CSENV 812 Crop Ecology and Land Use 3(3,0)
Concepts and factors affecting adaptation and distribution of crop plants; microclimate and crop response to environmental factors with modifications in agricultural operations; interactions among crop plants and between weeds and crop plants under field conditions. Offered fall semester of even-numbered years only.

CSENV (BOT) 824 Mode of Action of Growth Substances 4(3,3) Study of the physiology and biochemistry of both natural and synthetic growth regulators, hormones, growth retardants, herbicides and other inhibitors. Considers methodology and mechanism of action. Offered spring semester of odd-numbered years only. Prereq. BIOSC 601 and 602 and general biochemistry or BOT 822 or consent of instructor.

CSENV (PES) 850 Agricultural Biotechnology 3(3,3) For students specializing in applied life sciences. Scientific principles, limitations, novel concepts and widening applications of biotechnology to agricultural industry.

CSENV 890 Special Topics in Agronomy 1-3(1-3,0) Group discussion of recent developments in agronomic research. May be repeated for a maximum of six credits. Prereq. Consent of instructor.

DIGITAL PRODUCTION ARTS

D PA 600 Technical Foundations of Digital Production I 3(3,0) The technical, conceptual, and algorithmic foundations of computer graphics. Covers the Unix operating system, scripting, C programming, and an interactive graphics API. Prereq. Consent of instructor. Not open to Computer Science, Computer Engineering, or Computer Information Systems majors.

D PA 601 Technical Foundations of Digital Production II 3(3,0) The technical, algorithmic and architectural foundations of computer graphics. Covers spatial data structures, object oriented programming in C++, mathematics for graphics, and 3-D graphics API. Prereq. D PA 600 or consent of instructor. Not open to Computer Science, Computer Engineering, or Computer Information Systems majors.

D PA 602 Visual Foundations of Digital Production I 3(3,0) Presents the visual foundations underlying computer graphics production. Covers perspective, observational drawing, color and value, principles of composition and design, and storyboarding. Incorporates the studio method, involves students in hands-on work and the critique process, and stresses examples from the history of art, animation and film. Prereq. Consent of instructor. Not open to Architecture or Visual Arts majors.

D PA 603 Visual Foundations of Digital Production II 3(3,0) Extends the foundational visual principles underlying computer graphics production begun in D PA 402. Stresses representation of the figure in drawing and the use of cameras. Incorporates the studio method and the critique process, and stresses examples from the history of art, animation and film. Prereq. D PA 402 or consent of instructor. Not open to Architecture or Visual Arts majors.

D PA 660 Digital Production Studio 1-6(2-12) Students develop as accomplished visual problem solvers in a digital production team setting. As part of the studio experience, students take a production project from concept, through story development, character design, modeling and rigging, animation, lighting, and post production. May be repeated for a maximum of 12 credits. Prereq. Enrollment in the Digital Production Arts program.

D PA 880 Graduate Research Studio 1-6(2-12) Students complete a project or projects, under the direction of a faculty advisor, in an area supporting personal goals and vision. Work may be individually or team oriented, and may be of a technical or an artistic nature. May be repeated for a maximum of six credits. Prereq. Enrollment in the Digital Production Arts program.

D PA 891 Master of Fine Arts Thesis Research 1-6 Students research a thesis project, under the guidance of the student's advisor and thesis committee. The thesis project is developed to a refined degree, articulated in the form of a written document, and presented orally in a thesis defense. May be repeated for a maximum of six credits. Prereq. Consent of thesis committee chair.

EARLY CHILDHOOD EDUCATION

ED EC 880 Parent Education in Early Childhood Multicultural Settings 3(3,0) Focuses on a multicultural perspective on parent involvement in early childhood education settings. Theory and applications of parent involvement in multicultural environments are studied with an emphasis on activities that set the stage for science and math concept development and on uses of technology with young children.

ED EC 885 Advanced Early Childhood Education Foundations and Methods 3(3,0) In-depth study of developmentally appropriate and effective instructional methods in early childhood classrooms and the history of early childhood education as a professional field.

ED EC 820 Advanced Early Childhood Education Curriculum 3(3,0) In-depth study of curriculum development and current approaches in the field of early childhood education. Students explore the research literature on effective curriculum in early childhood education at both the national and international levels. Prereq. Consent of instructor.

ED EC 840 Theories of Early Childhood Education 3(3,0) Examines the theoretical, philosophical and research foundations of early childhood education with emphasis on how these foundations intersect with science, math and technology concept development in young children. Students develop skills in critical inquiry as they explore specific topics related to early childhood education.

ED EC 850 Creative and Cognitive Development in Early Childhood: Creating Connections to Math and Science 3(3,0) Examines the theoretical, philosophical and cognitive foundations of creative thought during the early childhood years. Students develop skills in critical inquiry as they explore the connections between creativity and math/science education during the early childhood years.

ED EC 880 Current Issues in Early Childhood 3(3,0) Focuses on factors that impact early childhood policy, identification of current problems/issues and development of research-based advocacy strategies.

ED EC 885 Thesis Hours in Early Childhood Education 3(3,0) Students work with thesis advisor and committee to complete thesis requirements; thesis must address a STEM discipline. Required of students enrolled in thesis track in Early Childhood Education. May be repeated for a maximum of six credits. Prereq. 18 credit hours including ED F 778, 879, consent of thesis advisor.

ED EC 890 Assessment and Program Planning in Early Childhood 3(3,0) Study of instructional planning and assessment for young children in all content areas including math, science and technology. Also explores multiple assessment and screening strategies; evaluates atypical and gifted preschool children with typical and atypical development; includes quantitative and qualitative assessment methods for program planning.

ED EC 895 Math, Science and Technology Inquiry in Early Childhood 3(3,0) Emphasizes theory to practice and exploration of the processes of inquiry in mathematics, science and technology for early childhood education.

ED EC 896 Early Childhood Math and Science Curriculum 3(3,0) Provides a vertical articulation of math and science curricula for the early childhood years through an in-depth analysis of national standards for content and pedagogy. Students experience the progression of math and science understanding in the early years.

ECONOMICS

ECON 605 Introduction to Econometrics 4(3,3) Introduction to the methods of quantitative analysis of economic data. Reviews basic statistical methods and probability distribution. Topics include data management using professional statistical software applications; multiple regression analysis; hypothesis testing under conditions of multicollinearity, heteroscedasticity; and serial correlation. Prereqs: ECON 211 and 212, MTHSCS 108 or 207, EX ST 301 or MTHSCS 301 or 309.

ECON 606 Advanced Econometrics 3(3,0) Reviews statistical inference using multiple regression (OLS) analysis and model specification. Topics include multicollinearity; heteroscedasticity and serial correlation; two-stage least squares and instrumental variables models; simultaneous equations models; limited dependent variable models using maximum likelihood estimation and time-series analysis; and presentation of results in technical writing. Prereq: ECON 405 or consent of instructor.

ECON 610 Economic Development 3(3,0) Consideration and analysis of economic and related problems of underdeveloped countries. Attention is given to national and international programs designed to accelerate solution of these problems. Prereq: ECON 316 or consent of instructor.
ECON 611 Economics of Education 3(3,0) Analysis of economic issues related to education. The decision to invest in education, elementary and secondary school markets and reform, the market for college education, teacher labor markets and education's effects on economic growth and income distribution. Preparatory: ECON 314 or consent of instructor.

ECON 612 International Microeconomics 3(3,0) Analysis of the essential aspects of international economic linkages. Discusses gains and redistributive effects of trade and the barriers to trade within the context of a variety of economic models. Also discusses the history of trade policy and the political economy of its determination. Preparatory: ECON 314 or consent of instructor.

ECON 613 International Macroeconomics 3(3,0) Examination of macroeconomic linkages between an individual country and the rest of the world and how these linkages are affected by the choice of exchange rate regimes. Topics include the relation between domestic and foreign interest rates and exchange rates and the ability to pursue independent monetary policies. Preparatory: ECON 315.

ECON 622 Monetary Economics 3(3,0) Intensive study of the role of monetary factors in economic change. Modern monetary theories and their empirical relevance for policy are developed against a background of monetary history and institutions. Preparatory: ECON 314 and 315 or consent of instructor.

ECON 623 Economics of Health 3(3,0) Applies microeconomic theory to examine the demand for health services and medical care, the market for insurance, the behavior of physicians and hospitals, and the role of government in healthcare provision and regulation. Preparatory: ECON 314.

ECON 624 Organization of Industries 3(3,0) Empirical, historical, and theoretical analyses of market structure and concentration in American industry: the effects of oligopoly, monopoly, and cartelization upon price, output, and other policies of the firm; antitrust and other public policies and problems are studied. Preparatory: ECON 314 or consent of instructor.

ECON 625 Antitrust Economics 3(3,0) Analysis of economic and legal issues created by the exercise of market power. The motivation and execution of government policy toward mergers, predator conduct, and various restraints of trade are extensively examined. Preparatory: ECON 109 or 314 or consent of instructor.

ECON 626 Seminar in Sports Economics 3(3,0) Economic analysis of sports teams, leagues and institutions. Topics include antitrust issues, public funding of sports venues, labor relations, wagering markets, athlete compensation and application of economic principles to sports settings. Empirical research project is cornerstone of course. Preparatory: ECON 314 and 405 or consent of instructor.

ECON 627 Development of the American Economy 3(3,0) Explores several topics relevant to understanding the American experience. Considers the institutions and developments critical to America's ascendency from a small country to a dominant global economic power. Investigates immigration, innovation, education, finance and the changing role of race and gender in the economy. Preparatory: ECON 314, 315.

ECON 628 Cost-Benefit Analysis 3(3,0) Develops techniques for the appraisal of public expenditure programs with particular emphasis on investment in infrastructure. Topics include the choice of an appropriate discount rate and the calculation of social costs and benefits in the presence of market distortions. Preparatory: ECON 314 or consent of instructor.

ECON 630 Topics in Mathematical Economics 3(3,0) Skills acquired in freshman mathematics are applied to selected topics in economic theory. Course is a good complement to ECON 314 and provides excellent preparation for 400-level courses in economics, especially ECON 450. May be taken concurrently with ECON 314. Preparatory: ECON 314, and MTHSC 108 or 207.

ECON 640 Game Theory 3(3,0) Introduction to the formal analysis of strategic interaction among rational, self-interested rationalists. Basic theoretical aspects of games are discussed and applied to such topics as oligopoly, price leadership, and the behavior of physicians and hospitals. Preparatory: ECON 314 and MTHSC 106, or ECON 430, or consent of instructor.

ECON 655 Applied Microeconomic Research 3(3,0) Students conduct research in applied microeconomics. Topics vary according to student and professor interests. Students read papers in the literature, formulate their own economic hypotheses and collect and analyze data to test those hypotheses. May be repeated for a maximum of nine credits. Preparatory: ECON 314 or consent of instructor.

ECON (AP EC) 657 Natural Resource Use, Technology and Policy 3(3,0) See AP EC 657.

ECON 751 Selected Topics for Teachers 3(3,0) Current economic policy issues such as inflation, regulation, protectionism and energy policy. Emphasis is on the presentation of these topics to secondary school students. Topics vary from year to year. May be repeated for credit. Preparatory: ECON 200, 211.

ECON (AP EC) 800 History of Economic Thought 3(3,0) Development of economic thought from early Greek to Keynesian economics; writings of major economists such as Smith, Ricardo, Marx, Marshall and Keynes; development of major economic theories. Preparatory: ECON 801 Microeconomic Theory 3(3,0) Microeconomic theory and its use to analyze and predict the behavior of industries, firms and consumers under various market conditions. Offered fall semester only.

ECON (AP EC) 802 Advanced Economic Concepts and Applications 3(3,0) Rigorous development of price theory under alternative product and resource market structures. Preparatory: Consent of instructor.

ECON (AP EC) 804 Applied Mathematical Economics 3(3,0) See AP EC 804.

ECON 805 Macroeconomic Theory 3(3,0) Macroeconomic theory involving static and dynamic models and their use in analysis of economic problems and policies. Preparatory: ECON (AP EC) 806 Econometrics I 3(3,0) See AP EC 806.

ECON 807 Econometrics II 3(3,0) Econometric models expressed as systems of equations; problems of identification, parameter estimation, measurement errors and statistical inference; techniques of simulation, forecasting, model validation and interpretation. Offered fall semester only.
ECON (AP EC) 827 Economics of Property Rights
3(3,0) Analyzes the evolution and impact of various property rights institutions on individual behavior and the subsequent use of resources. Particular attention is paid to the importance of property rights structures in the organization of business and in managerial decision making. Prag: ECON 801.
ECON (AP EC) 828 Applied Demand Analysis
3(3) See AP EC 828.
ECON (AP EC) 831 Economic Development 3(3,0)
Economic analysis of development of urban areas within the system of cities; central place theory and general equilibrium models of interregional economic activity emphasizing central place systems, spatial interaction and stochastic processes; internal development of the city focusing on housing and land use patterns, transportation and urban form.
ECON (AP EC) 832 Community and Regional Economics 3(3,0) See AP EC 832.
ECON 836 Research in Economics of Education 3(3,0) Theoretical and econometric analysis of education including such topics as human capital theory, pricing and competition in higher education, public financing and provision of education, cost/benefit analyses of education reforms such as accountability, school finance equalization and school choice. Includes discussion and research on current topics in the economics of education. Prag: AP EC (ECON) 806 or consent of instructor.
ECON (AP EC) 840 International Trade Theory
3(3,0) Theory of free trade from Ricardo to the present; theory and application of optimal and second-best tariffs; recent empirical testing of trade and tariff theory. Prag: ECON 314 and (AP EC) 802 or consent of instructor.
ECON (AP EC) 841 International Finance 3(3,0)
Financial economics of decision making in a multinational environment featuring autonomous governments and multiple currencies. Typical topics include the macroeconomic problems of unemployment and inflation in an international economy, management of exchange rate risk, credit risk, political risk and taxation Prag: ECON 807.
ECON 845 Advanced Game Theory 3(3,0) Introduces central concepts in game theory, emphasizing economic problems involving strategic behavior by consumers, firms and governments. Covers static and dynamic games, with both complete and incomplete information. Specific topics may include oligopolies, bargaining, auction theory, mechanism design, repeated games and information transmission.
ECON (AP EC) 855 Financial Economics 3(3,0)
Study of modern theory of corporate finance. Includes basic theories of efficient markets, portfolio selection, capital asset pricing, option pricing and agency costs. Prag: ECON (AP EC) 801 or consent of instructor.
ECON 888 Directed Reading in Economics 1-3(1-
3,0) Directed reading and research in the student's field of interest. May be repeated for a maximum of three credits.
ECON 891 Master's Thesis Research 1-12
ECON 900 Selected Topics in Economics 3(3,0) Current topics in economic theory and empirical research. May be repeated for credit, but only if different topics are covered.
ECON (AP EC) 901 Price Theory 3(3,0) Neoclassical paradigm of market price and quantity; rigorous consideration of consumer behavior, the theory of the firm and market equilibrium, production and resource demands and the supply of resources. Prag: ECON (AP EC) 801 or equivalent.
ECON (AP EC) 904 Seminar in Resource Economics
3(3,0) See AP EC 904
ECON 905 Advanced Macroeconomic Issues 3(3,0) Current unsettled issues in macroeconomic analysis. Topics include disequilibrium macro models, macro models of open economies, rational expectations and its critics, government stabilization policies and the controversy surrounding the concept of Ricardian equivalence. Prag: ECON 805 or equivalent.
ECON (AP EC) 906 Seminar in Area Economic Development 3(3,0) See AP EC 906.
ECON 915 General Equilibrium and Economic Growth 3(3,0) Risk sharing and efficient allocations are presented. Basic aggregation theory is covered producing the representative agent model. The neoclassical growth model with and without technological progress is presented, followed by the endogenous growth model. The modifications to this model produce multiple development regimes, convergence, biconvergence and switching phenomena. Prag: ECON 805
ECON 916 Advanced Economic Growth 3(3,0) Alternative models of endogenous growth are developed, including the public education models of growth, endogenous technology-R&D models, international trade and diffusion models, public policies and institutions, geography and growth, and finance and growth. Particular focus is on the empirical applications of growth models. Prag: ECON 915.
ECON (AP EC) 917 Advanced Seminar in Labor Economics 3(3,0) Continuation of ECON 816; bridging the gap between theory and modern empirical research in labor economics. Emphasizes reading recent empirical research papers to understand the techniques of modern research in labor economics. Prag: ECON (AP EC) 816.
ECON 920 Empirical Public Economics 3(3,0) Studies the effects of taxation on household and firm behavior, public goods, income transfer and welfare policies. Considers fiscal federalism, public policy and economic growth. Includes selected topics on effects of legislation and institutions on economic outcome. Prag: ECON (AP EC) 801, 807, (AP EC) 820.
ECON 924 Advanced Industrial Organizations 3(3,0) Coverage of advanced concepts and methods involving strategic interaction among firms. Topics may include pricing, capacity choice, advertising, collusion and industry dynamics. Prag: ECON (AP EC) 824 or consent of instructor.
ECON 940 Empirical International Economics 3(3,0) Investigates empirical applications of international issues. Typical topics include the theoretical and empirical international issues, including the Heckscher-Ohlin model, the gravity model of trade, models of exchange rate determination and dynamic stochastic general equilibrium models. Prag: ECON 840 or 841.
ECON (AP EC) 950 Monetary Economics 3(3,0) Economic analysis of money in our economy and effects of monetary policy on prices, interest rates, output and employment.
ECON 981 Applications of Economic Analysis 1-2(1-2) Presentations of economic research by guest lecturers, principally department faculty members. Presentations include description of one or more research projects typically taken from a common agenda. Discussion of methodology, data and data collection. Course is for first-year PhD students. To be taken Pass/Fail only. May be repeated for a maximum of four credits.
ECON 982 Workshop in Applied Economics 3(3,0) Forum for presentation and critical evaluation of ongoing research by candidates for the PhD degree in Applied Economics. May be repeated for a maximum of nine credits. Prag: Consent of instructor.
ECON (AP EC) 991 Doctoral Dissertation Research 1-12 See AP EC 991.
EDUCATION
ED 641 Middle School Curriculum 3(3,0) Concepts and methods for teaching middle school students. Discusses nature of middle school students, teacher characteristics, curricular and co-curricular programs, organization and teaching.
ED (CATE) 700 Supervising the Student Teacher in the Public School 2-3(2-3) Knowledge and skills desirable for supervisors of student teachers; use of observation instruments for recording objective data and evaluating teaching performance. To be taken Pass/Fail only. Prag: Professional teaching certicate, at least one year of teaching experience, recommendation from employing school district, or consent of instructor.
ED 757 Teacher Professional Development: Selected Topics 1-3(1-3) Selected topics determined by professional development needs for teachers. Does not count toward a master's degree; for professional development credit only. May be repeated, but only if different topics are covered.
ED 837 Independent Study in Education 1-3(1-
3) Master's-level study of selected topics under the direction of a faculty member chosen by the student. Student and faculty member develop a course of study different from any existing courses and designed for the individual student. May be repeated for a maximum of 24 credits, but only if different topics are covered.