

**Descriptions – Crop and Soil Sciences
of
Courses**

831. World Food Crops
Spring of odd-numbered years. 3(3-0)
World food crop production and related systems of agriculture which provide this resource. The impact of modern discoveries and opportunities for change.

833. Soil Fertility and Plant Nutrition
Winter. 3(3-0) CSS 430 or approval of department.

Fundamental concepts in soil fertility and mineral nutrition of plants; fate of nutrients applied to soils, nutrient uptake, translocation and utilization by plants; principles of laboratory, greenhouse and field research methods.

840. Soil Physics
Fall. 5(3-6) CSS 430, CEM 162 or approval of department.

Physical properties of soil (texture, structure, consistency, aeration, water, temperature, etc.), their quantitative measurement, and relation to plant growth, and agronomic and engineering practices.

842. Advanced Soil Microbiology
Fall of odd-numbered years. 3(3-0) MPH 425 or approval of department. Interdepartmental with and administered by the Department of Microbiology and Public Health.
Biochemistry, biology, and community ecology of microorganisms indigenous to soil. Emphasis on current research problems.

843. Soil Microbiology Laboratory
Fall of odd-numbered years. 2(0-6) MPH 842 concurrently or approval of department. Interdepartmental with and administered by the Department of Microbiology and Public Health.

Fundamental techniques of dealing with microorganisms indigenous to soil. Metabolic activity of microorganisms. Interaction between microorganisms and plants.

850. Soil Chemistry
Winter. 5(3-6) CSS 430; CEM 162, CEM 383; or approval of department.

Chemistry of mineral weathering and soil formation, ion activities, ionic exchange and equilibrium reactions, soil pH, specific elements and their chemical analysis, and availability of nutrients to plants.

851. Developmental Genetics and Plant Breeding
Fall of odd-numbered years. 4(3-1)
One course each in genetics, statistics and plant breeding.

Plant breeding in relation to genetics of growth and development. Problem sets in statistical treatment of plant breeding data.

865. Organic Chemistry of Soils
Spring of odd-numbered years. 3(3-0) CEM 242.

Relationship of natural and synthetic organic chemicals to chemical and biochemical processes in the soil environment.

870. Origin and Classification of Soils
Winter. 4(3-2) CSS 470, CSS 840, or approval of department.

Genesis, morphology and classification of major soils of the world. Relationships among soils in natural and cultural landscapes. How soil properties affect their use, management and conservation. Land classifications for various purposes.

899. Master's Thesis Research
Fall, Winter, Spring, Summer. Variable credit. Approval of department.

920. Design and Analysis of Agronomic Experiments
Spring. 3(3-0) STT 423 or approval of department.

Constructing and analyzing designs for experimental investigations in the biological sciences.

951. Cytogenetics in Plant Breeding
Winter of odd-numbered years. 3(3-0) BOT 427, BOT 828, or approval of department.

Application of cytogenetic principles to plant breeding. Significance of recombination, role of induced mutations, polyploid, chromosome substitution, and aneuploid analyses as they apply to the field of plant breeding.

952. Plant Breeding Biometrics
Winter of even-numbered years. 4(3-2) Approval of department.

Biometrical genetics as it applies to plant breeding. Includes studies of path coefficients, partitioning of variance, and the principles of selection in a changing environment.

999. Doctoral Dissertation Research
Fall, Winter, Spring, Summer. Variable credit.

DAIRY SCIENCE

See Animal Science.

EARTH SCIENCE

See Geological Sciences.

ECONOMICS EC

College of Business and Graduate School of Business Administration

Courses are classified as follows:
Applied Welfare Economics—410.
Labor Economics and Industrial Relations—305, 306, 455, 457.
Money and Banking—318, 330, 470.
International Economics—428.
Public Finance—406, 407, 408.
Price and Value Theory—324, 325, 426.
Income and Employment Theory—326, 451, 470.
History of Economic Thought—421, 422.
Industrial Organization and Control—444, 445.
Economic Development, Regional Studies, and Comparative Economics
Systems—430, 431, 434.

200. Introduction to Macroeconomics
Fall, Winter, Spring, Summer. 4(4-0)
Open to Freshmen. Students may begin sequence with either EC 200 or EC 201. Not open to students with credit in IDC 204.

Determinants of Gross National Product, unemployment, inflation and economic growth. National income accounting, fiscal policy; aggregate demand and supply management.

201. Introduction to Microeconomics
Fall, Winter, Spring, Summer. 4(4-0)
Open to Freshmen. Students may begin sequence with either EC 200 or EC 201. Not open to students with credit in IDC 205.

Economic institutions, reasoning and analysis. Consumption, production, determination of price and quantity in different markets, income distribution, market structure and normative analysis.

210. Fundamentals of Economics
Fall, Winter. 4(4-0) MTH 215 or MTH 228; or concurrently. Students may not earn credit in EC 210 if they have credit in either EC 200 or EC 201.

Economic principles, institutions and reasoning using mathematics, when useful, as a tool of analysis. Consumption, production, the market system, income distribution and elements of employment and inflation theory.

251H. Households, Firms and Markets
Fall. 5(5-0) Honors College students.

Microeconomic theory and its applications to analysis and policy. Substitutes for EC 201, EC 324, and EC 325.

252H. Macroeconomics and Public Policy
Winter. 5(5-0) Honors College students.

Theory of national income, unemployment, inflation and economic growth and its application to economic analysis and policy. Substitutes for EC 200, EC 326 and EC 327 combined.

305. Industrial Relations and Trade Unionism
Fall, Winter, Spring, Summer. 4(4-0)

Development, aims, structure, and functions of labor and employer organizations. Their relation to economic, political, and legal institutions and their impact on society. Primary issues in collective bargaining.

306. Government Programs for Workers
(456.) Winter. 4(4-0) EC 201. Interdepartmental with Public Affairs Management.

Economics of selected government institutions and programs for workers. Social security, worker's compensation, Unemployment Insurance, OSHA, employment and training programs, wages and hours legislation, anti-discrimination programs.

318. Money, Credit and Banking
Fall, Winter, Spring, Summer. 4(4-0) EC 200 or EC 210.

Commercial banking and the money supply. The Federal Reserve System, the Treasury, and other financial institutions. Sources and uses of funds in the financial market.

324. Microeconomics I
Fall, Winter, Spring, Summer. 3(3-0) EC 200 and EC 201, or EC 210.

Theory of production and cost. Theory of the firm under varying market structures.

325. Microeconomics II
Fall, Winter, Spring, Summer. 3(3-0) EC 200 and EC 201, or EC 210, and EC 324.

Consumer choice and theory of demand. Theory of distribution and factor rewards. Welfare economics and general equilibrium theory.

- 326. Macroeconomics I**
(320.) Fall, Winter, Spring, Summer.
3(3-0) EC 200 and EC 201 or EC 210.
Review of national income accounting, Determination of aggregate output, employment, the price level, and the inflation rate. Policy applications.
- 327. Macroeconomics II**
(321.) Fall, Winter, Spring, Summer.
3(3-0) EC 326.
Consumption theories, investment theories, role of expectations, theories of economic growth and cycles, stabilization policies, and other advanced topics.
- 330. Investments and Security Markets**
Fall, Spring. 3(3-0) EC 200 or EC 210,
Juniors.
The stock market; principles of investment; analysis of selected industries and corporations; regulation by the Securities and Exchange Commission.
- 337. American Social and Economic History: Foundations**
Winter. 4(4-0) Interdepartmental with and administered by the Department of History.
Multiple sources of economic growth in economic, social and political change, education, science and technology, political action, and other factors, mid-19th century.
- 338. American Social and Economic History: Modern Trends**
Spring. 4(4-0) Interdepartmental with and administered by the Department of History.
Urbanization, origins and implications of largescale organizations in business and other sectors of society, and sources of economic growth since mid-19th century.
- 361. Economic Development of Asia**
Fall. 3(3-0) EC 200 and EC 201 or EC 210.
Population and resources; comparison of three economic systems: Communism in China, free enterprise in Japan and socialism in India; the role of Japan in regional trade and development.
- 362. Economic Development of Latin America**
Winter. 3(3-0) EC 200 and EC 201 or EC 210.
Concentration of political and economic power as related to income distribution, tax structures, agrarian reform; inflation, trade, exchange rates, integration; population and employment policy.
- 363. Economic Development of Tropical Africa**
Spring. 3(3-0) EC 200 and EC 201 or EC 210. Interdepartmental with Public Affairs Management.
African economic development in historical perspective. Analysis of contemporary economic development problems faced by tropical African countries. Alternative strategies for African economic development.
- 371A. European Economic History to 1800**
Fall. 4(4-0) Interdepartmental with and administered by the Department of History.
Economic history of medieval and early modern Europe stressing the nature of agrarian societies, the growth of cities, the divergence of the European economies, and the Industrial Revolution in England.
- 371B. European Economic History after 1800**
Winter. 4(4-0) Interdepartmental with and administered by the Department of History.
The industrialization of Europe stressing urbanization, national rivalry, problems of the maturation of capitalist institutions, and the social and ecological impact of economic growth in the twentieth century.
- 400. Independent Study**
Fall, Winter, Spring, Summer. 1 to 4 credits. Seniors or approval of department.
Research and reading course for students interested in doing independent work in economics.
- 401. Interpreting Economic News and Research**
Winter. 3(3-0) EC 200 and EC 201 or EC 210 or EC 251H and EC 252H.
Reporting and interpreting economic news and research. Sources of data and research information. Critical examination of written and broadcast reports through application of economic principles. Case studies.
- 406. Public Expenditure: Theory and Policy**
Fall, Spring. 4(4-0) EC 201 or EC 210. Interdepartmental with Public Affairs Management.
Expenditure theory; objectives and rationale of government activity in the market system; efficiency criteria in government decision-making; planning-programming-budgeting systems and cost-benefit analysis.
- 407. Public Revenues**
Winter. 4(4-0) EC 201 or EC 210.
Principles and theory of the distribution of tax burdens and the incidence of taxation. Income, sales, property, and other major revenue sources.
- 408. State and Local Finance**
Spring. 4(4-0) EC 201 or EC 210 or EC 251H.
Fiscal problems at the state and local levels of government, including revenues, expenditures, borrowing, and intergovernmental fiscal relations.
- 410. Medical Economics**
Spring. 3(3-0) EC 200, EC 201, or approval of department.
Demand, supply and economic efficiency in the markets for health services. Demand for medical care, organization forms, methods of payment, utilization and cost, and public policy for health care.
- 412. The Economics of Poverty**
Winter. 3(3-0) EC 200, EC 201.
Theory of the distribution of income and wealth. Concepts and measurement of welfare. Definitions of poverty. Effects of public and private programs on the poor.
- 413. Urban Economics**
Fall. 4(4-0) EC 200, EC 201.
Location theory and urban development. Economics of city size and urban-suburban conflict. Economic aspects of certain community problems like housing, transportation, welfare and poverty. Strategies for urban development.
- 417. Land Economics**
Fall, Spring. 4(4-0) Interdepartmental with Public Affairs Management, and Food Systems Economics and Management and the Department of Resource Development. Administered by the Department of Resource Development.
Factors affecting the economic use of land and space resources by people. Input-output relationships; development, investment, and enterprise location decisions. Land markets; property rights, area planning, zoning and land use controls.
- 421. Economic Thought I**
Fall, Summer. 4(4-0) EC 200 and EC 201, or EC 210.
Forerunners of classical economics. Development of classical economic thought from Adam Smith to J. S. Mill. The socialist reaction.
- 422. Economic Thought II**
Winter, Spring. 4(4-0) EC 200 and EC 201, or EC 210.
The decline of classical economics and the rise of marginalist value and distribution theory. Marxism and institutionalism.
- 426. Introductory Mathematical Economics**
Spring. 3(3-0) EC 324, EC 326, MTH 214.
Mathematical analysis of production, cost, and consumer choice. Mathematical models of aggregative and general-equilibrium economic systems.
- 428. International Trade**
(427.) Fall, Winter, Spring, Summer. 3(3-0) EC 200 and EC 201, or EC 210. EC 428 and EC 429 are a two-term sequence. Student should take the courses in succeeding terms, though they may begin with either course.
Pure theory of trade and comparative advantage. Free trade versus protection. Customs unions. U.S. commercial policy. Trade problems of less-developed nations.
- 429. International Finance**
Fall, Winter, Spring, Summer. 3(3-0) EC 200 and EC 201, or EC 210. EC 428 and EC 429 are a two-term sequence. Students should take the courses in succeeding terms, though they may begin with either course.
Balance-of-payments accounting. Foreign exchange markets. Balance-of-payments mechanisms. The international monetary system.
- 430. Stagnation and Development in Emerging Societies**
Winter, Summer. 4(4-0) EC 200 and EC 201, or EC 210.
Obstacles to economic growth, theories of economic development, reorganizing agriculture and industry; problems in mobilizing the economy to accommodate new productive techniques; population problems.
- 431. Principal Issues in Promoting Economic Development**
Spring. 4(4-0) EC 430.
Structural change and growth, capital formation and investment criteria; financing development; foreign trade and finance in development; government and planning.
- 434. Comparative Economic Systems**
Fall, Winter, Summer. 4(4-0) EC 200 and EC 201, or EC 210.
Characteristics and functions of an economic system. Analysis of alternative patterns of economic control, planning and market structure. Experiences under capitalism, socialism and mixed economies. Consideration of their theories and philosophies.

Descriptions – Economics

of

Courses

440. Radical Political Economy

Spring, 3(3-0) EC 200 and EC 201, or EC 210, or EC 251H and EC 252H.

Development and contemporary characteristics of capitalism from Marxian-radical perspective. Historical materialism and class analysis. Radical critique of modern economics. Relationship of inequality, racism, alienation and other problems to the structure of capitalism.

444. Private Enterprise and Public Policy

Fall, Winter, Spring, Summer, 3(3-0) EC 201 or EC 210.

Competition and monopoly in the American economy. Problems of antitrust.

445. Economics of Regulated Industries

Winter, 4(4-0) EC 444.

Government policy and role of competition in the public utility and transportation industries.

451. Introduction to Econometric Methods

Fall, Spring, 4(4-0) EC 324, EC 326; STT 422 or STT 442 or STT 316.

Specification, estimation and interpretation of econometric models. Understanding and evaluation of current quantitative work in economics.

453. Women and Work: Issues and Policy Analysis

Winter, 3(3-0) PAM 201 or EC 200 or EC 201 or approval of department. Interdepartmental with and administered by Public Affairs Management.

Quantity and quality of labor force participation by women, current status and past trends. Issues analyzed include differential earnings and occupations of men and women, employment discrimination and labor legislation.

455. Labor and the Law

Spring, 4(4-0) EC 305.

Development and current status of labor law as it applies to unions, employers, employees and collective bargaining. Economic and social issues regulated by, and posed by, labor law.

457. Analysis of Labor Markets

Spring, 4(4-0) EC 200 and EC 201, or EC 210.

Theories of labor market behavior, empirical evidence and policy implications. Topics include labor supply, labor demand, wage differentials (due to education, discrimination, and union membership), competition and mobility.

460. Regional Economics

Winter, 4(4-0) RD 417 or EC 324. Interdepartmental with Food Systems Economics and Management, Public Affairs Management, and the Department of Resource Development. Administered by the Department of Resource Development.

Forces affecting location decisions of firms, households and governments. Applications to agricultural, industrial, and regional developments.

461. Regional Economics Laboratory

Spring, 1(0-2) RD 460 and approval of department. Interdepartmental with Public Affairs Management, and Food Systems Economics and Management and the Department of Resource Development. Administered by the Department of Resource Development.

Evaluation and use of analytical models designed to solve regional economic problems.

463. Economics of Urban Education

(UMS 463.) Spring, 3(3-0) EC 201 or EC 210.

Political economy of urban schools. Education as a commodity; efficient production and distribution, supply and demand for education, financing education, planning education to meet job needs and social mobility.

470. Monetary Theory

Fall, 3(3-0) EC 327.

Relationship between money and interest rates, prices and output.

480. Mathematics for Economists

Fall, 5(5-0) MTH 113, graduate status in either economics, agricultural economics or College of Business, or approval of department. Interdepartmental with and administered by the Department of Mathematics.

Matrix algebra, determinants, quadratic forms, characteristic values. Partial derivatives, chain rule, Jacobian matrix, Taylor series, constrained optimization, linear differential equations. Mathematics introduced and developed using student's background in economics.

803. Managerial Economics

(860.) Fall, Winter, Summer, 4(4-0) Graduate students in Business Administration or approval of department. Not open to undergraduates or to those with credit in EC 805A, EC 812A, or EC 860.

Analysis of the firm. Problems facing management; economizing in use of resources, optimal combinations of products, pricing, competitive forces in markets affecting the firm.

804. Macroeconomic Models

(861.) Fall, Winter, Spring, Summer, 4(4-0) Graduate students in Business Administration or approval of department. Not open to undergraduates or to those with credit in EC 805B, EC 813A or EC 861.

Determinants of the national income, employment, and capital formation. National income accounts. Business fluctuations. Fiscal and monetary policy.

805A. Microeconomics Theory

Fall, Winter, 3(3-0) MTH 113, EC 324; not open to students with credit in EC 812A.

A review of microeconomic theory with calculus: production, costs, demand, markets, general equilibrium and welfare theory.

805B. Macroeconomic Theory

Fall, Spring, 3(3-0) MTH 113, EC 326; closed to students with credit in EC 813A.

A review of macroeconomic theory with calculus; comparative statics of macroeconomic models; theories of inflation and unemployment.

806A. Public Expenditures

Fall, 3(3-0) Approval of department.

Public sector allocation and redistribution. Public goods, externalities, market imperfections, property rights. Cost-benefit analysis and PPBS. Alternative theories of the state. Political theories of public expenditures.

806B. Public Revenues

Winter, 3(3-0) Approval of department.

Theory of taxation. Incidence and economic effects, especially on income and wealth redistribution. Institutional and policy analysis of the U.S. federal tax system.

806C. State and Local Public Finance

Spring, 3(3-0) Approval of department.

State and local expenditure systems in theory and practice; tax and nontax revenues; intergovernmental fiscal relationships; the fiscal problems of metropolitan governments.

807. Survey of Microeconomic Analysis

Winter, Spring, 3(3-0) EC 805A or EC

812A.

Analytical methods taught through journal readings and practical examples from public finance, labor economics, industrial organization, and international trade. Such topics as measurement of tax incidence and effects of unemployment insurance.

808. Techniques of Microeconomic Analysis

Spring, 3(3-0) EC 803 or EC 805A or EC 812A.

Techniques of microeconomic analysis taught through examples drawn from current economic events; an emphasis on getting answers to problems encountered by practicing economists.

809. Macroeconomic Analysis

Winter, Summer, 3(3-0) EC 804 or EC 805B or EC 813A.

Analysis techniques taught through readings and examples from monetary economics, economic development, and international finance. Such topics as macroeconomic forecasting, sources of economic growth, and exchange constraints on monetary policy.

810. Economics of Public Choice

Winter, 3(3-0) Approval of department. Interdepartmental with the departments of Agricultural Economics, and Resource Development. Administered by the Department of Agricultural Economics.

Economics of alternative institutions for collective action. Emphasis on property rights and natural resources. Public goods, externalities non-marginal change, commonwealth, income and power distribution, grants, welfare criteria and market failure.

811. Public Program Analysis

Spring, Summer of odd-numbered years, 3(3-0) EC 324 or approval of department. Interdepartmental with the departments of Resource Development, and Agricultural Economics. Administered by the Department of Agricultural Economics.

Application of benefit-cost analysis to public programs of resources development. Issues and case studies in budgeting, investment criteria, pricing, externalities, and coordination.

812A. Microeconomics I

Winter, 3(3-0) EC 324, EC 325; EC 480 or MTH 215 or concurrently.

Theories of consumption and production; duality, cost and expenditure functions; imput demand; revealed preference.

812B. Microeconomics II

Spring, 3(3-0) EC 812A.

Functional forms in production and consumption; competitive equilibrium; theories of non-competitive markets; imperfect information and behavior under uncertainty; multiproduct firms.

812C. Microeconomics III

Fall, 3(3-0) EC 812B.

General equilibrium and welfare; optimality of competition; market failures; economics of linear and nonlinear programming and input-output analysis.

813A. Macroeconomics I

Fall. 3(3-0) EC 326, EC 327; EC 480 or MTH 215 or concurrently.
Income accounting and price indices; comparative statics of macroeconomics models; consumption and investment functions; the money supply.

813B. Macroeconomics II

Winter. 3(3-0) EC 813A.
Demand for money; portfolio theory; theories of inflation and unemployment.

813C. Macroeconomics III

Spring. 3(3-0) EC 813B.
Models of macroeconomic disequilibrium; macro dynamics and the effects of search; theories of neoclassical and optimal economics growth.

818A. Monetary Theory

Fall. 3(3-0) EC 812C, EC 813C, and EC 835 and approval of department.
Monetary and interest theories.

818B. The Theory of Monetary Policy

Winter. 3(3-0) EC 818A or approval of department.
Theories of the transmission of monetary policy to output, employment and prices.

818C. Problems in Monetary Policy

Spring. 3(3-0) EC 818B.
Goals and techniques of monetary policy.

821A. Competition and Monopoly in American Industry

Fall. 3(3-0) Approval of department.
Examination of structure, behavior, and performance in industries.

821B. Government Policy Toward Private Enterprise

Winter. 3(3-0) Approval of department.
Evolution of government policy with respect to such problems as conspiracy, monopoly, mergers, unfair practices, and discrimination. Economic and legal appraisal of policy alternatives.

821C. Problems Related to Regulated Industries

Spring. 3(3-0) Approval of department.
Departures from market competition as a policy norm, as in public utilities and transportation.

826A. Theory of International Trade

Fall. 3(3-0) EC 428 or approval of department.
Classical and modern theories of international trade. Application of modern techniques of economic analysis to international trade theory.

826B. Theory of International Trade Policy

Winter. 3(3-0) EC 826A.
Various means by which a government may influence the volume, character, and direction of its foreign commerce. In this connection an analysis is made of the theory of the tariff, the subsidy, exchange control, and quotas. Emphasis on the economic impact of trade controls upon a nation and the world.

826C. International Exchanges and Capital Flows

Spring. 3(3-0) EC 826B.
Theory of exchange rates and international money markets especially with reference to other than current account items in balances of payments. Analysis of sources, causes, effects of capital flows with developing economies considered as a special case.

831. Mathematical Economics I

Fall of even-numbered years. 3(3-0) EC 812; MTH 214, MTH 334.
Economic behavior of firms, households, commodity markets. Relation of traditional theories to programming models, theory of games and other decision theories. Dynamic models of behavior. Equilibrium of multiple markets.

832. Mathematical Economics II

Winter of odd-numbered years. 3(3-0) EC 813; MTH 215, MTH 334.
Mathematical models of growth and fluctuations dealing with macroeconomics, monetary theory, fiscal policy. The cobweb, static and dynamic multipliers, multiplier-accelerator models, trade cycle models. Relations among stocks, flows and time lags.

833. Mathematical Programming

Spring. 3(3-0) EC 800; or EC 812A; MTH 334. Interdepartmental with the departments of Agricultural Economics, and Statistics and Probability. Administered by the Department of Agricultural Economics.
Linear programming. Theory of linear economic models. Topics in nonlinear programming.

835. Introduction to Econometrics

Winter, Spring, Summer. 3(3-0) Approval of department. Interdepartmental with the Department of Agricultural Economics.
Specification, estimation and interpretation of economic models. Applications to empirical problems.

841A. History of Economic Thought: Classical

Fall. 3(3-0)
Early thought, mercantilism, physiocracy, and classical economics.

841B. History of Economic Thought: Heterodox

Winter. 3(3-0)
Historicism, socialism, and institutionalism.

841C. History of Economic Thought: Modern

Spring. 3(3-0)
Development of marginalism, general equilibrium theory, employment theory, and mathematical economics.

850. The Development of Economic Institutions

Fall. 3(3-0) EC 430 or approval of department.
Cross-cultural analysis of factors influencing the organization of economics. Motivation, values, and technological change. Growth of markets, entrepreneurship, industrial labor force and the diffusion of knowledge.

851. The Economics of Secular Change

Winter. 3(3-0) EC 324, EC 326 or approval of department.
Empirical studies of long-run economic trends and a consideration of alternative hypotheses explaining these trends including classical Marxian, Harrod-Domar, and other general theories of economic development. Population growth, technological change, capital formation, occupational distribution, urbanization, and international trade.

852. Economic Problems of Underdeveloped Areas

Spring. 3(3-0) EC 324, EC 326 or approval of department.
Overcoming problems relating to early stages of economic development, investment priorities, mobilizing savings, balance of payment considerations; and policies and programs of various types.

855. The Industrial Revolution in Europe

Winter of even-numbered years. 3(3-0) EC 318, EC 324. Interdepartmental with the Department of History.
The preconditions that led to the momentous changes in agriculture and industry in Europe from 1700-1914.

857. Wage Theory

Fall. 3(3-0) EC 324, EC 326 or approval of department. Interdepartmental with the School of Labor and Industrial Relations.
Advanced analysis of: theories of wage determination; labor market research, economic effects of collective bargaining upon the national wage structure, output, employment, distribution of national income, the price level; nature and effects of government wage policies.

858. Collective Bargaining

Fall, Winter, Spring. 3(3-0) EC 305 or approval of department. Open to graduate students in economics and related fields such as labor and industrial relations, psychology, sociology, anthropology, political science, business, and history. Interdepartmental with and administered by the School of Labor and Industrial Relations.
Problems and issues in the administration and negotiation of collective bargaining agreements; includes both economic and noneconomic aspects of industrial relations policies and practices.

862. Business and Public Policy

Winter. 4(4-0) EC 860 or approval of department. Not open to majors.
Problem of government regulation of business. Economic models which relate to regulation. Regulatory legislation, regulatory bodies, and alternatives available.

876. Statistical Inference in Economics I

Fall. 3(3-0) EC 812A or EC 801; STT 443 or STT 863; or approval of department. Interdepartmental with the departments of Agricultural Economics, and Statistics and Probability.
Review and extension of single-equation regression models. Properties of least-squares estimators under alternative specifications. Problems of analyzing nonexperimental data. Errors in variables, autoregressive and heteroscedastic models.

Descriptions – Economics

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Courses

877. *Statistical Inference in Economics II*

Winter. 3(3-0) EC 876 or approval of department. Interdepartmental with the departments of Agricultural Economics, and Statistics and Probability.

Specification interpretation and estimation of simultaneous equation models. Nonlinear models. Bayesian approach to estimation problems. Recent developments in econometrics.

878. *Statistical Inference in Economics III*

Spring. 3(3-0) EC 877 or approval of department. Interdepartmental with the departments of Agricultural Economics, and Statistics and Probability.

Validation and application of dynamic econometric models. Bayesian approach to estimation problems. Recent developments in econometric methods and in applied econometric research.

880. *Organization and Control in the Political Economy: Institutions and Theory*

Winter of even-numbered years. 4(4-0) Interdepartmental with the Department of Management.

Organization and technique in choice and implementation of economic (especially planning, programming) functions of political authority.

881. *Organization and Control in the Political Economy: Selected Problems*

Winter of odd-numbered years. 4(4-0) Approval of instructor. Interdepartmental with the Department of Management.

Analysis of role and tasks, appropriate techniques and organizational structures of political agencies in planning and management of complex programs.

891. *Topics in Applied Econometrics*

Spring. 3(3-0) EC 835 or EC 877.

Topics in applied econometrics with particular attention to problems of testing hypotheses in the context of economic models.

895. *Graduate Reading in Economics*

Fall, Winter, Spring, Summer. Variable credit.

900. *Special Topics in Economic Theory*

Fall, Winter, Spring, Summer. 3(3-0) May reenroll for a maximum of 12 credits. EC 812C; EC 813C.

Special topics in economic theory of current interest and importance.

972. *Methodological Approaches to Research*

Fall of even-numbered years, Summer of odd-numbered years. 3(3-0) Two terms of graduate study in social science or approval of department. Interdepartmental with and administered by the Department of Agricultural Economics.

Selection, planning and conduct of research. Alternative research approaches. Role of theory, beliefs and valuations. Critical appraisal of research studies.

990B. *Industrial Organization and Public Policy Workshop*

Fall, Winter, Spring. 3 to 16 credits. Approval of department.

Critical evaluation of research reports by staff and other students. Students writing doctoral dissertations in the appropriate areas are encouraged to participate in workshop and may do so while registered for EC 999.

990C. *Mathematical Economics and Econometrics Workshop*

Fall, Winter, Spring. 3 to 16 credits. EC 812A, EC 832; or approval of department. Interdepartmental with the Department of Agricultural Economics.

Critical evaluation of research reports by staff and other students. Students writing doctoral dissertations in the appropriate areas are encouraged to participate in workshop and may do so while registered for EC 999.

990D. *Economic Development Workshop*

Fall, Winter, Spring, Summer. 3 to 16 credits. EC 850, EC 851, EC 852 or approval of department.

Critical evaluation of research reports by staff and students. Students writing doctoral dissertations in Development are encouraged to participate in the workshop and may do so while registered for EC 999.

999. *Doctoral Dissertation Research*

Fall, Winter, Spring, Summer. Variable credit. Approval of department.

EDUCATION

See Administration and Curriculum; Counseling, Educational Psychology and Special Education; and Teacher Education.

ELECTRICAL ENGINEERING AND SYSTEMS SCIENCE

College of Engineering

Electrical Engineering

E E

230. *Digital Logic Fundamentals*

Fall, Winter, Spring, Summer. 4(4-0) CPS 120 or CPS 251.

Boolean algebra; combinational logic and minimization; sequential system fundamentals and components; arithmetic operations and devices; memory devices and ensembles; data conversion principles; digital integrated circuits; practical engineering design problems.

231. *Computer Organization and Usage*

Fall, Winter, Spring. 4(4-0) E E 230.

Computer structure and machine language; macros; addressing techniques; computer bus; program segmentation and linkage; microcomputer case study; survey of applications in science and engineering.

300. *Electric Circuits I*

Fall, Winter. 4(4-0) MTH 113.

Current voltage and power. DC and transient circuit analysis. Forced response. Sinusoids and the phasor concept. Bridges.

301. *Electric Circuits II*

Winter, Spring. 4(4-0) E E 300, MTH 214.

Sinusoidal steady-state response. Average power and rms concepts. Complex frequency response. Magnetically coupled circuits. Two-port networks. Transfer functions.

302. *Basic Electronic Circuits*

Spring, Summer. 4(4-0) E E 301, MTH 215.

Volt-ampere characteristics of diodes and transistors. Voltage, current and power amplification. Stability, transient and high-frequency effects. Feedback, oscillators and operational amplifiers.

303. *Electronics Laboratory I*

Winter, Spring. 1(0-3) E E 300; E E 301 concurrently.

Electronic test equipment and measurement fundamentals. Experimental verification of topics covered in E E 300 and E E 301. Computer-aided circuit analysis and design.

304. *Electronics Laboratory II*

Fall. 1(0-3) E E 302.

Experimental verification of topics covered in E E 302. Single-stage and multi-stage transistor amplifier design and analysis. Applications of linear integrated circuits. Computer-aided circuit design.

305. *Electromagnetic Fields and Waves I*

Fall, Winter. 3(3-0) MTH 310, PHY 288.

Vector analysis, Electrostatic fields; EM sources, scalar potential, Poisson's and Laplace's equations, dielectric media, capacitance, and energy storage. Boundary value problems for electrostatic fields.

306. *Electromagnetic Fields and Waves II*

Winter, Spring. 4(4-0) E E 305.

Magnetostatic fields; EM sources, vector potential, magnetic media, inductance, and energy storage, time-varying fields and Maxwell's equations; potential theory and boundary-value problems. Energy conservation and conversion.

307. *Electromagnetic Fields and Waves III*

Spring, Summer. 3(3-0) E E 306; E E 308 concurrently.

Application of Maxwell's equations; radiation, propagation, reflection, and power flow of plane EM waves; EM boundary value problems. Transmission line theory; transient and steady state waves, standing and traveling waves, reflections and standing-wave-ratio.

308. *Fields and Waves Laboratory*

Spring, Summer. 1(0-3) E E 306; E E 307 concurrently.

Experimental investigation of: charged particle motion in EM fields, dielectric and magnetic properties and materials, probing of currents and charges, and propagation of transient and steady-state waves. Digital computer solutions for EM field and wave problems.

345. *Introduction to Electronic Instrumentation Systems*

Fall, Winter, Spring. 4(3-3) PHY 288.

Basic electronic concepts; passive and active components; operational amplifiers; switching devices, equivalent circuits; transducers; signal conditioning; recording; data management; basic elements of control.