Undergraduate Economics Program Courses

About Course Numbers:
Each Carnegie Mellon course number begins with a two-digit prefix that designates the department offering the course (i.e., 76-xxx courses are offered by the Department of English). Although each department maintains its own course numbering practices, typically, the first digit after the prefix indicates the class level: xx-1xx courses are freshman-level, xx-2xx courses are sophomore level, etc. Depending on the department, xx-6xx courses may be either undergraduate senior-level or graduate-level, and xx-7xx courses and higher are graduate-level. Consult the Schedule of Classes (https://enr-apps.as.cmu.edu/open/SOC/SOCServlet/) each semester for course offerings and for any necessary pre-requisites or co-requisites.

73-003 Transfer Credit
All Semesters
This number “holds” a place for an economics transfer credit courses so that these courses can be used in the academic audit system. Student receiving 73-003 credit have met the requirement of earning the equivalent of a “C” in their non-CMU economics course; however, have not earned the equivalent of a “B” which would provide credit for a CMU economics course equivalency.

73-060 Economics: BaseCamp
Fall: 3 units
This short course will launch you into the economics intellectual space and get you thinking like an economist. Through a series of presentations by some of CMU’s great economics thinkers you will learn how economic reasoning harnessed to data can lead to better policy design and better business decision making. Presentations may cover the economics of bitcoin and crypto-currency, online market design, financial crises, the future of work, how to become involved in economics research, healthcare, the environment, and other topics. The presentations will be curated by one of CMU’s research economists and there will be plenty of opportunities for discussion and debate. The course will also introduce you to the CMU approach to economics and map out the CMU economics major landscape.

73-102 Principles of Microeconomics
Fall and Spring: 9 units
A one-semester course that teaches the fundamentals of microeconomics. Students will learn how microeconomic analysis can explain market successes, market failures, and how government intervention might improve outcomes. In addition to an investigation of firm behavior and consumer behavior, attention will be paid to: Game Theory, Behavioral Economics, Economics of Time and Risk, Economics of Information, Experimental Economics, and Auctions and Market Design. Students will also learn how to integrate basic data analysis and statistics. Not open to students who have received credit for 73-100. (Lecture, 2 hours; Recitation, 1 hour).

73-103 Principles of Macroeconomics
All Semesters: 9 units
A one-semester course that teaches the fundamentals of macroeconomics. Students will learn how macroeconomic analysis can explain national economic activity and how government intervention might stabilize an economy. Topics include: defining and measuring national wealth, economic growth, credit markets, unemployment, interest rates, inflation, and the monetary system. Additional emphasis will be paid to: long-term economic development, political economy, financial crises and topics that are central to contemporary macroeconomic debates such as the impact of technological change, migration, and trade on the macroeconomy. Students will access macroeconomic databases, and then use basic statistics to describe and isolate empirical patterns in macro-data. Not open to students who have received credit for 73-100. (Lecture, 2 hours; Recitation, 1 hour). Prerequisite: 73-102 Min. grade C

73-111 Internship I
All Semesters
The goal of this course is for you to reflect critically and constructively on your internship and to help you identify a path that will allow you to build on your internship experiences. By permission of the Undergraduate Economics Program. Open only to declared Economics, Economics and Mathematical Sciences, Economics and Politics, and Economics and Statistics majors.

73-112 Internship II
All Semesters: 3 units
The goal of this course is for you to reflect critically and constructively on your internship and to help you identify a path that will allow you to build on your internship experiences. By permission of the Undergraduate Economics Program. Open only to declared Economics, Economics and Mathematical Sciences, Economics and Politics, and Economics and Statistics majors.

73-113 Internship III
All Semesters: 3 units
The goal of this course is for you to reflect critically and constructively on your internship and to help you identify a path that will allow you to build on your internship experiences. By permission of the Undergraduate Economics Program. Open only to declared Economics, Economics and Mathematical Sciences, Economics and Politics, and Economics and Statistics majors.

73-155 Markets, Models, and Math
Spring: 9 units
The Markets, Models and Math course is designed to allow students to reflect on the thought processes that drive science, viewed through the lens of economics. While the economics focus will highlight the way economists use data and models to understand the economic phenomena we see in the real world, the course is also designed to add depth of understanding for students who major in some other discipline, for the simple reason that the things economists study touch on all aspects of human existence, whether it is understanding the cost-benefit trade-offs in architectural design, in the engineering of new products or production technologies, or understanding the grand arc of political discourse in history or the way it has shaped our laws. The course is to also meant to introduce, in an intuitive way, the kinds of mathematical tools and reasoning that economists use, what the economic historian Philip Mirowski has called “the unreasonable efficacy of mathematics in economic analysis”. As a GenEd course, the technical tools and methodologies we use will be the same as those you used in Principles. The work assignments will be similarly pitched in terms of difficulty, though unlike the problem set focus of the Principles course, your assignments here will be exploratory in nature, ranging from looking for and analyzing data relevant to the topics we cover, to participation in in-class experiments and analysis of the results, to researching and briefing topics of interest to you, from both class discussion and outside readings. Any new modeling or statistical tools that you might need will be taught along the way as part of the course; but again, these are tools meant to enhance understanding rather than providing ways for rigorous testing of models that are the heart of any scientific discipline. Prerequisites: 21-111 and 73-102 Min. grade C

73-158 Markets, Models, and Math
Spring: 9 units
The Markets, Models and Math (M3) course is designed to allow students to reflect on the thought processes that drive science, viewed through the lens of economics. While the economics focus will highlight the way economists use data and models to understand the economic phenomena we see in the real world, the course is also designed to add depth of understanding for students who major in some other discipline, for the simple reason that the things economists study touch on all aspects of human existence, whether it is understanding the cost-benefit trade-offs in architectural design, in the engineering of new products or production technologies, or understanding the grand arc of political discourse in history or the way it has shaped our laws. The course is also meant to introduce, in an intuitive way, the kinds of mathematical tools and reasoning that economists use, what the economic historian Philip Mirowski has called “the unreasonable efficacy of mathematics in economic analysis”. Prerequisites: 21-111 and 73-102 Min. grade C

73-210 Economics Colloquium I
Fall: 3 units
Economics majors meet weekly for discussions about current research by faculty or students, presentations on economics from economists outside academia, and expository talks on selected economics topics not part of the usual curricula. The colloquium provides students with opportunities to grow personally and intellectually by introducing them to campus resources (including special interest to undergraduates such as preparation for graduate school) and using the economic toolbox to examine current economic topics in the press. It is recommended that students take this course during the sophomore year so that economics majors realize the range of resources that exist on campus. (Colloquium, 1 hour)
73-230 Intermediate Microeconomics
Fall and Spring: 9 units
This course is a calculus-based study of microeconomics. Topics in partial equilibrium analysis include supply and demand, consumer theory, theory of the firm, profit maximizing behavior, monopoly theory, and perfect competition. The course concludes with an introduction to general equilibrium analysis and the welfare laws. (Lecture, 3 hours; Recitation, 1 hour). Minimum grade of "C" required in all economics pre-requisite courses. Not open to first year student during S18.
Prerequisites: (21-268 or 21-269 or 21-256 or 21-259) and (73-100 Min. grade C or 73-102 Min. grade C)

73-240 Intermediate Macroeconomics
Fall and Spring: 9 units
Through macroeconomic models built upon microeconomic foundations, insights are developed into economic growth processes and business cycles. Topics include aggregation and measurement, national income, business cycle measurement, economic welfare theorems and social inefficiencies, the effect of government fiscal policy upon employment and productivity, and the relationship between investment, interest rates and economic growth. (Lecture, 3 hours; Recitation, 1 hour). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-256 and 73-100 Min. grade C and 73-103 Min. grade C and 21-256) or (21-259 and 73-100 Min. grade C) or (73-102 Min. grade C and 73-103 Min. grade C and 21-259)

73-255 Independent Study in Economics
Fall and Spring
The Independent Study course in economics allows students to pursue their own research interests in any of a variety of topics in economics. A typical independent study course involves a semester long project under the supervision of an appropriate faculty advisor. The nature and scope of the project are determined by the student and faculty advisor; the project proposal must be approved by an Undergraduate Economics Program staff member. Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: 21-120 and 73-160 Min. grade C

73-258 Developing Blockchain Use Case
Intermittent: 6 units
Blockchains, or distributed ledger and consensus technologies, hold tremendous promise for improving markets and organically handling private, secure data. As CMU develops its own blockchain and token—CMU Coin—a central concern is to determine the set of applications that such technology would be most useful for. This course is designed for students to propose and, potentially, develop applications or use cases for a campus blockchain. http://tinyurl.com/cmucoincourse The course begins with a brief introduction to blockchain using Bitcoin as an example of a blockchain protocol. We will examine the market failure Bitcoin was intended to resolve as well as the role of cryptography and distributed systems in enabling this new technology to create societal value. The course will go on to discuss the boundaries of the role of cryptography in blockchain. Next, we will use these tools to evaluate existing, real-world blockchain use cases with an eye towards developing our own applications of these emerging technologies. Along the way, we will learn practical development skills in distributed ledger technologies to understand blockchain programming and application development. Finally, students will propose their own blockchain use cases for CMU’s own proprietary blockchain. No formal prerequisites, but familiarity with programming is highly recommended.

73-265 Economics and Data Science
Fall: 9 units
This course is at the intersection of economic analysis, computing and statistics. It develops foundational skills in these areas and provides students with hands-on experience in identifying, analyzing and solving real-world data challenges in economics and business. Students will learn the basics of database and data manipulation, how to visualize, present and interpret data related to economic and business activity by employing statistics and statistical analysis, machine learning, visualization techniques. Students will also be taught a programming language suitable for data science/anlalysis. Databases will include leading economic indicators; emerging market country indicators; bond and equity returns; exchange rates; stock options; education and income by zip code; sales data; innovation diffusion; experimental and survey data and many others. Applications will include analyzing the effectiveness of different Internet pricing strategies on firm sales, the impact of taking online classes on a worker's earnings, the relationship between regional employment and trade policies; constructing investment risk indices for emerging markets; predicting employee productivity with machine learning tools; assessing health (sleep and exercise) improvements associated with wearable technologies (e.g. FitBt). Additionally, the course will provide students with communication skills to effectively describe their findings for technical and non-technical audiences. Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: 21-120 and (21-325 or 15-259 or 70-207 or 36-247 or 36-225 or 36-220 or 36-219 or 36-218 or 36-217 or 36-207 or 36-202 or 36-200 or 36-201) and (73-102 Min. grade C or 73-100 Min. grade C)

73-270 Professional Communication for Economists
Fall and Spring: 9 units
A writing course specifically designed for third-year Economics majors and additional majors. Students gain experience with technical writing techniques and skills needed for both their senior thesis and their eventual professional careers. The course emphasizes both individual and group projects. (Seminar, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (76-107 or 76-108 or 76-101 or 76-102 or 76-106) and 73-100 Min. grade C and 73-103 Min. grade C

73-274 Econometrics I
Spring: 9 units
This course will provide an introduction to the analysis of economic field data. The first part of the course will discuss how data is generated and how this affects the inferences we can make. In particular, we will look at the difficulties of working with field data and learn how non-random sampling leads to poor inferences. We will then move on to some simple statistical techniques, in particular OLS and its extensions as well as Maximum Likelihood Estimators. We will also learn about the large sample properties of these estimators. At the end of the course, students should be able to understand what inferences can be made with field data and some basic statistical techniques that can be used to uncover patterns in the data. (Lecture, 3 hours; Recitation, 1 hour). Students pursuing the ECOMTH or MTHECO degrees may enroll in 73-274 after the completion of 36-225. Minimum grade of "C" required in all economics and statistics pre-requisite courses.
Prerequisites: (21-268 or 21-269 or 21-259 or 21-256) and 73-265 Min. grade C and (73-230 Min. grade C or 73-240 Min. grade C)
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73-315 Market Design
Intermittent: 9 units
In this course, we consider the design of various market mechanisms. We learn the typical causes of market failures and why we need to design new markets. For each topic, we start with a case study of a problem, develop a theory to address it, and consider its possible solutions. The class is roughly divided into three parts: matching, auctions, and further topics. In the first part, we study markets where there is no money and no prices (matching markets). Instead, we have people preferences over possible matching outcomes. Examples include placing doctors in residency positions, assigning students to schools, and assigning kidneys to transplant patients. We will learn algorithms that have desirable theoretical properties and are often used in practice. In the second part, we consider the problem of allocating of single or multiple goods (a house, a painting, or the rights to a natural resource such as oil or timber) using auctions. We discuss how different types of auctions work in theory and practice. We will look at the auctions used in financial markets to sell treasury bills, the auctions used by Google, Microsoft and Facebook to sell advertising, and the auctions used by governments to sell radio spectrum licenses. In the third part, we consider further important topics of market design. We will look into problems of high-frequency trading, digital markets, the allocation of refugees among European countries, and proposals to fix market for carbon pollution permits. An important goal of the course is to show how recent achievements of game theory and mechanism design lead to important practical applications and to inspire you to use these ideas in your life and workplace. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-268 or 21-256 or 21-259 or 21-269) and 73-230 Min. grade C

73-327 Advanced Topics In Macroeconomics And Real Business Cycles
Intermittent: 9 units
For analysts and decision makers in a variety of positions, such as business managers and government policy makers, a thorough understanding of the economy as a whole helps to make well-informed decisions. Examples of important knowledge about the economy are its sources of growth, the main impulses that cause the economy to fluctuate over time and enter into booms and recessions, the way in which these impulses propagate over time, and the state of the economy in general. The main objective of this course is to lay the foundation for such an understanding and present a framework within which we can (and will) evaluate a variety of aggregate phenomena. Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-269 or 21-256 or 21-259 or 21-269) and 73-230 Min. grade C

73-328 Health Economics
Fall: 12 units
This course will teach the student to use economic analysis to understand critical issues in health care and health policy. We will address issues such as the following: 1. What factors best explain the level and rate of growth of U.S. health expenditures? 2. Does the recent high rate of growth of U.S. health expenditures make U.S. firms less competitive in international markets? 3. What are some of the likely consequences of growth of U.S. health care expenditures? 4. Does the recent high rate of growth of U.S. health care expenditures make U.S. firms less competitive in international markets? 5. What are the typical causes of market failures and why we need to design new markets. For each topic, we start with a case study of a problem, develop a theory to address it, and consider its possible solutions. The class is roughly divided into three parts: matching, auctions, and further topics. In the first part, we study markets where there is no money and no prices (matching markets). Instead, we have people preferences over possible matching outcomes. Examples include placing doctors in residency positions, assigning students to schools, and assigning kidneys to transplant patients. We will learn algorithms that have desirable theoretical properties and are often used in practice. In the second part, we consider the problem of allocating of single or multiple goods (a house, a painting, or the rights to a natural resource such as oil or timber) using auctions. We discuss how different types of auctions work in theory and practice. We will look at the auctions used in financial markets to sell treasury bills, the auctions used by Google, Microsoft and Facebook to sell advertising, and the auctions used by governments to sell radio spectrum licenses. In the third part, we consider further important topics of market design. We will look into problems of high-frequency trading, digital markets, the allocation of refugees among European countries, and proposals to fix market for carbon pollution permits. An important goal of the course is to show how recent achievements of game theory and mechanism design lead to important practical applications and to inspire you to use these ideas in your life and workplace. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-269 or 21-256 or 21-259 or 21-269) and 73-230 Min. grade C

73-332 Public Policy Analysis
Intermittent: 9 units
The Public Policy Analysis course examines basic principles and tools for evaluating the performance of government programs and policies. We will consider the role of the government in economic, social, and political decisions, and the impact of these decisions on individuals and society. We will also consider the role of government in markets and the role of government in regulating industries. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-268 or 21-256 or 21-259 or 21-269) and 73-230 Min. grade C

73-333 Game Theory Applications for Economics and Business
Intermittent: 9 units
An introduction to the theory of non-cooperative games with an emphasis on economic applications. After an initial examination of two-person, zero-sum games, the notion of a Nash equilibrium in an n-person, non-cooperative game is considered. Existence of an equilibrium and refinements to the equilibrium concept are discussed in the context of both normal and extensive form games. Economic applications may include various topics, including Cournot and Bertrand oligopoly models, general competitive exchange equilibria, and free-rider problems. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-268 or 21-256 or 21-259 or 21-269) and 73-230 Min. grade C

73-334 Managing through Incentives
Intermittent: 9 units
We live in an exciting age of information and knowledge when inspiring employees within a firm becomes increasing important. Aligning the objectives of workers, managers, and owners by providing them with appropriate incentives becomes an emerging paradigm in the modern business world. In this course, we will learn how to reason about incentives between managers and workers, between managers and owners, and within a team of co-workers. We cover a broad range of topics including objective and subjective performance measurements, relative performance evaluations, relational contracts, and executive compensation. The course relies on business case discussions, rigorous theoretical material, and numerous class activities. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-256 or 21-269 or 21-268 or 21-256) and 73-102 Min. grade C and 73-240 Min. grade C

73-341 Political Economy
Intermittent: 9 units
The Political Economy course looks at how groups within society organize for self-governance. The course will begin with an overview of the ways groups of individuals organize for collective action by examining different types of political institutions, the role these institutions play in different contexts, and the economic and strategic micro-foundations that give rise to these institutions. We will then examine the empirical evidence supporting this taxonomy, leading to a more detailed consideration of institutions that moderate social conflicts. The next part of the course examines basic results in social choice theory: the Condorcet paradox, Arrow's Impossibility Theorem, majority rule, median voter theories, and modern treatments of probabilistic voting models that allow for strategic behavior, misrepresentation of preferences, and policy manipulation. From this basis for understanding collective choice mechanisms, we will then examine how institutions foster cooperation, looking in detail at problems of public goods allocation, redistribution of income, the organization of clubs - interest groups and lobbying associations -- in the private sector, and the organization of legislative activities in the public sector. In our examination of voting and electoral mechanisms, we will look at practical applications of the theory to problems of gerrymandering, voter suppression, and propaganda that feature prominently in contemporary political discourse. Prerequisites: (73-230 Min. grade C or 73-160 Min. grade C) and (36-200 or 36-201)

73-338 Financial Crises and Risk
Fall: 9 units
This course provides an in-depth examination of the causes of financial crises as well as what governments can do to prevent them or at least reduce their cost. The course is designed to provide an understanding of individual attitudes towards risk and individual decision making about savings and investment under uncertainty, and to use this understanding to evaluate the various economic roles played by financial institutions in helping individuals manage risk, especially those roles which may lead to economic instability and crises. In addition, the course may cover bubbles and swindles, especially when these spillover to the broader macroeconomy; the role of information in banking in normal times and in bank runs; crisis resolution techniques; and the extensive history of attempts to improve regulation so as to reduce the frequency and cost of crises. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-259 or 21-269 or 21-268 or 21-256) and 73-102 Min. grade C and 73-240 Min. grade C

73-332 Political Economy
Spring: 9 units
The Political Economy course looks at how groups within society organize for self-governance. The course will begin with an overview of the ways groups of individuals organize for collective action by examining different types of political institutions, the role these institutions play in different contexts, and the economic and strategic micro-foundations that give rise to these institutions. We will then examine the empirical evidence supporting this taxonomy, leading to a more detailed consideration of institutions that moderate social conflicts. The next part of the course examines basic results in social choice theory: the Condorcet paradox, Arrow's Impossibility Theorem, majority rule, median voter theories, and modern treatments of probabilistic voting models that allow for strategic behavior, misrepresentation of preferences, and policy manipulation. From this basis for understanding collective choice mechanisms, we will then examine how institutions foster cooperation, looking in detail at problems of public goods allocation, redistribution of income, the organization of clubs - interest groups and lobbying associations -- in the private sector, and the organization of legislative activities in the public sector. In our examination of voting and electoral mechanisms, we will look at practical applications of the theory to problems of gerrymandering, voter suppression, and propaganda that feature prominently in contemporary political discourse. Prerequisites: (73-230 Min. grade C or 73-160 Min. grade C) and (36-200 or 36-201)

73-347 Game Theory Applications for Economics and Business
Fall: 9 units
An introduction to the theory of non-cooperative games with an emphasis on economic applications. After an initial examination of two-person, zero-sum games, the notion of a Nash equilibrium in an n-person, non-cooperative game is considered. Existence of and refinements to the equilibrium concept are discussed in the context of both normal and extensive form games. Economic applications may include various topics, including Cournot and Bertrand oligopoly models, general competitive exchange equilibria, and free-rider problems. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-112 or 21-120) and 73-102 Min. grade C
73-348 Behavioral Economics
Spring: 9 units
This course introduces students to behavioral economics which is a subfield of economics that incorporates insights from other social sciences, such as psychology, into economic models and aims to explain the anomalies challenging some of the classical economic models. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-259 or 21-268 or 21-269 or 21-256) and 73-102 Min. grade C or 73-100 Min. grade C

73-352 Public Economics
Fall: 9 units
In this course, students analyze the role of governments in market economies and their impact on the behavior and welfare of citizens. Reasons for government intervention in markets are examined in light of some of the economic challenges faced by modern societies in an increasingly globalized marketplace. Topics include: taxation and expenditure policies, externalities and market failure, social security, public assistance and income redistribution programs. There will also be some coverage of the role of local governments in the economy with respect to such issues as crime, urban development and education. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-256 or 21-259 or 21-269 or 21-268) and 73-230 Min. grade C

73-353 Financial Regulation in the Digital Age
Spring: 9 units
The financial crisis and the digitalization of the financial markets have focused attention on the role of regulation for our financial system and the broader economy in recent years. Among the settings that are especially important in the digital economy are electronic trading, big data, algorithms, robo investing, winner-take-all economics, securities offerings, property rights and cyber assets. The course will address the foundations of regulation ("why regulate?") from various perspectives within a market economy, highlighting the sources of "market failure" (such as externalities, adverse selection, and natural monopoly) and potential remedies (such as disclosure, taxes and fees, antitrust prohibitions, privacy requirements, price regulation and guarantees). The conflicting goals among regulators (and why we have multiple regulators) and their impact on the meaning of regulation will be considered along with regulatory competition/ arbitration. Portions of the course will tackle relatively broad questions such as: Why regulate? Why could it be beneficial to restrict permitted algorithms? Are our markets rigged? How suitable are antitrust remedies in the digital era? What is the law of unintended consequences? What is the objective of a policy advocate? Are regulators and regulatory policies a systemic risk? How can regulators enhance the predictability and credibility of their policies? Should we bar insider trading? Should regulations be determined and motivated based upon cost-benefit analysis? How can we evaluate the success or failure of particular regulations and whether they have achieved their objectives? To what extent did the Dodd-Frank Act ensure financial stability? (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-256 or 21-259 or 21-269 or 21-268) and 73-230 Min. grade C

73-359 Benefit-Cost Analysis
Intermittent: 9 units
The evaluation of public private sector projects. The theory of benefit-cost analysis and related techniques, such as cost-effectiveness analysis. Attention is given to such issues as valuing goods and services that are not normally traded in the marketplace (e.g., the value of an individual's life and the social rate of discount. Applications are considered in detail. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (73-102 Min. grade C or 73-100 Min. grade C) and (36-220 or 36-225 or 70-207 or 36-217 or 36-202 or 36-200 or 36-207)

73-365 Firms, Market Structures, and Strategy
Fall: 9 units
This course is concerned with the economic analysis of industrial markets that are not perfectly competitive. The effects of imperfect competition on firms' decisions (pricing, location, advertising, research and development, among others) are reviewed. Implications of these effects in terms of public policy are also discussed from a variety of perspectives. Finally, applications to actual markets are considered. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-268 or 21-269 or 21-259 or 21-256) and 73-230 Min. grade C

73-366 Designing the Digital Economy
Spring: 9 units
This course analyzes the economics of e-commerce and technology. It will identify the critical features that differentiate the technology firms from traditional industries, and examine the implications for business strategy. The class will discuss topics such as network effects, switching costs, and platform markets. To complement the economic theory, we will also consider a case study of a firm each week. These have three aims: to provide applications for the concepts developed in the lectures; to inform you about different industries; and to help develop your written, rhetorical and presentation skills. Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-259 or 21-269 or 21-268 or 21-256) and 73-230 Min. grade C and (73-407 Min. grade C or 73-274 Min. grade C or 73-374 Min. grade C or 73-265 Min. grade C or 70-208 or 36-226 or 36-220 or 36-208 or 36-202)

73-374 Econometrics II
Fall: 9 units
The material covered in this course extends from the material covered in Econometrics I (73-274). The course will include both the theory behind the methods and a hands-on analysis of actual data, providing students the tools for both research and industry jobs. Theories and methodologies covered will include: nonlinear regression models, qualitative response regression models, panel data estimators, simultaneous-equation models, and time series. (Lecture, 3 hours; Recitation, 1 hour). Minimum grade of "C" required in all economics and statistics pre-requisite courses.
Prerequisites: (21-259 or 21-268 or 21-269 or 21-256) and 73-230 Min. grade C and 73-274 Min. grade C

73-395 Independent Study in Economics
Fall and Spring
The Independent Study course in economics allows the student to pursue his or her original research interests in any of a variety of topics in economics. A typical independent study course involves a semester long project under the supervision of an appropriate faculty advisor. The nature and scope of the project are determined by the student and faculty advisor; the project proposal must be approved by an Undergraduate Economics Program staff member. Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-259 or 21-268 or 21-269 or 21-256) and (73-230 Min. grade C or 73-240 Min. grade C)

73-408 Law and Economics
Intermittent: 9 units
This course will provide a broad overview of the scholarly field known as "law and economics." The focus will be on how legal rules and institutions can correct market failures. We will discuss the economic function of contracts and, when contracts fail or are not feasible, the role of legal remedies to resolve disputes. We will also discuss at some length the choice between encouraging private parties to initiate legal actions to correct externalities and governmental actors, such as regulatory authorities. Extensive attention will be given to the economics of litigation, and to how private incentives to bring lawsuits differ from the social value of litigation. The economic motive to commit crimes, and the optimal governmental response to crime, will be studied in depth. Specific topics within the preceding broad themes include: the Coase Theorem; the tradeoff between the certainty and severity of punishment; the choice between ex ante and ex post sanctions; negligence versus strict liability; property rules; remedies for breach of contract; and the American rule versus the English rule for allocating litigation costs. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: 21-120 and (73-230 Min. grade C or 73-160 Min. grade C)

73-415 Data Driven Business and Public Policy Decision Making
Intermittent: 9 units
In this course students will learn to leverage data to inform business and policy decisions. The course will teach students various methods for data description, including techniques of data visualization and statistical techniques. Students will learn how to assess the precision of estimation techniques. The final part of the course covers examples taken from epidemiology, economics, business and public policy. (Lecture, 3 hours; Recitation: 1 hour). Minimum grade of "C" required in all economics and statistics pre-requisite courses.
Prerequisites: (21-268 or 21-256 or 21-269 or 21-259) and 73-230 Min. grade C and 73-265 Min. grade C
73-421 Emerging Markets
Fall: 9 units
The goal of the course is to study the economic and institutional forces that spur or hinder business activity and growth in emerging economies. The course is designed to provide both quantitative and theoretical foundations for the study of emerging markets. On the quantitative side, the course will introduce students to the empirical analysis of the growth forces and obstacles facing emerging markets by providing numerous hands-on opportunities using real-world data. On the theory side, the course will provide an overview of fiscal, trade and exchange rate policies adopted in emerging economies. The course will focus on successful emerging economies such as India, China, S. Korea and Ireland with broader lessons and comparisons drawn from developed countries. The course will also look at distressed economies, such as North Korea and Venezuela analyzing the challenges and opportunities faced by these developing nations today. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (36-200 or 36-202 or 36-207 or 70-207) and 73-102 Min. grade C and 73-103 Min. grade C

73-423 Forecasting for Economics and Business
Spring: 9 units
Governments forecast economic indicators (e.g., GDP, job growth, etc.); businesses forecast sales; portfolio managers forecast asset return; the list goes on. Accurate forecasts are critical to robust organizational decision-making. This course will introduce students to modern methods for forecasting in economic and business applications. Topics covered include Bayesian, statistical, and online learning algorithms to forecast construction and assessment, univariate and multivariate time series models and algorithms, and principled combination of multiple methods and data sources along with subject matter expertise to improve performance. Methods will be motivated by applications in macroeconomics, technology, marketing, and finance, with cases drawn from forecasting processes in a variety of business and government organizations. Students will implement forecasting methods in R, including in a real data forecasting competition. Prerequisites: (21-256 or 21-259 or 21-268 or 21-269) and (73-230 Min. grade C or 73-240 Min. grade C or 73-274 Min. grade C)

73-427 Sustainability, Energy, and Environmental Economics
Fall: 9 units
Topics related to sustainability and the environment are increasingly important to businesses, policymakers, and the general public. This course applies the tools of economic analysis to the problems of environmental protection, natural resource management, and energy production and use. The course will begin by introducing students to how an economist approaches problems of market failure commonly found in environmental contexts. Next, we will explore models that characterize solutions to such environmental issues. We will then address questions regarding measurement, policy design, and, finally, we will apply the tools that we have developed during the semester to the problems of climate change, and the optimal management of non-renewable resources. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (73-102 Min. grade C or 73-100 Min. grade C) and (36-207 or 36-217 or 70-207 or 36-225 or 36-220 or 36-200 or 36-202)

73-469 Global Electronic Markets: Economics and the Internet
Fall: 9 units
The information revolution brought about by the Internet is having a dramatic impact on the organization of economic activity. Long-term contractual relationships that once governed corporate procurement are being dismantled as manufacturers use the Internet to market directly to the public. New transportation networks that used to simply move goods from point A to point B are evolving into dynamic inventory pipelines that allow manufacturers to track and even reroute shipments in real time. At the same time, individuals are making use of sophisticated search engines to comparison shop at a scale that would have been physically exhausting even five years ago. We will use the basic tools of economic analysis to understand how and why the changes in information technology are reshaping the economic landscape. (Lecture, 3 hours). Minimum grade standard of "C" applies only to economics courses.
Prerequisites: (21-268 or 21-269 or 21-256 or 21-259) and (73-160 Min. grade C or 73-230 Min. grade C)

73-476 American Economic History
Fall: 9 units
The study of economic history provides important perspective on current economic institutions and policies. A failure to understand the historical evolution of economic institutions or the variety of past economic experience is perhaps the worst shortcoming of many economists. The study of economic history provides an opportunity to test currently fashionable theories against data from those used in their construction. In fact, this is a course in applied economics. The theories developed in the intermediate courses will be applied to episodes from the past in ways that increase understanding both of the specific historical episodes considered and the economic theories employed. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: 21-120 and (73-230 Min. grade C or 73-160 Min. grade C)

73-497 Senior Project
Fall: 9 units
A fourth-year project course, open only to Economics primary and additional majors with Senior standing. The senior project is a capstone course in economics. The purpose of the course is to showcase the analytical and quantitative skills that you have acquired as an undergraduate at Carnegie Mellon. The course project should reflect some independent applied research that is genuinely your own work. Thus a “book report” or a “literature review” are not sufficient exercises to satisfy this requirement. The following research approaches are acceptable for the research project: an empirical study based on a data set that you put together, an experimental study based on an experiment that you conducted, an analysis of survey data based on a survey that you conducted, a theoretical analysis based on a model that you have developed, based on your own algorithm. Students who write an honor thesis are exempted from this class. (Lecture, 3 hours). Minimum grade of "C" required in all economics pre-requisite courses.
Prerequisites: (21-268 or 21-269 or 21-259 or 21-256) and (36-303 or 36-226 or 73-265 Min. grade C or 73-274 Min. grade C or 73-374 Min. grade C or 73-407 Min. grade C) and 73-230 Min. grade C and 73-240 Min. grade C

73-500 Tepper College Honors Thesis I
Fall and Spring
Economics majors with outstanding academic records and intellectual promise will be given the opportunity to undertake original research under the direction of individual faculty members. Research topics are selected by students and approved by faculty. Prerequisites: Senior standing in the Economics Program and permission of the Economics faculty. Minimum grade of "C" required in all economics and statistics pre-requisite courses.
Prerequisites: (21-256 or 21-269 or 21-268 or 21-259) and (73-274 Min. grade C or 73-265 Min. grade C or 36-226 Min. grade C) and 73-230 Min. grade C and 73-240 Min. grade C

73-501 Tepper College Honors Thesis II
Fall and Spring
Economics majors with outstanding academic records and intellectual promise will be given the opportunity to undertake original research under the direction of individual faculty members. Research topics are selected by students and approved by faculty. Prerequisites include: Senior standing in the Economics Program and permission of the Economics faculty. Minimum grade of "C" required in all economics and statistics pre-requisite courses, and a minimum grade of "B" required in Tepper College Honors Thesis I.
Prerequisites: (21-269 or 21-268 or 21-259 or 21-256) and 73-230 Min. grade C and 73-240 Min. grade C and 73-500 Min. grade B and (73-265 Min. grade C or 73-374 Min. grade C)