**COMPUTER SCIENCE (CSC)**

**CSC 100 The Beauty and Joy of Computing 3**
A broad-based introduction to key concepts and principles of computer science. Exploration of seven big ideas of computing: creativity, abstraction, data, algorithms, programming, the Internet, and impact of computing.

**CSC 101 Introduction to Computer Concepts 3**
Introduction to computers and computing. Topics cover impact of computers on society, ethical issues, hardware, and software applications.

**CSC 110 Computational Problem Solving 3**
Using computing to apply mathematical concepts in developing algorithmic solutions to real-world problems, stressing analysis and logical reasoning. A modern programming language will be introduced for examples and assignments.

**CSC 120 Introduction to Computer Programming for Non-Majors 3**
Introduction to computer programming for non-computer science majors, including programming concepts of variables, expressions, decision statements, iteration, functions, and modular design. Language and applications chosen to be relevant to non-majors.

**CSC 130 Introduction to Computer Science 3**
Programming in a high-level language. Emphasis on problem analysis, problem-solving techniques, and software design principles and techniques.

**CSC 230 Elementary Data Structures and Algorithms 3**

**CSC 250 Foundations of Computer Science I 3**
An introduction to the fundamental ideas underlying contemporary computer science with a focus on the computation and construction of objects.

**CSC 261 Computer Organization and Assembly Language 3**
Introduction to the organization of the computer through the use of Assembly Language programming. Data representation, parts of the computer system, Assembly Language fundamentals, instruction sets, memory, and floating-point operations.

**CSC 300X Experimental Course 1-6**
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

**CSC 312 Ethics in Computer Science 1**
Historical and social context of computing, ethical responsibilities of the computing professional, intellectual property rights, and risks and liabilities.

**Prerequisites:** Grade of at least C (2.0) in CSC 230 and in CSC 250, or permission of instructor.

**Notes:** Computer Science majors only.

**CSC 330 Advanced Data Structures 3**

**Prerequisites:** Grade of at least C (2.0) in CSC 230 and in CSC 250.

**CSC 339 Concepts of Programming Languages 3**
Concepts of block-structured, object-oriented, functional, logic, and concurrent programming languages. Comparative study of syntactic and semantic features of these languages and writing programs using them.

**Prerequisites:** Grade of at least C (2.0) in CSC 330.

**CSC 340 Software Engineering 3**
Practical and theoretical concepts of software engineering.

**Prerequisites:** Grade of at least C (2.0) in CSC 330.

**CSC 350 Foundations of Computer Science II 3**
High level concepts in the theoretical foundations of computer science.

**Prerequisites:** Grade of at least C (2.0) in CSC 250, or permission of instructor.

**CSC 400X Experimental Course 1-6**
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

**CSC 405 Data Science 3**
Problem-based learning introduction to Data Science, including programming with data; data mining, munging, and wrangling; statistics, analytics, visualization; and applied machine learning, directed towards scientific, social, and environmental challenges.

**Prerequisites:** A grade of C or better in CSC 330 and (STA 271 or STA 290), or permission of instructor (prior programming and statistics experience is required).

**CSC 407 Network Analysis 3**
Concepts and methods of network analysis, including network data extraction, management, model, visualization, and analysis of network structure and dynamics.

**Prerequisites:** Grade C or better in CSC 330, or permission of instructor.

**CSC 410 Big Data and Machine Learning 3**
Big data definitions and characteristics, computing environment for big data management and processing, machine learning models and algorithms, and scaling up machine learning (high dimensionality reduction).

**Prerequisites:** CSC 330. MAT 191; STA 271; Corequisites: CSC 477. MAT 292.

**CSC 415 Computer Graphics 3**
Survey of graphics algorithms, data structures, and techniques.

**Prerequisites:** Grades of at least C (2.0) in CSC 340, CSC 350, and MAT 292, or permission of instructor.

**CSC 416 Digital Image Processing 3**
Image representation, enhancement, compression, coding, restoration, and wavelet transforms.

**Prerequisites:** Grades of at least C (2.0) in CSC 330, CSC 350, and MAT 292, or permission of instructor. Successful completion of STA 271 or STA 290 recommended.
CSC 425 Bioinformatics 3
Introduction to the problems and methods in Bioinformatics. Problem areas include restriction mapping, map assembly, sequencing, DNA arrays, and sequence comparison.
Prerequisites: Permission of instructor.

CSC 427 Numerical Analysis and Computing 3
Number systems and errors, solutions of non-linear and linear systems, interpolation, numerical differentiation and integration, solution of differential equations. Implementation of numerical methods using a high-level programming language.
Prerequisites: Grades of at least C (2.0) in CSC 350 and MAT 293, or permission of instructor.

CSC 429 Artificial Intelligence 3
Logical foundations, knowledge representation and reasoning, search, and selected topics such as natural language processing and reasoning under uncertainty.
Prerequisites: Grade of at least C (2.0) in CSC 330 and CSC 350 or permission of instructor.

CSC 439 Introduction to Compiler Design 3
Basic techniques of compiler design and implementation: lexical analysis, parsing, code generation. Sizable programming project implementing a compiler for a block-structured language with strong typing.
Prerequisites: Grades of at least C (2.0) in CSC 261 and CSC 330 or permission of instructor.

CSC 442 Human-Computer Interface Development 3
Survey of concepts and techniques for human-computer interface development. Topics include user-centered design, user interface programming, and usability evaluation.
Prerequisites: Grades of at least C (2.0) in CSC 340 or permission of instructor.

CSC 452 Theory of Computation 3
Finite state automata and regular expressions, context-free grammars, push-down automata and their use in parsing, overview of language translation systems, models for programming language semantics, computability and undecidability.
Prerequisites: Grade of at least C (2.0) in CSC 350. or permission of instructor.

CSC 454 Algorithm Analysis and Design 3
Sequential algorithm design and complexity analysis. Dynamic programming. Greedy algorithms. Graph algorithms. Selected advanced topics from NP-completeness; approximation, randomized, parallel, number-theoretic algorithms; Fast Fourier Transform; computational geometry; string matching.
Prerequisites: Grade of at least C (2.0) in CSC 330.

CSC 461 Principles of Computer Architecture 3
Hardware and software components of computer systems, their organization and operations. Topics: comparative instruction set architectures, microprogramming, memory management, processor management, I/O, interrupts, and emulation of processors.
Prerequisites: Grades of at least C (2.0) in CSC 261, CSC 330, and CSC 350, or permission of instructor.

CSC 462 Principles of Operating Systems 3
Techniques and strategies used in operating system design and implementation: managing processes, input/output, memory, scheduling, file systems, and protection.
Prerequisites: Pr. grades of at least C (2.0) in CSC 261 and CSC 340 or permission of instructor.

CSC 471 Principles of Database Systems 3
Contemporary database systems. Emphasis on query processing, design, and implementation of applications in relational (SQL) databases. Introduction to other database models such as XML, object-oriented, and deductive.
Prerequisites: Grade of at least C (2.0) in CSC 330, or permission of instructor.

CSC 477 Principles of Computer Networks 3
Hardware and software components of computer networks, their organization and operations. Topics: open system interconnection; local area networks; TCP/IP internetworking, routing, and packet switching; network programming.
Prerequisites: Grades of at least C (2.0) in CSC 261 and CSC 330, or permission of instructor.

CSC 478 Principles of Wireless Networks 3
Digital communications, communication networks, wireless communication technology, wireless networking, wireless LANs, and wireless network programming.
Prerequisites: Grades of at least C (2.0) in CSC 330 and CSC 477, or permission of instructor.

CSC 481 Principles of Computer Security 3
Core concepts in computer security, including the security goals of confidentiality, integrity, and availability; authentication; access control; security software development; use of cryptography; and basic network security.
Prerequisites: Grade of C or better in CSC 261 and CSC 330, or permission of instructor.

CSC 485 Modern Cryptography 3
Theory and practice of cryptography, emphasizing formal models and security reasoning. Primitives covered include private and public-key encryption, message authentication codes, hash functions, digital signatures, secret sharing, and zero-knowledge proofs.
Prerequisites: A grade of C or better in CSC 481, or permission of instructor.

CSC 487 Network Security 3
The course explores the network security concepts of communication protocols; security in routing; remote authentication; access policies; web security; network vulnerabilities; intrusion detection and prevention; and network traffic analysis.
Prerequisites: Grade of C or better in CSC 481 or permission of instructor.

CSC 490 Senior Capstone 3
Application of classroom knowledge and skills in computer science to solve real-world problems and to develop research and development skills.
Prerequisites: Permission of instructor. student must be in the final semester of major coursework.

CSC 492 Directed Study in Computer Science 1-3
Directed Study in Computer Science.
CSC 493 Honors Work in Computer Science 3
Research in a topic of special interest at the Honors level.
**Prerequisites:** Permission of instructor.
**Notes:** May be repeated for credit when topic changes.

CSC 494 Directed Study in Computer Science 1-3
Notes: Grade: Pass/Not Pass (P/NP).

CSC 495 Selected Topics in Computer Science 3
A topic of special interest is studied in depth.
**Prerequisites:** Junior standing and permission of instructor.
**Notes:** May be repeated for credit for a total of 6 s.h. when topic of study changes.

CSC 600X Experimental Course 1-6
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

CSC 605 Data Science 3
Problem-based learning introduction to Data Science, including programming with data; data mining, munging, and wrangling; statistics, analytics, visualization; and applied machine learning, directed towards scientific, social, and environmental challenges.
**Prerequisites:** A grade of C or better in CSC 330 and (STA 271 or STA 290), or permission of instructor (prior programming and statistics experience is required).

CSC 607 Network Analysis 3
Concepts and methods of network analysis, including network data extraction, management, model, visualization, and analysis of network structure and dynamics.
**Prerequisites:** Permission of Instructor.

CSC 610 Big Data and Machine Learning 3
Big data definitions and characteristics, computing environment for big data management and processing, machine learning models and algorithms, and scaling up maching learning (high dimensionality reduction).
**Prerequisites:** CSC 330. MAT 191; STA 271; Corequisites: CSC 567. MAT 292.

CSC 615 Computer Graphics 3
Survey of graphics algorithms, data structures, and techniques.
**Prerequisites:** Grades of at least C (2.0) in CSC 340, CSC 350, and MAT 292, or permission of instructor.

CSC 616 Digital Image Processing 3
Image representation, enhancement, compression, coding, restoration, and wavelet transforms.
**Prerequisites:** Grades of at least C (2.0) in CSC 330, CSC 350, and MAT 292, or permission of instructor. Successful completion of STA 271 or STA 290 recommended.

CSC 625 Bioinformatics 3
Introduction to the problems and methods in Bioinformatics. Problem areas include restriction mapping, map assembly, sequencing, DNA arrays, and sequence comparison.
**Prerequisites:** Permission of instructor.

CSC 627 Numerical Analysis and Computing 3
Number systems and errors, solutions of non-linear and linear systems, interpolation, numerical differentiation and integration, solution of differential equations. Implementation of numerical methods using a high-level programming language.
**Prerequisites:** Grades of at least C (2.0) in CSC 350 and MAT 293, or permission of instructor.

CSC 629 Artificial Intelligence 3
Logical foundations, knowledge representation and reasoning, search, and selected topics such as natural language processing and reasoning under uncertainty.
**Prerequisites:** Grade of at least C (2.0) in CSC 330 and CSC 350 or permission of instructor.

CSC 639 Introduction to Compiler Design 3
Basic techniques of compiler design and implementation: lexical analysis, parsing, code generation. Sizable programming project implementing a compiler for a block-structured language with strong typing.
**Prerequisites:** Grades of at least C (2.0) in CSC 261 and CSC 330 or permission of instructor.
**Notes:** Successful completion of CSC 553 helpful.

CSC 640 Software Engineering 3
Organization and scheduling of software engineering projects and structured software design. Specification methods, metrics, software engineering tools, design, prototyping, version control, and testing.
**Prerequisites:** CSC 330 or permission of instructor.

CSC 642 Human-Computer Interface Development 3
Survey of concepts and techniques for human-computer interface development. Topics include user-centered design, user interface programming, and usability evaluation.
**Prerequisites:** Grades of at least C (2.0) in CSC 340 or permission of instructor.

CSC 652 Theory of Computation 3
Finite state automata and regular expressions, context-free grammars, push-down automata and their use in parsing, overview of language translation systems, models for programming language semantics, computability and undecidability.
**Prerequisites:** Grade of at least C (2.0) in CSC 350. or permission of instructor.

CSC 653 Advanced Theory of Computation 3
Computability theory including Church-Turing thesis (Turing machines, variants, other models), decidability (decidable and undecidable problems for automata and grammars, the halting problem), reducibility (undecidability of mathematical truth).
**Prerequisites:** CSC 553, or permission of instructor.

CSC 654 Algorithm Analysis and Design 3
Sequential algorithm design and complexity analysis. Dynamic programming. Greedy algorithms. Graph algorithms. Selected advanced topics from NP-completeness; approximation, randomized, parallel, number-theoretic algorithms; Fast Fourier Transform; computational geometry; string matching.
**Prerequisites:** Grade of at least C (2.0) in CSC 330.

CSC 655 Advanced Topics in Algorithms 3
Modern development of algorithm design and analysis for sequential and parallel computers; parallel, number-theoretic, probabilistic, and approximation algorithms, string matching, computational geometry, NP-completeness: worst-case versus average-case.
**Prerequisites:** Grade of at least C in CSC 555.

CSC 656 Foundations of Computer Science 3
Introduces the mathematical foundations that support advanced studies in computer science including computer programming and the analysis of algorithms.
**Prerequisites:** CSC 350 or permission of instructor.
CSC 661 Principles of Computer Architecture 3
Hardware and software components of computer systems, their organization and operations. Topics: comparative instruction set architectures, microprogramming, memory management, processor management, I/O, interrupts, and emulation of processors.
Prerequisites: Grades of at least C (2.0) in CSC 261, CSC 330, and CSC 350, or permission of instructor.

CSC 662 Principles of Operating Systems 3
Techniques and strategies used in operating system design and implementation: managing processes, input/output, memory, scheduling, file systems, and protection.
Prerequisites: Pr. grades of at least C (2.0) in CSC 261 and CSC 340 or permission of instructor.
Notes: Successful completion of CSC 561 helpful.

CSC 663 Advanced Topics in Computer Systems 3
Prerequisites: CSC 330 and CSC 567 or CSC 561 or CSC 562 or permission of instructor.
Notes: May be repeated for credit when topics vary.

CSC 671 Advanced Database Systems 3
Prerequisites: CSC 330 or permission of instructor.

CSC 672 Database System Architecture 3
File organization and indexing techniques. Query processing and optimization. Concurrency control and crash recovery. Distributed and heterogeneous database systems. Selected topics of current interest in database and knowledge-base systems.
Prerequisites: CSC 570 or CSC 671, or permission of instructor.

CSC 676 Topics in Database Systems 3
Selected topics of current interest such as: deductive databases, modeling and management of uncertain and inaccurate information, multi-database systems, data mining, on-line analytical processing and data warehousing.
Prerequisites: CSC 671 or permission of instructor.

CSC 677 Principles of Computer Networks 3
Hardware and software components of computer networks, their organization and operations. Topics: open system interconnection; local area networks; TCP/IP internetworking, routing, and packet switching; network programming.
Prerequisites: Grades of at least C (2.0) in CSC 261 and CSC 330, or permission of instructor.

CSC 678 Principles of Wireless Networks 3
Digital communications, communication networks, wireless communication technology, wireless networking, wireless LANs, and wireless network programming.
Prerequisites: Grades of at least C (2.0) in CSC 330 and CSC 567, or permission of instructor.

CSC 681 Principles of Computer Security 3
Core concepts in computer security, including the security goals of confidentiality, integrity, and availability; authentication; access control; security software development; use of cryptography; and basic network security.
Prerequisites: Grade of C or better in CSC 261 and CSC 330, or permission of instructor.

CSC 685 Modern Cryptography 3
Theory and practice of cryptography, emphasizing formal models and security reasoning. Primitives covered include private and public-key encryption, message authentication codes, hash functions, digital signatures, secret sharing, and zero-knowledge proofs.
Prerequisites: Grade of C or better in CSC 581, or permission of instructor.

CSC 687 Network Security 3
The course explores the network security concepts of communication protocols, security in routing, remote authentication, access policies, web security, network vulnerabilities, intrusion detection and prevention, and network traffic analysis.
Prerequisites: Grade of C or better in CSC 581 or permission of instructor.

CSC 692 Directed Study in Computer Science 1-3
Directed Study in Computer Science.

CSC 693 Advanced Topics in Computer Science 3-6
Algorithms, architecture, languages, systems, theory, or other areas of computer science.
Prerequisites: Permission of instructor.
Notes: May be repeated once for credit.

CSC 694 Directed Study in Computer Science 1-3
Notes: Grade: Pass/Not Pass (P/NP).

CSC 697 Research Problems in Computer Science 3
Advanced research in specialized areas of computer science under the direction of a faculty member. Preparation for master's thesis.
Prerequisites: Permission of instructor.
Notes: Grade: Satisfactory/Unsatisfactory (S/U).

CSC 698 Project in Computer Science 3-6
Prerequisite: Permission of instructor;
Notes: May be repeated for up to 6 credit hours with permission of instructor. Grade: Satisfactory/Unsatisfactory (S/U).

CSC 699 Thesis 1-6
Individual guidance in the development of a specific research problem.

CSC 750X Experimental Course 1-6
This number reserved for experimental courses. Refer to the Course Schedule for current offerings.

CSC 801 Thesis Extension 1-3
Thesis Extension.

CSC 803 Research Extension 1-3
Research Extension.