COMPUTER SCIENCE (COMP)

COMP 100 | INTRODUCTORY COMPUTER PROGRAMMING
Units: 3 Repeatability: No
An elementary introduction to computer programming and applications for non-majors and non-minors. Computer organization; problem solving; algorithms; structured programming in a simple computer language; computer applications; and current issues and trends in computer science. This course does not satisfy any of the requirements for the computer science major or minor and is not a substitute for COMP 110.

COMP 110 | COMPUTATIONAL PROBLEM SOLVING
Units: 3.5 Repeatability: No
Core Attributes: First Yr Integration (LC Only)
Prerequisites: MATH 115 with a minimum grade of C- or MATH 130 (Can be taken Concurrently) or MATH 133 (Can be taken Concurrently) or MATH 150 (Can be taken Concurrently) or MATH 151 (Can be taken Concurrently)
An introduction to computational problem solving using the Python programming language. Students will learn the basic elements of programming (e.g. conditionals, loops, inputs/outputs), modular program design, and the basics of data abstraction through object-oriented programming.

COMP 120 | PROGRAMMING ABSTRACTIONS AND METHODOLOGIES
Units: 3.5 Repeatability: No
Prerequisites: COMP 110 with a minimum grade of C-
A continued exploration of computational problem solving, with a focus on using abstraction to manage program complexity. Students will learn to use both functional and data abstractions, analyze the time and space complexity of algorithms, and utilize functional, object-oriented, and event-driven paradigms within their programs.

COMP 160 | PROGRAMMING LANGUAGES
Units: 1-3 Repeatability: Yes (Can be repeated for Credit)
Prerequisites: COMP 110 with a minimum grade of C-
Introduction to a particular high-level programming language such as C, C++, Java, Ruby, MATLAB, and Maple. Programming assignments appropriate to the language studied. This course does not satisfy any of the requirements for the major in computer science.

COMP 230 | ADVANCED COMPUTATIONAL PROBLEM MODELING
Units: 3.5 Repeatability: No
Prerequisites: COMP 120 with a minimum grade of C- and (MATH 260 with a minimum grade of C- or MATH 262 with a minimum grade of C-)
Advanced data structures (e.g. graphs, priority queues, quad trees, etc.) from the perspective of solving advanced computational problems. Students will learn to program in the Java programming language using object-oriented features such as inheritance, interfaces and generics.

COMP 280 | INTRODUCTION TO COMPUTER SYSTEMS
Units: 3.5 Repeatability: No
Prerequisites: COMP 120 with a minimum grade of C-
Introduction to computer systems; data representation; machine/assembly languages; memory organization; virtual memory; and concurrency.

COMP 294 | SPECIAL TOPICS IN COMPUTER SCIENCE
Units: 1-4 Repeatability: Yes (Can be repeated for Credit)
Special topics course in areas of special interest to computer science. May be repeated for credit with a different topic.

COMP 299 | INDEPENDENT STUDY
Units: 1-3 Repeatability: Yes (Can be repeated for Credit)
Individual study including library or laboratory research or program writing. A written report is required. Project proposal must be submitted and approved prior to enrollment. May be repeated for credit.

COMP 300 | PRINCIPLES OF DIGITAL HARDWARE
Units: 3.5 Repeatability: No
Prerequisites: (MATH 160 with a minimum grade of C- or MATH 260 with a minimum grade of C- or MATH 222 with a minimum grade of C- or MATH 262 with a minimum grade of C-) and COMP 280 with a minimum grade of C-
Combinational and sequential logic, registers, arithmetic units. Introduction to computer architecture. Three lectures and one laboratory per week.

COMP 305 | OBJECT-ORIENTED SOFTWARE DESIGN
Units: 3.5 Repeatability: No
Core Attributes: Advanced writing competency
Prerequisites: COMP 230 with a minimum grade of C-
In this course, we will focus on how we can use object-oriented principles including inheritance, encapsulation, abstraction, and polymorphism to develop robust software projects. You will learn how to use design patterns and frameworks within your projects and engage in best practices for software design including writing clean code, conducting code reviews, and refactoring code. As part of this process, you will learn how to design your project and classes, write robust tests, and document your projects in a way that allows you to effectively communicate the project to others.

COMP 310 | OPERATING SYSTEMS
Units: 3.5 Repeatability: No
Prerequisites: COMP 280 with a minimum grade of C-
Principles of computer operating systems; process management; memory management; file systems; protection; deadlock. Concurrent programming.

COMP 331 | USER-CENTERED DESIGN AND PROTOTYPING
Units: 3 Repeatability: No
Core Attributes: Oral communication competency
Prerequisites: COMP 110 with a minimum grade of C-
To develop effective software products, Human-Computer Interaction (HCI) methods are needed to align user needs with the product design. Some considerations in this design are how to maximize usefulness and enjoyment while reducing frustration and human error. HCI methods draw from a range of disciplines including computer science, cognitive science, and design. In this course, we will engage in a user-centered approach to this design problem including ideation, evaluation of systems based on design principles, gathering and evaluation of user needs, and rapid prototyping and testing of designs.

COMP 332 | HUMAN-CENTERED SYSTEMS
Units: 3 Repeatability: No
Prerequisites: COMP 120 with a minimum grade of C-
Computing systems are everywhere in our daily lives as tools to complete tasks and guiding our decisions through providing information. In this course, we will discuss the interaction techniques through which we use these systems. As part of this conversation we will discuss different forms of human-centered systems such as personal computing, VR/AR, robotics, ubiquitous computing, and social computing and principles of human factors that guide the design of these systems.

COMP 333 | HUMAN-CENTERED DATA SCIENCE
Units: 3 Repeatability: No

Prerequisites: COMP 110 with a minimum grade of C- and (MATH 115 with a minimum grade of C- or MATH 130 with a minimum grade of C- or MATH 133 with a minimum grade of C- or MATH 150 with a minimum grade of C-)

Data is constantly being collected through our everyday computing devices and one question is what do we do with it. With human-centered systems, data can be used to both provide users with a better experience, test the current experience, and provide information to the user. In this class, we will address how to measure the effectiveness of a user system - including the collection of data and testing, the use of machine learning to support human behaviors, and how to visualize data for humans to interpret along with the ethics of this data collection and use.

COMP 340 | NUMERICAL ANALYSIS
Units: 3 Repeatability: No

Prerequisites: (COMP 110 with a minimum grade of C- or MATH 150 with a minimum grade of C-) and MATH 151 with a minimum grade of C-

Approximate computations and round-off errors; Taylor expansions; numerical solution of equations and systems of equations; systems of linear equations; numerical integration; numerical solution of differential equations; interpolation; and problem solving on the computer.

COMP 341 | NUMERICAL ANALYSIS II
Units: 3

Prerequisites: MATH 250 with a minimum grade of C- and MATH 320 with a minimum grade of C- and MATH 330 with a minimum grade of C- (Can be taken Concurrently) and COMP 340 with a minimum grade of C-

Estimation of eigenvalues and eigenvectors of matrices; numerical solutions of differential equations, existence, and stability theory; and computer lab assignments. Prereq: MATH 250, 320, 330 (may be taken concurrently), and COMP 340, all with a grade of C- or better. Cross-listed as MATH 341.

COMP 345 | DATABASE MANAGEMENT SYSTEMS DESIGN
Units: 3 Repeatability: No

Prerequisites: COMP 230 with a minimum grade of C-

Introduction to database concepts; data models; query facilities; and file organization and security.

COMP 350 | COMPUTER GRAPHICS
Units: 3 Repeatability: No

Prerequisites: COMP 230 with a minimum grade of C- and MATH 320 with a minimum grade of C-

The development of high-level, device-independent graphics routines; basic line drawing algorithms, text design, and other graphics primitives; 2-D representations of coordinate systems, image segmentation, and windowing.

COMP 351 | INTRODUCTION TO ARTIFICIAL INTELLIGENCE
Units: 3 Repeatability: No

Prerequisites: COMP 110 with a minimum grade of C- (Can be taken Concurrently)

Recent advances in big data, computational power, smart homes, and autonomous vehicles have rendered artificial intelligence (AI) as a major technological revolution in engineering and computer science. The goal of this course is to introduce students to the fundamental principles, techniques, challenges, and applications of AI, machine learning, and natural language processing. Topics covered include heuristic search and optimization techniques, genetic algorithms, machine learning, neural networks, and natural language understanding. Several applications of AI will be explored including computer vision, pattern recognition, image processing, biomedical systems, internet of things, and robotics.

COMP 352 | DATA SCIENCE FOUNDATIONS AND PROGRAMMING
Units: 3 Repeatability: No

Prerequisites: COMP 110

This course is an introduction to fundamental concepts of data science, data science programming, and problem-solving techniques for data-driven problems. Python and R are the languages used to analyze and deliver insights from real-world datasets in this course. Topics include the basics of R, the application of Python to data science, data acquisition, integration and transformation, problem understanding, data preparation, standardization, and exploratory data analysis. In addition, command-line tools and editors are explored in UNIX, and methods to access and analyze RDBMS databases are examined. The course ends with introducing students to the basics of machine learning models.

COMP 355 | DIGITAL MODELING AND SIMULATION
Units: 3

Prerequisites: MATH 151 with a minimum grade of C- and COMP 305 with a minimum grade of C-

Mathematical modeling; probabilistic and deterministic simulations; pseudo-random number generators; event generators; queuing theory; game theory; and continuous models involving ordinary and partial differential equations. Prereq: COMP 305 with a grade of C- or better and MATH 151 with a grade of C- or better.

COMP 360 | PRINCIPLES OF PROGRAMMING LANGUAGES
Units: 3 Repeatability: No

Prerequisites: COMP 230 with a minimum grade of C- and (MATH 260 with a minimum grade of C- or MATH 262 with a minimum grade of C-)

The organization of programming languages with emphasis on language semantics; language definition, data types, and control structures of various languages.

COMP 365 | PRINCIPLES OF INFORMATION SECURITY
Units: 3 Repeatability: No

Prerequisites: COMP 280 with a minimum grade of C-

Introduction to fundamental concepts in cyber security: policies, threats, vulnerabilities, risk and controls; Identification and authentication; Access control; Cryptographic mechanisms: Ciphers, hashes, message authentication codes, and digital certificates; Malware, infection vectors, and mitigations; Attacks on various application domains, such as web applications; Tools and techniques for developing secure software.

COMP 370 | AUTOMATA, COMPUTABILITY AND FORMAL LANGUAGES
Units: 3 Repeatability: No

Prerequisites: COMP 230 with a minimum grade of C- and (MATH 260 with a minimum grade of C- or MATH 262 with a minimum grade of C-)

Finite state machines; formal grammars; computability and Turing machines.

COMP 375 | NETWORKING
Units: 3.5 Repeatability: No

Prerequisites: COMP 280 with a minimum grade of C-

Introduction to the design and implementation of computer and communication networks. The focus is on the concepts and the fundamental design principles that have contributed to the global Internet's success. Topics covered will include MAC layer design (Ethernet/802.11), the TCP/IP protocol stack, routing algorithms, congestion control and reliability, and applications (HTTP, FTP, etc.) and advanced topics such as peer-to-peer networks and network simulation tools. Recent trends in networking such as multimedia networking, mobile/cellular networks and sensor networks will also be discussed. Prereq: COMP 280 with a grade of C- or better.

COMP 380 | NEURAL NETWORKS
Units: 3 Repeatability: No

Prerequisites: COMP 230 with a minimum grade of C- and MATH 320 with a minimum grade of C-

A study of the fundamental concepts, architectures, learning algorithms and applications of various artificial neural networks, including perceptron, Kohonen self organizing maps, learning vector quantization, backpropagation, and radial basis functions.

COMP 382 | INTRODUCTION TO DATA MINING
Units: 3 Repeatability: No

Prerequisites: COMP 230 with a minimum grade of C- and ISYE 330 with a minimum grade of C-

The course provides a comprehensive introduction to data mining with a primary focus on fundamental concepts, algorithms and applications of association analysis, classification and clustering modeling. It will also cover ethical issues related to data mining.

COMP 421 | EMBEDDED SOFTWARE DEVELOPMENT
Units: 3 Repeatability: No

Prerequisites: COMP 280 with a minimum grade of C-

Development of "bare metal" embedded software, running on a microcontroller with no operating system support. Real-time requirements for finishing tasks within a fixed interval of time and for responding to asynchronous events are emphasized, along with techniques for writing reliable code for a memory-constrained microcontroller. All code is written in C using freely available development tools.

COMP 422 | ADVANCED EMBEDDED SOFTWARE DEVELOPMENT
Units: 3 Repeatability: No

Prerequisites: COMP 421 with a minimum grade of C- or GENG 421 with a minimum grade of C-

Development of embedded software (firmware) using a real-time operating system (RTOS). Development of an application as a set of independent threads that communicate with each other via message queues and semaphores.

COMP 480 | ALGORITHMS
Units: 3 Repeatability: No

Prerequisites: COMP 230 with a minimum grade of C- and (MATH 260 with a minimum grade of C- or MATH 262 with a minimum grade of C-)

Advanced theory of algorithms. Topics may include: algorithm analysis; algorithm design techniques; and computational complexity.

COMP 491 | SENIOR PROJECT I
Units: 3 Repeatability: No

Prerequisites: COMP 305 with a minimum grade of C- and COMP 280 with a minimum grade of C-

Students will develop professional skills in realistic software design and engineering, including human/computer interface design techniques, software architecture, teamwork, and project management, incorporating technical and non-technical considerations. Work will prepare students for implementing, testing and documenting the project in COMP 492, Senior Project II.

COMP 492 | SENIOR PROJECT II
Units: 3 Repeatability: No
Core Attributes: Advanced Integration

Prerequisites: COMP 491

This course is the second semester of the required two semester senior capstone experience for the computer science majors. In this course, students working in teams integrate their training in computer science and other disciplines, to implement, test, and document a significant piece of software based on a design developed in the first semester of the capstone experience, COMP 491. Students document their work, and demonstrate it in multiple public venues.

COMP 494 | SPECIAL TOPICS IN COMPUTER SCIENCE
Units: 1-4 Repeatability: Yes (Can be repeated for Credit)

Special topics course in areas of special interest to computer science. May be repeated for credit with a different topic.

COMP 496 | UNDERGRADUATE RESEARCH
Units: 0.5-3 Repeatability: Yes (Can be repeated for Credit)

Faculty-directed undergraduate research in computer science. Problem proposal must be submitted and approved prior to enrollment. Written report required. Upper division standing in engineering. Prior approval by department chair is required. May be repeated for credit.

COMP 498 | INTERNSHIP
Units: 1-3 Repeatability: Yes (Can be repeated for Credit)
Non-Core Attributes: Experiential

Practical experience in the application of the principles of computer science. Students will be involved in a software or hardware project. Enrollment is arranged on an individual basis according to the student's interest, background, and the availability of positions. A written report is required. Units may not normally be applied toward the major or minor in computer science. COMP 498 may be repeated for a total of three units.

COMP 499 | INDEPENDENT STUDY
Units: 1-3 Repeatability: Yes (Can be repeated for Credit)

Individual study including library or laboratory research or program writing. A written report is required. Project proposal must be submitted and approved prior to enrollment. May be repeated for credit.