Computer Science Courses

Courses

CS 102. Fundamentals of Computer and Information Security. 4 Credits.
This course introduces fundamental concepts, terminologies, principles, methods, and scenarios of computer and information security.

CS 110. Fluency with Information Technology. 4 Credits.
Introduction to information technology (IT), the study of computer-based information systems. Basics of the Internet and World Wide Web. Students create websites using XHTML and CSS.

CS 111. Introduction to Web Programming. 4 Credits.
Project-based approach to learning computer programming by building interactive web pages using JavaScript and XHTML. Programming concepts including structured and object-oriented program design. CS 110 recommended preparation.
Prereq: MATH 101 or equivalent.

CS 122. Introduction to Programming and Problem Solving. 4 Credits.
Computational problem solving, algorithm design, data structures, and programming using a multi-paradigm programming language. Introduces techniques for program design, testing, and debugging.
Prereq: MATH 101 or equivalent.

CS 196. Field Studies: [Topic]. 1-2 Credits.
Repeatable.

CS 198. Workshop: [Topic]. 1-2 Credits.
Repeatable.

CS 199. Special Studies: [Topic]. 1-5 Credits.
Repeatable.

CS 199L. Special Studies in Computer Science: [Topic]. 1-5 Credits.
Repeatable.

CS 210. Computer Science I. 4 Credits.
Basic concepts and practices of computer science. Topics include algorithmic problem solving, levels of abstraction, object-oriented design and programming, software organization, analysis of algorithm and data structures. Sequence with CS 211, CS 212.
Prereq: MATH 112Z. Prior programming experience strongly encouraged.

CS 211. Computer Science II. 4 Credits.
Basic concepts and practices of computer science. Topics include algorithmic problem solving, levels of abstraction, object-oriented design and programming, software organization, analysis of algorithm and data structures. Sequence with CS 210, CS 212.
Prereq: CS 210.

CS 212. Computer Science III. 4 Credits.
Basic concepts and practices of computer science. Topics include algorithmic problem solving, levels of abstraction, object-oriented design and programming, software organization, analysis of algorithm and data structures. Sequence with CS 210, CS 211.
Prereq: CS 211.

CS 299. Special Studies: [Topic]. 1-5 Credits.
Repeatable.

CS 313. Intermediate Data Structures. 4 Credits.
Design and analysis of data structures as means of engineering efficient software; attention to data abstraction and encapsulation. Lists, trees, heaps, stacks, queues, dictionaries, priority queues.
Prereq: CS 210, CS 211, CS 212, MATH 231, MATH 232 with grades of B- or better.

CS 314. Computer Organization. 4 Credits.
Introduction to computer organization and instruction-set architecture -- digital logic design, binary arithmetic, design of central processing unit and memory, machine-level programming.
Prereq: CS 210, CS 211, CS 212 with grades of B- or better.

CS 315. Intermediate Algorithms. 4 Credits.
Algorithm design, worst-case and average-behavior analysis, correctness, computational complexity.
Prereq: CS 313.

CS 322. Introduction to Software Engineering. 4 Credits.
A project-intensive introduction to software engineering intended to build skills, knowledge, and habits of mind that prepare students for 400-level computer science courses, internships, and other software.
Prereq: CS 210, CS 211, CS 212 with grades of B- or better.

CS 330. C/C++ and Unix. 4 Credits.
Practical software design and programming activities in a C/C++ and Unix environment, with emphasis on the details of C/C++ and good programming style and practices.
Prereq: CS 314.

CS 333. Applied Cryptography. 4 Credits.
This course provides a systematic study of cryptography and its application. It covers cryptographic algorithms, including symmetric-key cryptography, public-key cryptography, cryptanalysis, cryptographic hash functions, and their usage toward message authentication codes, digital signatures, key management and distribution, and user authentication protocols.
Prereq: CS 212.

CS 372M. Machine Learning for Data Science. 4 Credits.
Introduction to Machine Learning, with an emphasis on topics relevant for data science. Multilisted with DSCI 372M.
Prereq: CS 212, DSCI 345M, MATH 342.

CS 399. Special Studies: [Topic]. 1-5 Credits.
Repeatable when the topic changes.

CS 400M. Temporary Multilisted Course. 1-5 Credits.
Repeatable

CS 401. Research: [Topic]. 1-16 Credits.
Repeatable.
Prereq: CS 313.

CS 402. Supervised College Teaching. 1-2 Credits.
Repeatable.
Prereq: CS 313.

CS 403. Thesis. 1-12 Credits.
Repeatable.
Prereq: CS 313.

CS 404. Internship: [Topic]. 1-4 Credits.
Repeatable.
Prereq: CS 313.

CS 405. Reading and Conference: [Topic]. 1-12 Credits.
Repeatable up to five times.
Prereq: CS 313.

CS 406. Practicum: [Topic]. 1-2 Credits.
Supervised consulting. Students provide learning assistance in computer science courses. Repeatable for a maximum of 4 credits.
Prereq: CS 313.

CS 407. Seminar: [Topic]. 1-5 Credits.
Repeatable when the topic changes. Opportunity to study in greater depth specific topics arising out of other courses.
Prereq: CS 313.

CS 408. Workshop: [Topic]. 1-21 Credits.
Repeatable.
Prereq: CS 313.

CS 409. Terminal Project. 1-12 Credits.
Repeatable.
Prereq: CS 313.

CS 410. Experimental Course: [Topic]. 1-5 Credits.
Repeatable when the topic changes.

CS 413. Advanced Data Structures. 4 Credits.
Complex structures, storage management, sorting and searching, hashing, storage of texts, and information compression.
Prereq: CS 315.

CS 415. Operating Systems. 4 Credits.
Principles of operating system design. Process and memory management, concurrency, scheduling, input-output and file systems, security.
Prereq: CS 330.

CS 420. Automata Theory. 4 Credits.
Provides a mathematical basis for computability and complexity. Models of computation, formal languages, Turing machines, solvability. Nondeterminism and complexity classes.
Prereq: CS 315.

CS 422. Software Methodology I. 4 Credits.
Technical and nontechnical aspects of software development, including specification, planning, design, development, management and maintenance of software projects. Student teams complete projects.
Prereq: CS 313.

CS 423. Software Methodology II. 4 Credits.
Application of concepts and methodologies covered in CS 422/CS 522. Student teams complete a large system design and programming project. Final system specification, test plan, user documentation, and system walk throughs.
Prereq: CS 422 with a grade of B- or better.

CS 425. Principles of Programming Languages. 4 Credits.
Syntax and semantics. Scope rules, environments, stores, denoted and expressed values, procedures, and parameters. Definitional interpreters. Types, overloading, parametric polymorphism, and inheritance. Varieties of abstraction.
Prereq: CS 315.

CS 429. Computer Architecture. 4 Credits.
RISC (reduced instruction-set computer) and CISC (complex instruction-set computer) design, storage hierarchies, high-performance processor design, pipelining, vector processing, networks, performance analysis.
Prereq: CS 313, CS 314, CS 330.

CS 431. Introduction to Parallel Computing. 4 Credits.
Parallel architecture, theory, algorithms, and programming with emphasis on parallel programming, focusing on models, languages, libraries, and runtime systems.
Prereq: CS 330.

CS 432. Introduction to Networks. 4 Credits.
Principles of computer network design. Link technologies, packet switching, routing, inter-networking, reliability. Internet protocols. Programming assignments focus on protocol design.
Prereq: CS 330. CS 415 recommended.

CS 433. Computer and Network Security. 4 Credits.
Security for various aspects of computers and networks. Elementary cryptography, program security, trusted operating systems, network security, privacy, and legal and ethical issues.
Prereq: CS 415.

CS 434. Computer and Network Security II. 4 Credits.
This course covers security threats and solutions for distributed systems and networks, particularly the Internet, the Internet of Things, and distributed systems based on them.
Prereq: CS 433.

CS 436. Secure Software Development. 4 Credits.
This course establishes a foundation for applying security principles to the lifecycle of software development in order to minimize software vulnerabilities and counter cyber threats.
Prereq: CS 330.

CS 441. Introduction to Computer Graphics. 4 Credits.
Introduction to the hardware, geometrical transforms, interaction techniques, and shape representation schemes that are important in interactive computer graphics. Programming assignments using contemporary graphics hardware and software systems.
Prereq: CS 330.

CS 443. User Interfaces. 4 Credits.
Introduction to user interface software engineering. Emphasis on theory of interface design, understanding the behavior of the user, and implementing programs on advanced systems.
Prereq: CS 313.

CS 445. Modeling and Simulation. 4 Credits.
Theoretical foundations and practical problems for the modeling and computer simulation of discrete and continuous systems. Simulation languages, empirical validation, applications in computer science.
Prereq: CS 315, CS 330.

CS 451. Database Processing. 4 Credits.
Fundamental concepts of DBMS. Data modeling, relational models and normal forms. File organization and index structures. SQL, embedded SQL, and concurrency control.
Prereq: CS 313, CS 314.

CS 453. Data Mining. 4 Credits.
Databases, machine learning, artificial intelligence, statistics, and data visualization. Examines data warehouses, data preprocessing, association and classification rule mining, and cluster analysis.
Prereq: CS 451/CS 551.

CS 461. Introduction to Compilers. 4 Credits.
Lexical analysis, parsing, attribution, code generation.
Prereq: CS 314, CS 425. CS 420 strongly recommended.

CS 471. Introduction to Artificial Intelligence. 4 Credits.
Basic themes, issues, and techniques of artificial intelligence, including agent architecture, knowledge representation and reasoning, problem solving and planning, game playing, and learning.
Prereq: CS 315.

CS 472. Machine Learning. 4 Credits.
A broad introduction to machine learning and its established algorithms. Topics include concept learning, decision trees, neural network.
Prereq: CS 315.

CS 473. Probabilistic Methods for Artificial Intelligence. 4 Credits.
Fundamental techniques for representing problems as probability distributions, performing inference, and learning from data. Topics include Bayesian and Markov networks, variable elimination, loopy belief propagation, and parameter.
Prereq: CS 315.

CS 500M. Temporary Multilisted Course. 1-5 Credits.
Repeatable.

CS 503. Thesis. 1-16 Credits.
Repeatable.

CS 507. Seminar: [Topic]. 1-5 Credits.
Repeatable. Opportunity to study in greater depth specific topics arising out of other courses.

CS 508. Workshop: [Topic]. 1-21 Credits.
Repeatable.

CS 510. Experimental Course: [Topic]. 1-5 Credits.
Repeatable.

CS 513. Advanced Data Structures. 4 Credits.
Complex structures, storage management, sorting and searching, hashing, storage of texts, and information compression.

CS 520. Automata Theory. 4 Credits.
Provides a mathematical basis for computability and complexity. Models of computation, formal languages, Turing machines, solvability. Nondeterminism and complexity classes.

CS 522. Software Methodology I. 4 Credits.
Technical and nontechnical aspects of software development, including specification, planning, design, development, management and maintenance of software projects. Student teams complete projects.

CS 523. Software Methodology II. 4 Credits.
Student teams complete a large system design and programming project. Final system specifications, test plan, user documentation, and system walk-through.
Prereq: CS 522.

CS 529. Computer Architecture. 4 Credits.
RISC (reduced instruction-set computer) and CISC (complex instruction-set computer) design, storage hierarchies, high-performance processor design, pipelining, vector processing, networks, performance analysis.

CS 531. Introduction to Parallel Computing. 4 Credits.
Parallel architecture, theory, algorithms, and programming with emphasis on parallel programming, focusing on models, languages, libraries, and runtime systems.

CS 532. Introduction to Networks. 4 Credits.
Principles of computer network design. Link technologies, packet switching, routing, inter-networking, reliability. Internet protocols. Programming assignments focus on protocol design.

CS 533. Computer and Network Security. 4 Credits.
Security for various aspects of computers and networks. Elementary cryptography,program security, trusted operating systems, network security, privacy, and legal and ethical issues.

CS 534. Computer and Network Security II. 1-4 Credits.
This course covers security threats and solutions for distributed systems and networks, particularly the Internet, the Internet of Things, and distributed systems based on them.

CS 536. Secure Software Development. 4 Credits.
This course establishes a foundation for applying security principles to the lifecycle of software development in order to minimize software vulnerabilities and counter cyber threats.

CS 541. Introduction to Computer Graphics. 4 Credits.
Introduction to the hardware, geometrical transforms, interaction techniques, and shape representation schemes that are important in interactive computer graphics. Programming assignments using contemporary graphics hardware and software systems.

CS 543. User Interfaces. 4 Credits.
Introduction to user interface software engineering. Emphasis on theory of interface design, understanding the behavior of the user, and implementing programs on advanced systems.

CS 545. Modeling and Simulation. 4 Credits.
Theoretical foundations and practical problems for the modeling and computer simulation of discrete and continuous systems. Simulation languages, empirical validation, applications in computer science.

CS 551. Database Processing. 4 Credits.
Fundamental concepts of DBMS. Data modeling, relational models and normal forms. File organization and index structures. SQL, embedded SQL, and concurrency control.

CS 553. Data Mining. 4 Credits.
Databases, machine learning, artificial intelligence, statistics, and data visualization. Examines data warehouses, data preprocessing, association and classification rule mining, and cluster analysis.
Prereq: CS 551.

CS 561. Introduction to Compilers. 4 Credits.
Lexical analysis, parsing, attribution, code generation.
Prereq: CS 314 or equivalent. CS 520 strongly recommended.

CS 571. Introduction to Artificial Intelligence. 4 Credits.
Basic themes, issues, and techniques of artificial intelligence, including agent architecture, knowledge representation and reasoning, problem solving and planning, game playing, and learning.

CS 572. Machine Learning. 4 Credits.
A broad introduction to machine learning and its established algorithms. Topics include concept learning, decision trees, neural network.

CS 573. Probabilistic Methods for Artificial Intelligence. 4 Credits.
Fundamental techniques for representing problems as probability distributions, performing inference, and learning from data. Topics include Bayesian and Markov networks, variable elimination, loopy belief propagation, and parameter.

CS 601. Research: [Topic]. 1-16 Credits.
Repeatable.

CS 603. Dissertation. 1-16 Credits.
Repeatable.

CS 604. Internship: [Topic]. 1-4 Credits.
Repeatable.

CS 605. Reading and Conference: [Topic]. 1-16 Credits.
Repeatable.

CS 606. Field Studies: [Topic]. 1-16 Credits.
Repeatable.

CS 607. Seminar: [Topic]. 1-5 Credits.
Repeatable. Research topics are presented.

CS 608. Workshop: [Topic]. 1-16 Credits.
Repeatable.

CS 609. Terminal Project. 1-16 Credits.
Repeatable. Final project for master's degree without thesis.

CS 610. Experimental Course: [Topic]. 1-5 Credits.
Repeatable.

CS 621. Algorithms and Complexity. 4 Credits.
Design and analysis of algorithms, strategies for efficient algorithms, introduction to complexity theory including NP-completeness.
Prereq: CS 520 recommended.

CS 624. Structure of Programming Languages. 4 Credits.
Introduction to axiomatic, operational, and denotational semantics. Environments, stores, and continuations. Type theory, subtypes, polymorphism, and inheritance. Functional and logic programming.

CS 630. Distributed Systems. 4 Credits.
Principles of distributed computer systems: interprocess communication, distributed file systems, distributed timing and synchronization, distributed programming, transactions, process scheduling, distributed shared memory.
Prereq: CS 529.

CS 631. Parallel Processing. 4 Credits.
Advanced topics in parallel processing including massively parallel computer architecture, supercomputers, parallelizing compiler technology, performance evaluation, parallel programming languages, parallel applications.
Prereq: CS 529.

CS 632. Computer Networks. 4 Credits.
Advanced issues in computer networks, focusing on research to extend the services offered by the Internet.
Prereq: CS 532.

CS 633. Advanced Network Security. 4 Credits.
Classic and state-of-the-art research topics in network security; threats and attacks, defense algorithms and mechanisms, measurement and evaluation of both security problems and solutions. Offered alternate years.
Prereq: CS 533.

CS 640. Writing in Computer Research. 2 Credits.
Students learn to provide and accept constructive criticism of writing samples in a workshop format.

CS 670. Data Science. 4 Credits.
Data science is the development of methods to study large and complex data sets. Methods that scale to very large data sets are of particular interest. This course introduces state-of-art data science methods focused on processing very large data sets of real-world data.
Prereq: CS 551.