

## Course Descriptions

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- CS 01080: Computer Literacy** 3 s.h.  
This Course teaches students how to use microcomputers effectively. Students learn about computer hardware and how it functions with an operating system and application software. Computer file management, data storage, multimedia, computer architecture, local area networks, the Internet, data security, and obtaining information from a library database are included. There is extensive hands-on use of windows, word processing, spreadsheets, and the Internet. This is a Basic Skills course; credit is not applied toward graduation.
- CS 01102: Introduction to Programming** 3 s.h.  
This course acquaints students with the logical structure of a computer, the algorithmic formulation of problems, and a modern high-level programming language. Extensive programming experience is included in the course. Proficiency equivalent to Basic Algebra II (MATH01.195) is expected for this course.
- CS 01104: Introduction to Scientific Programming** 3 s.h.  
This course emphasizes algorithmic solutions of problems. The syntax of the programming language is also studied, as well as the writing of structured code. Proficiency equivalent to Basic Algebra II.
- CS 01105: Web Literacy** 3 s.h.  
This is an introductory course on the world wide web, exposing how it works, and showing students how to use it appropriately. This course teaches students to create and modify basic web pages with markup languages and style directives, and how to embed non-text information such as video, images, and sound. The principles of publishing websites on the Internet and the process by which a page is delivered to end users will also be covered.
- CS 01190: Introduction to Computer Game Modeling** 3 s.h.  
This is an introductory computer games modeling course which examines the basics of computer game design and visual effects. Students will use graphics software modeling packages to create characters and visual effects, and to develop a computer game idea, including storyline and plots. Elementary programming techniques may also be taught.
- CS 01200: Computing Environments** 3 s.h.  
*Prerequisites: CS 01080 or Minimum Grade of P or Computer Competency Exam 70*  
Students will be exposed to a variety of computing environments. The course will include extensive hands-of a variety of software applications. Topics covered will include user tools, user programming techniques, application packages, and networking communications. Students will gain an understanding of the principles of computing which will enable them to adapt to future technological developments. A solid and fundamental understanding of computers and current operating systems, word processing and spreadsheet software are essential to this course.
- CS 01205: Computer Laboratory Techniques** 3 s.h.  
*Prerequisites: CS 04113 or CS 04103*  
A practical introduction to the hardware, software and networks used by the Computer Science Department. A foundation in programming using the language or languages required for intermediate and advanced computer science courses will be included.
- CS 01210: Introduction to Computer Networks and Data Communications** 3 s.h.  
*Prerequisites: CS 01200*  
This is an introductory computer networks course for students that are not majoring or minoring in computer science. This course will examine the basics of data communication and computer networks and will cover such topics as history and evolution of data communications, layered network architectures, physical and data link layers, introduction to internetworking, the Internet, IP protocols, basics of TCP and UDP transmission protocols, standard network applications and basics of network security, network utility software, and configuring local area networks in a popular operating system.
- CS 01395: Topics in Computer Science** 1 to 4 s.h.  
This course enables the faculty to offer courses in advanced topics which are not offered on a regular basis. Prerequisites will vary according to the specific topic being studied.
- CS 01400: Independent Study** 1 to 4 s.h.
- CS 04103: Computer Science and Programming** 4 s.h.  
This course emphasizes programming methodology, algorithms and simple data structures. A programming language rich enough to allow easy implementation of data structures is studied. Prior programming experience in any programming language is expected for this course.

- CS 04110: Introduction to Programming Using Robots 3 s.h.  
 This course teaches fundamental programming skills centered in the context of robot programming. Students will program small robots to perform a variety of tasks. In addition to learning a sophisticated programming language, students will gain skills in design techniques and experience working in teams to build complex systems.
- CS 04112: Java for Object Oriented Programmers 2 s.h.  
*Prerequisites: CS 04103*  
 This course is designed for students who have substantial programming experience in an object-oriented language, such as C++, but who need to learn Java as prerequisite knowledge for other courses in the curriculum. Students will study the syntax and semantics of Java, specifically, classes and objects, abstraction, encapsulation, data types, calling methods and passing parameters, decisions, loops, arrays and collections, documentation, testing and debugging, exceptions, design issues, inheritance, and polymorphic variables and methods.
- CS 04113: Introduction to Object Oriented Programming 4 s.h.  
*Prerequisites: MATH 01122 or MATH 01123 or MATH 01130*  
 Introduces the fundamental concepts of programming from an object-oriented perspective. Topics are drawn from classes and objects, abstraction, encapsulation, data types, calling methods and passing parameters decisions, loops, arrays and collections, documentation, testing and debugging, exceptions, design issues, inheritance and polymorphic variables and methods, The course emphasizes modern software engineering and design.
- CS 04114: Object Oriented Programming and Data Abstraction 4 s.h.  
*Prerequisites: CS 04113 or (CS 04103 and CS 04112)*  
 Objects and data abstraction continues from Introduction to Object-Oriented Programming to the methodology of programming from an object-oriented perspective. Through the study of object design, this course also introduces the basics of human-computer interfaces, graphics, with an emphasis on software engineering. A second operating system/programming platform is introduced.
- CS 04115: C++ for Java Programmers 1 s.h.  
*Prerequisites: CS 04113*  
 This course is designed for students who have substantial programming experience in an object-oriented language such as Java, but who wish to learn C++, a language that is still commonly used in research and industry. Students will study the syntax and semantics of C++, pointers, classes (inheritance, encapsulation, polymorphism, methods, etc.), control structures, file processing, and GUI programming.
- CS 04140: Enterprise Computing I 4 s.h.  
*Prerequisites: CS 01080, or minimum score of 70 on the Computer Competency Exam*  
 This course will acquaint students with data representation, data organization and data storage utilizing basic data structures. Students will perform basic file manipulation by reading data from files, writing data to files and data file formatting. Students will also understand basic logic, basic object oriented design and programming and the concepts of software engineering. Proficiency equivalent to Basic Algebra II (MATH01.195) is expected for this course.
- CS 04141: Enterprise Computing II 3 s.h.  
*Prerequisites: CS 04140*  
 This course is designed to extend the material presented in Enterprise Computing I by applying object oriented design and software engineering principles to develop a small scale enterprise system. This course will acquaint students with advanced features and data structures. Students will also understand basic graphical programming, event driven programs, exception handling and web programming.
- CS 04222: Data Structures and Algorithms 4 s.h.  
*Prerequisites: CS 04.114 (C- or better) and MATH 03.160*  
 This course features programs of realistic complexity. The programs utilize data structures (string, lists, graphs, stacks, trees) and algorithms (searching, sorting, etc.) for manipulating these data structures. The course emphasizes interactive design and includes the use of microcomputer systems and direct access data files
- CS 04225: Data Structures for Engineers 3 s.h.  
*Prerequisites: CS 04103 and MATH 01236*  
 The course features programs of realistic complexity. The programs utilize data structures (strings, lists, graphs, stacks) and algorithms (searching, sorting, etc.) for manipulating these data structures. The course emphasizes interactive design and includes the use of microcomputer systems and direct access data files.

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CS 04233:            Structured Design and Programming Using COBOL            3 s.h.  
*Prerequisites: CS 01102 or CS 04113 or CS 04103*

In this course students learn to write structured programs in COBOL. It includes a description of the language and a comparison with other languages. It emphasizes structured modular programming and documentation such as hierarchy charts (HIPO) and flow charts. Prior programming experience in any programming language is expected for this course.

CS 04234:            Advanced Structured Design and Programming Using COBOL            3 s.h.  
*Prerequisites: CS 04233*

This course prepares students for professional proficiency in the COBOL programming language, and includes structured and modular programming, top-down design, hierarchy charts and flow diagrams, table handling, sorting, searching, report preparation, character manipulation, sequential and ISAM files, programming standards and the transaction-master update problem.

CS 04305:            Web Programming            3 s.h.  
*Prerequisites: CS 01205 and CS 04222*

This course introduces the student to some of the underlying software components of the World Wide Web as it currently exists. Topics include markup languages, scripting languages, programming languages such as Java, and other software components of the Web.

CS 04315:            Programming Languages            3 s.h.  
*Prerequisites: (CS 04222 or CS 04225) and (CS 06205 or/and CS 06.205)*

A study of the fundamental principles underlying the design of programming languages. Students will study two or more languages from contrasting programming paradigms such as Functional, Object-Oriented, Logical, or Concurrent.

CS 04325:            Programming in Ada            3 s.h.  
*Prerequisites: CS 04222*

Students will gain an understanding of the major concepts of the programming language Ada. They will learn how the constructs of the Ada language can be used to produce software which is portable, readily maintained and modified, and efficiently designed. Students will do several programming projects in Ada, and will be exposed to problems in the design of real-time systems and concurrent programming.

CS 04327:            Power Java            3 s.h.  
*Prerequisites: CS 04222*

This advanced programming course explores the power of the Java programming language. It looks at the advanced features provided in Java: reflection and proxies, interfaces and inner classes, graphics programming, the event listener model, event handling, Swing user interface components, graphical user interface design, object serialization, multithreading, network programming, remote objects and remote method invocation, collection classes, database connectivity, and JavaBeans.

CS 04380:            Object Oriented Design            3 s.h.  
*Prerequisites: CS 07340*

This course will introduce important concepts, such as inheritance and polymorphism, which are crucial tools needed for crafting object-oriented solutions to real-world problems. Design patterns that commonly occur in design situations will be covered. A formal notation for describing and evaluating object-oriented designs such as the Unified Modeling Language (UML) will be taught. Students will apply the concepts to design and implement object-oriented solutions to one or more reasonably sized real-world problems.

CS 04390:            Operating Systems            3 s.h.  
*Prerequisites: CS 04222 and CS 06205*

The course concentrates on the design and functions of the operating systems of multi-user computers. Its topics include time sharing methods of memory allocation and protection, files, CPU scheduling, input-output management, interrupt handling, deadlocking and recovery and design principles. The course discusses one or more operating systems for small computers, such as UNIX.

CS 04391:            Concurrent Programming            3 s.h.  
*Prerequisites: CS 04390*

Introduces the motivation for and fundamental concepts of concurrent programming. Topics include processes, threads, context switching, atomic instructions/actions, shared data, race conditions, critical sections, mutual exclusion, synchronization, locks, barriers, semaphores, monitors, shared-memory multiprocessors, and an overview of distributed programming (distributed-memory multicomputers, interprocess communication, message passing, remote procedure call, rendezvous). The course includes developing concurrent programming skills by using a language that supports the multithreaded paradigm.

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- CS 04392: System Programming and Operating System Internals 3 s.h.  
This course examines the system kernel of a modern operating system including the file structure and implementation, the process structure and process scheduling, memory management policies, and the I/O subsystem. This course also covers the system call interface to the system kernel and various inter-process communication schemes.
- CS 04394: Distributed Systems 3 s.h.  
*Prerequisites: (CS 06205 and CS 04222) or (ECE 09242 and CS 04225)*  
This course will introduce students to the Distributed System ?a network of (possibly autonomous) computers that cooperatively solve single problems or facilitate parallel execution of related tasks. Key topics of study include Distributed Systems Architecture, Distributed Resource Management, and Accessing Distributed Resources. Students will participate in algorithm, process and system design for distributed systems.
- CS 04400: Computer Science - Senior Project 3 s.h.  
*Prerequisites: CS 04315 and CS 07340*  
This is an advanced programming course in which students work on large-scale individual or team programming projects and make a formal presentation on their work. The course discusses program development, methodologies and strategies.
- CS 04401: Compiler Design 3 s.h.  
*Prerequisites: CS 04315 and CS 07210*  
This course presents theory of compiler design, syntax-directed translation, and code generation. Students design a compiler for a subset of a high-level programming language.
- CS 04430: Database Systems: Theory and Programming 3 s.h.  
*Prerequisites: CS 07340*  
This course focuses on the design of DBMS and their use to create databases. The course covers both the theoretical concepts and the implementation aspects of database systems with a special emphasis on relational database systems, SQL, programming (in a modern programming language such as C++ or Java) using a real database Application Programming Interface (such as JDBC or ODBC)
- CS 06205: Computer Organization 3 s.h.  
*Prerequisites: CS 04113 and MATH 03160 or CS 04103 and MA03160*  
This course provides an introduction to computer organization. Students are exposed to the register level architecture of a modern computer and its assembly language. The topics include machine level data representation, von Neumann architecture and instruction execution cycle, memory hierarchy, I/O and interrupts, instruction sets and types, addressing modes, instruction formats and translation. This course is not open to students who have taken CS04.204 Assembly Language Programming.
- CS 06310: Principles of Digital Computers 3 s.h.  
*Corequisites: CS 06311 Prerequisites: CS 06205*  
This course provides an introduction to the fundamentals of computer hardware systems. The topics include digital logic, combinational circuits, sequential circuits, memory system structure, bus and interconnection structure, computer arithmetic and the ALU unit, I/O system structure, hardwired control unit, microprogrammed control unit, and alternative computer architectures. This course is not open to students who have taken CS06.370 Digital Design and Lab.
- CS 06311: Digital Computer Laboratory 1 s.h.  
*Corequisites: CS 06310 Prerequisites: CS 06205*  
This lab course provides the student with hands-on experience in the design and implementation of digital components. State-of-the-art systems are used to design, test, and implement digital circuits: Combinational circuits, sequential circuits, registers, counters, datapath, arithmetic/logic units, control units, and CPU design. This course is taken concurrently with Principles of Digital Computers.
- CS 06390: Introduction to Systems Simulation and Modeling 3 s.h.  
*Prerequisites: (CS 01102 or CS 01104 or CS 01100 or CS 04103 or CS 04113 or CS 04140) and (Math 01130 or Math 01140)*  
The students in this course will understand the fundamentals of and have practical experience with system modeling and simulation. Course topics include the Monte Carlo simulation technique, discrete event simulation algorithms and tools, and principles of mathematical modeling, queuing theory, input modeling, output analysis, and verification and validation of a simulation model. The students in this course will learn to use a commercial simulation software tool and will conduct a simulation study in an engineering field.

CS 06410: Data Communications and Networking 3 s.h.  
*Prerequisites: CS 07340 and STAT 02360*

Students in this upper-division course will study the principles of data communications and important network architectures and protocols. Its topics include: the advantages of networking, major network architectures, protocol reference models and stacks, the Data Link Layer, the Network Layer, the Transport Layer, and the Internet. Additional topics may include: local, metropolitan and wide area networks; wireless, telephone and cellular networks; network security; and network programming. Students complete a networking team project.

CS 06412: Advanced Computer Architecture 3 s.h.  
*Prerequisites: CS 06310*

This is an advanced course in computer architecture designed to expand the knowledge gained by students in the Principles of Digital Computers course. The topics include various performance enhancement techniques such as DMA, I/O processor, cache memory, multiport memories, RISC, pipelining, and various advanced architectures such as high-level language architecture, data-flow architecture, and multiprocessor and multi-computer architectures. This course also allows detailed examination of one or two contemporary computers.

CS 06415: Wireless Networks, Protocols and Applications 3 s.h.  
*Prerequisites: CS 06410*

This course prepares students to understand wireless networks systems, and the underlying communications technologies that make them possible. The course covers descriptive material on wireless communications technologies, and important deployed and proposed wireless networks and systems. Wireless system performance and Quality of Service capabilities are addressed. Students will prepare and deliver technical presentations on state-of-the-art topics in wireless networks and systems.

CS 06416: TCP/IP and Internet Protocols and Technologies 3 s.h.  
*Prerequisites: CS 06410*

This is an advanced computer networking course that will expand students knowledge received in the Data Communications and Networking course. This course will examine operation of the TCP/IP protocol as well as design and architecture of the Internet. This course will cover such topics as: Medium access protocols, address resolution protocols, Internet Protocol (IP), Quality of Service, Transport Protocol, and congestion control mechanisms. This course will also include selected topics on network security and network management. Students will prepare and deliver technical presentations on state-of-the-art research topics in the Internet.

CS 06420: Embedded Systems Programming 3 s.h.  
*Prerequisites: CS 04390, CS 06310, CS 06311*

Embedded software is used in almost every electronic device. This course deals with software issues that arise in embedded systems programming. Important concepts covered in this course will include device programming interfaces, device drivers, multi-tasking with real-time constraints, task synchronization, device testing and debugging, and embedded software development tools such as emulators and in-circuit debuggers. These concepts will be applied to design and implement embedded software for one or more modest-sized embedded systems.

CS 07210: Foundations of Computer Science 3 s.h.  
*Prerequisites: C- or better in MATH 03160 and any one of the following: CS 01102, CS 04103, CS 01104 or CS 04113*

This course provides an introduction to the theoretical foundations of computer science, including finite automata, context-free grammars, Turing machines, and formal logic.

CS 07310: Robotics 3 s.h.  
*Prerequisites: (CS 04113 and CS 04222 and MATH 01210) or (CS 04103 and CS 04225 and ENGR 01202 and MATH 01236)*

This course provides an introduction to the fundamentals of robotics. Students will study robot manipulators and mobile robots, robot sensors, and robot cognition. Students will also gain experience programming in small groups, and programming in a domain where noisy and imprecise data is commonplace.

CS 07320: Software Engineering Laboratory 1 s.h.  
*Prerequisites: concurrent enrollment in CS 07321*

This lab is designed for students who register for CS 07321 Software Engineering I and wish to learn how to develop and structure their deliverables, as well as how to use software development tools, under faculty guidance and supervision. Real-world projects will often be provided.

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- CS 07321: Software Engineering I 3 s.h.  
*Prerequisites:* (CS04.222 or CS 04.225) and (COMP 01.112 or ENGR 01.201) and (CMS 06.202 or ENGR 01.202)  
An introduction to the discipline of Software Engineering. Students will explore the major phases of the Software Lifecycle, including analysis, specification, design, implementation, and testing. Techniques for creating documentation and using software development tools will be presented. Students will gain experience in these areas by working in teams to develop a software system. Proficiency in programming is expected of the students entering this course.
- CS 07322: Software Engineering II 3 s.h.  
*Prerequisites:* CS 07321  
Students will apply their knowledge from Software Engineering to develop an advanced software system, working in teams. The project will be taken through each of the major software development phases and student teams will create appropriate deliverables for each phase. Advanced modern software engineering topics such as critical systems, real-time systems, formal specification and validation, and project management will be covered.
- CS 07340: Design and Analysis of Algorithms 3 s.h.  
*Prerequisites:* CS 04222 and CS 07210  
In this course, students will learn to design and analyze efficient algorithms for sorting, searching, graphs, sets, matrices, and other applications. Students will also learn to recognize and prove NP-Completeness.
- CS 07350: Computer Cryptography 3 s.h.  
*Prerequisites:* CS 07210  
This course introduces students to the principles and practices which are required for secure communication: cryptography, cryptanalysis, authentication, integrity, and digital certificates. Mathematical tools and algorithms are used to build and analyze secure cryptographic systems with computers. Social, political, and ethical aspects of cryptography are also covered.
- CS 07360: Introduction to Computer Graphics 3 s.h.  
*Prerequisites:* (MATH 01210 or MATH 01235) and CS 07340  
This junior/senior level course covers such topics as fundamentals of graphics devices; use of graphics language/packages; windowing and clipping; geometrical transformation in 2- and 3-D; raster display algorithms; hidden line and surface elimination; animation.
- CS 07370: Introduction to Information Visualization 3 s.h.  
*Prerequisites:* MATH 01210 or MATH 01236  
This is a junior/senior level course that introduces basic elements of Information Visualization. Topics covered include graphics programming, information visualization general principles, visualization techniques for 1-dimensional, 2-dimensional, and N-dimensional information, graph visualization, visualization techniques for image and digital libraries, as well as for the World Wide Web, interactivity, and focus+content techniques. This course also includes the implementation of techniques presented in lecture. Students are encouraged to devise new techniques, implement them, and determine their effectiveness. Students will be required to implement and document a large software project related to information visualization.
- CS 07380: Introduction to Computer Animation 3 s.h.  
*Prerequisites:* (MATH 01210 or MATH 01236) and PHYS 02200  
This is a junior/senior level course that takes a look at Computer Animation from a programmers perspective. It will investigate the theory, algorithms, and techniques for describing and programming motion for virtual 3D worlds. Approaches that will be explored include keyframing systems, kinematics, motion of articulated figures, and procedural and behavioral systems. This course includes the implementation of techniques presented in lecture. Students are encouraged to devise new techniques, implement them, and determine their effectiveness. Students will be required to implement and document a large software project related to computer animation.
- CS 07422: Theory of Computing 3 s.h.  
*Prerequisites:* CS 04222 and MATH 01131 and CS 07210  
This is an advanced course in the theoretical foundations of computer science, building on the introduction provided in the Foundations of Computer Science course. It studies models of computers, such as finite automata and Turing machines, formal languages, and computability, as well as the fundamentals of complexity theory and NP-completeness.
- CS 07450: Artificial Intelligence (AI) 3 s.h.  
*Prerequisites:* MATH 03160 and CS 04222 and CS 07210  
AI studies methods for programming "intelligent" behavior in computers. Students study the data representation methods and algorithms used in AI, and survey research areas such as puzzle solving, game-playing, natural language processing, expert systems, and learning. In addition to readings, discussion, and problem solving in AI, students will be expected to program in one of the languages commonly used in AI, such as LISP or Prolog.

## Course Descriptions

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- CS 07460: Computer Vision 3 s.h.  
This course examines the fundamental issues in computer vision and major approaches that address them. The topics include image formation, image filtering and transforms, image features, mathematical morphology, segmentation, camera calibration, stereopsis, dynamic vision, object recognition and computer architectures for vision.
- CS 07470: Theory and Applications of Pattern Recognition 3 s.h.  
This class will introduce a broad spectrum of pattern recognition algorithms along with various statistical data analysis and optimization procedures that are commonly used in such algorithms, with particular emphasis to engineering applications. Although mathematically intensive, pattern recognition is nevertheless a very application driven field. This class will therefore cover both theoretical and practical aspects of pattern recognition, Bayes decision theory for optimum classifiers, density estimation techniques, discriminant analysis, basic optimization techniques, introduction to basic neural network structures, unsupervised clustering techniques and more state of the art algorithm independent techniques.
- CS 99300: Computer Field Experience 3 to 9 s.h.  
*Prerequisites: permission of instructor (note: only 3 credits for CFE can be applied towards the restricted electives)*  
Students are assigned projects in a professional environment.
- INTR 01265: Computers and Society 3 s.h.  
*Prerequisites: CMS 06202*  
This interdisciplinary course focuses upon the effects of computer systems on individuals and institutions. How computer systems are developed and operated will be related to an analysis of current trends in American society. A study of present and probably future applications of computers in such areas as management, economic planning, data collection, social engineering, education and the military will be followed by an exploration of the relationship of computer systems to problem solving orientations, bureaucratization, centralization of power, alienation, privacy, autonomy and people's self concept. This course is open to students at any level who satisfy the prerequisite and have course work in computer science or sociology or permission of instructor.
- INTR 01266: Computer and Society - WI 3 s.h.  
*Prerequisites: CMS 06202*  
This interdisciplinary course focuses upon the effects of computer systems on individuals and institutions. How computer systems are developed and operated will be related to an analysis of current trends in American society. A study of present and probably future applications of computers in such areas as management, economic planning, data collections, social engineering, education and the military will be followed by an exploration of the relationship of computer systems to problem solving orientations, bureaucratization, centralization of power, alienation, privacy, autonomy and peoples' self-concept. This course is open to students at any level who satisfy the prerequisite and have course work in computer science or sociology or permission of instructor.
- ECON 04100: American Economic Systems 3 s.h.  
Focuses on the fundamental ideology, mechanics, development, and contemporary state of American economic system with reference to the global economy. Course is recommended for all students who want only a one semester course in economics.
- ECON 04101: An Introduction to Economics-A Macroeconomic Perspective 3 s.h.  
This course analyzes the overall level of economic activity in the United States and examines its major determinants, public stabilization policies, economic growth and international trade.
- ECON 04102: An Introduction to Economics-A Microeconomic Perspective 3 s.h.  
This course analyzes resource allocation among alternative uses. It studies consumer demand, product and factor price determination, general equilibrium and optimal income distribution.
- ECON 04200: History of Economic Ideas 3 s.h.  
This course investigates the development of economic thought. It analyzes the significant contribution of philosophers and economists from the works of Plato to those of Keynes.
- ECON 04205: American Economic History 3 s.h.  
This course surveys the process of U.S. economic development to the present day. It analyzes the factors behind the growth of the U.S. economy and the prospects for the future. This course may not be offered annually.