

**253. Optimization Techniques with Economic Applications (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: course 200C. Optimization techniques and methods including linear and nonlinear programming. Empirical applications to household, firm, general equilibrium and economic growth problems.—II. (II.)

**254. Dynamic Optimization Techniques with Economic Applications (4)**

Lecture—4 hours. Prerequisite: course 253 and elementary knowledge of ordinary differential equations. Necessary and sufficient conditions in the calculus of variations and optimal control, economic interpretations, the dynamic envelope theorem and transversality conditions, infinite horizon problems and phase diagrams, local stability and comparative statics of the steady state, comparative dynamics.—II. (II.)

**255. Advanced Topics in Economic Dynamics (3)**

Lecture—3 hours. Prerequisite: course 254. Local stability analysis, steady state comparative statics and comparative dynamics, dynamic duality theory and the principle of optimality, differential games, numerical solution of deterministic and stochastic dynamic models using GAMS, stochastic optimal control, plus other advanced topics in economic dynamics. Offered in alternate years.—III. (III.)

**256. Applied Econometrics (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: course 106, Economics 140, or equivalent, or consent of instructor. Application of statistical tools to economic and business analysis. Emphasis on regression analysis, problems of specification, and model development. (Same course as Economics 256.)—II. (II.)

**258. Demand and Market Analysis (3)**

Lecture—3 hours. Prerequisite: courses 204A and 256 or consent of instructor. Quantitative and theoretical analysis of the factors affecting supply, demand and price determination for agricultural products. Emphasis on analytical tools for assessing the impacts of changes in government policies and macroeconomic variables.—III. (III.)

**275. Economic Analysis of Resource and Environmental Policies (4)**

Lecture/discussion—4 hours. Prerequisite: course 204A. Development of externality theory, market failure concepts, welfare economics, theory of renewable and non-renewable resource use, and political economic models. Applications to policy issues regarding the agricultural/environment interface and managing resources in the public domain. (Same course as Environmental Science and Policy 275.)—III. (III.)

**276. Environmental Economics (4)**

Lecture—3 hours; discussion—1 hour. Prerequisite: course 204A or consent of instructor. Applications of externality theory to the design of efficient environmental policies. Evaluation of pollution control policy instruments in light of information limitations and market imperfections. Methods for nonmarket valuation of the benefits of environmental improvement.—I. (I.)

**277. Natural Resource Economics (4)**

Lecture—4 hours. Prerequisite: course 254 or consent of instructor. Application of capital theory and dynamic methods to issues of optimal use of renewable and nonrenewable resources. Examination of policy issues associated with forests, fisheries, groundwater, energy resources, watersheds, soil, global climate, and wildlife.—III. (III.)

**290. Topics in Agricultural and Resource Economics (3)**

Lecture—3 hours. Selected topics in agricultural and resource economics, focusing on current research. May be repeated 4 times for credit. Not offered every year.—I, II, III. (I, II, III.)

**293. Analysis of California Agriculture and Resources (3)**

Lecture—1.5 hours; fieldwork—45 hours total, including one 5-day summer field trip. Review and analysis of production, marketing, and resource issues facing agricultural firms in California. Application of economic theory and measurement to individual firm and industry decisions in an applied setting. (S/U grading only.)—II. (II.)

**298. Directed Group Study (1-5)**

Advanced study through special seminars, informal group studies, or group research on problems for analysis and experimentation. Sections: (1) Managerial Economics; (2) Agricultural Policy; (3) Community and Regional Development; (4) Natural Resources; (5) Human Resources; (6) Research Methods and Quantitative Analysis.

**299. Individual Study (1-12)**

Sections: (1) Managerial Economics; (2) Agricultural Policy; (3) Community and Regional Development; (4) Natural Resources; (5) Human Resources; (6) Research Methods and Quantitative Analysis; and (7) Dissertation Research Prospectus. (S/U grading only.)

**299D. Special Study for Doctoral Dissertation (1-12)**

(S/U grading only.)

**Professional Course****396. Teaching Assistant Training Practicum (1-4)**

Prerequisite: graduate standing. May be repeated for credit. (S/U grading only.)—I, II, III. (I, II, III.)

## Agricultural Systems and Environment

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See **Agricultural Management and Rangeland Resources**, on page 124.

## Agronomy

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See **Plant Sciences**, on page 419.

## Agronomy and Range Science

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See **Plant Sciences**, on page 419.