

ECE 4710 Electric Vehicles and Energy Storage 3 (3)

Introduction to hybrid electric propulsion systems and energy storage systems. Topics include a review of fundamentals of electric vehicles and hybrid electric vehicles architectures covering reasons for hybridization, energy analysis of architecture and components; overview of energy storage systems (batteries and supercapacitors); modeling of components; vehicle simulation; and supervisory control. Preq: ECE 3200 with a C or better.

ECE 4730, 6730 Introduction to Parallel Systems

3 (3) Introduces parallel computer architectures and their programming. Includes an introduction to MPI and OpenMP and a number of engineering problems, including numerical simulations. Introduces scalability analysis. Preq: ECE 3220 or ECE 3290, each with a C or better.

ECE 4910 Undergraduate Honors Research 1-6 (1-6)

Individual research projects conducted under the direct supervision and guidance of a faculty member. May be repeated for a maximum of six credits.

ECE 4920, 6920 Special Problems 1-3 (1-3)

Special assignment in electrical or computer engineering. Some typical assignments include computer programs, term papers, technical literature searches, hardware projects, and design project leadership. May be taken only once for credit.

ECE 4930, 6930 Selected Topics 1-3 (1-3)

Classroom study of current and new technical developments in electrical and computer engineering. May be repeated for a maximum of six credits, but only if different topics are covered. Preq: Consent of instructor.

ECE 4950 Integrated System Design I 2 (1)

Considers engineering design of systems in a continuous process of project definition, planning, execution, and evaluation. This process includes consideration of both technical and non-technical factors in design. Strong emphasis is placed on the development of effective technical communications skills, particularly oral communications competency. Preq: Electrical Engineering major and ECE 3200 and ECE 3300 and ECE 3600 and ECE 3800, each with a C or better; or Computer Engineering major and ECE 3200 and ECE 3220 and ECE 3300 and ECE 3520 and ECE 3710, each with a C or better. Coreq: ECE 4951.

ECE 4951 Integrated System Design I Laboratory

0 (3) Non-credit laboratory to accompany ECE 4950. Coreq: ECE 4950.

ECE 4960 Integrated System Design II 2 (6)

Project-oriented course which brings together electrical and computer engineering students of dissimilar training in teams or project groups. Group assignments are designed to develop an appreciation for individual and creative thinking, as well as team effort. Preq: Electrical Engineering major and ECE 3210 and ECE 3710 and ECE 3810 and ECE 4090 and ECE 4950, each with a C or better or Computer Engineering majors and ECE 4090 and ECE 4950, each with a C or better.

ECE 4990 Creative Inquiry—Electrical and Computer Engineering 1-4 (1-4)

In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Includes Honors sections. Preq: Consent of faculty member/mentor.

ECONOMICS

Professors: H. Bodenhorn, W.R. Dougan, M. Espey, R.K. Fleck, T.A. Mroz, R.D. Sauer, Jr., *Chair*; C.J. Simon, Jr., R.F. Tamura, R.D. Tollison, P.W. Wilson; *Associate Professors:* S.L. Baier, F.A. Hanssen, M.J. Jerzmanowski, M. Lewis, S.R. Templeton, K.K. Tsui; *Assistant Professors:* T. Cvrcek, C. Lam, D. Miller, S. Mityakov, J. Oliveira, P. Warren, D. Wood; *Visiting Professor:* G.P. Dwyer, Jr.

ECON 2000 Economic Concepts 3 (3)

One-semester survey of basic economic concepts that offers an overview of both microeconomics and macroeconomics. Not intended for business majors or other students seeking a comprehensive introduction to economic analysis and its applications. Credit will not be given to students who have received credit for ECON 2110 or 2120.

ECON 2110 Principles of Microeconomics 3 (3)

Introduction to economic reasoning and its application to the study of the behavior of consumers and business firms. Particular topics include competition, monopoly, international trade, and the impact of selected public policies. Intended as the first of a two-semester sequence in the foundations of economics. Includes Honors sections.

ECON 2120 Principles of Macroeconomics 3 (3)

Continuation of ECON 2110 in which fundamental economic principles are applied to the study of aggregate economic performance. Topics include the forces determining the rates of inflation, unemployment, and economic growth, with particular emphasis on the influence of fiscal and monetary policies through financial markets. Includes Honors sections. Preq: ECON 2110.

ECON 3010 Economics of Labor 3 (3)

Introduces students to the economics of the labor market and labor relations. Considers the theories of wages and employment, determination, unemployment, investment in human capital, discrimination, and public policy toward the labor market. Also considers the role of labor unions. May not be used to satisfy requirements for a degree in Economics. Preq: ECON 2110.

ECON 3020 Money and Banking 3 (3)

Considers the function of money and banking in both the product and financial markets. Special emphasis is placed on monetary theory and current problems of monetary policy. May not be used to satisfy requirements for a degree in Economics. Preq: ECON 2120.

ECON 3030 Economics and Sports 3 (3)

Economic analysis of sports teams, leagues, and institutions. Analyzes basic economic issues using sports data. May not be used to satisfy requirements for a degree in Economics. Credit will not be given to students who have completed ECON 4260. Preq: Sophomore standing and ECON 2110.

ECON 3060 Managerial Economics 3 (3) Uses tools of economic analysis in classifying problems in organizing and evaluating information, and in comparing alternative courses of action. Bridges the gap between economic theory and managerial practices. May not be used to satisfy requirements for a degree in Economics. Preq: ECON 2110.

ECON 3070 Arbitration 3 (3) Analyzes dispute settlement procedures emphasizing mediation, fact-finding, and arbitration as they are used to resolve labor-management disputes in the public and private sectors. Preq: Consent of instructor.

ECON 3090 Government and Business 3 (3)

Relationships between government and business, including, among other topics, government efforts to enforce competition; to regulate public utilities; and to protect the special interest of laborers, farmers, and consumers. May not be used to satisfy requirements for a degree in Economics. Preq: ECON 2110.

ECON 3100 International Economy 3 (3)

Studies of the process of international commerce. Covers basic theory of trade and exchange rates, institutional and legal environment, current policy issues. Not open to students who have taken ECON 4120. May not be used to satisfy requirements for a degree in Economics. Preq: ECON 2110 and ECON 2120.

ECON 3140 Intermediate Microeconomics 3 (3)

Analytical study of basic concepts of value and distribution under alternative market conditions. Includes Honors sections. Preq: ECON 2110.

ECON 3150 Intermediate Macroeconomics

3 (3) Macroeconomic problems of inflation and unemployment are focal points. Includes statistics (measures of real output and the price level) and theory (covering the sources of short-run fluctuations and long-run growth). Analyzes appropriate public policies addressing these issues. Includes Honors sections. Preq: ECON 2120.

ECON 3190 Environmental Economics 3 (3)

Study of the application of economic logic to issues surrounding environmental management and policy. Examines individual, firm, and collective decision making as well as the evolution of regulatory approaches for controlling environmental use. Preq: ECON 3140.

ECON 3210 Economics of Innovation 3 (3)

Examines the nature of entrepreneurship and the contribution of innovation to economic growth. Investigates the organizational and institutional sources of innovation in different firms and different countries as well as the work of economic theorists concerning the role entrepreneurs play in bringing new products to market. Preq: ECON 3060 or ECON 3140.

ECON 3250 Personnel Economics 3 (3)

Study of various compensation and personnel practices firms employ. Explains when each of those practices should be followed to elicit the desired employee effort and labor force quality. Topics include piece-rate and time-rate systems, seniority-based incentive schemes, promotion contests, evaluation systems, mandatory retirement, and up-or-out rules. Preq: ECON 2110.

- ECON 3400 Behavioral Economics 3 (3)** Introduces the economic, sociological, and psychological aspects of decision making under uncertainty. Presents the psychology of prediction, intuitive prediction: biases and corrective procedures. Topics also include framing, choice with costly information, and social influences on individual behavior. Preq: ECON 2110.
- ECON 3440 Economics of Institutions and Property Rights 3 (3)** Study of fundamental property rights structures and institutions in the capitalist economy and the arrangements that create incentives to produce and exchange. Preq: ECON 2110 and ECON 2120.
- ECON 3500 Moral and Ethical Aspects of a Market Economy 3 (3)** Can a market system produce results that are fundamentally just? Is justice possible without voluntary exchange? Applies both economic and philosophical analyses to these questions. Emphasizes the causes, consequences, and morality of the distribution of wealth and income in a free-market system. Includes Honors sections. Preq: ECON 3140.
- ECON 3600 Public Choice 3 (3)** Covers the economic approach to political activities and institutions. Topics include voting, voting rules, constitutions, political competition, political business cycles, vote trading, interest groups, bureaucracy, committees, legislators, executives, and judges. Designed for Economics and non-Economics majors and requires only basic skills in microeconomics. Preq: ECON 2110.
- ECON 3900 Junior Honors Research 1 (1)** Readings and research in conjunction with an approved economics course at the 3000 or 4000 level. Honors status required. May be repeated for a maximum of three credits.
- ECON 3970 Creative Inquiry—Economics I 1-4 (1-4)** In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of four credits.
- ECON 4010 Labor Market Analysis 3 (3)** Develops the methods of economic analysis of labor markets. Requires students to apply these methods to problems of the labor market. Topics include labor demand and supply, human capital, occupational choice, compensating wage differentials, organizational wage structures and incentive systems, unemployment, and discrimination. Preq: ECON 3140.
- ECON 4020 Law and Economics 3 (3)** Application of economics to the law of property, torts, and contracts; regulation of markets, business organizations, and financial transactions; distribution of income and wealth; and criminal law. Preq: ECON 2110.
- ECON 4040 Comparative Economic Systems 3 (3)** Comparative analytical and historical study of the principal economic systems which have been important in the modern world including, among others, capitalism and socialism. Preq: ECON 3140.
- ECON 4050, 6050 Introduction to Econometrics 4 (3)** Introduction to 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. Preq: ECON 2110 and ECON 2120; and either MTHS 1080 or MTHS 2070; and one of EXST 3010 or MTHS 3010 or MTHS 3090. Coreq: ECON 4051, 6051.
- ECON 4051, 6051 Introduction to Econometrics Laboratory 0 (3)** Non-credit laboratory to accompany ECON 4050, 6050. Coreq: ECON 4050, 6050.
- ECON 4060, 6060 Advanced Econometrics 3 (3)** Reviews statistical inference using multiple regression (OLS) analysis and model specification. Topics include multicollinearity, heteroscedasticity, and serial correlation; two-staged 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. Preq for ECON 4060: ECON 4050. Preq for ECON 6060: ECON 4050 or consent of instructor.
- ECON 4100, 6100 Economic Development 3 (3)** 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. Preq for ECON 4100: ECON 3140. Preq for ECON 6100: ECON 3140 or consent of instructor.
- ECON 4110, 6110 Economics of Education 3 (3)** 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 educations effects on economic growth and income distribution. Preq for ECON 4110: ECON 3140. Preq for ECON 6110: ECON 3140 or consent of instructor.
- ECON 4120, 6120 International Microeconomics 3 (3)** 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. Preq for ECON 4120: ECON 3140. Preq for ECON 6120: ECON 3140 or consent of instructor.
- ECON 4130, 6130 International Macroeconomics 3 (3)** 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. Preq: ECON 3150.
- ECON 4190 Economics of Defense 3 (3)** Examines the American defense establishment in terms of resources utilized, alternative uses, and the contribution to the national economy and scientific progress generated by resources in a defense use. Discusses economic problems inherent in shifting resources between defense and nondefense uses and among alternative defense uses. Preq: ECON 3140.
- ECON 4200 Public Sector Economics 3 (3)** Study of the role of government and its proper functions and limitations in a market. Provision of goods and services by all levels of government and instruments of taxation are evaluated according to efficiency and equity criteria. Contemporary public sector issues are emphasized throughout. Preq: ECON 3140.
- ECON 4220, 6220 Monetary Economics 3 (3)** 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. Preq for ECON 4220: ECON 3140 and ECON 3150. Preq for ECON 6220: ECON 3140 and ECON 3150 or consent of instructor.
- ECON 4230, 6230 Economics of Health 3 (3)** Applies microeconomic theory to examine the demand for health services and medical care, the market for medical insurance, the behavior of physicians and hospitals, and the role of government in health-care provision and regulation. Preq: ECON 3140.
- ECON 4240, 6240 Organization of Industries 3 (3)** 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. Preq for ECON 4240: ECON 3140. Preq for ECON 6240: ECON 3140 or consent of instructor.
- ECON 4250, 6250 Antitrust Economics 3 (3)** Analysis of the economic and legal issues created by the exercise of market power. The motivation and execution of government policy towards mergers, predatory conduct, and various restraints of trade are intensively examined. Preq for ECON 4250: ECON 3090 or ECON 3140. Preq for ECON 6250: ECON 3090 or ECON 3140 or consent of instructor.
- ECON 4260, 6260 Seminar in Sports Economics 3 (3)** 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. Includes Honors sections. Preq for ECON 4260: ECON 3140 and ECON 4050. Preq for ECON 6260: ECON 3140 and ECON 4050; or consent of instructor.
- ECON 4270, 6270 Development of the American Economy 3 (3)** Explores several topics relevant to understanding the American experience. Considers the institutions and developments critical to Americas ascendancy 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. Preq: ECON 3140 and ECON 3150.
- ECON 4280, 6280 Cost-Benefit Analysis 3 (3)** Develops techniques for the appraisal of public expenditure programs with particular emphasis on investment in infrastructure. Topics include choice of an appropriate discount rate and the calculation of social costs and benefits in the presence of market distortions. Preq for ECON 4280: ECON 3140. Preq for ECON 6280: ECON 3140 or consent of instructor.

ECON 4300, 6300 Topics in Mathematical Economics 3 (3) This course develops the mathematical tools underlying economic analysis and prepares students for doing advanced theoretical work in economics. The topics covered in this course provide excellent preparation for advanced economics courses, and lay the foundation for doing quantitative analysis associated with both career work and graduate study in economics. Preq: ECON 3140; and either MTHS 1080 or MTHS 2070.

ECON 4350 Family Economics 3 (3) Analysis of economic aspects of the family. Economics of marriage, divorce, fertility, public policies affecting the family, women's labor force participation, and the gender gap are studied using main economic theories and empirical studies. Preq: ECON 3140.

ECON 4400, 6400 Game Theory 3 (3) Introduction to the formal analysis of strategic interaction among rational, self-interested rivals. Basic theoretical aspects of games are discussed and applied to such topics as bargaining, voting, auctions, and oligopoly. Preq for ECON 4400: ECON 3140 and MTHS 1060; or ECON 4300. Preq for ECON 6400: ECON 3140 and MTHS 1060; or ECON 4300 or consent of instructor.

ECON 4550, 6550 Applied Microeconomic Research 3 (3) 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, but only if different topics are covered. Preq for ECON 4550: ECON 3140. Preq for ECON 6550: ECON 3140 or consent of instructor.

ECON 4570, 6570 Natural Resource Use, Technology, and Policy 3 (3) Focuses on economic analyses of actual, efficient, and sustainable uses of natural resources, impacts of technologies that affect these uses, and policies that affect development and use of such technologies. Resource-technology-policy combinations may vary, but an example is crude oil, hybrid automotive engines, and fuel economy standards. May also be offered as APEC 4570, 6570. Preq: MTHS 1020 or MTHS 1060; and APEC 3570 or CRD 3570 or ECON 3140.

ECON 4910 Senior Honors Thesis Research 3 (3) Reading and research for the Senior Honors Thesis. Preq: ECON 3140 and ECON 3150 and senior honors standing.

ECON 4920 Senior Honors Thesis Writing 3 (3) Writing and oral presentation of the Senior Honors Thesis. Preq: ECON 4910.

ECON 4960 Independent Study 1-3 (1-3) Research and writing on a selected economics topic chosen by the student. A written proposal must be approved by the instructor prior to the start of the semester. May be repeated for a maximum of six credits. Preq: ECON 3140.

ECON 4970 Creative Inquiry—Economics II 1-3 (1-3) Engages students in research projects selected by the Economics Department faculty. Research projects vary depending on faculty and student interest. May be repeated for a maximum of six credits. Preq: ECON 3140.

ECON 4980 Selected Topics in Economics 3 (3) In-depth treatment of topics not covered fully in regular courses. Topics vary from year to year. May be repeated for a maximum of nine credits, but only if different topics are covered. Includes Honors sections. Preq: ECON 3140 and ECON 3150.

ECON 4990 Senior Seminar in Economics 1-3 (1-3) Discussion of topics of current interest in economics. Students conduct directed research on a particular topic. Preq: Consent of instructor.

EDUCATION

Associate Professor: S.N. Rosenblith, Chair

ED 1010 Effective Strategies for College Success 3 (3) Provides knowledge of specific strategies to increase academic success for college students. Includes instruction in strategies to address engagement and participation, organizational and study skills, test taking, note taking, reading content area text, and writing.

ED 1050 Orientation to Education 2 (2) Introduction to teaching addresses basic program requirements, SoE Conceptual Framework, state evaluation system, the nature of the diverse and multicultural classroom, standards and practices of professional conduct and requirements in teaching. A field experience involving tutoring in a P-12 classroom is required. Coreq: ED 1051.

ED 1051 Orientation to Education Laboratory 0 (1) Non-credit laboratory to accompany ED 1050. Coreq: ED 1050.

ED 1900 Leadership, Citizenship, and Community Service 3 (3) Provides active learning opportunities for students to understand better the system of government, learn the mechanics of how leadership can influence education and other initiatives, and develop interpersonal skills that will assist them throughout their professional lives. Culminates with a service learning plan for the students local community.

ED 1970 Creative Inquiry—Education 1-4 (1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

ED 2970 Creative Inquiry—Education 1-4 (1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

ED 3220 Responding to Emergencies 3 (2) Provides the citizen responder with the knowledge and skills necessary in a variety of emergencies to help sustain life and to minimize pain and the consequences of injury until professional help arrives. Includes first aid, CPR, and automated external defibrillation (AED). Coreq: ED 3221.

ED 3221 Responding to Emergencies Laboratory 0 (1) Non-credit laboratory to accompany ED 3220. Coreq: ED 3220.

ED 3970 Creative Inquiry—Education 1-4 (1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

ED 4050 Multiculturalism 3 (3) Introduces prospective teachers to the influence of culture on learning from an anthropological and historical perspective. Preq: HIST 1720 or HIST 1730.

ED 4380 Selected Topics in Education 1-3 (1-3) Specific education topics not found in other courses are selected for in-depth study. May be repeated for a maximum of 12 credits, but only if different topics are covered.

ED 4390 Independent Study in Education 1-3 (1-3) Study of selected topics in education 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 12 credits, but only if different topics are covered.

ED 4410, 6410 Middle School Curriculum 3 (3) 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 4970 Creative Inquiry—Education 1-4 (1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

ED 4990 Education Honors Capstone 1-6 (1-6) Students seeking departmental honors complete honors research under faculty mentors. Students take a minimum of six hours across at least two semesters. May be repeated for a maximum of 12 credits. Preq or concurrent enrollment: EDF 3010 and EDF 3020. Coreq: ED 4991.

ED 4991 Education Honors Capstone Laboratory 0 (4) Non-credit laboratory to accompany ED 4990. Coreq: ED 4990.

EDUCATIONAL COUNSELING

EDC 1990 Creative Inquiry—Counselor Education 1-4 (1-4) In consultation with and under the direction of a faculty member, students pursue scholarly activities individually or in teams. These creative inquiry projects may be interdisciplinary. Arrangements with mentors must be established prior to registration. May be repeated for a maximum of eight credits. Preq: Consent of faculty member/mentor.

EDC 2340 Introduction to Addictions: Basic Education and Prevention 3 (3) Basic review of addictions and chemical dependence. Gives future educators skills in the identification of chemical abuse, techniques for intervention, and methods of prevention education. SOC 3960 and 3970 are recommended as follow-up courses for those interested in pursuing the topic.