Computer Science (CS)

CS 1000. Introduction to Microcomputers and Applications. 3 Hours.
Computing technology and concepts; applications of personal computers. Topics include hardware and software terminology, word processing, spreadsheets, e-mail, the Internet, the microcomputer's operating system and its use, ethics, and current trends in the use of computers. A hands on laboratory is integrated with the course.

CS 1003. Introduction to Interactive Media. 3 Hours.
An introduction to tools designed for interactive multimedia, using the Processing language, developed for the electronic arts and visual design communities. Through intensive and immersive laboratory exercises, student will learn valuable programming fundamental and essential concepts from graphics, audio processing and human-computer interaction.

CS 1010. Algorithmic Problem Solving. 3 Hours.
An introduction to algorithm design and programming as components of the software life cycle, with emphasis on the development of algorithms for solving problems; introduction to the development environment for a particular programming language.

CS 1020. Website Design and Development. 3 Hours.
The design and development of websites. The course covers a brief history of the Internet and the World Wide Web, Hypertext Markup Language, Cascading Style Sheets, website authoring tools, basic graphics, website design principles, as well as personal, educational and e-commerce applications.

CS 1301. Principles of Programming I. 4 Hours.
Prerequisite: MATH 1101 or MATH 1111 or MATH 1112 or MATH 1113 or MATH 1261 or MATH 2261 or MATH 2262, with a grade of "C" or better. Programming-language syntax and semantics; problem solving; algorithm design and implementation using modern programming paradigms and techniques; data types and elementary data structures. This course involves extensive programming activities. Students without strong math and programming background are encouraged to take CS 1010 first.

CS 1302. Principles of Programming II. 4 Hours.
Prerequisite: CS 1301 with a grade of "C" or better. A study of advanced object-oriented programming. The course involves extensive programming that includes inheritance, polymorphism, dynamic binding, object composition, exception handling, file I/O, GUI, class diagrams, and unit testing.

CS 1340. Computing for Scientists. 3 Hours.

CS 2620. Discrete Structures. 3 Hours.
Prerequisite: MATH 1111, MATH 1112, or MATH 1113 or MATH 1261 or MATH 2261, with a grade of C or better. Propositional and predicate logic mathematical induction, and recursion. Sets, relations, functions. Graphs and trees. Boolean algebra and computer logic. Finite state machines and computability.

CS 3000. Tutoring in Computer Science I. 2 Hours.
Prerequisite or corequisite: CS 3410 or consent of instructor. Graded "Satisfactory" or "Unsatisfactory." Fundamentals of one-on-one tutoring in computer science. Review of the principles in programming, including programming language syntax and semantics; problem solving; algorithm design and implementation using current paradigms; data types and data structures; theory and applications of stacks, queues, lists, and binary trees; recursion; and file processing. Introduction to techniques and guidelines for tutoring. Designed for the Tutoring Center tutors in computer science.

CS 3001. Tutoring in Computer Science II. 1 Hour.
Prerequisite: CS 3000. Graded "Satisfactory" or "Unsatisfactory." Advanced techniques for one-on-one tutoring in computer science. Review of discrete structures, computer organization, and advanced programming principles. Identification and discussion of effective methods for correcting common problems and misconceptions encountered by beginning and intermediate programming students. Discussion of techniques with less experienced tutors. Designed for the Tutoring Center tutors in computer science.

CS 3101. Computer Organization. 3 Hours.
Prerequisite: CS 1302 with a grade of "C" or better. An overview of computer organization and design including Boolean algebra, combinational and sequential circuits, data representation, register transfer and micro operations, CPU organization, microprogrammed control, and machine language programming.

CS 3102. Assembly Language. 3 Hours.
Prerequisite: CS 3101 with a grade of "C" or better. A continuation of CS 3101 with emphasis on machine and assembly language instruction and programming techniques, addressing modes, data representations, I/O, and the assembly process.

CS 3200. Security and Ethics in Computing. 3 Hours.
Prerequisite: CS 1301 with a "C" or better. An overview of principles of secure computing, and cyberethics, and the impact of cybertechnology on the ethical, legal, and technological issues in society. Topics include ethical principles, professional code of ethics, security practices, cybercrime and law, censorship and intellectual property protection on cyberspace, and emerging and converging technologies.

CS 3300. UNIX Programming. 3 Hours.
Prerequisite: CS 1302 with a grade of "C" or better. An overview of UNIX and shell programming. UNIX file and process systems, commands, regular expressions and their use in filters, programming environment, and shell scripting are introduced.

CS 3335. The C Programming Language. 3 Hours.
Prerequisite: CS 1302 with a grade of “C” or better. Programming using C programming language that includes C preprocessor and libraries, standard and file I/O, memory handling, and stylistic consideration. The course includes basic understanding of UNIX to write, execute, test, and debug C programs.

CS 3340. Web Programming. 3 Hours.
Prerequisite: CS 1302 with a grade of “C” or better. A study of the fundamentals of web-based computing, including HTML, CSS, client-side scripting and APIs, server-side programming, state management, and data access.

CS 3410. Data Structures. 3 Hours.
Prerequisite: CS 1302 and CS 2620 with a grade of C or better. Trees, graphs, and other forms of data structures and their implementations. Emphasizing abstract data types; static memory allocation vs. dynamic storage allocation; searching, hashing, and sorting methods; algorithm analysis.

CS 3520. Algorithms. 3 Hours.
Prerequisite: CS 3410 with a grade of “C” or better. Sequential and parallel algorithms for solving a variety of different problems; paradigms for algorithms; algorithm analysis; NP-complete problems.

CS 3700. Introduction to E-Commerce. 3 Hours.
Prerequisite: CS 1302 with a grade of “C” or better. An introduction to e-commerce trends, technologies, and strategies. Topics include the importance and impact of e-commerce, business-to-consumer, business-to-business, wireless networks, mobile commerce, online marketing, web services, supply chains, electronic payment, security, and legal issues.

CS 3750. Introduction to Cybersecurity. 3 Hours.
Prerequisite: CS 1302 and CS 2620 with a grade of "C" or better. A study of the basic concepts related to strengths and weaknesses of a computing system. Topics include forms of malware, threats to and attacks on computers, applications, and networks; mechanisms and tools to detect and deter cyber-attacks and to secure a system; and standard security goals, principles, models, policies, and practices.

CS 3800. Foundations of Artificial Intelligence. 3 Hours.
Prerequisites: CS 1301 and 2620 with a grade of "C" or better. Introduction to foundational principles, mathematical concepts, computational techniques used in artificial intelligence. The course explores intelligent agents through search, logic, and machine learning. Mathematical foundations in linear algebra, calculus, probability and statistics and hands-on implementation in Python are covered. The course include discussions on ethical considerations and Agentic AIs.

CS 4121. Data Communications and Networks I. 3 Hours.
Prerequisites: CS 3410 with a grade of “C” or better. A study of the basic concepts of data communications and computer networks, emphasizing hands-on experience. Cloud computing, TCP/IP model and related protocols, packet switching, local area networks, and network security are addressed.

CS 4122. Data Communications and Networks II. 3 Hours.
Prerequisite: CS 4121 with a grade of “C” or better. A continuation of CS 4121 in which advanced topics in data communication and networking are studied.

CS 4242. Mobile Application Development. 3 Hours.
Prerequisite: CS 3410 with a grade of "C" or better. An introduction to mobile application development for the Android platform. Topics include activity lifecycle, intents, fragments, location tracking, SQLite, and maps. The course culminates in a substantial project.

CS 4321. Software Engineering I. 3 Hours.
Prerequisite: CS 3410 with a grade of “C” or better. A study of the concepts and techniques used in all aspects of the software life-cycle relevant to the production of large object-oriented software systems with emphasis on Agile methodologies. Students will work in teams on a project.

CS 4322. Software Engineering II. 3 Hours.
Prerequisite: CS 4321 with a grade of “C” or better. Advanced topics in software engineering, such as analysis, design, architecture, testing, and maintenance.

CS 4330. Theory of Programming Languages. 3 Hours.
Prerequisite: CS 3410 with a grade of C or better. Formal description of programming languages, standard and advanced features of modern programming languages, complexity.

CS 4340. Systems Programming. 3 Hours.
Prerequisites: CS 3335 and CS 3410, each with a grade of “C” or better. Implementation of concepts pertaining to the UNIX environment: process control and interprocess communication, job control, file and directory structures, and client/server processes.

CS 4345. Operating Systems. 3 Hours.
Prerequisites: CS 3101 and CS 3410, each with a grade of “C” or better. An overview of structures, components, and services of a general-purpose operating system. Topics include kernel designs, process management and synchronization, memory management, I/O system, and file systems. An overview of distributed systems is also included.

CS 4500. Formal Languages and Automata Theory. 3 Hours.
Prerequisites: CS 3410 with a grade of C or better. Concepts pertaining to regular expressions, finite state machines, regular languages, regular grammars, non-regular languages, decidability, context-free grammars, and Turing machines.

CS 4625. Network and System Security. 3 Hours.
Prerequisites: CS 3750 and 4121 with a grade of "C" or better. A survey of advanced theories and practices of cybersecurity, emphasizing hands-on experiments with cybersecurity tools. Students work individually and in groups within a controlled environment, to examine strategies of cyberattacks targeting a network or system and to test counter-measure techniques.

CS 4635. Digital Forensics. 3 Hours.
Prerequisite: CS 3410 with a grade of "C" or better. A survey of the fundamentals of digital forensic investigation and use of computer forensics tools. Topics include core forensics procedures to ensure court admissibility of evidence as well as the legal and ethical implications, and forensic investigation and analysis on both Unix/Linx and Windows systems.

CS 4700. E-Commerce Design. 3 Hours.
Prerequisite: CS 3410 with a grade of “C” or better. An in-depth study of e-commerce implementation. Through programming projects, students will learn e-commerce design principles, tools, and techniques.

CS 4721. Database Design I. 3 Hours.
Prerequisite: CS 3410 with a grade of “C” or better. A study of the logical design and organization of databases using the entity-relationship model, the hierarchical model, the network model, the relational model, relational algebra, functional dependencies, and normal forms. Students learn SQL statements for creating, querying, and managing databases, and query optimization.

CS 4722. Database Design II. 3 Hours.
Prerequisite: CS 4721 with a grade of “C” or better. An in-depth study of advanced database design and implementation concepts including transaction processing, concurrency, control techniques, recovery techniques, distributed databases and client/server architecture, and security and authorization.

CS 4731. Introduction to Big Data and Machine Learning. 3 Hours.
Prerequisites: CS 3410 with a grade of "C" or better. The theory and implementation of algorithms to solve industry problems.

CS 4800. Internship in Computer Science. 3-6 Hours.
Prerequisites: Junior or senior standing, a minimum 2.5 GPA, and permission of the internship coordinator and Department Head. Graded “Satisfactory” or “Unsatisfactory.” Active participation in research or development in computer science or in a closely allied field. A daily log of activities, a report on the work done, and a report on the internship experience or a research paper relating the work done to the field of computer science are required. Students planning to take this course should submit the Internship Approval Form which will be evaluated by a faculty committee.

CS 4820. Artificial Intelligence. 3 Hours.
Prerequisites CS 3410 With a grade of C or better. A study of theories and techniques associated with Deep Learning (DL) as a specific field of Artificial Intelligence. The course covers various aspects of DL and shows how they can be useful in practical applications.

CS 4830. Computer Graphics. 3 Hours.
Prerequisites: CS 3410 with a grade of “C” or better. A survey of graphics systems and graphics programming. Topics include output primitives, transformations and viewing, modeling, user interfaces, and interactive methods. Both 2-D and 3-D concepts are discussed.

CS 4835. Parallel Programming. 3 Hours.
Prerequisite: CS 3335 with a grade of "C" or better. Introduction to data parallel architectures, models, and programming environments. Students will design, develop, and optimize software for parallel computing resources.

CS 4840. Full-Stack Web Programming. 3 Hours.
Prerequisites: CS 3410 and 3300 with a grade of "C" or better. A project-driven course where students will work throughout the complete Web application development lifecycle and learn both the front-end and back-end Web development technologies in web API services.

CS 4850. Graph Theory and Applications. 3 Hours.
Prerequisite: CS 3410 with a grade of "C" or better. A survey of properties of different types of graphs. Topics include use of basic graph theory concepts to model real life applications; graph traversals; shortest path and spanning tree algorithms; network flow and matching; topologies; and graph data structures.

CS 4884. Biometric Recognition. 3 Hours.
Prerequisites: CS 3410 with a grade of "C" or better. An introduction to fundamental principles and applications of biometrics. Topics include design, implementation, and performance evaluation of biometric systems, fingerprint recognition, iris recognition, face recognition, multi-biometrics, attacks in biometric systems, and biometric system security.

CS 4900. Senior Seminar. 3 Hours.
Prerequisites: CS 3410, each with a grade of "C" or better, and senior standing. A capstone experience intended primarily for computer science majors that involves group development and management of a substantial software project using current technologies and culminating in an oral presentation, product demonstration, and formal report. Advanced programming skills are used in this course.

CS 4950. Directed Study in Computer Science. 1-3 Hours.
Prerequisite: Consent of instructor. The student will undertake at least one major computer-science project under the supervision of the instructor. Credit will be assigned on the basis of the effort required by the project. May be taken more than once if topics are different.

CS 4990. Topics in Computer Science. 1-3 Hours.
Prerequisite: Consent of instructor. Topics to be assigned. May be taken more than once if topics are different.