CS-419. PRINCIPLES OF PROGRAMMING LANGUAGES  
Credits: 3  
A study of the principles that govern the design and implementation of programming languages. Topics include language structure, data types, and control structures. Programming projects will familiarize students with the features of programming languages through their implementation in interpreters.  
Pre-Requisites  
[[CS-226]] or equivalent

CS-421. SIMULATION AND DATA ANALYSIS  
Credits: 3  
Methods of handling large databases including statistical analysis and computer simulations. The emphasis will be upon discrete simulation models with a discussion of relevant computer languages, SLAM, GPSS, and/or SIMSCRIPT.  
Pre-Requisites  
[[CS-125]] (or the equivalent programming experience) and one semester of calculus.

CS-423. THEORY OF COMPUTATION  
Credits: 3  
This course formalizes many topics encountered in previous computing courses. Topics include: languages, grammars, finite automata, regular expressions and grammars, context-free languages, push-down automata, Turing machines and computability.  
Pre-Requisites  
[[MTH-232]] (Discrete Mathematics II) and [[CS-126]] (or the equivalent programming experience).

CS-424. SYSTEMS ANALYSIS  
Credits: 3  
A study of the design and implementation of large computer projects. Special emphasis is placed on applications to business systems. Students will use a CASE tool for automated systems analysis and design.  
Pre-Requisites  
[[CS-226]] or equivalent

CS-425. DATABASE MANAGEMENT  
Credits: 3  
Practical experience in solving a large-scale computer problem including determination of data requirements, appropriate data organization, data manipulation procedures, implementation, testing and documentation.  
Pre-Requisites  
[[CS-126]] or permission of the instructor.

CS-426. OPERATING SYSTEM PRINCIPLES  
Credits: 3  
Analysis of the computer operating systems including Batch, Timesharing, and Realtime systems. Topics include sequential and concurrent processes, processor and storage management, resource protection, processor multiplexing, and handling of interrupts from peripheral devices.  
Pre-Requisites  
[[CS-226]] or equivalent

CS-427. COMPILER DESIGN  
Credits: 3  
A study of compiler design including language definition, syntactic analysis, lexical analysis, storage allocation, error detection and recovery, code generation and optimization problems.  
Pre-Requisites  
[[CS-226]] or equivalent

CS-428. ALGORITHMS  
Credits: 3  
Theoretical analysis of various algorithms. Topics are chosen from sorting, searching, selection, matrix multiplication and multiplication of real numbers, and various combinational algorithms.  
Pre-Requisites  
[[CS-226]] or equivalent and [[MTH-232]] (Discrete Mathematics II).

CS-430. COMPUTER ARCHITECTURE  
Credits: 3  
A study of the design, organization, and structure of computers, ranging from the microprocessors to the latest ‘supercomputers.’  
Pre-Requisites  
[[CS-226]] or equivalent

CS-434. SOFTWARE ENGINEERING  
Credits: 3  
A course in ‘programming in the large.’ Topics include software design, implementation, validation, maintenance and documentation. There will be one or more team projects. Prerequisite [[CS-226]] or equivalent

CS-435. ADVANCED DATABASE CONCEPTS  
Credits: 3  
Practical experience involving unstructured data collections. Topics cover big data, data mining, predictive modeling, decision analysis, and indexing and retrieval including probabilistic, clustering, thesauri, and passage based retrieval strategies.  
Pre-Requisites  
[[CS-325]] (Database Management) or CS340 Artificial Intelligence
CS-440. ARTIFICIAL INTELLIGENCE  
Credits: 3  
This course will provide an overview of artificial intelligence (AI) application areas and hands-on experience with some common AI computational tools. Topics include search, natural language processing, theorem proving, planning, machine learning, robotics, vision, knowledge-based systems (expert systems), and neural networks.

Pre-Requisites  
[[CS-126]] (Unix) and equivalent programming experience in a high-level language.

CS-450. OBJECT-ORIENTED PROGRAMMING  
Credits: 3  
Object-oriented concepts and their application to human-computer interaction. Concepts to be covered include objects, classes, inheritance, polymorphism, design patterns, GUI interface guidelines and design of interfaces. There will be programming projects in object-oriented languages.

Pre-Requisites  
[[CS-226]] or equivalent

CS-455. COMPUTER NETWORKS  
Credits: 3  
This course introduces basic concepts, architecture, and widely used protocols of computer networks. Topics include the Open System Interconnection (OSI) model consisting of physical link layer, data layer, network layer, transport layer, session layer, presentation layer, and application layer, medium access sublayer and LAN; various routing protocols; Transmission Control Protocol (TCP) and Internet Protocol (IP) for internetworking.

Pre-Requisites  
Either [[CS-225]] and [[CS-246]]

CS-463. OPERATIONS RESEARCH  
Credits: 3  
A survey of operations research topics such as decision analysis, inventory models, queueing models, dynamic programming, network models, and linear programming. (Cross-listed with [[MTH-463]])

Pre-Requisites  
Programming experience in a high-level language and completion of one semester of calculus.

CS-464. NUMERICAL ANALYSIS  
Credits: 3  
An introduction to numerical algorithms as tools to providing solutions to common problems formulated in mathematics, science, and engineering. Focus is given to developing the basic understanding of the construction of numerical algorithms, their applicability, and their limitations. (Cross-listed with [[MTH-464]])

Pre-Requisites  
Programming experience in a high-level language and completion of a one-year calculus sequence.

CS-467. COMPUTER GRAPHICS  
Credits: 3  
Introduction to equipment and techniques used to generate graphical representations by computer. Discussion of the mathematical techniques necessary to draw objects in two and three-dimensional space. Emphasis on application programming and the use of a high-resolution color raster display.

Pre-Requisites  
[[CS-226]] or equivalent

CS-483. WEB DEVELOPMENT  
Credits: 3  
An introduction to the development of dynamic, database-driven sites, including active server pages, PHP, authentication, session tracking and security, and the development of shopping cart and portal systems.

Pre-Requisites  
[[CS-283]] (Web Development I) and [[CS-325]] (Database Management).

CS-498. TOPICS IN COMPUTER SCIENCE  
Credits: variable  
Variable creditStudy of one or more special topics in computer science. May be repeated for credit provided a different topic is selected.