Computer Science and Information Systems Courses

CSCI 503 - Trusted Artificial Intelligence and Autonomous Systems
Hours: 3
This course explores the critical intersection of trustworthiness and autonomy in the age of artificial intelligence. It offers insights into the core principles of autonomous AI, emphasizing transparency, explainability, fairness, and robustness. Students will engage with real-world case studies, explore regulatory landscapes, and partake in hands-on labs to apply theoretical knowledge. This course prepares students to design, evaluate, and manage trustworthy autonomous technologies in our AI-driven world.

CSCI 505 - Internship
Hours: 3
This course gives students the opportunity to earn credit while obtaining valuable working experience. This course is offered to students who have obtained an internship with a company or organization that employs personnel with computer science and information technology skills. Students are supervised by the employer and by Computer Science faculty.

CSCI 513 - Python Programming for AI
Hours: 3
This course provides students with the fundamental computational thinking knowledge necessary for further study in the field of artificial intelligence. Students will be introduced to the fundamentals of Python programming applied to artificial intelligence problems.

CSCI 515 - Fundamentals Of Programming C/C++
Hours: 4
Three hours of lecture and two hours of lab. This is an advanced programming course using a high level programming language. Specific objectives are to introduce the development of algorithms as a disciplined approach to problem solving; to present programming practices in design, decoding, debugging, testing and documentation of computer programs; to provide the student with the basic knowledge necessary for further study in the field of computer science.

CSCI 516 - Fundamental Concepts in Computing and Machine Organization
Hours: 3
Concepts of assembly language programming and machine organization of a modern digital computer are presented. Students will have the opportunity to study machine addressing, stack operations, subroutines, programmed and interrupt driven I/O, machine organization and computer architecture at the register level. Students will utilize the 80x86 instruction set and will perform programming exercises.

CSCI 518 - Thesis
Hours: 3-6
Thesis. Six semester hours.

CSCI 520 - Data Structures and Algorithm Analysis
Hours: 4
Three hours of lecture and two hours of lab. The concept of abstract data structures forms the basis for the study of the data structures introduced in this course. Well known, basic data structures and the algorithms associated with them form the primary subject matter. Knowledge of these basic data structures will allow the student to create large scale programs which process meaningful amounts of data. Comparative efficiency analysis of the algorithms studied in the course will be introduced. The student will also become acquainted with formal methods for specifying abstract data types as well as algorithms. Prerequisites: CSCI 515.

CSCI 520A - Data Structures and Algorithm Analysis
Hours: 4
(Same as CSCI 520) Three hours of lecture and two hours of lab. The concept of abstract data structures forms the basis for the study of the data structures introduced in this course. Well known, basic data structures and the algorithms associated with them form the primary subject matter. Knowledge of these basic data structures will allow the student to create large scale programs which process meaningful amounts of data. Comparative efficiency analysis of the algorithms studied in the course will be introduced. The student will also become acquainted with formal methods for specifying abstract data types as well as algorithms. Prerequisites: CSCI 515. Crosslisted with: CSCI 520.

CSCI 524 - Analysis & Design Softwr Sys
Hours: 3
This course will provide the student with the opportunity to experience the several phases of conventional software development. Established software engineering practices will be presented. Various software architectures will be introduced. Each student is expected to fully participate in a team project over the course of the semester. Prerequisites: CSCI 515.

CSCI 525 - Computer Networks
Hours: 3
This course provides a self-contained overview of computer networking by introducing many key concepts and terminology. In particular, we will study the concepts of computer networks and communication including layered architecture, network application services and domain name resolution, transport layer services and TCP/UDP protocols, network layer forwarding and routing functions and subnet/NAT configurations, and link layer functions with the focus of Ethernet standards.

CSCI 526 - Database Systems
Hours: 3
Basic database concepts, organization, and definitions; data and management systems; data description languages; logical and physical differences of database; indexed and multiple-key organization; relational database concepts and examples; and comparison of database systems. Prerequisites: None.

CSCI 527 - Data Mining
Hours: 3
This course covers the general principles, and concepts of data mining. The goal of the course is to design and implement data mining techniques used in practice. Topics include data preparation, association rule discovery, classification, regression, and clustering. Prerequisites: CSCI 513 or 515.

CSCI 528 - Advanced Object-Oriented Programming
Hours: 3
This course investigates object-oriented methods including object-oriented programming, analysis and design. Current methodology is emphasized. The use of object-oriented features such as encapsulation, information hiding, inheritance and polymorphism is reinforced by class assignments and programming exercises. Prerequisites: CSCI 515.

CSCI 530 - Operating Systems
Hours: 3
The course objectives are two-fold: (1) to learn general theory, concept, and techniques related to the design of operating systems; (2) to practice the design of an operating system by performing a design project. The course is basically divided into four sections: Introduction to Operating Systems, Process Management, Storage Management, and UNIX (Shell and Interpreter). Prerequisites: CSCI 515 and CSCI 516.

CSCI 531 - Java Language Programming
Hours: 3
This is a computer programming course designed to teach the use of the Java Programming Language. The course will emphasize Java applets and their use in HTML files as applied to Internet web pages. Students will learn how to write Java applets, how to utilize pre-existing Java controls, and how to write new Java controls. Students will be expected to complete numerous programming assignments and programming projects. Experience with C++ programming language and object oriented methods are required. Prerequisites: CSCI 515.

CSCI 532 - Algorithm Design
Hours: 3
Algorithms, being the foundation of computing, allow us to create well-defined sequences of computational steps in order to solve computational problems – with stipulation on input/out relation, correctly and efficiently within a definite time frame. This course provides a comprehensive introduction to the modern study of computer algorithms. In particular, we will study the design and analysis of algorithms with special emphasis on correctness of algorithms, asymptotic notations, divide-and-conquer, dynamic programming, greedy algorithms, graph algorithms, shortest paths, and selected special topics. Prerequisites: CSCI 520.

CSCI 532A - Algorithm Design
Hours: 3
(Same as CSCI 532) Algorithms, being the foundation of computing, allow us to create well-defined sequences of computational steps in order to solve computational problems – with stipulation on input/out relation, correctly and efficiently within a definite time frame. This course provides a comprehensive introduction to the modern study of computer algorithms. In particular, we will study the design and analysis of algorithms with special emphasis on correctness of algorithms, asymptotic notations, divide-and-conquer, dynamic programming, greedy algorithms, graph algorithms, shortest paths, and selected special topics. Prerequisites: CSCI 520. Crosslisted with: CSCI 532.

CSCI 534 - Networking - Routers and Switches
Hours: 3
This course instructs students in the detailed operation and configuration of network routers and data communication switches. Topics include the use of routers and switches in a modern digital network, router configuration, switch configuration, and common network security techniques such as Virtual Local Area Networks (VLANs) and Access Control Lists (ACLs). Students will have the opportunity to gain experience in configuring these network devices as they work with routers and switch equipment in the laboratory. Note About 50% of class time will be spent in the CCNA Networking Laboratory. Prerequisites: CSCI 525.

CSCI 538 - Artificial Intelligence Using Python
Hours: 3
This course introduces students to the history of Artificial Intelligence (AI), its different types, and its various applications We also go over the major approaches, representational techniques, and core algorithms for the main branches of AI. Topics to be covered include knowledge representation, problem solving, reasoning, deduction, searching, planning, and reinforcement learning. Advanced topics in application areas, such as natural language processing, computer vision, pattern recognition, and robotics will also be examined. Prerequisites: CSCI 513 or CSCI 515.

CSCI 540 - Computer Architecture
Hours: 3
Computer Architecture. Three semester hours. Introduction to current high level computing machines in both hardware and software design. Topics include the design decisions involved in the development of computer architectures, hardware organizations needed to implement various instructions sets, and future trends in computer architectures. Prerequisites: CSCI 516.

CSCI 544 - Evolutionary Compututation & Genetic Programming
Hours: 3
Evolutionary Computation and Genetic Programming - Three semester hours Evolutionary computing is the collective name for a range of problem solving techniques based on principles of biological evolution, such as natural selection and genetic inheritance. These techniques have proven to be particularly successful in many diverse problem domains, ranging from economics and finance, to design and automatic programming. Specific topics addressed include theoretical models of evolutionary computation; search, optimization, and machine learning; evolution of programs; population dynamics; and emergent behavior. Prerequisites: CSCI 515.

CSCI 546 - Numerical Analysis
Hours: 3
The course will include numerical methods for derivatives approximation; will teach data approximation and interpolation by Fourier series; Euler's and Runge-Kutta methods for solving ordinary differential equations (ODE) and systems of ODE. Also, the students will study methods for approximate solution of partial differential equations (PDE), including parabolic PDE. Further, the students will learn how to generalize methods for their computer implementation, and will program the basic methods in MatLab. Prerequisites: CSCI 515 and MATH 2414. Crosslisted with: MATH 546.

CSCI 548 - Software Testing
Hours: 3
This course presents an overview of the principles and practices of software testing. It covers different concepts and techniques on how to test and debug software. Topics include various testing methods such as structural and functional testing; various testing approaches such as unit, integration, regression and system testing. Students will also be introduced to manual and automatic techniques for generating test cases. Prerequisites: CSCI 515.

CSCI 549 - Automata Theory
Hours: 3
This course teaches the general theory, concept, and techniques related to the theory of automata. Practical examples related to programming languages are emphasized. Students will have the opportunity to utilize theoretical aspects of automata theory by performing a medium-scale design project. Topics include: Finite Automata, Transition Graphs, Nondeterminism, Finite Automata with Output, Context-Free Grammars, Regular Grammars, Chomsky Normal Form, Pushdown Automata, Context-Free Languages, Non-Context-Free Languages, Parsing, and Turing Machines. Prerequisites: CSCI 515.

CSCI 551 - Compiler Design
Hours: 3
This class introduces the fundamental concepts in the design and implementation of a compiler, a computer program that converts one programming language into another. The goal is to familiarize students with the basic structure of a typical modern compiler. A variety of tools such as JFLex, JavaCUP and Jasmin will be introduced and used. Prerequisites: CSCI 515.

CSCI 554 - Digital Forensics
Hours: 3
This course presents an overview of the principles and practices of digital investigation. The objective of this class is to emphasize the fundamentals and importance of digital forensics. Students will learn different techniques and procedures that enable them to perform a digital investigation. This course focuses mainly on the analysis of physical storage media and volume analysis. It covers the major phases of digital investigation such as preservation, analysis and acquisition of artifacts that reside in hard disks and random access memory. Prerequisites: CSCI 515.

CSCI 556 - Data Analysis & Visualization
Hours: 3
Modern data sets are growing exponentially both in size and complexity. Extracting meaningful information from these data requires not only programming skills, but also understanding the analysis methods, mathematical models and visualization tools that help to condense large amounts of information into a comprehensible story. This course will introduce standard data analysis and modeling methods, including correlation functions, linear regression, clustering, classification, as well as fundamental statistical and probabilistic concepts. With the data analysis functions, relevant visualization tools will be introduced for helping data explorations and analysis.

CSCI 559 - Software Development for Mobile Devices
Hours: 3
This course introduces development of software applications for network enabled mobile devices including smart phones. Topics include components for graphical user interface, memory management, custom user interface development, touch-based or timer-based event handling, file I/O, animation using 2-D/3-D graphics, audio and video application programming interfaces, Bluetooth applications, client-server models, database access, data storage, marketing research. Object Oriented Programming will be introduced with the Objective–C, Java, or Swift. Prerequisites: CSCI 515.

CSCI 560 - Neural Networks and Deep Learning
Hours: 3
In this course the theory and practice of neural computation for machine learning are introduced. Artificial neural networks are used for many real-world problems: classification, time-series prediction, regression, pattern recognition. The class starts with an introduction to feed forward neural networks. More complicated multi-layered "deep" networks are then covered. Basic backpropagation, gradient descent and modern regularization techniques are implemented in assignments. The class will look at modern deep learning techniques: convolutional neural networks, deep belief networks and deep recurrent neural models such as LSTM nets. Readings and current results from the literature on neural network research will be discussed. Prerequisites: CSCI 574.

CSCI 563 - Information Security
Hours: 3
This course provides an introduction to the study of information security and covers the most important features of computer security. Topics include basic concepts and principles in information security, authentication and access control, operating systems security, software vulnerabilities and threats, database security, and basic cryptography including encryption and key establishment. Prerequisites: CSCI 525.

CSCI 567 - Image Processing with Elements of Learning
Hours: 3
This class will provide the students with an introduction to image processing, with applications to medical, urban agricultural and satellite images. Students will learn methods for 2D image enhancement, sharpening, blurring, noise detection, modeling and cleaning, as well as edge detection in gray level images. The methods students will be able to implement include local statistics, Laplacian and Gradient operators, Fourier transforms and the Fast Fourier Transform. Further, the class will introduce basic elements of convolutional neural networks to learn noise and its cleaning. At the end of the class the students will know which gray level image methods apply to color images. The students will develop skills in programming, reporting and presenting advanced method from the field. Prerequisites: CSCI 513 or CSCI 515. Crosslisted with: MATH 563.

CSCI 569 - Image Analysis and Recognition with Learning
Hours: 3
This class will start with a study of the basic color image models. Next, the students will learn how to decompose a function to Wavelets. In the following stage the students will learn the basic methods for image segmentation to objects and background. The students will have a knowledge on image segmentation with active contours using deep learning. Further they will learn about images and objects representation and description. The students will know methods from two major approaches: boundary and regions description. The following methods will be taught from the field of Recognition: Decision making; structural methods; features extraction and classification with convolutional neural networks. The students will develop skills in programming, reporting and presenting advanced method from Prerequisites: CSCI 513 or CSCI 515. Crosslisted with: MATH 569.

CSCI 571 - Statistics for Scientific Computation and Analysis
Hours: 3
This course provides an introductory framework for the statistical background required for scientific computation and data analysis. The course introduces fundamental statistical concepts such as probability, random variables, probability distributions, statistical expectation, sampling distributions, hypothesis testing, linear regression, correlation, and visualization/plotting of data, with emphasis on applications to scientific computing and computational science problems. Concepts will be reinforced by having students use a statistical/scientific computing & visualization software in order to apply the concepts that they learn by solving problems from various disciplines.

CSCI 573 - Big Data Computing and Analytics
Hours: 3
Big Data computing is a new computing paradigm, involving analysis of large quantities of data in industry and science communities. It has led to the development of large distributed systems with thousands of computing servers and disks connected over a high-speed network. For such distributed systems, there are several challenges of performance, scalability, and reliability as well as data storage. The goal of this course is to study modern technologies that are used to construct big-data computing systems and methods and tools for big-data analytics. Topics of interest include big-data computing paradigms, big-data storage, and big-data analytics. Prerequisites: CSCI 515 or Instructor Approval.

CSCI 574 - Machine Learning
Hours: 3
Study of computer algorithms that automatically acquire new knowledge and improve their own performance through experience. Theory and practical implementation of algorithms for machine learning. Topics include linear and logistic regression, artificial neural networks, Bayesian networks and learning, decision trees, kernel / support-vector machines, statistical learning methods, unsupervised learning, reinforcement learning, and other modern, emerging algorithms. Short programming assignments and/or projects with hands-on experiments with various learning algorithms will be given. Prerequisites: CSCI 515 or Instructor Approval.

CSCI 575 - IoT Security
Hours: 3
This course introduces security topics in Internet of Things (IoT). Topics discussed in the course will include introduction to IoT, IoT applications, IoT architecture and endpoint devices, mobile applications, and cloud platforms. This course will also discuss the threats against IoT components with countermeasures defeating the threats. Prerequisites: CSCI 525.

CSCI 576 - Computer Vision
Hours: 3
This course will introduce Computer Vision. Topics include the fundamental theory and techniques of digital image representation, modeling and processing; edge and feature detection; segmentation and recognition; motion estimation, etc. This course will also introduce state-of-art methods in Computer Science research and applications such as face detection, text recognition, and object classification. Prerequisites: CSCI 515 or CSCI 513.

CSCI 581 - Network Security
Hours: 3
This course provides key concepts in network security. Topics include overview of TCP/IP networks; cryptography including symmetric/asymmetric ciphers, cryptographic hash functions, message authentication codes, and digital signatures; mutual trust including key distribution and user authentication protocols; network and Internet security; and network system security including firewalls. Prerequisites: CSCI 525.

CSCI 589 - Independent Study
Hours: 1-4
Independent Study. One to four semester hours. Individualized instruction/research at an advanced level in a specialized content area under the direction of a faculty member. No more than three hours of independent study may be counted towards the degree. Prerequisite: Consent of department head and supervising faculty member.

CSCI 595 - Research Literature and Techniques
Hours: 3
A course designed to acquaint the student with the role of research in the initiation, development and modification of concepts and theories in computer science. A final written report and presentation and/or demonstration of results obtained during the course will be made to interested faculty members and students. Prerequisite: Completion of the core courses and instructor approval.

CSCI 597 - Special Topics
Hours: 1-4
Organized class in a specialized area of current interest. May be repeated when topics vary. The naming convention of this course is defined as: <prefix>:<topic-title>, where prefix refers to the category/specialization (e.g., {“General CS”, “AI & Data Science”, “Cybersecurity”} and topic-title refers to the subject of the topic.