COMPUTATIONAL ECONOMICS

Contact Information

Economics
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The Master of Computational Economics (MCEcon) at Rice University is designed to equip students with cutting-edge computational tools and advanced economic modeling techniques to tackle complex economic challenges. This program bridges economic theory, econometrics, and high-performance computing, preparing graduates for careers in research, policy analysis, finance, and consulting. Graduates of the MCEcon program will be equipped to lead and contribute to high-impact projects that leverage computational tools and economic analysis to address complex challenges. They will be prepared to design and evaluate economic policies using data-driven simulations, model financial markets to assess risk and inform investment strategies, and develop machine learning applications for economic forecasting and decision-making. Additionally, they will conduct empirical research on labor markets, trade, and public policy interventions, analyze and optimize market structures in industrial organization and competition policy, and explore macroeconomic trends using computational methods to support central banking and economic planning.

The program prepares students for careers as economic consultants, financial analysts, policy researchers, and data scientists in industries such as finance, energy, healthcare, and government. Additionally, students aiming for a PhD will develop the strong quantitative and research foundation needed to pursue advanced academic studies.

With a unique curriculum integrating theory, econometrics, and computation, the MCEcon program at Rice University offers a forward-looking education that empowers students to solve today's most pressing economic challenges using the latest technological advancements.

The Master of Computational Economics (MCEcon) is a professional master's program, administered by the Department of Economics (https://ga.rice.edu/programs-study/departments-programs/social-sciences/economics/#header).

Computational Economics does not currently offer an academic program at the undergraduate level.

Master's Program

- Master of Computational Economics (MCEcon) Degree (https://ga.rice.edu/programs-study/departments-programs/social-sciences/computational-economics/computational-economics-mcecon/)

Certificate

- Certificate in Computational Economics (https://ga.rice.edu/programs-study/departments-programs/social-sciences/computational-economics/computational-economics-certificate/)*
- Certificate in Computational Economics, online program (https://ga.rice.edu/programs-study/departments-programs/social-sciences/computational-economics/computational-economics-certificate-online/)*

* *This certificate program is open to both Rice students enrolled in a graduate degree-granting program and to (standalone)* graduate certificate students (https://ga.rice.edu/graduate-students/academic-opportunities/certificates/)*. Additionally, these certificates are stackable, meaning graduate certificate students may decide to apply for and (upon acceptance) return for a MCEcon degree.*

Department Chair, Economics

Flávio Cunha

Program Director

Zachary Bethune

For Rice University degree-granting programs:
To view the list of official course offerings, please see Rice's Course Catalog (https://courses.rice.edu/admweb/!SWKSCAT.cat?p_action=cata).
To view the most recent semester's course schedule, please see Rice's Course Schedule (https://courses.rice.edu/admweb/!SWKSCAT.cat).

Economics (ECON)

ECON 100 - PRINCIPLES OF ECONOMICS
Short Title: PRINCIPLES OF ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: Introduction to the basic concepts of microeconomics and macroeconomics. Microeconomics component includes analysis of supply and demand, consumer and producer behavior, and competitive and noncompetitive market equilibria, with applications to current policy issues. Macroeconomics component provides an overview of the determination of national output, employment, interest rates, and inflation, and analyzes monetary fiscal policies and international trade. Designed for both non-majors and majors.

ECON 101 - INTRODUCTION TO MICROECONOMICS
Short Title: INTRODUCTION TO MICROECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: Introduction to microeconomic analysis at a level suitable for non-majors. Applies only for transfer credit and requires departmental approval. Approved credit counts toward total credit hours required for graduation and for distribution, but does not count toward the ECON or MTEC majors. Mutually Exclusive: Cannot register for ECON 101 if student has credit for ECON 111.

ECON 102 - QUANTITATIVE ANALYSIS FOR SOCIAL SCIENCES: ECONOMICS LAB
Short Title: ECONOMICS STATISTICS LAB
Department: Economics
Grade Mode: Standard Letter
Course Type: Laboratory
Credit Hours: 0
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: This lab companion course to SOSC 302: Quantitative Analysis for the Social Sciences involves economics-specific applications of statistical analysis. The lab focuses on the use of software to analyze data from research in economics sciences. Students who enroll in this lab section must also enroll in SOSC 302 during the same semester.

ECON 103 - INTRODUCTION TO MACROECONOMICS
Short Title: INTRODUCTION TO MACROECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: Introduction to macroeconomic analysis at a level suitable for non-majors. Applies only for transfer credit and requires departmental approval. Approved credit counts toward total credit hours required for graduation and for distribution, but does not count toward the ECON or MTEC majors. Mutually Exclusive: Cannot register for ECON 103 if student has credit for ECON 112/ECON 113.

ECON 111 - AP/OTH CREDIT IN MICROECONOMICS
Short Title: AP/OTH CREDIT MICROECONOMICS
Department: Economics
Grade Mode: Transfer Courses
Course Type: Transfer
Credit Hours: 1-6
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: Provides transfer credit based on student performance on approved examinations in microeconomics, such as the Advanced Placement microeconomics exam, the International Baccalaureate higher-level economics exams, or the A-Level economics exam, or for an approved introductory microeconomics course. Approved credit counts toward total credit hours required for graduation, but does not count for distribution or toward the ECON or MTEC majors. Mutually Exclusive: Cannot register for ECON 111 if student has credit for ECON 101.

ECON 113 - AP/OTH CREDIT IN MACROECONOMICS
Short Title: AP/OTH CREDIT MACROECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Transfer
Credit Hours: 1-6
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: Provides transfer credit based on student performance on approved examinations in macroeconomics, such as the Advanced Placement macroeconomics exam, the International Baccalaureate higher-level economics exams, or the A-Level economics exam, or for an approved introductory macroeconomics course. Approved credit counts toward total credit hours required for graduation, but does not count for distribution or toward the ECON or MTEC majors. Mutually Exclusive: Cannot register for ECON 113 if student has credit for ECON 103.

ECON 200 - MICROECONOMICS
Short Title: MICROECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Distribution Group: Distribution Group II
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Prerequisite(s): (MATH 102 or MATH 106) and (ECON 100 or MATH 212)
Description: Intermediate level analysis of theories of household behavior, including demand for consumer goods, labor supply, and savings/investment decisions, and producer behavior including the supply of output and demands for labor, capital and other production inputs. Emphasizes individual and interactive decision making under resource constraints and discusses equilibria in competitive markets.

ECON 203 - MACROECONOMICS
Short Title: MACROECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Prerequisite(s): ECON 100
Description: Analyzes aggregate performance of the national economy including output, inflation, interest rates, employment, the business cycle, monetary and fiscal policy, and more generally the role of government in influencing aggregate economic performance. Introduces both the traditional aggregative only approach to Macroeconomics and the more recent New Classical and New Keynesian micro-foundations approaches.

ECON 205 - INTRODUCTION TO GAME THEORY
Short Title: INTRODUCTION TO GAME THEORY
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: This course provides an introduction to game theory, a branch of mathematics that studies decision-making by agents in situations where the outcome for each depends on the actions taken by all. Students will develop a familiarity with analytical tools that have found applications in, for example, economics and other social sciences, biology, computer science, and philosophy. Mutually Exclusive: Cannot register for ECON 205 if student has credit for ECON 300/ECON 305.

ECON 208 - PROGRAMMING FOR ECONOMISTS
Short Title: PROGRAMMING FOR ECONOMISTS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: This course teaches students the Python programming language and helps them understand how writing code can empower them to answer economic questions. Students are taught how to use the “core Python data libraries” like pandas, numpy, and matplotlib. Additionally, there is an emphasis on the fact that “real-world” data are messy; the course presents tools that allow students to thrive in such an environment. Graduate/Undergraduate Equivalency: ECON 632. Mutually Exclusive: Cannot register for ECON 208 if student has credit for ECON 632.

ECON 209 - APPLIED ECONOMETRICS
Short Title: APPLIED ECONOMETRICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Distribution Group: Distribution Group II
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Prerequisite(s): (ECON 100 or ECON 200) and (ECON 307 or STAT 310 or STAT 315 or DSCI 301 or SOSC 302 or BUSI 395)
Description: Applied econometric methods: econometric theory with practical emphasis on modeling, estimation, and hypothesis testing. A computer lab one day a week focuses on empirical implementation of econometric methods using statistical software.

ECON 210 - BEHAVIORAL ECONOMICS
Short Title: BEHAVIORAL ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Prerequisite(s): ECON 100 or ECON 200
Description: Examines behavioral economics, which seeks to insert more behavioral realism into economic theory by incorporating into economic models insights based on empirical observations from psychology, sociology, and neuroscience. Emphasizes attempts by behavioral economists to explain anomalies that depart from the predictions of standard economic theory. Topics include temptation and self-control, fairness and reciprocity, reference dependence, bounded rationality and choice under risk and uncertainty.

ECON 211 - MONEY MATTERS: ECONOMIC LITERACY AND DECISION-MAKING
Short Title: MONEY MATTERS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: Economic literacy and decision-making are critical to attaining financial well-being. This course will equip students with knowledge and skills to help them better navigate a lifetime of financial decision-making. It will cover topics including credit cards, financial investments, and debt management. Students will understand important decisions regarding student loans, mortgages, bank accounts, and retirement funds. The course will rely on empirical research to inform the best decision-making practices. Finally, the course will examine the current regulatory environment in financial markets, tools and products for consumers to navigate financial decisions, and policy prescriptions to improve financial markets in terms of the risks for consumers.

ECON 213 - INTRODUCTION TO ENVIRONMENTAL AND NATURAL RESOURCE ECONOMICS
Short Title: INTRO TO ENVIRONMENTAL ECON
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Prerequisite(s): ECON 100
Description: The course uses a policy-oriented approach to study some of the major environmental and natural resource issues. We use economic theory and empirical work from the field to understand the causes and consequences of these issues and explore how economics can provide potential solutions. Some of the topics covered include: the problem of externalities and property rights, static and dynamic efficiency, depletable resource allocation, recycling resources, fishery, forestry, and climate change. Students will leave the course with a global perspective of both environmental and natural resource economics and how they interact. Various techniques in Excel for general calculations, optimization, present value analysis, regression, and graphs are taught and used in the course. No previous knowledge of excel is required.

ECON 214 - INTRODUCTION TO MANAGERIAL ECONOMICS
Short Title: INTRO TO MANAGERIAL ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Prerequisite(s): ECON 100
Description: The course utilizes economic tools such as supply and demand, elasticity, cost-benefit analysis, and models of perfect competition, monopoly, and monopolistic competition to support managerial decision-making. Real-world examples and case studies include topics in welfare, globalization, artificial intelligence and cost minimization, product differentiation, collusion, game theory, markup pricing, price discrimination, bundling, and predatory pricing. Various techniques in Excel for general calculations, optimization, present value analysis, regression, and graphing are taught and used in the course.

ECON 215 - SPORTS ECONOMICS
Short Title: SPORTS ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Prerequisite(s): ECON 100
Description: This course covers different dimensions of sports economics, with particular attention paid to strategic behavior, markets, and the use of statistics—or "advanced analytics"—in decision-making. Topics covered may include in-game decision-making, player personnel decisions, anti-competitive behavior, and labor market outcomes.

ECON 238 - SPECIAL TOPICS
Short Title: SPECIAL TOPICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Internship/Practicum, Laboratory, Lecture, Lecture/Laboratory, Seminar, Independent Study
Credit Hours: 1-4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: Topics and credit hours vary each semester. Contact department for current semester's topic(s). Repeatable for Credit.

ECON 239 - LAW AND ECONOMICS
Short Title: LAW AND ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Prerequisite(s): ECON 100 or ECON 200
Description: Exploration of the law using economic tools based on microeconomic theory. Focuses on legal issues most applicable to business. Mutually Exclusive: Cannot register for ECON 239 if student has credit for ECON 438.

ECON 299 - EXPERIENTIAL EDUCATION IN ECONOMICS
Short Title: EXPERIENTIAL EDUC IN ECONOMICS
Department: Economics
Grade Mode: Satisfactory/Unsatisfactory
Course Type: Internship/Practicum
Credit Hour: 1
Restrictions: Enrollment is limited to students with a major in Economics, Managerial Econ & Org Sci or Mathematical Economic Analysis. Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Prerequisite(s): ECON 200
Description: Provides one hour of university credit for faculty-approved internship. Students must obtain approval from a member of the department's undergraduate committee and must submit an offer letter from the internship provider as well as a letter indicating completion and satisfactory performance. Instructor Permission Required. Repeatable for Credit.

ECON 300 - GAME THEORY AND OTHER MICRO TOPICS FOR ECON MAJORS
Short Title: GAME THEORY, MICRO TOPICS/ECON
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and (ECON 307 or STAT 310 or STAT 315 or DSCI 301)
Description: Advanced applied analysis of topics in microeconomics designed for students in the ECON major. Topics include the foundations and applications of game theory, the economics of choice under uncertainty, and information economics including issues of asymmetric information. Additional topics may include auction theory and mechanism design. Mutually Exclusive: Cannot register for ECON 300 if student has credit for ECON 205.

ECON 305 - GAME THEORY AND OTHER MICRO TOPICS FOR MTEC MAJORS
Short Title: GAME THEORY, MICRO TOPICS/MTEC
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): (ECON 307 or STAT 310 or STAT 315 or DSCI 301) and ECON 308
Description: Advanced theoretical analysis of topics in microeconomics, focusing on mathematical modeling. Topics include the foundations and applications of game theory, general equilibrium theory and applications, the economics of choice under uncertainty, and information economics including issues of asymmetric information. Additional topics may include auction theory and mechanism design. Open to all majors but designed for students in the MTEC major. Mutually Exclusive: Cannot register for ECON 305 if student has credit for ECON 205.

ECON 307 - PROBABILITY AND STATISTICS
Short Title: PROBABILITY & STATISTICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group III
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): MATH 102 or MATH 106
Description: Probability and the central concepts and methods of statistics including probability, random variables, distributions of random variables, expectation, sampling distributions, estimation, confidence intervals, and hypothesis testing. Cross-list: STAT 310. Recommended Prerequisite(s): MATH 212. Mutually Exclusive: Cannot register for ECON 307 if student has credit for DSCI 301/STAT 311/STAT 312/ STAT 315.

ECON 308 - MATHEMATICS FOR ECONOMISTS
Short Title: MATHEMATICS FOR ECONOMISTS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200
Description: Topics in linear algebra, multivariate calculus, and optimization used in economics and econometrics. Graduate/ Undergraduate Equivalency: ECON 631. Mutually Exclusive: Cannot register for ECON 308 if student has credit for ECON 631.

ECON 310 - ECONOMETRICS
Short Title: ECONOMETRICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 209 and ECON 308
Description: Survey of estimation and forecasting models. Includes multiple regression time series analysis. A good understanding of linear algebra is highly desirable. Cross-list: STAT 376. Mutually Exclusive: Cannot register for ECON 310 if student has credit for ECON 409/STAT 400.

ECON 343 - CORPORATE FINANCE
Short Title: CORPORATE FINANCE
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): (ECON 100 or ECON 200) and (STAT 280 or STAT 305 or STAT 310 or STAT 315 or ECON 307 or STAT 312 or POLI 395 or PSYC 339 or SOSC 302) and BUSI 305
Description: Corporate financial management including tools used to evaluate and select investment projects and the method of financing those investments. The influence of corporate control on investment decisions. The valuation of stocks, bonds and options using the time value of money, the trade-off between risk and return, and arbitrage. Mutually Exclusive: Cannot register for ECON 343 if student has credit for BUSI 343.

ECON 355 - FINANCIAL MARKETS
Short Title: FINANCIAL MARKETS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group II
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200
Description: Principles governing U.S. and international equity and debt markets, and the interactions between such markets and national monetary and exchange rate policies. Focuses on the role of financial markets and institutions in the allocation and transfer of credit and risk, and examines various existing and suggested regulatory frameworks.

ECON 365 - WORLD ECONOMIC HISTORY
Short Title: WORLD ECONOMIC HISTORY
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group I
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 100 and ECON 200 and ECON 203
Description: Study and analysis of world economy focusing on the economic expansion of Western countries between the 14th and 21st centuries. Emphasis on contextual changes in economy, geography, history, society, culture, religion and politics in determining economic leadership of certain economies, such as Italy, Portugal, Spain, the United Kingdom, Belgium, the Netherlands, France, Germany, Sweden, the United States and Japan. Cross-list: HIST 365.

ECON 399 - INDEPENDENT RESEARCH
Short Title: INDEPENDENT RESEARCH
Department: Economics
Grade Mode: Standard Letter
Course Type: Research
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 203 and ECON 209 and (ECON 300 or ECON 305)
Description: Independent research project under the supervision of a faculty member who must approve the topic.Consult the department website under "Independent Research" for additional details. Students must have a GPA of 3.0 or higher in the prerequisite courses and must have taken the 400-level course or courses most relevant to the research topic. Faculty advisors may require additional prerequisites. Instructor and department permission required. Not offered during the summer. Instructor Permission Required.

ECON 415 - LABOR ECONOMICS
Short Title: LABOR ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200
Description: Empirical evidence and theories relating to several features of labor markets. Topics covered may include fertility, health, criminal behavior, labor force participation, hours of work, education and training, geographical and inter-firm labor mobility, static and dynamic labor demand, unions, discrimination, government intervention in labor markets, and "hedonic" equilibria in labor markets. Graduate/Undergraduate Equivalency: ECON 515. Mutually Exclusive: Cannot register for ECON 415 if student has credit for ECON 515.

ECON 418 - ECONOMIC FORECASTING
Short Title: ECONOMIC FORECASTING
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 203 and ECON 209
Description: Application of econometric techniques to problems in macroeconomics and financial economics. The course focuses on macroeconomic forecasting and test of economic theories using stationary and non-stationary time-series data. Methods include predictive regressions, vector autoregressions, impulse response functions, and variance decomposition. Tests and comparisons of forecast accuracy are also included. Projects will be completed in STATA.

ECON 421 - QUANTITATIVE METHODS FOR POLICY EVALUATION + PRACTICAL LAB
Short Title: QUANTITATIVE METHODS + LABS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and ECON 209
Description: The central challenge in policy evaluation is establishing a causal link between interventions and outcomes. This course introduces the main econometric methods used to evaluate public policies and social programs. Theoretical discussions are complemented by real-world applications, including case studies and empirical exercises based on actual policy interventions. Students will engage with quantitative evaluations using real data and will work with statistical and econometric software to apply the methods in practice. Graduate/Undergraduate Equivalency: ECON 624. Mutually Exclusive: Cannot register for ECON 421 if student has credit for ECON 624.

ECON 422 - INTERNATIONAL ECONOMICS AND FINANCE
Short Title: INTERNATIONAL ECON & FINANCE
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and ECON 203
Description: Studies the economic relationships among countries. Explores the sources of comparative advantage and reasons for trade policies. Examines foreign exchange and international capital markets and linkages between exchange rates, interest rates, and prices. Includes trade theory, tariffs, and other trade restrictions, an overview of historical and institutional developments, and current policy issues.

ECON 423 - ADVANCED ECONOMETRICS FOR ENERGY MARKETS
Short Title: ADV ECON FOR ENERGY MARKETS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): (ECON 209 or ECON 310) and ECON 437
Description: This course provides an introduction to advanced econometric techniques, focusing on time series and panel data as applied to energy markets. Students will learn to handle issues such as autocorrelation and seasonality in energy data, develop ARIMA models for forecasting, and apply these techniques in Python. The course emphasizes practical applications through lab sessions and concludes with a final project that requires students to conduct demand estimation and forecasting for an energy commodity, presented in an interactive dashboard format. Graduate/Undergraduate Equivalency: ECON 623. Mutually Exclusive: Cannot register for ECON 423 if student has credit for ECON 623.

ECON 432 - POLITICAL ECONOMY
Short Title: POLITICAL ECONOMY
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and (ECON 300 or ECON 305)
Description: Analyzes income redistribution, taxation, the production of public goods, and other actions of the public sector as determined by a political process simultaneously with the economic process of exchange and production. Investigates the connection between public policies and the political forces that shape them.

ECON 433 - DYNAMIC MODELS FOR COMPUTATIONAL ECONOMICS
Short Title: DYNAMICS IN COMPUTATIONAL ECON
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 208 and ECON 308
Description: This course covers models with dynamic components and procedures for decision making in the context of economics. The topics include, but are not limited to, multi-armed bandits, dynamic programming + the Bewley model, and time-series analysis (both Bayesian and frequentist). Graduate/Undergraduate Equivalency: ECON 633. Mutually Exclusive: Cannot register for ECON 433 if student has credit for ECON 633.

ECON 434 - MACHINE LEARNING AND ALGORITHMS FOR COMPUTATIONAL ECONOMICS
Short Title: MACHINE LEARNING FOR COMP ECON
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 208 and ECON 308
Description: This course will cover supervised learning (both regression and classification) , reinforcement learning, and model selection via validation procedures. The course prepares students to apply a variety of classical and cutting-edge machine learning techniques to problems in economics. Students will be taught principled approaches that adhere to best practices and promote understanding and transparency. Graduate/Undergraduate Equivalency: ECON 634. Mutually Exclusive: Cannot register for ECON 434 if student has credit for ECON 634.

ECON 435 - INDUSTRIAL ORGANIZATION
Short Title: INDUSTRIAL ORGANIZATION
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 205 or ECON 300 or ECON 305
Description: Economic analysis of monopoly and imperfect competition, with a focus on price discrimination, revenue management, and strategies firms may use to gain and maintain market power. Ideas are developed using a variety of theoretical models. Prior knowledge of game theory (with calculus) is assumed.

ECON 437 - ENERGY ECONOMICS
Short Title: ENERGY ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200
Description: Discussion of key aspects in the supply and demand of energy. Topics include optimal extraction of depletable resources, transportation, storage, end-use and efficiency, and the relationship between economic activity, energy, and the environment. Cross-list: ENST 437. Graduate/Undergraduate Equivalency: ECON 601. Mutually Exclusive: Cannot register for ECON 437 if student has credit for ECON 601.

ECON 439 - ADVANCED TOPICS IN LAW AND ECONOMICS
Short Title: ADV TOPICS IN LAW AND ECON
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200
Description: Addresses the role of economics in understanding the legal system, in particular how the law allocates entitlements and risk in property, tort and contract law. Intended primarily for students who are considering attending law school and uses instruction methods appropriate for that goal.

ECON 441 - ECONOMIC ANALYSIS OF STRATEGIC BEHAVIOR
Short Title: ANALYSIS OF STRATEGIC BEHAVIOR
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and ECON 209
Description: This course introduces students to models for analyzing economic markets, with a focus on strategic behaviors of consumers and firms. The course provides an opportunity to learn to estimate such models using real-world market data.

ECON 443 - FINANCIAL ECONOMICS
Short Title: FINANCIAL ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 305 and (ECON 307 or STAT 310 or STAT 315 or DSCI 301)
Description: Economic analysis of the operation of financial markets from a mathematical and theoretical perspective. Topics include asset pricing, risk management, portfolio theory, arbitrage theory, and market efficiency. Emphasizes the application of the financial concepts to decisions faced by households and firms.

ECON 445 - HONORS MANAGERIAL ECONOMICS
Short Title: HONORS MANAGERIAL ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and (STAT 310 or ECON 307 or STAT 315 or STAT 376)
Description: Understanding how Risk, Hidden Action, Holdups, and Hidden information affect managerial decisions and how to quantify these costs. Although any student who satisfies the prerequisites can take this course, they must have a GPA of at least 3.67 in all courses taken toward satisfying major requirements and earn at least a B- in this course to graduate with honors in MEOS.

ECON 449 - PRINCIPLES OF FINANCIAL ENGINEERING
Short Title: FINANCIAL ENGINEERING
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): (ECON 308 or MATH 211) and MATH 212 and (ECON 310 or STAT 376)
Description: Covers the use of financial securities and derivatives to take or hedge financial risk positions, including most commonly used instruments, from simple forwards and futures to exotic options and swaptions. Studies the pricing of derivative securities with emphasis on the mechanics and uses of financial engineering methods. Mutually Exclusive: Cannot register for ECON 449 if student has credit for STAT 449.

ECON 450 - ECONOMIC DEVELOPMENT
Short Title: ECONOMIC DEVELOPMENT
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and ECON 203
Description: This course covers different dimensions of economic development, focusing on poverty, inequality, demography, and health. It provides an overview of the economies of less developed countries, the lives of the poor, and the theories for why some countries are rich and others are poor. It also describes how labor and credit markets function in poor countries, the consequences for health and education, and the role of institutions.

ECON 452 - RELIGION, ETHICS, AND ECONOMICS
Short Title: RELIGION, ETHICS, & ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and (ECON 307 or STAT 310 or STAT 315 or DSCI 301)
Description: Reviews economic models of the demand, supply, and markets for religion, including the effects of economic conditions on religious choice and vice versa. Students will write a term paper on topics of their choosing, subject to professor's approval. Recommended Prerequisite(s): ECON 209 or ECON 310 or STAT 376.

ECON 455 - MONEY AND BANKING
Short Title: MONEY AND BANKING
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and ECON 203
Description: Micro-foundations of monetary, fiscal and financial theory. Examines the unique roles of money and of banking in providing the transactions mechanism and in the functioning of financial markets. Explains the use of valued fiat, unbacked money which appears to violate basic microeconomics, in the context of Samuelson's overlapping generations model, including the implications for monetary and fiscal policy and for inflation. Discusses bank runs and financial instability.

ECON 456 - TOPICS IN BUSINESS ECONOMICS: FINANCIAL MARKET AND INVESTMENTS
Short Title: INVESTMENTS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 100 and ECON 200 and ECON 203
Description: The course is a rigorous, quantitative introduction to financial market structure and financial asset valuation. The main topics of the course include time value of money, discounted cashflow analysis, CAPM model, portfolio selection, equilibrium asset pricing. Recommended Prerequisite(s): Students must be comfortable with statistics, linear algebra, calculus, and microeconomics.

ECON 460 - ADVANCED TOPICS IN ECONOMIC DEVELOPMENT
Short Title: ADV TOPICS ECON DEVELOPMENT
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200
Description: Focuses on role of taxation, finance and international trade, foreign investment and foreign aid in economic development.

ECON 461 - URBAN ECONOMICS
Short Title: URBAN ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200
Description: In this course, we will develop theories of urban economics and then use these theories to analyze current policy issues. The theories cover a broad range of topics related to the emergence of cities, different forms of cities, and the problems associated with the process of urbanization. We will discuss potential solutions to these problems.

ECON 462 - ECONOMICS OF HUMAN CAPITAL
Short Title: ECONOMICS OF HUMAN CAPITAL
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 320
Description: This course covers theory that describes the central role of human capital in determining economic growth and inequality, uses advanced econometric techniques to test if the theory is consistent with data, and presents insights for public policy that can improve human capital formation, increase economic growth and reduce social inequality.

ECON 470 - MARKET DESIGN
Short Title: MARKET DESIGN
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and (ECON 307 or STAT 310 or STAT 315 or DSCI 301)
Description: Regulators, entrepreneurs and economists have recently been involved in the design of novel markets for radio spectrum, kidneys, on-line advertising, school choice, etc. This course utilizes game theory to provide the theoretical underpinning of such markets via real world examples, including the study of institutional details that can determine the success or failure of a market. Graduate/Undergraduate Equivalency: ECON 625. Mutually Exclusive: Cannot register for ECON 470 if student has credit for ECON 625.

ECON 471 - DATA ANALYSIS FOR MARKET DESIGN AND POLICY
Short Title: DATA ANALYSIS FOR MKT DESIGN
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 209 and (ECON 300 or ECON 305 or ECON 470)
Description: This advanced course integrates economic theory with data analysis methods to study the workings of markets and discover ways to improve their design. Examples include auctions---ranging from natural resource auctions to treasury auctions---matching markets, and bargaining; specific markets studied may vary. Students will be active users of computational software. Graduate/Undergraduate Equivalency: ECON 616. Mutually Exclusive: Cannot register for ECON 471 if student has credit for ECON 616.

ECON 477 - SPECIAL TOPICS
Short Title: SPECIAL TOPICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture, Laboratory, Internship/Practicum, Seminar, Lecture/Laboratory
Credit Hours: 1-4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: Topics and credit hours vary each semester. Contact department for current semester's topic(s). Repeatable for Credit.

ECON 480 - THE ECONOMICS OF ENERGY & THE ENVIRONMENT
Short Title: ECON OF ENERGY & ENVIRONMENT
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200
Description: Uses economic theories of externalities and common property resources to analyze how markets, legal institutions, regulations, taxes and subsidies, and voluntary activity can affect the supply of environmental amenities, such as clean air, clean water, and wilderness areas. Also discusses methods for determining the demand for environmental amenities. Cross-list: ENST 480. Graduate/Undergraduate Equivalency: ECON 607.

ECON 481 - HEALTH ECONOMICS
Short Title: HEALTH ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and (ECON 209 or ECON 310 or STAT 376)
Description: Study of determinants of health, including behavioral, economic and social factors and access to health care. Application of economics to understand health insurance, the hospital and physician markets, pharmaceuticals, and the health care system. Effects of regulation and methods of payment. Graduate/Undergraduate Equivalency: ECON 565. Mutually Exclusive: Cannot register for ECON 481 if student has credit for ECON 565.

ECON 483 - PUBLIC ECONOMICS: TAXATION
Short Title: PUBLIC ECONOMICS: TAXATION
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200
Description: Provides an economic analysis of the theory and practice of tax policy, focusing on the evaluation of alternative tax systems in terms of equity, efficiency, and simplicity. Analyzes tax the effects of various taxes on individual and business behavior, including labor supply, saving, and investment. Discusses general equilibrium modeling of the economic and distributional effects of alternative tax systems and tax reforms. Special topics include the choice between income-based and consumption-based taxation, tax incidence, optimal taxation, taxation of the family, and state and local public finance.

ECON 484 - PUBLIC ECONOMICS: EXPENDITURES
Short Title: PUBLIC ECONOMICS: EXPENDITURES
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200
Description: Provides an economic analysis of the theory and practice of government expenditure policy, focusing on issue related to efficiency and equity. Analyzes issues related to budget deficits, government debt, and fiscal sustainability. Special topics include national public goods, state and local public goods, political economy, policies that correct for externalities including those associated with carbon emissions and pollution, education policy, income redistribution programs such as the Earned Income Tax Credit, and social insurance programs such as Social Security.

ECON 485 - THE ECONOMICS OF SUSTAINABILITY, CONSERVATION, AND PANDEMICS
Short Title: ECON, CONSERVATION & PANDEMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200
Description: This course will cover issues related to conservation, sustainability and pandemics from an economics point of view. Topics will include the need for conservation policies and planning, how science informs conservation strategies, incentives and the design of conservation agreements, and the role of deforestation and wildlife markets in pandemic emergence. Policies to reduce the likelihood of pandemic emergence, as well as the effects of pandemics like influenza, HIV, and COVID-19 on the global economy will also be discussed. Recommended Prerequisite(s): MATH 212

ECON 489 - ECONOMICS OF SOCIAL NETWORKS
Short Title: ECONOMICS OF SOCIAL NETWORKS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and ECON 209
Description: This course introduces research on social networks and analyzes how these networks affect our choices: the products we buy, the careers we follow, whom we marry, how we raise our children. Students will learn about network measurement and formation and the influence of social networks on our decisions.

ECON 494 - COMPUTATIONAL GAME THEORY
Short Title: COMPUTATIONAL GAME THEORY
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 200 and (ECON 300 or ECON 305) and ECON 308 and (ECON 307 or STAT 310 or STAT 315 or DSCI 301)
Description: This course introduces computational approaches to game theory. Topics include but are not limited to algorithms for solution concepts, fixed point theorems, learning dynamics, and potential games. Students will explore both theoretical foundations and applications to economics, with assignments combining analytical problem-solving and computational exercises. This course will use Python.

ECON 496 - RESEARCH IN ECONOMIC THEORY
Short Title: RESEARCH IN ECONOMIC THEORY
Department: Economics
Grade Mode: Standard Letter
Course Type: Research
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 203 and (ECON 310 or STAT 376) and (ECON 205 or ECON 300 or ECON 305)
Description: Research course for students whose primary interest is in economic theory. Review and analysis of seminal and current research in economic theory, including independent analysis by the student. Topics vary from year to year.

ECON 497 - RESEARCH IN ECONOMETRICS
Short Title: RESEARCH IN ECONOMETRICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Research
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 203 and (ECON 310 or STAT 376) and (ECON 205 or ECON 300 or ECON 305)
Description: Capstone course for MTEC majors whose primary interest is in econometrics. Review and analysis of seminal and current research in econometrics, including independent analysis by the student. Topics vary from year to year.

ECON 498 - HONORS PROGRAM IN ECONOMICS-I
Short Title: HONORS PROGRAM IN ECONOMICS-I
Department: Economics
Grade Mode: Standard Letter
Course Type: Research
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 203 and (ECON 209 or ECON 310) and (ECON 300 or ECON 305)
Description: Research workshop open to ECON and MTEC majors. Students must have a GPA of at least 3.67 in all courses taken toward satisfying major requirements, and must have taken all ECON courses directly related to the topic of their research. Students develop a research idea, construct an economic model with testable hypotheses, test those hypotheses, and write and present an academic quality paper. Econometrics pre-requisite is ECON 209 for ECON majors and ECON 310 for MTEC majors.

ECON 499 - HONORS PROGRAM IN ECONOMICS-II
Short Title: HONORS PROGRAM IN ECONOMICS-II
Department: Economics
Grade Mode: Standard Letter
Course Type: Research
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 498
Description: Continuation of ECON 498. University credit only.

ECON 501 - MICROECONOMICS I
Short Title: MICROECONOMICS I
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Formal mathematical treatments of the classic topics in microeconomics: consumer and producer theory, choice under risk and uncertainty, revealed preference theory and general equilibrium theory. Introduces and uses mathematical tools that are the workhorses of economic theory: real analysis, constrained optimization, monotone comparative statics and fixed point theorems.

ECON 502 - MACROECONOMICS I
Short Title: MACROECONOMICS I
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Review of static general equilibrium theory; elements of functional analysis for optimization; deterministic and stochastic difference equations, local stability analysis; introduction to Markov processes; dynamic optimization techniques, including stochastic optimal control theory, dynamic programming, and robust control; applications to growth theory, search, industrial organization, and monetary economics; dynamic stochastic general equilibrium modeling.

ECON 504 - COMPUTATIONAL ECONOMICS
Short Title: COMPUTATIONAL ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 501 and ECON 502 and ECON 505 and ECON 508 and ECON 510 and ECON 511 and MATH 321
Description: Numerical methods most commonly used in economics and their application to frontier research projects in economic modeling. Topics include optimization theory and numerical integration. Cross-list: STAT 604.

ECON 505 - FINANCIAL ECONOMICS I
Short Title: FINANCIAL ECONOMICS I
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 501 and ECON 502
Description: Introduction to asset pricing and portfolio choice theory. Covers mathematical analysis of single-period and dynamic models, including pricing by arbitrage, mean-variance analysis, factor models, dynamic optimization, recursive utility, and an introduction to continuous-time finance. Cross-list: BUSI 521.

ECON 507 - MATHEMATICAL ECONOMICS I
Short Title: MATHEMATICAL ECONOMICS I
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: The purpose of this course is to provide the first-year PhD students in Economics with the essential mathematical tools. The course covers topics in real analysis, topology, linear algebra, etc. Aside from providing the mathematical tools, a primary aim of this course is to develop the level of mathematical sophistication necessary to conduct research in modern economics. The course will therefore emphasize logical clarity and mathematical rigor, along with the ability to follow and construct mathematical proofs.

ECON 508 - MICROECONOMICS II
Short Title: MICROECONOMICS II
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 501 and MATH 321
Description: Two modules: (1) Introduces students to the mathematical tools of game theory, and the modeling of economic settings as games. Covers normal form games, extensive form games with perfect information, Bayesian games, and extensive form games with imperfect information; (2) introduces students to information economics and the theory of social choice and mechanism design.

ECON 509 - TOPICS IN MICROECONOMICS
Short Title: TOPICS IN MICROECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 508
Description: Discussion of selected topics in microeconomic theory. Recently, the topic has been behavioral economics, especially individual choice under risk and uncertainty, reference-dependent preferences, behavioral time discounting, temptation and self-control, other-regarding preferences, behavioral game theory, behavioral welfare economics, limited attention, mental accounting, and neuroeconomics. Repeatable for Credit.

ECON 510 - ECONOMETRICS I
Short Title: ECONOMETRICS I
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Estimation and inference in single equation regression models, multicollinearity, autocorrelated and heteroskedastic disturbances, distributed lags, asymptotic theory, and maximum likelihood techniques. Emphasis is placed on critical analysis of the literature. Cross-list: STAT 610.

ECON 511 - ECONOMETRICS II
Short Title: ECONOMETRICS II
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 510 or STAT 610
Description: Topics in linear and nonlinear simultaneous equations estimation, including panel data, qualitative and categorical dependent variable models, duration analysis, simulation-based estimation, treatment effects, stochastic production frontier estimation. Cross-list: STAT 611.

ECON 512 - INTERNATIONAL TRADE THEORY
Short Title: INTERNATIONAL TRADE THEORY
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Exploration of classical, neoclassical, and modern trade theory. Includes welfare aspects of trade such as the theory of commercial policy, with emphasis on applications.

ECON 513 - ECONOMICS OF INSURANCE
Short Title: ECONOMICS OF INSURANCE
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 501 and ECON 510
Description: This course will cover the theory of insurance, including classic and some behavioral models of insurance demand. The course will heavily focus on estimation techniques including estimating demand for insurance, tests for moral hazard and selection, insurance design, and measures of welfare. Empirical topics will include property insurance, health insurance, annuities, life insurance, and unemployment insurance.

ECON 514 - EMPIRICAL INDUSTRIAL ORGANIZATION
Short Title: EMPIRICAL INDUSTRIAL ORGANIZAT
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Topics include structural analysis of auction, nonlinear pricing, insurance and bargaining data. Emphasizes the use of advanced econometric methods (nonparametric and semiparametric) to estimate and test models under incomplete information.

ECON 515 - LABOR ECONOMICS
Short Title: LABOR ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Mathematical and statistical analysis of empirical evidence and theories relating to several features of labor markets. Topics covered may include fertility, health, criminal behavior, labor force participation, hours of work, education and training, geographical and inter-firm labor mobility, static and dynamic labor demand, unions, discrimination, government intervention in labor markets, and “hedonic” equilibria in labor markets. Graduate/Undergraduate Equivalency: ECON 415. Mutually Exclusive: Cannot register for ECON 515 if student has credit for ECON 415.

ECON 516 - EMPIRICAL MICROECONOMICS
Short Title: EMPIRICAL MICROECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 508
Description: This course studies topics in empirical microeconomics through papers in the recent economics literature. The emphasis will be on economic models that have been brought to data, identification of the models from observable data, and empirical findings.

ECON 517 - EMPIRICAL INDUSTRIAL ORGANIZATION II
Short Title: EMPIRICAL INDUSTRIAL ORG II
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Examines economic models of competition and industry structure. These include models of demand, supply, investment and entry. Special attention is paid to economic statistical modeling of industries and the use of price and game theory in industrial organization. Matching and market design are also covered.

ECON 518 - INTERNATIONAL MACROECONOMICS
Short Title: INTERNATIONAL MACROECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Effects of fiscal and monetary policies on exchange rates and the current account and balance of payments. Includes exchange market efficiency, exchange rates and prices, LDC debt, and policy coordination.

ECON 519 - ECONOMIC GROWTH AND DEVELOPMENT
Short Title: ECONOMIC GROWTH &DEVELOPMENT
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 501 and ECON 508 and ECON 510 and ECON 511
Description: Mathematical and statistical analysis of topics in microeconomic development and introduction to some frequently used applied econometric methods. Topics covered include poverty and inequality, health, education, fertility, marriage markets, and other gender issues. Special focus is given to intra-household bargaining models and their applications.

ECON 521 - MATCHING AND MARKET DESIGN
Short Title: MATCHING AND MARKET DESIGN
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 501 and ECON 502 and ECON 510 and ECON 505 and ECON 508 and ECON 511 and MATH 321
Description: This course begins with an overview of different matching markets (e.g., one-to-one or many-to-one AND with or without transfers AND centralized or decentralized) and the common empirical models; it then provides a relatively in-depth discussion of market design, both theoretical and empirical, for school choice and kidney transplants.

ECON 522 - PUBLIC ECONOMICS: TAX POLICY
Short Title: PUBLIC ECONOMICS: TAX POLICY
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Provides an economic analysis of the theory and practice of tax policy, focusing on the evaluation of alternative tax systems in terms of equity, efficiency, and simplicity. Analyzes the effects of various taxes on individual and business behavior, including labor supply, saving, and investment including the calculation of effective tax rates. Discusses general equilibrium modeling of the economic and distributional effects of alternative tax systems and tax reforms. Special topics include the choice between income-based and consumption-based taxation, tax incidence, optimal taxation, and state and local public finance.

ECON 523 - DYNAMIC OPTIMIZATION
Short Title: DYNAMIC OPTIMIZATION
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Study of dynamic optimization in discrete and continuous time, including numerical methods and applications to macroeconomics, finance and resource and energy economics.

ECON 547 - ADVANCED TOPICS IN ENERGY ECONOMICS
Short Title: ADV TOPICS IN ENERGY ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): (ECON 301 or ECON 370) and (ECON 309 or ECON 446 or ECON 409 or ECON 400 or STAT 400) and ECON 437
Description: A detailed development and analysis of topics in energy modeling. Topics include optimal extraction of depletable resources, models of storable energy commodities, energy demand by end-use sector, models of non-competitive behavior, energy security and the relationship between energy and commodity prices. ECON 547 requires an additional assignment in addition to the assignments of ECON 447. Recommended Prerequisite(s): ECON 477 or ECON 401. Mutually Exclusive: Cannot register for ECON 547 if student has credit for ECON 447/ECON 604.

ECON 565 - HEALTH ECONOMICS
Short Title: HEALTH ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Application of empirical and theoretical economic models to health and healthcare. Includes production, cost, demand and supply factors; methods of payment and effects of regulation. Topics include optimal design of health insurance markets, cost-benefit analysis of healthcare technologies, econometric evaluation of government regulations and reimbursement in the healthcare sector, and testing of hypothesis that explain rising prices and costs of healthcare. Graduate/Undergraduate Equivalency: ECON 481. Mutually Exclusive: Cannot register for ECON 565 if student has credit for ECON 481.

ECON 575 - TOPICS IN MACROECONOMICS I
Short Title: TOPICS IN MACROECONOMICS I
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Discussion topics in macroeconomics. Repeatable for Credit. Repeatable for Credit.

ECON 576 - TOPICS IN MACROECONOMICS II
Short Title: TOPICS IN MACROECONOMICS II
Department: Economics
Grade Mode: Standard Letter
Course Type: Seminar
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: The course will cover topics on the aggregate implications of quantitative models of producer heterogeneity, with applications to firm dynamics, innovation and aggregate growth, cross-country income differences, and international trade. Repeatable for Credit.

ECON 577 - TOPICS IN ECONOMIC THEORY I
Short Title: TOPICS IN ECONOMIC THEORY I
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 501 and ECON 502
Description: This is an advanced topics PhD course for PhD students in Economics. It will cover advanced topics in economic theory, including applications of calculus of variations and optimal control theory, differential games, and mean-field games to economics and finance. Repeatable for Credit.

ECON 578 - TOPICS IN ECONOMETRICS I
Short Title: TOPICS IN ECONOMETRICS I
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Discussion of selected topics in advanced econometrics. Repeatable for Credit.

ECON 579 - TOPICS IN ECONOMETRICS II
Short Title: TOPICS IN ECONOMETRICS II
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 511
Description: Discussion of selected topics in advanced econometrics that focus on the mathematical and statistical modeling of such phenomena as (1) extended panel data methods; (2) spatial econometrics; (3) bootstrapping; (4) factor models, wavelets, smoothing-splines, sieves; (5) model averaging; (6) continuous and discrete dynamic programming models; (7) econometrics of auctions; (8) BLP methods of demand estimation; (9) structural and non-structural models of producer behavior; (10) point and set identification; (11) Bayesian Econometrics/Metropolis-Hastings MCMC algorithms. Repeatable for Credit.

ECON 592 - TOPICS IN POLICY AND APPLIED ECONOMICS
Short Title: TOP-POLICY&APPL'D ECON
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Discussion of selected topics and applied economics. Repeatable for Credit.

ECON 593 - WORKSHOP IN MICROECONOMICS
Short Title: WORKSHOP IN ECONOMICS
Department: Economics
Grade Mode: Satisfactory/Unsatisfactory
Course Type: Seminar
Credit Hour: 1
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 501 and ECON 502 and ECON 510 and ECON 505 and ECON 508 and ECON 511
Description: Seminars on advanced topics in macroeconomics, microeconomics, econometrics and applied microeconomic theory, presented through guest lectures by leading researchers. Repeatable for credit. Repeatable for Credit.

ECON 594 - WORKSHOP IN ECONOMICS II
Short Title: WORKSHOP IN ECONOMICS II
Department: Economics
Grade Mode: Satisfactory/Unsatisfactory
Course Type: Seminar
Credit Hour: 1
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 508 and ECON 510
Description: Seminars on advanced topics in macroeconomics, microeconomics, econometrics and applied microeconomic theory, presented through guest lectures by leading researchers. Repeatable for credit. Repeatable for Credit.

ECON 595 - WRITING WORKSHOP
Short Title: WRITING WORKSHOP
Department: Economics
Grade Mode: Satisfactory/Unsatisfactory
Course Type: Lecture
Credit Hours: 1-4
Restrictions: Enrollment limited to students with a class of Graduate. Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Students in this course will read instructional materials on writing in the field of economics as well as generally in social science and will write both short and long pieces directly related to their research and the larger field of economics. Instructional topics will include appropriate tone, style, organizational patterns, grammar, and word choice for different genres of writing within the field.

ECON 596 - RESEARCH SEMINAR
Short Title: RESEARCH SEMINAR
Department: Economics
Grade Mode: Satisfactory/Unsatisfactory
Course Type: Seminar
Credit Hours: 0.5
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Supervises fourth-year and fifth-year Ph.D. students in their quantitative dissertation research in preparation for graduation. Students must present their own research at least once during the semester. Repeatable for Credit.

ECON 597 - COLLOQUIUM ON RESEARCH IN ECONOMICS
Short Title: COLLOQUIUM ON RESEARCH IN ECON
Department: Economics
Grade Mode: Satisfactory/Unsatisfactory
Course Type: Independent Study
Credit Hour: 1
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Workshop prepares graduate students for completing innovative and original research. All second year graduate students must attend the workshop. Each week, a faculty member will give a brief lecture about their experience with research. Possible topics include how they came up with ideas, how those ideas evolved and became papers, how these papers proceeded through the publication process, etc. Alternatively, faculty members can present a broad overview of particular research areas and discuss outstanding questions in those areas. Instructor Permission Required. Repeatable for Credit.

ECON 598 - READINGS IN ADVANCED TOPICS
Short Title: READINGS IN ADVANCED TOPICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Independent Study
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Prepares second-year Ph.D. students to conduct quantitative research. After a critical review of existing economic models, statistical analysis of data and economic evaluations, students develop their own research agenda. Repeatable for Credit.

ECON 599 - SEMINAR WORKSHOP
Short Title: SEMINAR WORKSHOP
Department: Economics
Grade Mode: Satisfactory/Unsatisfactory
Course Type: Research
Credit Hours: 0.5
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Promotes graduate students' attendance and active participation in the Econ 593 and Econ 594 seminar workshops. Each student is required to attend at least fifteen ECON 593/594 seminars per semester, write a brief report on each seminar presentation they attend, prepare to present a background paper for three of the seminars they plan to attend, and participate in post seminar discussions. Repeatable for Credit.

ECON 601 - ENERGY ECONOMICS I
Short Title: ENERGY ECONOMICS I
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Introduces the energy sector to students, discusses key aspects of energy supply, demand and pricing, and is foundational for the MEECON degree. Topics include optimal extraction of depletable resources, investment in energy-using capital, trade of energy commodities, storage, end-use demand and energy efficiency, and the relationship between economic activity, energy and the environment. Students learn to apply dynamic optimization, linear programming and econometric techniques in addressing the course topics. Graduate/Undergraduate Equivalency: ECON 437. Mutually Exclusive: Cannot register for ECON 601 if student has credit for ECON 437.

ECON 602 - MICROECONOMICS OF THE ENERGY SECTOR
Short Title: MICROECONOMICS - ENERGY SECTOR
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Covers basic microeconomic concepts and applies them to contemporary issues in the energy sector. Topics covered include demand and supply analysis, market equilibrium and different market structures, international trade, investment and capacity expansion, risk and investment finance, and economic analysis of energy policy including environmental policy. This course enables students to apply quantitative microeconomic theory in order to make data-driven recommendations to case studies presented by industry partners.

ECON 603 - APPLIED ECONOMETRICS FOR ENERGY MARKETS
Short Title: APPLIED ECONOMETRICS ENGY MKTS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Students will be introduced to basic concepts in statistical analysis and how to use statistical tools to analyze economic data and test economic theories. The course includes a laboratory session where students practice using the tools discussed in lectures with data that is particularly relevant to the energy industry.

ECON 604 - ENERGY ECONOMICS II
Short Title: ENERGY ECONOMICS II
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Explores a variety of topics in energy modeling and energy data analysis. Topics include optimal extraction of depletable resources, game theoretic approaches to OPEC behavior, national oil company behavior, models of storable energy commodities and energy demand by end-use sector, energy security and fundamental drivers of commodity prices. This course tasks students to expand on the dynamic optimization problems and econometric techniques applied to energy economics. Mutually Exclusive: Cannot register for ECON 604 if student has credit for ECON 547.

ECON 605 - TAXATION IN THE ENERGY SECTOR
Short Title: TAXATION IN THE ENERGY SECTOR
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Provides an introductory economic analysis of the theory and practice of taxes and the energy sector, focusing on the evaluation of alternative tax systems in terms of equity, efficiency, and simplicity. Includes general equilibrium modeling of the economic effects of taxes, with an application to federal and state taxes on the energy sector. Topics include royalties, resource rent taxes, corporate income taxes including international tax issues such as transfer pricing and income shifting, excess profit taxes, production-sharing agreements, auctions, and environmental taxes such as carbon taxes. Students will formulate, implement, and use a computable general equilibrium model to solve problems related to private and public decision making in the context of taxes applied to the U.S. energy sector.

ECON 606 - CORPORATE FINANCE FOR THE ENERGY SECTOR
Short Title: CORP FINANCE - ENERGY SECTOR
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Examines the investment decisions of corporations, the valuation of stock, bonds and options investments by individual investors. The implications of investor decisions for corporations, and specifically the manner in which they evaluate investment projects and finance investments are a core focus. Examples and case studies focus on the energy sector. Students will increase their understanding of financing and investment decision as the relate to energy companies and energy related projects using analytical and mathematical techniques to make data-driven recommendation to real-world problems.

ECON 607 - THE ECONOMICS OF ENERGY AND THE ENVIRONMENT
Short Title: ECON OF ENERGY & ENVIRONMENT
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: This course evaluates policies used to protect environmental resources from harmful externalities, with a focus on those arising from energy production and use. After analyzing different policy tools, the course will focus on the issue of carbon dioxide emissions and climate. Key issues discussed will include electricity system economics and the trade-offs involved in energy and climate policy. The course will conclude with a discussion of some non-emission externalities associated with mining. Graduate/Undergraduate Equivalency: ECON 480.

ECON 608 - RISK MANAGEMENT IN THE ENERGY INDUSTRY
Short Title: RISK MANAGEMENT/ENERGYINDUSTRY
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: This course introduces quantitative risk management techniques often employed in the energy industry. It covers topics such as real options, value at risk, conditional value at risk, and expected shortfall, as well as the use of derivatives for trading and hedging various risk exposures. The course is methodologically self-contained and provides students with hands-on experience with state-of-the-art software to measure and manage risk-adjusted returns of heterogeneous asset portfolios.

ECON 609 - ADVANCED ECONOMETRIC TOPICS FOR APPLIED ENERGY ECONOMICS
Short Title: ADVANCED ENERGY ECONOMETRICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 603
Description: Students will be introduced to econometric methods beyond the simple linear model under classical assumptions with application to energy economics. Coverage will be sufficient to allow informed consumption, application, and even supervision of applications using these techniques. The course includes a laboratory session to afford an opportunity to apply and observe the methods in action.

ECON 610 - ENERGY AND THE MACROECONOMY
Short Title: ENERGY & THE MACROECONOMY
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Discusses connections between energy and economic activity at the regional, national, and international level, and especially the role of energy shocks in economic fluctuations, innovations in energy supply as drivers of regional economic growth, and the role of energy commodities in transportation and international trade.

ECON 611 - GEOPOLITICS OF ENERGY
Short Title: GEOPOLITICS OF ENERGY
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Explores the geopolitical issues around energy security and trade by focusing on role of energy as the world's largest business and a strategic requirement of the modern nation-state, a source of power in international relations, and a major influence on national politics and institutions. This course equips students with the analytical skills to inform policy debates, advocate for the interests of principals, and advise policy makers and firms amid rapid changes in energy markets. Students learn both to produce sound empirical analysis by employing state of the art econometric techniques and to be discerning consumers of empirical research.

ECON 612 - ENERGY PROJECT DEVELOPMENT
Short Title: ENERGY PROJECT DEVELOPMENT
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: This course will cover the development of energy projects, especially electric power projects, from inception through to financing. It examines key issues such as: siting/permitting, including compliance with federal, state and local environmental and regulatory issues; fuel supply agreements; capital cost pricing; off-take agreements; and the various methods of project financing. Microsoft Excel is used for project financial analysis, including revenue and cost modeling, debt management, project net cash flow, project internal rate of return and net present value. The course also will cover strategies to monetize the project including development fees, carried equity, and private and public sale of equity, including initial public offerings (“IPOs”).

ECON 613 - INTERNATIONAL TRADE IN ENERGY
Short Title: INTERNATIONAL TRADE IN ENERGY
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: This course explores the effects of international trade and the determinants of the amount of trade between countries in energy commodities, and the role of international capital flows in financing energy projects, in particular. It will also discuss the many ways that governments can alter international trade through various policies.

ECON 614 - POLITICAL ECONOMY OF ENERGY AND RESOURCES POLICY
Short Title: POLITICAL ECONOMY OF OIL
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: This course evaluates the political and economic determinants of energy and resources policies in developing countries and their impact on world markets, the interaction between states and extractive industries, the challenges of resource wealth management, and the causal links between resource abundance/dependency and development, institutions, and political regimes. Resource contracts, fiscal and regulatory regimes, and national resource companies are analyzed.

ECON 615 - SOCIAL STUDIES OF ENERGY
Short Title: SOCIAL STUDIES OF ENERGY
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Investigate the ways in which energy production and consumption impacts social life. By studying the implementation and use of renewable and on-renewable energy infrastructures in different parts of the world, the students will develop a contextual, self-reflexive and critical lens that will help them make decisions in later stages of their careers.

ECON 616 - DATA ANALYSIS FOR MARKET DESIGN AND POLICY
Short Title: DATA ANALYSIS FOR MKT DESIGN
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Prerequisite(s): ECON 603 and ECON 620 (may be taken concurrently)
Description: This advanced course integrates economic theory with data analysis methods to study the workings of markets and discover ways to improve their design. Examples include auctions---ranging from natural resource auctions to treasury auctions---matching markets, and bargaining; specific markets studied may vary. Students will be active users of computational software. Graduate/Undergraduate Equivalency: ECON 471. Mutually Exclusive: Cannot register for ECON 616 if student has credit for ECON 471.

ECON 620 - INDUSTRIAL ORGANIZATION AND THE ENERGY SECTOR
Short Title: INDUSTRIAL ORG & ENERGY SECTOR
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: The course will discuss monopoly, oligopoly, and the underlying sources of monopoly power in energy industries and how the industries can be restructured to isolate the monopoly elements from the more competitive ones. Other topics include price discrimination, vertical control, mergers and acquisitions, and strategic behavior between firms.

ECON 621 - THE ECONOMICS OF THE ELECTRICITY INDUSTRY
Short Title: ELECTRICITY INDUSTRY ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Discusses the determinants of the cost of electricity, the effects of organizing the industry in different ways, the need to encourage sufficient investment in reserve capacity, and the use of information technology to allow for new ways of pricing electricity, operating the network and coordinating supply and demand. Students will learn to analyze the behavior of power markets, the effect of different policies, and draw empirical solutions to the real-world issues.

ECON 622 - TRANSPORTATION ECONOMICS
Short Title: TRANSPORTATION ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Discusses transportation as a major source of energy demand in modern post-industrial economies and of future demands in emerging economies. Emphasizes that the demand for energy use in the transportation sector involves modeling household choices, economic growth and demographic transition, government decisions to support transportation infrastructure development, and the introduction of new technologies. Students will apply problem solving and analytical skills to perform calculations related to transportation energy and its environmental impact.

ECON 623 - ADVANCED ECONOMETRICS FOR ENERGY MARKETS
Short Title: ADV ECON FOR ENERGY MARKETS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 601 and ECON 603
Description: This course is designed for students in the Master of Energy Economics (MEECON) program, offering advanced training in econometric methods with a focus on empirical applications in energy markets. The course emphasizes time series and panel data analysis, key for understanding energy trading, demand forecasting, and policy evaluation. Students will review key econometric techniques such as Ordinary Least Squares (OLS), ARIMA models, and handling seasonality, applying them to real-world energy data through practical lab sessions using Python. This course provides the empirical tools necessary to reinforce and apply the knowledge gained throughout the MEECON program, culminating in a final project where students analyze and forecast market demand for an energy commodity using interactive dashboards. Graduate/Undergraduate Equivalency: ECON 423. Mutually Exclusive: Cannot register for ECON 623 if student has credit for ECON 423.

ECON 624 - ADVANCED QUANTITATIVE METHODS + LABS
Short Title: ADVANCED QUANTITATIVE METHODS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 602 and ECON 603
Description: The central challenge in policy evaluation is establishing a causal link between interventions and outcomes. This course introduces the main econometric methods used to evaluate public policies and social programs. Theoretical discussions are complemented by real-world applications, including case studies and empirical exercises based on actual policy interventions. Students will engage with quantitative evaluations using real data and will work with statistical and econometric software to apply the methods in practice. Graduate/Undergraduate Equivalency: ECON 421. Mutually Exclusive: Cannot register for ECON 624 if student has credit for ECON 421.

ECON 625 - ADVANCED MARKET DESIGN
Short Title: ADVANCED MARKET DESIGN
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 200 and (ECON 307 or STAT 310 or STAT 315 or DSCI 301)
Description: Regulators, entrepreneurs and economists have been involved in the design of novel markets for radio spectrum, kidneys, on-line advertising, school choice, etc. This course utilizes game theory to provide the theoretical underpinning of such markets via real world examples, including the study of institutional details that can determine the success or failure of a market. Graduate/Undergraduate Equivalency: ECON 470. Mutually Exclusive: Cannot register for ECON 625 if student has credit for ECON 470.

ECON 631 - MATHEMATICAL FOUNDATIONS FOR COMPUTATIONAL ECONOMICS
Short Title: MATH FOR COMPUTATIONAL ECON
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: This course introduces core concepts underlying computational social science, including, optimization, probability, and statistical modeling. We learn how to apply these concepts to a variety of economics and social science questions. Graduate/Undergraduate Equivalency: ECON 308. Recommended Prerequisite(s): Students should have taken at least a course in calculus and a course in linear algebra. Prior courses in probability and statistics will also be helpful. Highly motivated graduate students lacking some prerequisites can still succeed in this course but will have to put in more time and effort. Such students should meet with us well in advance of the course so that we can recommend readings that will help close the gaps in their preparations. Also, a willingness to consult Wikipedia for math and statistics concepts will help all students. Mutually Exclusive: Cannot register for ECON 631 if student has credit for ECON 308.

ECON 632 - DATA TOOLS FOR COMPUTATIONAL ECONOMICS
Short Title: COMPUTATIONAL ECONOMICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: This course teaches the foundational skills necessary to do modern data analytics using the Python programming language. We assume that students have previously worked with Python. We will add to existing Python skills and teach the core scientific and data-specific libraries (numpy, scipy, matplotlib, and pandas). We will use these skills to analyze a variety of economics and social science datasets and answer research and business questions. Graduate/Undergraduate Equivalency: ECON 208. Recommended Prerequisite(s): Students should have prior experience using the Python programming language before starting this course. Throughout this course we will leverage programming skills such as control flow constructs (if/else, for/while), defining custom functions (def), and finding help on existing functions (? in Jupyter environments and help elsewhere). Although a course in probability or statistics is not a prerequisite, students will find some knowledge of these topics to be helpful. Mutually Exclusive: Cannot register for ECON 632 if student has credit for ECON 208.

ECON 633 - DYNAMIC MODELS FOR COMPUTATIONAL ECONOMICS
Short Title: DYNAMICS IN COMPUTATIONAL ECON
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 510
Description: This course covers models with dynamic components and procedures for decision making in the context of economics. The topics include, but are not limited to, multi-armed bandits, dynamic programming + the Bewley model, and time-series analysis (both Bayesian and frequentist). Graduate/Undergraduate Equivalency: ECON 433. Mutually Exclusive: Cannot register for ECON 633 if student has credit for ECON 433.

ECON 634 - MACHINE LEARNING AND ALGORITHMS FOR COMPUTATIONAL ECONOMICS
Short Title: MACHINE LEARNING FOR COMP ECON
Department: Economics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 510
Description: This course will cover supervised learning (both regression and classification) , reinforcement learning, and model selection via validation procedures. The course prepares students to apply a variety of classical and cutting-edge machine learning techniques to problems in economics. Students will be taught principled approaches that adhere to best practices and promote understanding and transparency. Graduate/Undergraduate Equivalency: ECON 434. Mutually Exclusive: Cannot register for ECON 634 if student has credit for ECON 434.

ECON 677 - SPECIAL TOPICS
Short Title: SPECIAL TOPICS
Department: Economics
Grade Mode: Standard Letter
Course Type: Internship/Practicum, Laboratory, Lecture, Seminar, Independent Study, Lecture/Laboratory
Credit Hours: 1-4
Restrictions: Enrollment is limited to Graduate or Visiting Graduate level students.
Course Level: Graduate
Description: Topics and credit hours vary each semester. Contact department for current semester's topic(s). Repeatable for Credit.

ECON 699 - PRACTICUM
Short Title: PRACTICUM
Department: Economics
Grade Mode: Standard Letter
Course Type: Internship/Practicum
Credit Hours: 4
Restrictions: Enrollment is limited to Graduate level students. Enrollment limited to students in a Master of Energy Economics degree.
Course Level: Graduate
Description: Projects developed by an industry advisory group to be researched and presented to participating industry at completion of all course work. Internships with an approved employer may be substituted. Emphasis on skill building components may include: analyzing data for accuracy and reconciliation across different sources, quantitative analysis and risk assessment of a firm's portfolio of assets and capital investment opportunities, and briefing expert and non-expert audiences.

ECON 700 - DEPARTMENTAL SERVICE COURSE
Short Title: DEPARTMENTAL SERVICE COURSE
Department: Economics
Grade Mode: Satisfactory/Unsatisfactory
Course Type: Independent Study
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: In each semester in which students perform departmental service, they need to register in the departmental service course Econ 700. Students must meet their faculty supervisors as early as possible before the semester starts and regularly during the semester to ensure there is a mutual understanding of the job responsibilities. Repeatable for Credit.

ECON 800 - GRADUATE RESEARCH
Short Title: GRADUATE RESEARCH
Department: Economics
Grade Mode: Satisfactory/Unsatisfactory
Course Type: Research
Credit Hours: 1-12
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Assists students in the dissertation writing process. Students must write an independent and original piece of quantitative research that is of sufficient quality to merit publication in an academic economics journal. Towards this objective, faculty mentor evaluate and critique the research of PhD students who are either preparing research before formally selecting a dissertation topic or actively engaged in dissertation research. Repeatable for Credit.

Description and Code Legend

Note: *Internally, the university uses the following descriptions, codes, and abbreviations for this academic program. The following is a quick reference:*

Course Catalog/Schedule

- Course offerings/subject code: ECON

Home School Description and Code

- Social Sciences: SS

Home Department Description and Code

- Economics: ECON

Graduate Degree Description and Code

- Master of Computational Economics degree: MCEcon

Graduate Degree Program Description and Code

- Degree Program in Computational Economics: COEC

Graduate Certificate Description and Code

- Certificate in Computational Economics: COE

Graduate Certificate Program Descriptions and Codes*

- Certificate Program Option - Online and Standalone (COE certificate): GR CERT O-SS
- Certificate Program Option - On-Campus and Standalone (COE certificate): GR CERT M-SS
- Certificate Standalone (Degree) Code: (Standalone, Post-Baccalaureate): GC-B

CIP Code and Description[1]

- **COEC** Major/Program: CIP Code/Title: *45.0603 - Econometrics and Quantitative Economics*
- **COE** Certificate: CIP Code/Title: *45.0603 - Econometrics and Quantitative Economics*

* *Systems Use Only: this information is used solely by internal offices at Rice University (such as OTR, GPS, etc.) and primarily within student information systems and support.*

[1] Classification of Instructional Programs (CIP) 2020 Codes and Descriptions from the National Center for Education Statistics: https://nces.ed.gov/ipeds/cipcode/.