

## Computer Science

CS 00100: Computer Science Learning Community 1 s.h.  
 One semester requirement for all students who enter the major.

CS 01101: Computer Science Principles 3 s.h.  
 This course introduces students to the foundational concepts of computer science and challenges them to explore how computing and technology can impact the world. More than a traditional introduction to programming, it is a rigorous, engaging, and approachable course that explores many of the foundational ideas of computing so all students understand how these concepts are transforming the world we live in. Topics covered include creativity and innovation, abstraction, data and Information (e.g., the role of data analytics), algorithms, programming, the Internet and the global impact of computing. This course is designed to map to the relatively new high school Advance Placement course and exam.

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 01110: Computing Environments 3 s.h.  
 Students will be exposed to a variety of computing environments. The course will include extensive hands-on 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 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 01205: Computer Laboratory Techniques 3 s.h.  
*Prerequisite(s): CS 04113 or CS 04103; and Sophomore Standing*  
 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.  
 This course examines the basics of data communication and computer networks and covers such topics as IT system components, layered network architectures, 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, network traffic analysis, network mapping techniques, and configuring local area networks in a popular operating system.

CS 01211: Principles Of Information Security 3 s.h.  
 Students will be exposed to the spectrum of security activities, methods, technologies, and threats. This course will cover a range of key topics in the area of information and computer security including inspection and protection of information assets, detection of and reaction to security threats, taxonomy of security threats, and concentrating on issues in computer and operating systems security, principles of network security, and basics of cryptography.

CS 01295: Special Topics in Computer Science .5 to 3 s.h.  
*Restricted to CS Majors and Minors*  
 Specific topical outline to be covered will vary depending upon the topic chosen for the course and will be clearly stated on the course syllabus.

## Course Descriptions

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CS 01395:	Topics In Computer Science	1 to 4 s.h.
<i>Prerequisite(s): CS 04222 or CS 04225</i>		
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 02421:	Big Data Tools and Techniques	3 s.h.
<i>Prerequisites: CS 10337 or MIS 02337 or CS 04430 or (CS 10338 and CS 10339)</i>		
Big data refers to the large, diverse sets of information that grow at ever-increasing rates. It encompasses the volume of information, the velocity or speed at which it is created and collected, and the variety or scope of the data points being covered. Big data often comes from multiple sources and arrives in multiple formats. This course discusses various tools for loading, storing, visualizing and analyzing Big-Data sets.		
CS 04103:	Computer Science and Programming	4 s.h.
<i>Prerequisite(s): MATH 01122 or MATH 01130 or CS 01104</i>		
This course emphasizes programming methodology, algorithms and simple data structures. Topics to be covered include top down design of functions and classes, basic data abstraction and encapsulation, control structures, file i/o, user defined classes and object-oriented principles.		
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 04113:	Introduction To Object Oriented Programming	4 s.h.
<i>Prerequisite: MATH 01122 or MATH 01130</i>		
This course 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. Students are expected to be sufficiently proficient in mathematics such that they are ready to take Calculus I (MATH 01130).		
CS 04114:	Object Oriented Programming and Data Abstraction	3 s.h.
<i>Prerequisite(s): CS 04113 or (CS 04103 and CS 04112)</i>		
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 introduces software engineering and focuses on file I/O, function prototypes, exception handling, decoupling strategies, and other advanced topics.		
CS 04171:	Creating Android Applications	3 s.h.
<i>Prerequisite(s): None</i>		
This course is designed for students who want to start developing mobile applications on Android platforms and understand the basic concepts of Computer Science. The course will start with the basics of Android programming by covering the most recent version of Android and understanding its development framework. Students will then learn to develop feature-rich Android applications using the MIT App Inventor Integrated Development Environment and learn the basic "Big Ideas" of Computer Science such as, algorithmic thinking, abstractions, logic, flow control, and data representation, storage and manipulation.		
CS 04210:	Advanced Programming Workshop	2 s.h.
<i>Prerequisite(s): CS 04103 or CS 04113 Minimum Grade of C-</i>		
Programming languages, integrated development environments, application programming interfaces, software packages, and libraries are examples of programming technologies. This project intensive course, which is part of B.A. in Computing and Informatics program, explores a specified programming technology at an advanced level.		
CS 04222:	Data Structures and Algorithms	4 s.h.
<i>Prerequisite(s): CS 04.114 (C- or better) and MATH 03.160 or MATH 03.150; Co-requisite: CS 01205</i>		
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:	Principles of Data Structures	3 s.h.

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- CS 04391: Concurrent Programming** 3 s.h.  
*Prerequisite(s): 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.
- CS 04392: System Programming and Operating System Internals** 3 s.h.  
*Prerequisite(s): 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 04394: Distributed Systems** 3 s.h.  
*Prerequisite(s): (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.  
*Prerequisite(s): CS 01205 and CS 07340 and CS 07321*  
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.  
*Prerequisite(s): 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.  
*Prerequisite(s): CS 04222*  
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 04440: Data Warehousing** 3 s.h.  
*Prerequisite(s): MIS 02337 or CS 10337 or CS 04430*  
This course teaches Data Warehousing and its applications to Data Analytics and Knowledge Discovery. Topics include requirements gathering for data warehousing, data warehouse architecture, dimensional model design for data warehousing, physical database design for data warehousing, extracting, transforming, and loading strategies, introduction to Knowledge Discovery, design and development of analytics applications, expansion and support of a data warehouse.
- CS 04471: Topics in Mobile Programming** 3 s.h.  
*Prerequisite(s): Permission of the instructor or sufficient programming background*  
Students will explore topics in mobile application development. This course covers the various mobile operating systems, mobile development tools, and all that is needed to create mobile applications, using programming languages appropriate for the mobile platform being studied. Students will gain an advanced understanding of mobile application development and have an exciting opportunity to write and publish feature-rich mobile applications.
- CS 06205: Computer Organization** 3 s.h.  
*Prerequisite(s): Minimum Requirement C- for each of the following: (CS 04113 or CS 04103) and (MATH 03160 or MATH 03150)*  
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.
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- CS 06310: Principles Of Digital Computers** 3 s.h.  
*Prerequisite:* 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.  
*Co-requisites:* CS 06310 *Prerequisite(s):* 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.  
*Prerequisite(s):* (CS 04222 or CS 04225) and (MATH 01210 or (ENGR 01202 and MATH01235))  
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.  
*Prerequisite(s):* CS 07340 and STAT 02290  
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.  
*Prerequisite(s):* 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.  
*Prerequisite(s):* 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.  
*Prerequisite(s):* 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 06417: Principles of Network Security** 3 s.h.  
*Prerequisite(s):* CS 01210 or CS 06410 and CS 07351  
This course examines the fundamentals of network security. The material covered in this course includes such topics as cryptographic systems necessary for network security, public key infrastructure, principles of data integrity, authentication, and key management, Internet architecture and TCP/IP protocol suite, application layer security, secure sockets layer and transport layer security protocols, IPSec, distributed and cloud security, wireless and mobile security, network security techniques and components, network-based vulnerability detection and penetration testing, defense in depth, and others. Students will prepare and deliver technical presentations on state-of-the-art research topics in the network security.
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- CS 06420: Embedded Systems Programming** 3 s.h.  
*Prerequisite(s): (CS 04390 and CS 06310 and CS 06311) or (CS 04390 and ECE 09241 and ECE 09242)*  
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 06440: Cloud Computing and the Internet Things** 3 s.h.  
*Prerequisite(s): (CS 01210 or CS 06410) and (CS 04225 or CS 04222)*  
This course exposes students to the variety, complexity, and capabilities of modern cloud platforms and investigates Embedded Systems and the Internet of Things (IoT) techniques, and architectures. The topics covered in the course include cloud infrastructure components, essential characteristics of cloud platforms, security implication of cloud resources, typical instruction sets and architectures of embedded systems, IoT system architectures, IoT networking and security, MQTT and REST protocols, cyber considerations and issues related to embedded systems and IoT devices, hands-on experience in using Amazon and Microsoft cloud (AWS and Azure) to visualize live data streams of IoT devices as well as other topics. Coursework will include student presentations and a term project that will provide exposure to scientific research in cloud computing and IoT.
- CS 06470: Cyber Operations** 3 s.h.  
*Prerequisite(s): CS 06417 and CS 01205*  
This course exposes students to the principals and practice of the cyber operations and will introduce a high-level overview of the different phases of cyber operations and required critical skills. The topics covered in the course include offensive cyber operations, software reverse engineering, detecting software vulnerabilities, identifying command and control operations, implementing exploits for discovered vulnerabilities as well as other topics through hands-on experiences and technical presentations.
- CS 07210: Foundations Of Computer Science** 3 s.h.  
*Prerequisite(s): C- or better in (MATH 03160 or MATH 03150) and 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 07252: Foundations of Computer Forensics** 3 s.h.  
This interdisciplinary course focuses on the legal and technical principles of digital forensics. Analysis of complex legal issues and current trends in high technology crime will be followed by exploration of formal methodologies and best practices for the forensically sound acquisition and analysis of digital evidence. Social and ethical impacts will also be explored throughout the course as it relates to high technology crime. Hands-on scenario based activities will provide students with opportunities to develop the legal understanding and technical skills that will serve as a foundation to pursue careers in computer forensics in law enforcement and the private sector.
- CS 07310: Robotics** 3 s.h.  
*Prerequisite(s): (CS 04222 and MATH 01210) or (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.  
This lab is designed for students who are not taking CS 07321 Software Engineering I yet wish to learn how to use software development tools. The course will cover selected topics in software engineering models and methods as well as software design notations. Any prerequisite software engineering knowledge will not be expected of students and will be included in this course.
- CS 07321: Software Engineering I-Writing Intensive** 4 s.h.  
*Prerequisite(s): (CS 04.222 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.
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CS 07322: Software Engineering II-Writing Intensive 3 s.h.

*Prerequisite(s): 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.

*Prerequisite(s): 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.

*Prerequisite(s): CS 04222 and 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 07351: Cyber Security: Fundamentals, Principles and Applications 3 s.h.

*Prerequisite(s): (MATH 03150 or MATH 03160) and CS 06205*

This course exposes students to the security fundamental principles and will introduce a wide range of security activities, methodologies, and procedures. The topics covered in the course include fundamental concepts of computer security, principles of cryptography, software security and trusted systems, isolation and virtualization, host-based vulnerability detection, security architecture, Windows and Linux system administration, access control and least privilege, legal and ethics as well as other topics.

CS 07353: Security of Mobile Devices 3 s.h.

*Prerequisite(s): CS 04222 and CS 06205*

This course focuses on the technical and logistical principles of securing mobile devices. Current operating systems, applications and networks will be addressed. Social and ethical implications will also be explored throughout the course. Both hands-on experience and scenario-based analysis will be emphasized in the course.

CS 07360: Introduction To Computer Graphics 3 s.h.

*Prerequisite(s): (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.

*Prerequisite(s): CS 04.222 or CS 04.225 or MIS 02.234*

This is a junior/senior level course that introduces basic elements of Information Visualization, which is concerned with the creation of visual representation of Big Data abstract phenomena for which there may not be a natural physical reality, such as stock market movements, social relationships, gene expression levels, manufacturing production monitoring, survey data from political polls, or supermarket purchases. Students will be exposed to techniques covering the five main phases of developing information visualization tools: representation, presentation, interaction, perception and interpretation, and evaluation. Students will be required to develop a large project related to information visualization.

CS 07380: Introduction To Computer Animation 3 s.h.

*Prerequisite(s): (MATH 01210 or MATH 01236) and (PHYS02200 or PHYS 00220)*

This is a junior/senior level course that takes a look at Computer Animation from a programmer's 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.

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- CS 07390: Introduction To Computer Game Design and Development** 3 s.h.  
*Prerequisite(s): (CS 04222 or CS 04225) and (Math 01210 or MATH 01235)*  
This is a junior/senior level course that introduces the technology, science, and art involved in the creation of computer games. Games will be examined in a systems context to understand gaming and game design fundamentals. The theory and practice of developing computer games will be investigated from a blend of technical, aesthetic, and cultural perspectives. Extensive study of past and current computer games will be used to illustrate course concepts. Group game development and implementation projects will culminate in classroom presentation and evaluation.
- CS 07422: Theory Of Computing** 3 s.h.  
*Prerequisite(s): 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 07430: Human-Computer Interaction** 3 s.h.  
*Prerequisite(s): CS 04222 or CS 04225*  
This course teaches the fundamental concepts of Human Computer Interaction (HCI) and user-centered design. Students will learn how to create effective interfaces to both software and hardware systems that are both effective and usable. Students will study modeling, user testing, user interaction analysis techniques, and prototyping. Team projects are required.
- CS 07450: Artificial Intelligence (Ai)** 3 s.h.  
*Prerequisite(s): (MATH 03160 or MATH 03150) 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 07455: Machine Learning** 3 s.h.  
*Prerequisite(s): MATH 01210 or MATH 01235 and STAT 02290 or ECE 09363*  
The use of computational approaches to extract information from vast amounts of data and make intelligent decision based on that information constitutes the foundation of machine learning, a field that has made a dramatic impact on our daily lives. From weather prediction to medical diagnosis, end-user recommendations to smart homes, autonomous vehicles to speech identification, machine learning is now everywhere. This course introduces concepts, issues, and algorithms in machine learning and pattern recognition, and will discuss both theoretical and practical aspects. Main topics of the course will include basic learning theory, convex and evolutionary optimization techniques, supervised, unsupervised and semi-supervised learning, ensemble systems, model selection and combination, feature selection and performance evaluation techniques. The class will feature assignments and projects that allow students to implement various traditional and emerging machine learning algorithms, and evaluate them on real-world applications.
- CS 07460: Computer Vision** 3 s.h.  
*Prerequisite(s): CS 04222, MATH 01210, and STAT 02290*  
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 07480: Introduction to Data Mining** 3 s.h.  
*Prerequisite(s): CS 04222 and STAT 02290 or STAT 02360 and STAT 02361 or STAT 02360 and STAT 02260*  
This course teaches the fundamental concepts of Data Mining. Students will learn how to program systems to gather and analyze large data sets to discover important patterns.
- CS 07485: Web and Text Mining** 3 s.h.  
*Prerequisite(s): CS 04225 or CS 04222*  
This course teaches methods of mining large amounts of text. Students will be introduced to methods for obtaining, exploring, and preprocessing large amounts of text. Tools for natural language processing, topic modeling, sentiment analysis and Bayesian classifiers will be introduced. Business and biomedical applications of text mining will be discussed.
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- CS 10200: Fundamentals of Network Security 3 s.h.  
*Prerequisite:* CS 01210  
This course introduces network security focusing on the overall processes with an emphasis on hands-on skills in the following areas: security policy design and management; security technologies, products and solutions; firewall and secure router design, installation, configuration, and maintenance; AAA implementation, and VPN implementation using routers.
- CS 10215: Penetration Testing Fundamentals 3 s.h.  
*Prerequisite:* CS 01210  
The purpose of this course is to give students of all backgrounds and experience levels a well-researched and engaging introduction to the realm of penetration testing. With real-world examples that reflect today's most important and relevant security topics, this course addresses how and why people attack computers and networks, so that students can be armed with the knowledge and techniques to successfully combat hackers. Because the world of information security changes so quickly and is often the subject of much hype, this course also aims to provide a clear differentiation between hacking myths and hacking facts. Many hands-on exercises are included, which allow students to practice skills as they are learned.
- CS 10218: Ethical Hacking Fundamentals 3 s.h.  
This course introduces students to ethical hacking, security testing, and network defense/counter measures. Students who have strong knowledge of computer and networking learn how to protect networks by using an attacker's technique to compromise network and systems security. Hands-on lab activities enable students to learn how to protect network/systems by using the tools and methods used by hackers to break into networks/systems. Discussion topics include: hacker methodology and tools, how hackers operate, as well as setting up strong countermeasures to protect networks/systems.
- CS 10250: Cryptography and Blockchain Essentials 3 s.h.  
This introduction to the basic theory and practice of cryptographic techniques used in computer security will explore the inner workings of cryptographic techniques and how to use them correctly. It will include consensus algorithms (such as Proof of Work and Byzantine Consensus) and their role in blockchains and cryptocurrencies, cryptographic tools employed in cryptocurrencies (including digital signatures algorithm and zero knowledge proofs) and trusted hardware in blockchain-based systems.
- CS 10271: Introduction to Android Programming 3 s.h.  
*Prerequisite(s):* CS 04113 or CS 04171 or CS 04103 or CS 01104 or CS 01102  
This course is targeted for students who want to start writing mobile applications on Android platforms. Android has become a formidable mobile operating system, and this course will provide hands-on learning on writing Android applications. The course will start with the basics of Android programming by covering the most recent version of Android and understanding its development framework. Students will then learn both the fundamentals and the nuts and bolts of Android application development and have an exciting opportunity to write feature-rich Android applications.
- CS 10275: Introduction to iOS Application Programming 3 s.h.  
*Prerequisite(s):* CS 04113 or CS 04171 or CS 04103 or CS 01104 or CS 01102  
This course is targeted for students who wanted to start writing mobile applications on iOS platforms. iOS has become a formidable mobile operating system, and the courses will provide hands-on learning on writing iOS applications. The course will start with the basics of iOS programming by covering the most recent version of iOS and understanding its development framework. Students will then learn both the fundamentals and the nuts and bolts of iOS application development and have an exciting opportunity to write feature-rich iOS applications.
- CS 10310: Introduction to Web Development 3 s.h.  
*Prerequisite(s):* (MIS 02337 or CS 10337) or CS 04430 and (CS 04114 or CS 04210) and (CS 04222 or CS04225)  
This course, which is part of the BA in Computing and Informatics, teaches students the basic techniques of web site development, including some of the tools, languages, and platforms that are commonly used for web sites. This course does not count as a restricted elective for the BS in Computer Science.
- CS 10337: Applied Database Technologies 3 s.h.  
*Prerequisite(s):* Must be enrolled in the BA in Computing & Informatics Major or the CUGS in MIS; May not be enrolled as the following classifications: Freshman or Sophomore  
This course covers the practical aspects of relational database systems, including database modeling using ER and EER diagrams, physical database design, the relational database query language SQL, normal forms, database integrity and transaction management. Includes a project involving an RDBMS.
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- CS 10340: Systems Administration** 3 s.h.  
*Prerequisite(s): CS 01211 and CS 01210 or permission of the instructor.*  
This course is designed to introduce students to the universal principles of systems administration that apply to all platforms and the major operating system families: Linux/Unix and Windows. The students will have hands on experience with the installation, configuration, administration, and management of core servers and core server operating systems.
- CS 10342: Web Server Platforms** 3 s.h.  
*Prerequisite(s): CS 10.310 or permission of the instructor.*  
This course is designed to prepare students to install, configure, and maintain Web Servers. Students will learn about the installation, access control, security, performance, managing, and troubleshooting of web server hardware, software, and services.
- CS 10344: Concepts of Computing Technologies** 3 s.h.  
*Prerequisite(s): (CS 01210 or CS 06410) and (CS 01211 or CS 07351)*  
This course, which is part of the B.A. in Computing and Informatics program, examines the role, proper architecture, and potential contributions of Information technologies and systems - what they are, how they should be configured, and how they affect users of the technologies. This course covers a range of topics such as architectural planning, system and network administration, identity and authentication systems, change and problem administration, configuration of computing systems, data center and facilities management, capacity planning, document and content control, maintaining servers for system availability and uptime, systems monitoring and performances tuning, as well disaster recovery and system continuity.
- CS 10430: Computing and Informatics Capstone Experience** 3 s.h.  
*Prerequisite(s): CS 10310 and CS 04225 and CMS 04205*  
This course is designed to introduce students to all aspects of software production from the early stages of system specification through to systems maintenance. This course provides an - exposure to the software development process by which user needs are translated into a tangible software product.
- CS 99210: Introductory Learning Assistant Experience in Computer Science** 1 s.h.  
*Prerequisite: Permission of Supervising Instructor*  
The course is designed to provide students with an introductory experience in applied pedagogy associated with collegiate-level Learning Assistant (LA) Models while deepening their mastery of computing fundamentals. Students will review and prepare for practicum in a computing related course with exposure to LA skills and strategies. Students will utilize learned LA skills and fundamental computing knowledge to facilitate in-class active and collaborative learning exercises in small student groups. This course is recommended for all students interested in developing depth of their computing knowledge with some specific pedagogical methods while also enhancing their communication and interpersonal skills via student mentorship and staff collaboration.
- CS 99300: Computer Field Experience** 3 to 12 s.h.  
*Prerequisite(s): Permission of instructor and CS 04222 or CS 04225*  
Students are assigned projects in a professional environment.
- CS 99310: Advanced Learning Assistant Seminar in Computer Science** 3 s.h.  
*Prerequisite: Permission of Instructor*  
This course is designed to provide students with more advanced experience in applied pedagogy associated with collegiate-level Learning Assistant (LA) Models while further deepening their mastery of computing fundamentals. Students will focus on the implementation of LA skills and strategies while completing their practicum in a computing related course. Students will apply learned LA skills and computing knowledge in areas of assessment, design, development, and facilitation of in-class active and collaborative learning activities and exercises. This course is recommended for all students interested in continuing their development of some specific computing pedagogical methods, communication techniques, and interpersonal skills via student mentorship and staff collaboration.
- INTR 01265: Computers and Society** 3 s.h.  
*Prerequisite(s): COMP 01112 or HONR 01112 or ENGR 01201*
- INTR 01266: Computers and Society - WI** 3 s.h.  
*Prerequisite(s): COMP 01112 or HONR 01112 or ENGR 01201*  
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.
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