

# COURSES FOR COMPUTER SCIENCE

## Computer Science Courses

### CS100 CS I for Majors

Hours 4

A first course in programming for students majoring in computer science. Language concepts include primitives, variables, sequences, function, selection, iteration and recursion. Software engineering concepts include testing and debugging. System concepts include directories, paths, files, and text editing.

Prerequisite(s): (MATH 112 and MATH 113) or MATH 115 or UA ACT Subject Math Placement 565 or UA Placement Mathematics 440

Prerequisite(s) with concurrency: MATH 125 or MATH 126 or MATH 145 or MATH 146

### CS101 CS II for Majors

C

Hours 4

A second course in programming for students majoring in computer science. Using a high-level language, students use object-oriented practices to study fundamental data structures and algorithms. Issues such as computability, problem complexity and algorithm analysis, efficient searching and sorting, data structures, and the object-oriented programming paradigm are introduced and explained. Computing proficiency is required for a passing grade in this course.

Prerequisite(s): (CS 100 or CS 110 or RRS 102) and (MATH 125 or MATH 145)

Computer Science

### CS102 Computer Applications

C

Hours 3

Familiarization with Windows, fundamental and intermediate word processing commands, spreadsheet applications, and database management. Computing proficiency is required for a passing grade in this course.

Computer Science

### CS104 Computer Science Principles

C

Hours 3

An introductory course that overviews the core principles of computer science from a broad spectrum of topics. The course content is focused on computing and its relation to creativity, abstraction, algorithms, programming, Big Data, Internet/networking, and societal impact. Students will work on team-based projects that explore topics in Big Data, investigate the impact of the internet, and create their own games and/or smartphone applications. Students will use the graphical programming language Snap. Computing proficiency is required for a passing grade in this course.

Prerequisite(s) with concurrency: MATH 112 or MATH 115 or MATH 125 or MATH 126 or MATH 145 or MATH 146

Computer Science

### CS110 Honors CS I for Majors

UH

Hours 4

This course covers the same material as CS 100 but in a depth appropriate for honors students. It is an honors version of the first course in programming for students majoring in computer science. Prior knowledge of programming is not required, but the course is appropriate for students with prior programming experience. Language concepts include primitives, variables, sequences, function, selection, iteration and recursion. Software engineering concepts include testing and debugging. System concepts include directories, paths, files, and text editing.

Prerequisite(s): (MATH 112 and MATH 113) or MATH 115 or UA ACT Subject Math Placement 565 or UA Placement Mathematics 440

Prerequisite(s) with concurrency: MATH 125 or MATH 126 or MATH 145 or MATH 146

University Honors

### CS111 Honors CSII for Majors

UH

Hours 4

This course covers the same material as CS 101 but in a depth appropriate for honors students. It is an honors version of the second course in programming for students majoring in computer science. Using a high-level language, students use object-oriented practices to study fundamental data structures and algorithms. Issues such as computability, problem complexity and algorithm analysis, efficient searching and sorting, data structures, and the object-oriented programming paradigm are introduced and explained.

Prerequisite(s): (CS 110 or CS 100 or RRS 102) and (MATH 125 or MATH 145)

University Honors

### CS121 The Discipline of Computing

Hours 1

An introduction to the discipline of computing designed for students who are considering a major or minor in computer science.

Prerequisite(s): MATH 112 OR higher OR UA Math Placement Test Score of 370

Prerequisite(s) with concurrency: MATH 112

### CS140 Introduction to Cyber Security

Hours 3

This course provides an introduction to cyber security. It covers fundamental concepts necessary to understand the threats to security as well as various defenses against those threats. The material includes an understanding of existing threats, planning for security, technology used to defend a computer system, and implementing security measures and technology.

Prerequisite(s): CS 100

**CS200 Software Design and Engineering**

C

Hours 4

Introduction to software engineering: the software crisis, program life cycle, software systems analysis techniques, software modeling, theory and practice of design, program testing methodologies, programmer team organization, and program verification and synthesis. Computing proficiency is required for a passing grade in this course.

Prerequisite(s): CS 101 or CS 111

Computer Science

**CS201 Data Structures and Algorithms**

C

Hours 4

Data structures including balanced search trees, heaps, hash tables, and graphs. Algorithm design techniques including divide-and-conquer, greedy method, and dynamic programming. Emphasis on problem solving, design, analysis, and reasoning about data structures and algorithms. Computing proficiency is required for a passing grade in this course.

Prerequisite(s): (CS 101 or CS 111) and MATH 301

Computer Science

**CS202 Web Foundations**

C

Hours 3

Introduces the student to the fundamentals of the internet and web page design and development. Students will be shown how to use the internet, text editors, and build basic web pages using HTML coding. This will include, but not be limited to hyperlinks, tables, basic CSS styling, frames and forms. The student will also be given demonstrations and assignments using a WYSIWYG editor. Computing proficiency is required for a passing grade in this course.

Computer Science

**CS285 Intro to Spreadsheet Applications**

C

Hours 3

Use of spreadsheets and other environments to build business and scientific applications. Course includes development of problem-solving skills and an introduction to the object-oriented paradigm. Computing proficiency is required for a passing grade in this course.

Computer Science

**CS300 Operating Systems**

Hours 3

Study of basic operating system concepts with an emphasis on memory, processor, device, and information management.

Prerequisite(s): CS 200, CS 201

**CS301 Database Management Systems**

W

Hours 3

Constituent parts of database management (design, creation, and manipulation of databases), including the conceptual and relational data models, SQL, normalization and security. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course.

Prerequisite(s): CS 200 and CS 201

Writing

**CS302 Database Applications**

C

Hours 3

An introduction to commercial database packages. Students will gain familiarity with both creating and using standard database software packages to solve real-world problems. Computing proficiency is required for a passing grade in this course.

Computer Science

**CS305 Advanced Database Applications and Design**

C

Hours 3

This course is a follow-up course to CS 302 for non-majors wishing to learn more about the design and use of database systems. Now that the underpinnings of data, data representation, and data visualization are in place from CS 302, students will undertake an investigation into the uses of data and the construction of and understanding of databases design principles. Computing proficiency is required for a passing grade in this course.

Prerequisite(s): CS 302 with a grade of C- or higher

Computer Science

**CS312 Website Design**

C

Hours 3

A course designed to teach website design principles and implementation techniques. The course requires prior knowledge of the fundamentals of the internet and web page design and development. This class is not cross-listed as a graduate course. Computing proficiency is required for a passing grade in this course.

Prerequisite(s): CS 202 with a grade of C- or higher

Computer Science

**CS322 Python Programming**

C

Hours 3

A course designed to introduce programming and problem solving using Python. This class is not cross-listed as a graduate course. Computing proficiency is required for a passing grade in this course.

Prerequisite(s): MATH 112 or higher

Computer Science

**CS340 Legal & Ethical Issues in Comp**

C

Hours 3

By way of case study, the course finds and frames issues related to legal and ethical issues in computing. Topics include privacy, free speech, intellectual property, security, and software reliability and liability issues. Computing proficiency is required for a passing grade in this course.

Computer Science

**CS345 Advanced Legal and Ethical Issues in Computing**

C

Hours 3

By way of case study and fact pattern analysis, we will find and frame advanced legal and ethical issues presented by past, contemporary and emerging technology. Cases and events will be examined. At the conclusion of the semester, students will be able to identify and discuss legal and ethical issues presented by technology. Students will create a seminal project showcasing their understanding of a chosen issue as well as the student's ability to use computing technology to communicate, share and display their work. Computing proficiency is required for a passing grade in this course.

Prerequisite(s): CS 340 with a grade of C- or higher

Computer Science

**CS347 Cyber Law and Ethics**

HU

Hours 3

We will analyze advanced legal and ethical issues confronting the usage of new technologies and how these issues impact society. We will examine past, contemporary and emerging cases that have a connection to computing technology. Human values and ethics will be at the forefront of our approach, and we will study the intersection of human values, law and professional ethics.

Prerequisite(s): CS 100 or CS 322

Humanities

**CS385 Advanced Spreadsheet Applications**

C

Hours 3

Design and construction of standard user interfaces using a visual programming environment. Course includes the prototyping of several standard user interface mechanisms. Computing proficiency is required for a passing grade in this course.

Prerequisite(s): CS 285 with a grade of C- or higher

Computer Science

**CS391 Special Topics**

Hours 3

Special topics in computing.

**CS393 Software Practicum**

Hours 3

Software development course designed to meet the needs of individual students. This course is specifically for students developing software for an enterprise, such as those at The Edge Incubator and Accelerator.

Prerequisite(s) with concurrency: CS 301

**CS403 Programming Languages**

Hours 3

Formal study 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-procedural programming paradigms.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS404 CS Curriculum for Math Educators**

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

**CS407 Software Interface Design**

Hours 3

Basic concepts of human-computer interaction, including guidelines for interface design, evaluation of interface designs, virtual environments, menus, forms, natural language interactions, novel interaction devices, information search and information visualization.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS415 Software Design & Development**

Hours 3

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

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS416 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.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS417 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.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS420 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.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS428 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.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS434 Compiler Construction**

Hours 3

Syntax and semantics of procedure-oriented languages and translation techniques used in their compilation; includes computer implementation.

Prerequisite(s): CS 300, CS 301, and ECE 383

**CS435 Computer Graphics**

Hours 3

Fundamentals of interactive 3-D computer graphics, including modeling and transformations, viewing, lighting and shading, mapping methods, graphics pipeline, shading languages, and interaction techniques. Programming projects are required.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS438 Computer Comm & Networks**

Hours 3

The study 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.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS442 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.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS443 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.

Prerequisite(s): CS 300, CS 301, and ECE 383

**CS444 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.

Prerequisite(s): CS 300, CS 301, and ECE 383

**CS445 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.

Prerequisite(s): CS 300, CS 301, and ECE 383

**CS448 Network Security**

Hours 3

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

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS451 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): CS 300, CS 301, MATH 237, (MATH 355 or GES 255), ECE 383

**CS452 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.

Prerequisite(s): CS 300, CS 301, ECE 383

**CS455 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.

Prerequisite(s): CS 300, CS 301, and ECE 383

**CS460 Intro to Autonomous Robotics**

Hours 3

Issues involved with the implementation of robot control software including motion, kinematics, simulation testing, sensor incorporation and unmodeled factors.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS461 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.

**CS465 Artificial Intelligence**

Hours 3

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

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS470 Computer Algorithms**

Hours 3

Construction of efficient algorithms for computer implementation.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS475 Formal Languages & Machines**

Hours 3

Regular expressions and finite automata. Context free grammars and pushdown automata. Recursively enumerable languages and the Turing machine. The Chomsky hierarchy.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS480 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.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS481 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.

Prerequisite(s): (CS 300, CS 301 and ECE 383) or permission of instructor.

**CS491 Special Topics**

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 from time to time.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS492 Special Prob (Area)**

Hours 1-3

Reading and research course designed to meet the needs of individual students. This course cannot be used as a required 400-level computer science elective.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS493 Special Problems in Software Engineering**

Hours 3

Reading, research, and development course designed to meet the needs of individual students. This course is specifically for students pursuing the Software Engineering Concentration.

Prerequisite(s): CS 300, CS 301 and ECE 383

**CS494 CyberCorps Scholarship For Service Seminar**

Hours 1

The CyberCorps® Scholarship for Service (SFS) Seminar is only for the students in the SFS@Bama program. This course will focus on important information necessary to be successful in a government cyber security career. The CyberCorps® SFS program prepares the next generation of cyber security employees to protect and defend the United States of America's infrastructure from threats, attacks, and potential intrusions. The course will include briefings, presentations, job related tasks, job fairs, and guest speakers.

**CS495 Capstone Computing**

W

Hours 3

A culminating capstone project course that integrates the skills and abilities throughout the curriculum into a comprehensive design and development experience for computer science majors. Writing proficiency is required for a passing grade in this course. A student who does not write with the skill normally required of an upper-division student will not earn a passing grade, no matter how well the student performs in other areas of the course.

Prerequisite(s): (CS 403 or CS 470 or CS 475) Minimum Grade of C- AND three additional hours of 400-level CS classes

Writing



**CS499 Undergraduate Thesis Research**

Hours 3

Independent research and participation within a faculty member's research group. Permission of the supervising faculty member is required.

Prerequisite(s): (CS 403 or CS 470 or CS 475) Minimum Grade of C- AND three additional hours of 400-level CS classes

**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.

**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.

**CS557 Database Management Systems**

Hours 3

This course provides a graduate level presentation of Database Management Systems. Constituent parts of database management (design, creation, and manipulation of databases), client-server, relational, and object-oriented data models.

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

**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.

**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.

**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.

**CS591 Special Topics In CS**

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.

**CS592 Independent Study**

Hours 1-12

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

**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.

**CS600 Foundatns Software Engr**

Hours 3

Introduction to formal software development techniques; theoretical foundations of specification, design, and testing; and programming methodologies and software reuse.

**CS602 Adv Formal Lang & Machin**

Hours 3

Regular languages, context-free languages, recursive and recursively enumerable languages, nondeterminism, and undecidability.

Prerequisite(s): CS 475 or CS 575

**CS603 Organz Program Languages**

Hours 3

Design and implementation of programming languages; syntax and translation; semantic structures and run-time representations; data, operations, control structures, and storage management.

Prerequisite(s): CS 403 or CS 503

Prerequisite(s) with concurrency: CS 403

**CS605 Artificial Intelligence**

Hours 3

An advanced course in artificial intelligence topics. These topics include, but are not limited to, topics such as problem solving, knowledge representation, planning, and machine learning. The course will examine the various branches within the field as well as applications of artificial intelligence.

**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

Prerequisite(s) with concurrency: CS 457

**CS612 Advanced Data Structures**

Hours 3

A graduate-level study of data structures. Topics include self-balancing trees binomial and Fibonacci heaps, disjoint sets, graphs and digraphs.

Prerequisite(s): CS 470 or CS 570

**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 Netwrk 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 or ECE 406 or ECE 506 or ECE 502

**CS630 Empirical Software Engineering**

Hours 3

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



**CS691 Special Topics**

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.

**CS692 Independent Study**

Hours 1-12

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

**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.