COURSES FOR COMPUTER SCIENCE

Computer Science Courses

CS503 Programming Languages
Hours 3

This course provides a graduate level presentation of Programming Languages. Formal student of programming language specification, analysis, implementation, and run-time support structures; organization of programming languages with emphasis on language constructs and mechanisms; and study of non-programming paradigms. Students who have successfully completed CS 403 may not also receive credit for CS 503.

CS504 CS Curriculum for Math Education
Hours 3

Building upon the concepts from CS 104, students will explore in-depth how computer science education is presented in the secondary education setting. Students will get the opportunity to explore current computer science curriculum and develop resources for future teaching, with a specific emphasis on the College Board's AP CS Principles (AP CSP) curriculum.

Prerequisite(s): CS 104 or permission by instructor.

CS507 Software Interface Design
Hours 3

Concepts of the human-computer interface, emphasizing the software aspects. Dialog styles, form models, user documentation and the evaluation of human-computer software interfaces. Students who have successfully completed CS 407 may not also receive credit for CS 507.

CS515 Software Design and Development
Hours 3

Object-oriented design and development using UML and Java, design patterns, and architectural patterns.

Prerequisite(s): CS 200, CS 201, and ECE 383 each with a minimum grade of C-

CS516 Testing and Quality Assurance
Hours 3

Study of verification & validation and related processes. Topics include techniques and tools for software analysis, testing, and quality assurance. Students who have successfully completed CS 416 may not also receive credit for CS 516.

CS517 Requirements Engineering
Hours 3

Study of requirements engineering and its phases. Topics include formal, semi-formal, and informal paradigms for elicitation, documentation, and management of software system requirements. Students who have successfully completed CS 417 may not also receive credit for CS 517.

CS520 Software Evolution
Hours 3

Study of techniques and tools for design-time and run-time software adaptation, including principles of reflection and metaprogramming, software modularity, metamodeling and software language engineering.

CS523 Python for Big Data
Hours 3

Students in this course will utilize Python libraries such as Pandas, NumPy, and Dask for data manipulation and analysis, along with tools like Apache Spark for handling large datasets efficiently. The course will cover key concepts such as data ingestion, processing, and visualization, ensuring students can transform raw data into meaningful insights. Hands-on projects and real-world case studies provide students with practical experience, in order to address the challenges in data processing and analytics.

CS526 Intro Operating Systems
Hours 3

This course provides a graduate level presentation of Introduction to Operating Systems. Study of basic operating system concepts with an emphasis on memory processor, device, and information management.

Prerequisite(s): CS 200, CS 201 and ECE 383 with a minimum grade of C-

CS528 Computer Security
Hours 3

An examination of computer security concepts, such as cryptographic tools, user authentication, access control, database security, intrusion detection, malicious software, denial of service, firewalls and intrusion prevention systems, trusted computing and multilevel security, buffer overflow, software security, physical and infrastructure security, human factors, and security auditing. Students who have successfully completed CS 428 may not also receive credit for CS 528.

CS534 Compiler Construction
Hours 3

This course provides a graduate level presentation of Compiler construction. Syntax and semantics of procedure-oriented languages and translation techniques used in their compilation; includes computer implementation.

CS535 Computer Graphics
Hours 3

Display memory, generation of points, vectors, etc. Interactive versus passive graphics, analog storage of images on microfilm, etc. Digitizing and digital storage, pattern recognition by features, syntax tables, and random nets. The mathematics of three dimensions, projections, and the hidden-line problem. Students who have successfully completed CS 435 may not also receive credit for CS 535.

CS538 Computer Comm & Networks
Hours 3

This course provides a graduate level presentation of Computer Communications and Networks. The student of the issues related to Computer communications. Topics include physical topologies, switching, error detection and correction, routing, congestion control, and connection management for global networks (such as the Internet) and local area networks (such as Ethernet). In addition, network programming and applications will be considered. Students who have successfully completed CS 438 may not also receive credit for CS 538.

CS542 Cryptography
Hours 3

This course will cover algorithms and concepts in cryptography and data security. We will undertake an examination of algorithms and concepts in cryptography and data security, such as symmetric ciphers, asymmetric ciphers, public-key cryptography, hash functions, message authentication codes, key management and distribution, etc.

CS543 Digital Forensics
Hours 3

Digital Forensics is an area of study that is rapidly growing in importance and visibility. It involves preserving, identifying, extracting, documenting and interpreting digital data. Though sometimes misunderstood, digital forensics is like other types of investigation. With the continuous rise of computer-related incidents and crimes, and the increased emphasis on homeland defense in this country, there is a growing need for computer science graduates with the skills to investigate these crimes. This course will introduce the topics of computer crime and digital forensics. Students will be required to learn different aspects of computer crime and ways in which to uncover, protect and exploit digital evidence.

CS544 Software Security
Hours 3

This course is an introduction to software security principles and practices. Topics for this course will include but not be limited to security architectures, defensive programming, web security, secure information flow, and common software vulnerabilities.

CS545 Software Reverse Engineering
Hours 3

Software Reverse Engineering is an area of study that is rapidly growing in importance and visibility. This course will reveal to students the challenges of monitoring and understanding software systems. During the course students will become familiar with the practice of software reverse engineering files by utilizing static and dynamic techniques, and methods in order to gain an understanding as to what impact a file may have on a computer system.

CS548 Network Security
Hours 3

Concepts concerning network security, including an examination of network security concepts, algorithms, and protocols.

CS551 Data Science
Hours 3

This course introduces fundamental concepts & techniques in data science as well as develops practical skills for data analysis in real-world applications. Given the multi-disciplinary nature of data science, the course will primarily focus on the advantages and disadvantages of various methods for different data characteristics, but will also provide some coverage on the statistical or mathematical foundations. Topics to cover include data preprocessing, data exploration, relationship mining, prediction, clustering, outlier detection, deep learning, spatial and spatiotemporal data analysis, text data analysis, and big data.

Prerequisite(s): MATH 237 with a grade of C- or higher, (MATH 355 or GES 255) with a grade of C- or higher

CS552 Information Retrieval
Hours 3

This course is an introduction to information retrieval principles and practices. The course will cover several aspects of Information Retrieval including; indexing, processing, querying, and classifying data. Also, retrieval models, algorithms, and implementations will be covered. Though the class will focus primarily on textual data, other media including images/videos, music/audio files, and geospatial information will be addressed. Topics for this course will include but not be limited to: text processing and classification, web search development techniques, and document clustering.

CS555 Social Media Data Analytics
Hours 3

The world is experiencing rapid growth in the amount of published data which come from different sources, including Social Media platforms. The availability of programming interfaces to these platforms allows for near real-time processing of these data for various purposes. This course will reveal to students the inherent challenges of analyzing Social Media data and introduce tools and techniques that are available to address them.

CS560 Introduction To Autonomous Robotics
Hours 3

Issues involved with the implementation of robot control software including motion, kinematics, simulation testing, sensor incorporation and unmodeled factors. Students who have successfully completed CS 460 may not also receive credit for CS 560.

Prerequisite(s): CS 300 or CS 426

CS561 Brain Computer Interface
Hours 3

This course involves the exploration of new forms of Human-Computer Interaction (HCI) based on passive measurement of neurophysiological states (cognitive and affective). These include the measurement of cognitive workload and affective engagement.

CS563 Computer Vision
Hours 3

This course is a broad introduction to computer vision. Topics include camera models, multi-view geometry, reconstruction, some low-level image processing, and high-level vision tasks like image classification and object detection.

CS565 Artificial Intelligence
Hours 3

The advanced study of topics under the umbrella of artificial intelligence including problem solving, knowledge representation, planning and machine learning.

CS566 Mathematics for AI
Hours 3

This course provides a comprehensive foundation in the mathematical concepts and techniques essential for understanding and developing artificial intelligence algorithms. Emphasizing both theoretical principles and practical applications, key areas including linear algebra, calculus, probability, and statistics will be explored.

CS567 Computer Systems Architecture
Hours 3

Computer architectures, computer design, memory systems design, parallel processing concepts, supercomputers, networks, and multiprocessing systems.

CS570 Computer Algorithms
Hours 3

This course provides a graduate level presentation of Introduction to Computer Algorithms. Construction of efficient algorithms for computer implementation. Students who have successfully completed CS 470 may not also receive credit for CS 570.

CS575 Formal Languages & Machines
Hours 3

Regular expressions and finite automata. Context free grammars and pushdown automata. Recursively enumerable languages and turing machine. The Chomsky hierarchy. Students who have successfully completed CS 475 may not also receive credit for CS 575.

CS580 Computer Simulation
Hours 3

Introduction to simulation and use of computer simulation models; simulation methodology, including generation of random numbers and variants, model design, and analysis of data generated by simulation experiments. Students who have successfully completed CS 480 may not also receive credit for CS 580.

CS581 High Performance Computing
Hours 3

This course provides students with knowledge and fundamental concepts of high performance computing as well as hands-on experience of the core technology in the field. The objective of this class is to understand how to achieve high performance on a wide range of computational platforms. Topics include: optimizing the performance of sequential programs based on modern computer memory hierarchies, parallel algorithm design, developing parallel programs using MPI, analyzing the performance of parallel programs.

CS583 Computational Foundations of Machine Learning
Hours 3

This course offers a comprehensive overview of machine learning, encompassing both theoretical foundations and practical algorithmic approaches from multiple perspectives. The curriculum includes foundational learning theory, supervised learning with a particular emphasis on modern deep learning techniques, unsupervised learning, and reinforcement learning.

Prerequisite(s): GES 255 or MATH 355 or consent of instructor.

CS584 Reinforcement Learning
Hours 3

This course covers fundamental principles, algorithms, and implementations of reinforcement learning, including the design of computational agents based on machine learning and control theory. The typical methods include reinforcement algorithms, dynamic programming, approximate functions, and temporal difference learning for policy evaluation and control problems. The course will involve the application of these concepts and methods in simulation or real# world problems as well as potentially in the context of psychology and neuroscience.

CS591 Special Topics In CS
SP

Hours 3

Formal courses that cover new and innovative topics in computer science and do not yet have their own course numbers. Specific course titles will be announced.

Special Topics Course

CS592 Independent Study
SP

Hours 1-12

This course requires a written proposal that must be approved by the sponsoring faculty member before registration.

Special Topics Course

CS598 Non-Thesis Research
Hours 1-6

No description available

.

CS599 Thesis Research
Hours 1-6

This independent research course partially fulfills required master's-level research thesis hours toward the master's degree in Computer Science. The course is conducted under the guidance of the thesis advisor. Material covered will be of an advanced nature aimed at providing master's students with an understanding of the latest research and current developments within the field. Discussion and advisor guidance will be directed towards readings of research articles and development of research methodology, with the aim of producing an original research contribution that represents a novel development in the field, or a novel perspective on a pre-existing topic in the field.

CS606 Analys Operating Systems
Hours 3

Design of operating systems; advanced examination of synchronization, deadlock, virtual memory, and security; and parallel and distributed systems.

Prerequisite(s): CS 300

CS609 Database Management
Hours 3

An advanced view of database management systems, addressing both practical and theoretical aspects of database systems. The implementation and performance of the relational and NoSQL models will be examined, along with system techniques associated with transaction processing and recovery. Distributed databases, database security, and databases in clouds will also be discussed.

Prerequisite(s): CS 301

CS613 Adv Computer Comm & Networks
Hours 3

Study of computer networks, including telecommunications and related data transmission techniques. Network philosophy, design, and implementation.

Prerequisite(s): CS 438 or CS 538

CS618 Wireless Mbile Netrwrk Protocl
Hours 3

Network protocol design and analysis in wireless and mobile networks. Topics include ad hoc.

Prerequisite(s): CS 438 or CS 538 or CS 613

CS630 Empirical Software Engineering
Hours 3

Introduction to empirical research methods in software engineering. Focus on measuring processes and designing experiments.

CS642 Modern Cryptography
Hours 3

This course offers a comprehensive introduction to Modern Cryptography, and, specifically, its main formalisms, solutions, and open questions, with a heavy focus on application aspects, including case studies for real-life uses of Modern Cryptographic Protocols.

Prerequisite(s): CS 442 or CS 542

CS648 IoT and IoT Security
Hours 3

Concepts and technologies in IoT and IoT security, including introduction to IoT applications, IoT protocols, threats and countermeasures.

CS651 Deep Generative Modeling
Hours 3

This course teaches the design of deep generative learning methods for modeling physics processes, such as water sciences, material sciences, and neuroscience. The course aims to teach the theoretical methods of artificial intelligence that act appropriately and effectively in novel situations that occur in open worlds. The course will cover the scientific principles to quantify and characterize novelty in open-world domains, teach students how to develop generative AI systems that react to novelty in those domains and demonstrate and evaluate these systems in a selected domain. The course will involve applying concepts and methods in the context of physics processes.

CS665 Intelligent Robotics
Hours 3

The study of intelligent robotics allows robots to gather information from surrounding environments and take actions autonomously. This course will cover fundamental principles and methods of manipulation and navigation for intelligent robotics.

CS683 Large Language Models
Hours 3

This course explores the architecture, training, and applications of large language models (LLMs), exploring their impact on natural language processing (NLP) and machine learning at large. Students will engage with theoretical foundations, practical implementations, and ethical considerations surrounding LLMs. Through lectures, hands-on projects, and collaborative research, participants will develop a comprehensive understanding of how to leverage these models for innovative solutions in various domains.

Prerequisite(s): CS 483 or CS 583 or equivalent course

CS691 Special Topics
SP

Hours 3

Formal courses that cover new and innovative topics in computer science and do not yet have their own numbers; specific course titles will be announced.

Special Topics Course

CS692 Independent Study
SP

Hours 1-12

This course requires a written proposal that must be approved by the sponsoring faculty member before registration.

Special Topics Course

CS697 PhD Mentored Instructional Experience
Hours 1-2

This course provides Ph.D. students with pedagogical instruction, mentoring, and practical experience related to teaching and mentoring in a higher education environment. Does not count toward Ph.D. coursework requirements.

CS698 Preparing Dissertation Proposal
Hours 1-12

This independent research course is designed for Ph.D. students in Computer Science who have completed their coursework and the Ph.D. Qualifying Exam, but have not been admitted to Ph.D. candidacy. The course is conducted under the guidance of the dissertation advisor. Material covered will be of an advanced nature aimed at providing doctoral students with an understanding of the latest research and current developments within the field. Discussion and advisor guidance will be directed towards readings of research articles and development of research methodology to prepare the dissertation proposal.

CS699 Dissertation Research
Hours 1-12

This independent research course partially fulfills required doctoral-level research dissertation hours toward the Ph.D. degree in Computer Science. The course is conducted under the guidance of the dissertation advisor. Material covered will be of an advanced nature aimed at providing doctoral students with an understanding of the latest research and current developments within the field. Discussion and advisor guidance will be directed towards readings of research articles and development of research methodology, with the aim of producing an original research contribution that represents a novel development in the field, or a novel perspective on a pre-existing topic in the field.