Computer Science Courses

Courses

CS 5303. Logical Foundations of CS.
Logical Foundations of Computer Science (3-0) A presentation of fundamental tools required in advanced Computer Science, including topics such as propositional and first order logic, topological properties of networks, managing tasks in parallel systems using graphs as well as modeling, simulation and queuing processes. .
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5313. Computer Networks.
Introduction to network design and programming. The course covers topics such as data transmission, link control, encoding, network topologies, internetworking, address resolution, protocol layering, routing methods, network and data security, socket programming, and remote procedure calls.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, CSCI, SWE

Classification Restrictions:
Restricted to class of DR

CS 5314. Decision Making.
This course will introduce students to fundamental concepts and algorithms in Artificial Intelligence focusing on problem solving, reasoning, and decision-making capabilities. We will begin with relatively simple environments, and gradually add complications like sequential decisions, uncertainty, multiple agents, and learning. Topics covered include problem-solving search, evolutionary algorithms, constraint satisfaction, uncertainty and decision theory, sequential decision making, reinforcement learning, and game theory.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

CS 5315. Theory of Computation.
Theory of Computation (3-0) A review of formal languages and models of computation such as Turing machines, followed by an in-depth study of undecidability, computational complexity theory, and intractability. Major Restriction: CS .
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5317. Human-Computer Interaction.
Human-Computer Interaction (3-0) Models of user behavior and human information processing, models of interaction, interaction styles including direct manipulation, interface design and development methods, implementation issues, interface programming, evaluation methods, and human-computer interaction research methods. .
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5319. Topics in Language Processing.
Topics in Language Processing (3-0) Concepts and techniques of computational processing of human language. Topics may include natural language processing, spoken language understanding, natural language generation, machine translation, dialogue systems, information extraction, and information retrieval. May be repeated for credit when topic varies.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5323. Wireless Networks.
The course focuses on the analyses of mobile, cellular, and Wireless Networks (WN) and provides fundamental techniques in architecture, operation, and security of second, third, and fourth generation of wireless LANs. Topics covered include technical foundations and evolution of WN, transmission fundamentals, communication networks, and TCP/IP Suite. The course places a significant emphasis on the design of security-related features within wireless networks. The course includes multiple individual and team laboratory assignments. Keywords: Security, Network, Wireless.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5334. Parallel & Concurrent Program.
Parallel and Concurrent Programming (3-0) The study of software and hardware architectures for parallel and distributed systems, including techniques for task partitioning and allocation, interprocess communication and synchronization, load balancing, and performance issues, in particular, task granularity, locality, and scalability.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5339. Secure Web-Based Systems.
An introduction to web-based technology and applications, emphasizing development. Topics may include: client- and server-side programming; web services; e-business models; security and privacy issues; the provisioning, development, and deployment of web sites, including dynamic web content generation and the management of database back ends; cloud computing; legal and business aspects; and relevant copyright law.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5340. Advanced Operating Systems.
Advanced Operating Systems (3-0) Examination of current research topics in operating systems such as kernel architectures and support for asynchronous I/O, multiple CPUs, memory management, filesystems, real-time processing, network protocols, and virtualization. Typical student projects include modifications or extensions to services provided by an existing operating system. Students are assumed to already understand classical operating systems theory at a level similar to that taught in CS 4375 including process scheduling, memory management, synchronization, and deadlock avoidance.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5341. Advanced Computer Architecture.
Advanced Computer Architecture (3-0) A review of the fundamentals of computer design and instruction set principles, followed by the study of the techniques used in modern high-performance computing systems, such as instruction-level parallelism, multiprocessors and thread-level parallelism, memory hierarchy design, and storage systems. Knowledge of undergraduate level Computer Architecture is assumed. Restricted to majors: CS and CE. . . .
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5342. Database Management.
Database Management: Introduction to database fundamentals, database design and implementation, the use of database management systems for application, and current trends for data management. Topics in this course include: relational algebra, entity-relationship models, relational data models, normalization, semi-structured data models, schema design, query processing, data integrity, privacy, security and data analytics.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

Prerequisite(s): (CS 2302 w/C or better)

CS 5350. Advanced Algorithms.
Advanced Algorithms (3-0) Review of mathematical techniques for analysis of computer algorithms,techniques for design of efficient algorithms, description and analysis of both well-established and recently developed algorithms. . .
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5351. Interval Computations.
Interval Computations (3-0) An overview of interval computations that take into account how input uncertainties influence the computation result. A review of the main ideas behind interval computations, main interval techniques, and applications to practical problems such as robotics, computer graphics, control, and bioinformatics.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5352. Computer Security.
Computer Security (3-0) General concepts and applied methods of computer security, especially as they relate to confidentiality, integrity, and availability of information assets. Topics include system security analysis, access control and various security models, identification and authentication, protection against external and internal threats, communication protocols and internet security.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5354. Topics/Intelligent Computing.
Topics in Intelligent Computing (3-0) Introduction to advanced concepts and techniques of intelligent and soft computing and their applications. Topics may include neural computations, fuzzy computations, evolutionary computations, intelligent control and intelligent web design, machine learning, computer vision. May be repeated for credit when topic varies.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5355. Integrated Prob. Solv. for AI.
The course will cover methodologies and best practices for developing AI solutions that integrate knowledge and perspectives across multiple disciplines. Keywords: AI Problem solving, Artificial intelligence.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS

CS 5361. Machine Learning.
Machine Learning Machine Learning studies the development of programs that can improve in the performance of a task with experience. For many difficult problems, such as speech understanding, image classification, and text analysis, solutions based on machine learning outperform all others proposed to date. In this course we will study several of the most commonly used machine learning algorithms, their application to problems in several areas of interest, and their quantitative evaluation. We will also discuss current research issues in machine learning. Each student will do a research project related to a problem of his/her interest.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

Prerequisite(s): (CS 2302 w/C or better)

CS 5362. Data Mining.
Data Mining The focus of this course is exploration of data to discover knowledge. The topics covered in this course are useful to gain insights from big data and to develop expertise in mining massive datasets. In addition to the state-of-the-art algorithms used in the knoledge discovery process, the course will cover recent literature on big data analytics. Along with regular lectures and discussions in this course, there will be a semester-long-group-project and hands-on activities, especially on algorithm design, tool development and data analysis.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

Prerequisite(s): (CS 2302 w/C or better)

CS 5363. Computer Vision.
Computer Vision Computer Vision is concerned with the development of programs that enable computers to extract useful information from digital images. In this course we will study techniques for solving several of the most relevant problems in computer vision, including three-dimensional reconstruction, object detection, and tracking. We will also study rea- world applications of these techniques, including face recognition, surveillance, robot navigation, medical image analysis, and computational photography. Each student will do a research project related to a problem of of his/her interest.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

Prerequisite(s): (CS 2302 w/C or better)

CS 5364. Topics in Data Science.
Topics in Data Science: Introduction to advanced concepts and algorithms in data science and their applications. Topics may include deep learning, speech processing, language processing, data integration, information retrieval, and information visualization. May be repeated for credit when topic varies.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

Prerequisite(s): (CS 2302 w/C or better)

CS 5365. Deep Learning.
The course will cover methodologies and best practices for developing AI solutions that integrate knowledge and perspectives across multiple disciplines. Keywords: AI Problem Solving, Artificial Intelligence
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS

Prerequisite(s): (CS 5361 w/C or better)

CS 5371. Software Safety & Risk Anlysis.
Principles of software development for safety and mission critical systems. Topics include safety-related analysis, specification, design, implementation, and maintenance techniques; survey of programming language and operating system issues for implementing safety-related software; safety requirements, hazard and risk analyses, fault tolerance, basics of software reliability, and issues of verification, validation, and certification; models for safety in a distributed system; safety standards and guidelines across application domain and selected tools supporting safety assurance of software components. Restricted to majors of CS and SWE.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, SWE

Classification Restrictions:
Restricted to class of DR

CS 5372. Spec. & Desgn of Real-Time Sys.
Basic concepts, methods, and techniques used in the specification, design, implementation, and testing of real- time embedded software components. Topics include the characteristics of real-time systems, differences between real-time operating systems and general operating systems capabilities, schedulability analyses, degraded mode analyses, software design patterns for real-time systems, methods specifically suited for real-time systems and verification and validation of real-time embedded systems. Restricted to majors of CS and SWE.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, SWE

Classification Restrictions:
Restricted to class of DR

CS 5373. Graduate Student Internship.
A professional internship in an industrial, governmental, or other organization where a student applies and enhances his or her knowledge of software engineering principles, approaches, techniques, and methods. To receive a passing grade, the student must submit a written report from the internship supervisor to the program director that presents the results of the internship, including a description of applied and acquired skills.
Department: Computer Science
3 Credit Hours
400 Total Contact Hours
0 Lab Hours
0 Lecture Hours
400 Other Hours
Major Restrictions:
Restricted to majors of SWE

Classification Restrictions:
Restricted to class of DR

CS 5374. Software Construction.
Survey of professional software construction techniques and practices including agile development, software tools and environments, configuration management, defect tracking, coding style, coding standards, cross-compilation, techniques for optimization (time, space, and I/O bandwidth), refactoring, software maintenance, and software development automation. Provides an integrated view of subjects related to the different phases of software development. Prerequisites: CS 5386 or consent of instructor. Restricted to majors of CS and SWE.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, SWE

Classification Restrictions:
Restricted to class of DR

Prerequisite(s): (CS 5386 w/C or better)

CS 5375. Software Reverse Engineering.
The course focuses on incorporating security technologies and methods into new and existing systems; using reverse engineering techniques and methodologies to explore the internal operations of compiled, executable machine code to identify possible security vulnerabilities and examine ways attackers can expose such vulnerabilities; analyzing threats; applying methods to prevent and defeat attacks; and understanding the ethical responsibilities and obligations associated with developing, acquiring, and operating software systems. Restricted to Majors of MSCS, MSSWE, and PhDCSCI.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5376. Comp. Dec Making & Risk Anal.
The course covers a variety of mathematical and computational techniques for modeling and analyzing security problems; fundamentals of mathematical approaches for analyzing risk, decision-making under uncertainty, adversarial reasoning, extracting patterns from data for modeling and analysis; and methods to analyze security problems in rigorous ways. The course includes case studies and examples related to security to illustrate techniques and contemporary issues in cyber security.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, CSCI, SWE

Classification Restrictions:
Restricted to class of DR

CS 5377. Cyber-Sec for Critical Op Tech.
The course explores a variety of topics associated with the cyber-security of operational technology supporting critical sectors as defined by the U.S Department of Homeland Security. The course provides hands-on experience on the construction and configuration of cyber-infrastructures to secure critical operational technology components such as Programmable Logic Controllers (PLC). Students work in teams to simulate an operational technology component using off-the-shelf hardware and software, and design a secure cyber-infrastructure to prevent the component from being compromised. Restricted to Majors of MSCS and MSSWE.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5381. Topics in Software Engineering.
Topics in Software Engineering (3-0) Advanced topics related to techniques, methods, procedures, and paradigms in software engineering. May be repeated for credit when topic varies.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5382. Model-Based Software Devlpmnt.
Model-Based Software Development (3-0) Engineering practices of formalized models as the basis for analyzing and specifying software artifacts. Topics include key software engineering skills required for formal modeling, techniques for model building and analysis, and applications of formal modeling techniques in the requirements, design, and implementation phases of software development.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5385. Software Requirements Engr.
Software requirements engineering. Topics may include: functional and non-functional requirements; specification styles including informal, test-case, documentation, and formal specifications; elicitation techniques, requirements maintenance, configuration management, cost estimations, cost negotiation, feasibility metrics, and tools support. Restricted to graduate students.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5386. Software Architecture & Design.
Architectural and design of software systems, in particular concepts related to real-time and safety critical systems. Topics include: architectural styles and views; mapping requirements to architecture and design entities; software product line architectures; software design patterns and frameworks; design validation; documentation of architectural design decisions; design maintenance and metrics.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5387. Software Integration and V&V.
Principles and processes of validation, verification, integration, and testing within a disciplined software development environment. Topics include efficient integration of software systems or components that meet customer requirements and needs, as well as disciplined approaches for 1) Integration and testing in software requirements, architecture, design, and construction; 2) selection of alternative methods for integration and testing; 3) fault diagnosis; and 4) transition of systems throughout the life cycle.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

Prerequisite(s): (CS 5385 w/C or better)

CS 5388. Software Project Management.
Fundamentals of project management, including software management strategies. Topics include process improvement, quality assurance of both product and process, risk management, project planning, project staffing, schedule and cost estimation, project budget development, contracts and liability, intellectual property, freedom of information, continuous quality improvement, project- management metrics, project tracking, and project team building and leadership.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5389. Software Engineering Practicum.
Capstone software project in which the student applies concepts learned in the program. The practicum can be completed in a course in which the instructor oversees teams of students, or through an arrangement with an industry partner in which a manager evaluates the work of a student on a particular project. The latter requires prior approval.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of SWE

Classification Restrictions:
Restricted to class of DR

CS 5390. Special Topic Computer Science.
Special Topics in Computer Science (3-0) Advanced topics of contemporary interest in computer science May be repeated for credit when topic varies. Restricted to major: CS and EE. Prerequisite: Department approval.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5391. Individual Studies.
Individual Studies (0-0-3) Individual variable-credit research, design or analysis on advanced phases of computer science problems conducted under the direct supervision of a faculty member. A maximum of three credit hours may be applied towards the M.S. degree. Restricted to major: CS. Prerequisite: Department approval.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5392. Graduate Research Methods.
Graduate Research Methods (3-0) Introduction to research methods, including research paradigms and methodologies across computer science, research question formulation, design of research approach, literature search and presentation of related work, analysis of results, verbal and written presentation skills, and research ethics. Students prepare and defend a thesis proposal or project proposal in an area of their choice.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5394. Graduate Research.
Graduate Research (0-0-3) Individual variable-credit research of contemporary topics in computer science. Restricted to major: CS. Prerequisite: Department approval.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5396. Graduate Projects.
Graduate Projects (0-0-3) Individual research, design or analysis on advanced phases of computer science problems conducted under the direct supervision of a faculty member. The course, including a written report, are required of all students in the non-thesis option.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 5397. Graduate Projects.
Graduate Projects (0-0-3) Individual research, design or analysis on advanced phases of computer science problems conducted under the direct supervision of a faculty member. The courses, including a written report, are required of all students in the non-thesis option.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
Classification Restrictions:
Restricted to class of DR

Prerequisite(s): (CS 5396 w/P or better)

CS 5398. Master's Thesis.
Thesis (0-0-3) Restricted to major: CS.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours

CS 5399. Master's Thesis.
Thesis (0-0-3) Restricted to major: CS. Prerequisite: CS 5398.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
Prerequisite(s): (CS 5398 w/P or better)

CS 5694. Graduate Research.
Graduate Research (0-0-6) Individual variable-credit research of contemporary topics in computer science. Major Restriction: CS Prerequsite: Department approval
Department: Computer Science
6 Credit Hours
6 Total Contact Hours
0 Lab Hours
0 Lecture Hours
6 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 6193. Doctoral Seminar.
Doctoral Seminar This course is designed to involve doctoral students in the academic life of the department, including participating in seminar, colloquia, and other departmental events. Students will also complete writing and presentation assignments to improve their communication skills.
Department: Computer Science
1 Credit Hour
1 Total Contact Hour
0 Lab Hours
1 Lecture Hour
0 Other Hours

CS 6194. Doctoral Research.
Doctoral Research (0-0-1) Individual research in Computer Science. Prerequisite: Department approval.
Department: Computer Science
1 Credit Hour
1 Total Contact Hour
0 Lab Hours
0 Lecture Hours
1 Other Hour
Major Restrictions:
Restricted to majors of CSCI

CS 6294. Doctoral Research.
Doctoral Research (0-0-2) Individual research in Computer Science. Prerequisite: Department approval.
Department: Computer Science
2 Credit Hours
2 Total Contact Hours
0 Lab Hours
0 Lecture Hours
2 Other Hours

CS 6303. Logical Foundations of CS.
A presentation of fundamental tools required in advanced Computer Science, including topics such as propositional and first order logic, topological properties of networks, managing tasks in parallel systems using graphs as well as modeling, simulation and queuing processes. Restricted to Majors of CS, MSSWE, and PhDCSCI.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, CSCI, SWE

CS 6313. Computer Networks.
Introduction to network design and programming. The course covers topics such as data transmission, link control, encoding, network topologies, internetworking, address resolution, protocol layering, routing methods, network and data security, socket programming, and remote procedure calls.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, CSCI, SWE

CS 6314. Artificial Intelligence I.
Artificial Intelligence I (3-0) A study of first-order logic, including an introduction to Prolog, knowledge representation including semantic networks and logical representations, query answering, and reasoning methods.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS

CS 6315. Theory of Computation.
A review of formal languages and models of computation such as Turing machines, followed by an in-depth study of undecidability, computational complexity theory, and intractability. Restricted to Majors of MSCS, MSSWE, and PhDCSCI.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, CSCI, SWE

CS 6317. Human-Computer Interaction.
Human-Computer Interaction (3-0) Models of user behavior and human information processing, models of interaction, interaction styles including direct manipulation, interface design and development methods, implementation issues, interface programming, evaluation methods, and human-computer interaction research methods.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 6319. Topics in Language Processing.
Topics in Language Processing (3-0) Concepts and techniques of computational processing of human language. Topics may include natural language processing, spoken language understanding, natural language generation, machine translation, dialogue systems, information extraction, and information retrieval. May be repeated for credit when topic varies.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

CS 6334. Parallel & Concurrent Program.
Parallel and Concurrent Programming (3-0) The study of software and hardware architectures for parallel and distributed systems, including techniques for task partitioning and allocation, interprocess communication and synchronization, load balancing, and performance issues, in particular, task granularity, locality, and scalability.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, EE

CS 6339. Secure Web-Based Systems.
An introduction to web-based technology and applications, emphasizing development. Topics may include: client- and server-side programming; web services; e-business models; security and privacy issues; the provisioning, development, and deployment of web sites, including dynamic web content generation and the management of database back ends; cloud computing; legal and business aspects; and relevant copyright law.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

CS 6340. Advanced Operating Systems.
Advanced Operating Systems (3-0) Examination of current research topics in operating systems such as kernel architectures and support for asynchronous I/O, multiple CPUs, memory management, filesystems, real-time processing, network protocols, and virtualization. Typical student projects include modifications or extensions to services provided by an existing operating system. Students are assumed to already understand classical operating systems theory at a level similar to that taught in CS 4375 including process scheduling, memory management, synchronization, and deadlock avoidance.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

CS 6341. Adv Computer Architecture.
A review of the fundamentals of computer design and instruction set principles, followed by the study of the basic principles underlying the design of today's computers, including advanced pipelining, instruction-level parallelism, memory-hierarchy design, storage systems, interconnection networks, and multiprocessors. Real examples, measurements on real machines, cost/performance tradeoffs, and good engineering design are emphasized. Restricted to Majors of MSCS, MSSWE, and PhDCSCI.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

CS 6342. Database Management.
Database Management: Introduction to database fundamentals, database design and implementation, the use of database management systems for application, and current trends for data management. Topics in this course include: relational algebra, entity-relationship models, relational data models, normalization, semi-structured data models, schema design, query processing, data integrity, privacy, security and data analytics.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (CS 2302 w/C or better)

CS 6350. Advanced Algorithms.
Review of mathematical techniques for analysis of computer algorithms, techniques for design of efficient algorithms, description and analysis of both well-established and recently developed algorithms. Restricted to Majors of MSCS, MSSWE, and PhDCSCI.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, CSCI, SWE

CS 6351. Interval Computations.
Interval Computations (3-0) An overview of interval computations that take into account how input uncertainties influence the computation result. A review of the main ideas behind interval computations, main interval techniques, and applications to practical problems such as robotics, computer graphics, control, and bioinformatics.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 6352. Computer Security.
Computer Security (3-0) General concepts and applied methods of computer security, especially as they relate to confidentiality, integrity, and availability of information assets. Topics include system security analysis, access control and various security models, identification and authentication, protection against external and internal threats, communication protocols and internet security.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

CS 6354. Topics/Intelligent Computing.
Topics in Intelligent Computing (3-0) Introduction to advanced concepts and techniques of intelligent and soft computing and their applications. Topics may include neural computations, fuzzy computations, evolutionary computations, intelligent control and intelligent web design, machine learning, computer vision. May be repeated for credit when topic varies.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

CS 6361. Machine Learning.
Machine Learning Machine Learning studies the development of programs that can improve in the performance of a task with experience. For many difficult problems, such as speech understanding, image classification, and text analysis, solutions based on machine learning outperform all others proposed to date. In this course we will study several of the most commonly used machine learning algorithms, their application to problems in several areas of interest, and their quantitative evaluation. We will also discuss current research issues in machine learning. Each student will do a research project related to a problem of his/her interest.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (CS 2302 w/C or better)

CS 6362. Data Mining.
Data Mining The focus of this course is exploration of data to discover knowledge. The topics covered in this course are useful to gain insights from big data and to develop expertise in mining massive datasets. In addition to the state-of-the-art algorithms used in the knowledge discovery process, the course will cover recent literature on big data analytics. Along with regular lectures and discussions in this course, there will be a semester-long-group-project and hands-on activities, especially on algorithm design, tool development and data analysis.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (CS 2302 w/C or better)

CS 6363. Computer Vision.
Computer Vision Computer Vision is concerned with the development of programs that enable computers to extract useful information from digital images. In this course we will study techniques for solving several of the most relevant problems in computer vision, including three-dimensional reconstruction, object detection, and tracking. We will also study rea- world applications of these techniques, including face recognition, surveillance, robot navigation, medical image analysis, and computational photography. Each student will do a research project related to a problem of of his/her interest.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (CS 2302 w/C or better)

CS 6364. Topics in Data Science.
Topics in Data Science: Introduction to advanced concepts and algorithms in data science and their applications. Topics may include deep learning, speech processing, language processing, data integration, information retrieval, and information visualization. May be repeated for credit when topic varies.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (CS 2302 w/C or better)

CS 6371. Software Safety & Risk Anlysis.
Principles of software development for safety and mission critical systems. Topics include safety-related analysis, specification, design, implementation, and maintenance techniques; survey of programming language and operating system issues for implementing safety-related software; safety requirements, hazard and risk analyses, fault tolerance, basics of software reliability, and issues of verification, validation, and certification; models for safety in a distributed system; safety standards and guidelines across application domain and selected tools supporting safety assurance of software components.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, SWE

Classification Restrictions:
Restricted to class of DR

CS 6372. Spec. & Desgn of Real-Time Sys.
Basic concepts, methods, and techniques used in the specification, design, implementation, and testing of real- time embedded software components. Topics include the characteristics of real-time systems, differences between real-time operating systems and general operating systems capabilities, schedulability analyses, degraded mode analyses, software design patterns for real-time systems, methods specifically suited for real-time systems and verification and validation of real-time embedded systems.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, SWE

Classification Restrictions:
Restricted to class of DR

CS 6373. Graduate Student Internship.
A professional internship in an industrial, governmental, or other organization where a student applies and enhances his or her knowledge of software engineering principles, approaches, techniques, and methods. To receive a passing grade, the student must submit a written report from the internship supervisor to the program director that presents the results of the internship, including a description of applied and acquired skills.
Department: Computer Science
3 Credit Hours
400 Total Contact Hours
0 Lab Hours
0 Lecture Hours
400 Other Hours
Major Restrictions:
Restricted to majors of SWE

CS 6374. Software Construction.
Survey of professional software construction techniques and practices including agile development, software tools and environments, configuration management, defect tracking, coding style, coding standards, cross-compilation, techniques for optimization (time, space, and I/O bandwidth), refactoring, software maintenance, and software development automation. Provides an integrated view of subjects related to the different phases of software development.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, SWE

Classification Restrictions:
Restricted to class of DR

Prerequisite(s): (CS 5386 w/C or better)

CS 6375. Software Reverse Engineering.
The course focuses on incorporating security technologies and methods into new and existing systems; using reverse engineering techniques and methodologies to explore the internal operations of compiled, executable machine code to identify possible security vulnerabilities and examine ways attackers can expose such vulnerabilities; analyzing threats; applying methods to prevent and defeat attacks; and understanding the ethical responsibilities and obligations associated with developing, acquiring, and operating software systems.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, CSCI, SWE

CS 6376. Comp. Dec Making & Risk Anal.
The course covers a variety of mathematical and computational techniques for modeling and analyzing security problems; fundamentals of mathematical approaches for analyzing risk, decision-making under uncertainty, adversarial reasoning, extracting patterns from data for modeling and analysis; and methods to analyze security problems in rigorous ways. The course includes case studies and examples related to security to illustrate techniques and contemporary issues in cyber security.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, CSCI, SWE

CS 6377. Cyber-Sec for Critical Op Tech.
The course explores a variety of topics associated with the cyber-security of operational technology supporting critical sectors as defined by the U.S Department of Homeland Security. The course provides hands-on experience on the construction and configuration of cyber-infrastructures to secure critical operational technology components such as Programmable Logic Controllers (PLC). Students work in teams to simulate an operational technology component using off-the-shelf hardware and software, and design a secure cyber-infrastructure to prevent the component from being compromised.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, SWE

CS 6381. Topics in Software Engineering.
Topics in Software Engineering (3-0) Advanced topics related to techniques, methods, procedures, and paradigms in software engineering. May be repeated for credit when topic varies.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

CS 6382. Model-Based Software Devlpmnt.
Model-Based Software Development (3-0) Engineering practices of formalized models as the basis for analyzing and specifying software artifacts. Topics include key software engineering skills required for formal modeling, techniques for model building and analysis, and applications of formal modeling techniques in the requirements, design, and implementation phases of software development.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Classification Restrictions:
Restricted to class of DR

CS 6385. Software Requirements Engr.
Software requirements engineering. Topics may include: functional and non-functional requirements; specification styles including informal, test-case, documentation, and formal specifications; elicitation techniques, requirements maintenance, configuration management, cost estimations, cost negotiation, feasibility metrics, and tools support.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

CS 6386. Software Architecture & Design.
Architectural and design of software systems, in particular concepts related to real-time and safety critical systems. Topics include: architectural styles and views; mapping requirements to architecture and design entities; software product line architectures; software design patterns and frameworks; design validation; documentation of architectural design decisions; design maintenance and metrics.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

CS 6387. Software Integration and V&V.
Principles and processes of validation, verification, integration, and testing within a disciplined software development environment. Topics include efficient integration of software systems or components that meet customer requirements and needs, as well as disciplined approaches for 1) Integration and testing in software requirements, architecture, design, and construction; 2) selection of alternative methods for integration and testing; 3) fault diagnosis; and 4) transition of systems throughout the life cycle.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Prerequisite(s): (CS 5385 w/C or better)

CS 6388. Software Project Management.
Fundamentals of project management, including software management strategies. Topics include process improvement, quality assurance of both product and process, risk management, project planning, project staffing, schedule and cost estimation, project budget development, contracts and liability, intellectual property, freedom of information, continuous quality improvement, project- management metrics, project tracking, and project team building and leadership.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours

CS 6389. Software Engineering Practicum.
Capstone software project in which the student applies concepts learned in the program. The practicum can be completed in a course in which the instructor oversees teams of students, or through an arrangement with an industry partner in which a manager evaluates the work of a student on a particular project. The latter requires prior approval.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of SWE

CS 6390. Special Topics.
Special Topics (3-0) Advanced topics of contemporary interest in Computer Science. May be repeated for credit when topic varies. Prerequisite: Department approval.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CSCI

CS 6391. Individual Studies.
Individual Studies (0-0-3) Individual study of a specific topic advanced in computer science under the direct supervision of a faculty member. A maximum of three credit hours may be applied toward the Ph.D. degree. Prerequisite: Department approval.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
Major Restrictions:
Restricted to majors of CSCI

CS 6392. Graduate Research Methods.
Introduction to research methods, including research paradigms and methodologies across computer science, research question formulation, design of research approach, literature search and presentation of related work, analysis of results, verbal and written presentation skills, and research ethics. Students prepare and defend a thesis proposal or project proposal in an area of their choice. Restricted to Majors of MSCS, MSSWE, and PhDCSCI.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
3 Lecture Hours
0 Other Hours
Major Restrictions:
Restricted to majors of CS, CSCI, SWE

CS 6394. Doctoral Research.
Doctoral Research (0-0-3) Individual research in computer science. Prerequisite: Department approval.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
Major Restrictions:
Restricted to majors of CSCI

CS 6396. Graduate Projects.
Graduate Projects (0-0-3) Individual research, design or analysis on advanced phases of computer science problems conducted under the direct supervision of a faculty member. The course, including a written report, are required of all students in the non-thesis option.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
Major Restrictions:
Restricted to majors of CS

CS 6397. Graduate Projects.
Graduate Projects (0-0-3) Individual research, design or analysis on advanced phases of computer science problems conducted under the direct supervision of a faculty member. The courses, including a written report, are required of all students in the non-thesis option.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
Major Restrictions:
Restricted to majors of CS

Prerequisite(s): (CS 5396 w/P or better)

CS 6398. Dissertation.
Dissertation (0-0-3) Initial work on the dissertation. Prerequisite: Department approval.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours

CS 6399. Dissertation.
Dissertation (0-0-3) Taken continuously during preparation of the disseration. Prerequisite: CS 6398.
Department: Computer Science
3 Credit Hours
3 Total Contact Hours
0 Lab Hours
0 Lecture Hours
3 Other Hours
Prerequisite(s): (CS 6398 w/P or better)

CS 6694. Doctoral Research.
Doctoral Research (0-0-3) Individual research in Computer Science. Prerequisite: Completion of the qualifying examination.
Department: Computer Science
6 Credit Hours
6 Total Contact Hours
0 Lab Hours
0 Lecture Hours
6 Other Hours
Major Restrictions:
Restricted to majors of CSCI