

Computer Science Courses

CS 01.102: 3 s.h. Introduction to Programming

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 Intermediate Algebra (MATH01.121) is expected for this course.

CS 01.104: 3 s.h. Introduction to Scientific Programming

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 Intermediate Algebra (CS01.121) is expected.

CS 01.200: 3 s.h. Computing Environments

Prerequisites: CS 01100 or CS 01050 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 01.205: 3 s.h. Computer Laboratory Techniques

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 01.210: 3 s.h. Introduction to Computer Networks and Data Communications

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 01.395: 1 to 4 s.h. Topics in Computer Science

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 04.103: 4 s.h. Computer Science and Programming

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 04.110: 3 s.h. An Introduction to Programming Using Robots

Prerequisites: CS 01100 or CS 01050 Minimum Grade of P or Computer Competency Exam 70

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 04.112: 1 s.h. Java for Object Oriented Programmers

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 variable.

CS 04.113: 4 s.h. Introduction to Object Oriented Programming

Prerequisites: MATH 01121 or MATH 01122 or MATH 01125 or MATH 01130 or MATH 01131

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 04.114: 4 s.h. Object Oriented Programming and Data Abstraction

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 04.115: 1 s.h. C++ for Java Programmers

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 04.140: 4 s.h. Enterprise Computing I

Prerequisites: CS 01100 or CS 01050 and MATH 01123 or MATH 03125 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.

CS 04.140: 4 s.h. Enterprise Computing II

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 04.222: 4 s.h. Data Structures and Algorithms

Prerequisites: CS 04114 and MATH 03160 or CS 04114 and CS 04112 Minimum Grade of A- and CS 04103 Minimum Grade of A-

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 04.225: 3 s.h. Data Structures for Engineers

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.

CS 04.233: 3 s.h. Structured Design and Programming Using COBOL

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 04.234: 3 s.h. Advanced Structured Design and Programming Using COBOL

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 04.305: 3 s.h. Web Programming

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 04.315: 3 s.h. Programming Languages

Prerequisites: CS 04222 and CS 06205

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 04.325: 3 s.h. Programming in Ada

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 04.327: 3 s.h. Power Java

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 04.380: 3 s.h. Object Oriented Design

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 04.390: 3 s.h. Operating Systems

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 04.391: 3 s.h. Concurrent Programming

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 program.

CS 04.392: 3 s.h. System Programming and Operating System Internals

Prerequisites: CS 04390 and CS 01205 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 04.394: 3 s.h. Distributed Systems

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 04.400: 3 s.h. Computer Science Senior Project

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 04.401: 3 s.h. Compiler Design

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 04.430: 3 s.h. Database Systems: Theory and Programming

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 06.205: 3 s.h. Computer Organization

Prerequisites: CS 04113 and MATH 03160 or CS 04103 and MATH 03160 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 06.310: 3 s.h. Principles of Digital Computers

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 06.311: 1 s.h. Digital Computer Laboratory

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 06.410: 3 s.h. Data Communications and Networking

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 06.412: 3 s.h. Advanced Computer Architecture

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 06.415: 3 s.h. Wireless Networks, Protocols and Applications

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 06.416: 3 s.h. TCP/IP and Internet Protocols and Technologies

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 07.210: 3 s.h. Foundations of Computer Science

Prerequisites: MATH 01122 and MATH 03160 and CS 04222 or MATH 01130 and MATH 03160 and CS 04222 This course provides an introduction to the theoretical foundations of computer science, including finite automata, context-free grammars, Turing machines, and formal logic.

CS 07.310: 3 s.h. Robotics

Prerequisites: CS 04113 and CS 04222 or CS 04113 and ENGR 01202 or MATH 01210 or 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 07.321: 3 s.h. Software Engineering I

Prerequisites: CS 04222 and CMS 06202 and STAT 02360 or ECE 09242 and CMS 06202 and STAT 02360 An introduction to the discipline of Software Engineering. Students will explore the major phases of the Software Lifecycle, including analysis, specification, design, and 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 07.322: 3 s.h. Software Engineering II

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 07.340: 3 s.h. Design and Analysis of Algorithms

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 07.350: 3 s.h. Computer Cryptography

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 07.360: 3 s.h. Introduction to Computer Graphics

Prerequisites: CS 04315 and MATH 01210 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 07.370: 3 s.h. Introduction to Information Visualization

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 07.380: 3 s.h. Introduction to Computer Animation

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 07.422: 3 s.h. Theory of Computing

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 07.450: 3 s.h. Artificial Intelligence (AI)

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.

CS 07.460: 3 s.h. Computer Vision

Prerequisites: CS 04103 and MATH 01210 and STAT 02360 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 07.470: 3 s.h. Theory and Applications of Pattern Recognition

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 99.300: 3 to 9 s.h. Computer Field Experience

Students are assigned projects in a professional environment.