# Computer & Information Science & Engineering

Not all courses are offered every semester. Refer to the schedule of courses for each term’s specific offerings.

More Info (http://registrar.ufl.edu/soc)

Courses at the University of Florida, with the exception of specific foreign language courses and courses in the online Master of Arts in Mass Communication program, are taught in English.

## Department Information

The mission of the Department of Computer & Information Science & Engineering is to educate students, as well as the broader campus community, in the fundamental concepts of the computing discipline; to create and disseminate computing knowledge and technology; and to use expertise in computing to help society solve problems.

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## Curriculum

- Combination Degrees
- Computer and Information Science and Engineering Minor
- Computer Science UF Online
- Computer Science | CLAS
- Computer Science | Herbert Wertheim College of Engineering
- Digital Arts and Sciences | Bachelor of Science

Bachelor's degree programs are currently available through the College of Liberal Arts and Sciences and the Herbert Wertheim College of Engineering. A minor in computer and information science, master's degree programs and a Ph.D. program also are available.

*There are strict limitations on the use of CGS and survey courses in the programs offered by the department.*

College of Engineering degree program in computer engineering: Refer to the Herbert Wertheim College of Engineering section of the catalog for degree requirements; this program is offered by the CISE department.

The Herbert Wertheim College of Engineering offers two degrees in computer engineering: the CEN degree (computer engineering: software option) is offered by the CISE department and the CEE degree (computer engineering: hardware option) is offered by the ECE department.


The college also offers a computer science degree program through the CISE department.


College of Liberal Arts and Sciences degree program in computer science: refer to the College of Liberal Arts and Sciences section of the catalog for degree requirements.

## Courses

**CAP 3020 Theory and Practice of Multimedia Production 3 Credits**

**Grading Scheme:** Letter Grade

Combines the traditional media production pipeline and software engineering processes to synthesize an approach geared for the production of works incorporating both artistic and computational elements.

**Prerequisite:** CAP 3027.

**CAP 3027 Introduction to Digital Arts and Sciences 3 Credits**

**Grading Scheme:** Letter Grade

Synergy between art and computing through a programming-oriented exploration of fundamental concepts in multimedia.

**Prerequisite:** COP 3504 or COP 3503.

**CAP 3032 Interactive Modeling and Animation 1 3 Credits**

**Grading Scheme:** Letter Grade

Introduces programming and data structures for interactive two-dimensional multimedia applications. Representing form and transforms in two dimensions, capturing user actions and driving application behavior interactively. Graphical interfaces, image processing, automata and basic artificial intelligence.

**Prerequisite:** MAC 1147 or equivalent.

**CAP 3034 Introduction to Computer-Aided Animation 3 Credits**

**Grading Scheme:** Letter Grade


**Prerequisite:** MAC 1147 or equivalent.

**CAP 3220 Introduction to Computer-Aided Modeling 3 Credits**

**Grading Scheme:** Letter Grade


**Prerequisite:** MAC 1147 or equivalent.

**CAP 4053 Artificial Intelligence for Computer Games 3 Credits**

**Grading Scheme:** Letter Grade

Examines the use of A.I. in computer games. Topics include general A.I. knowledge, path finding, movement, tactics and planning, strategy, state machines, learning, dialogue, and emotions.

**Prerequisite:** COP 3530.

**CAP 4621 Artificial Intelligence and Heuristics 3 Credits**

**Grading Scheme:** Letter Grade

Introduces artificial intelligence concepts. Heuristic search, clause form logic, knowledge representation, reasoning and inference, overview of computer vision, planning, natural language, Lisp and Prolog. (M)

**Prerequisite:** COP 3530.

**CAP 4680 Knowledge-Based System: Theory and Practice 3 Credits**

**Grading Scheme:** Letter Grade

Concepts, theory and various applications for knowledge-based (expert) systems, reasoning schemes, knowledge representation, knowledge-based system tools, building knowledge bases, knowledge acquisition, reasoning under certainty and inexact reasoning.

**Prerequisite:** COP 3530.
CAP 4730 Computational Structures in Computer Graphics 3 Credits
Grading Scheme: Letter Grade
Studies the major topics in computer graphics: display and output technology, two and three dimensional manipulations; space curves and surfaces, hidden surface removal and shading models.
Prerequisite: COP 3530.

CAP 4770 Introduction to Data Science 3 Credits
Grading Scheme: Letter Grade
Introduces the basics of data science including programming for data analytics, file management, relational databases, classification, clustering, and regression; lays the foundation for big data applications ranging from social networks to medical and business informatics.
Prerequisite: COP 3530.

CDA 3101 Introduction to Computer Organization 3 Credits
Grading Scheme: Letter Grade
Organization of computing systems. Logical basis of computer structure. Machine representation of instructions and data, flow of control, and basic machine instructions. Assembly language programming. (M)
Prerequisite: (COP 3504 or COP 3503) and (MAC 2233 or MAC 2311 or MAC 3472) and COT 3100.

CDA 4102 Computer Architecture 3 Credits
Grading Scheme: Letter Grade
Introduces computer architecture and system organization including virtual memory supports cache, pipeline, vector processing, multiprocessor and RISC architecture.
Prerequisite: CDA 3101 and COP 3530.

CDA 4630 Embedded Systems 3 Credits
Grading Scheme: Letter Grade
CEN 3031 Introduction to Software Engineering 3 Credits
Grading Scheme: Letter Grade
Topics include software planning, specifications, coding, testing and maintenance. Gain experience in the team approach to large system development. (M)
Prerequisite: COP 3530.

CEN 3907C Computer Engineering Design 1 3 Credits
Grading Scheme: Letter Grade
Reinforce basic computer engineering skills; design, produce, and report on a computer engineering project, meeting defined specifications and using a structured design methodology and project management.
Prerequisite: CEN 3031 and EEL 3744C with minimum grades of C.

CEN 3908C Computer Engineering Design 2 3 Credits
Grading Scheme: Letter Grade
Selected capstone design projects involving engineering applications in the various areas of computer engineering. Must be taken prior to the semester of graduation.
Prerequisite: CEN 3907C with minimum grade of C and senior standing.

CEN 3913 Computer and Information Science and Engineering Design 1 3 Credits
Grading Scheme: Letter Grade
Preparatory skills are developed for CISE Design 2 for Computer Engineering students. Teams design, produce and report on a software prototype, meeting defined specifications and using a structured design methodology and project management.
Prerequisite: CEN 3031.

CEN 4072 Software Testing and Verification 3 Credits
Grading Scheme: Letter Grade
Concepts, principles and techniques of software testing and verification. Strengths and limitations of black-box and white-box testing methods; techniques for proving the correctness of programs.
Prerequisite: CEN 3031.

CEN 4721 Human-Computer Interaction 3 Credits
Grading Scheme: Letter Grade
Studies the major topics in the study, planning and design of the interaction between people and computers. Topics include interface design (principles, theories and guidelines), virtual environments, interactive devices and collaboration.
Prerequisite: COP 3530.

CEN 4722 User Experience Design 3 Credits
Grading Scheme: Letter Grade
Introduces methods and tools used in User Experience Design (UXD): the early stages of software design focused on meeting user needs. Key concepts include user research, contextual design, design thinking, ideation, iterative design, prototyping, and design documentation. Projects utilize software tools used in the industry.
Prerequisite: COP 3530.

CEN 4725 Natural User Interaction 3 Credits
Grading Scheme: Letter Grade
Introduces the design, development and evaluation of Natural User Interaction (NUI) technologies (e.g., non-keyboard and mouse technologies such as touchscreen interaction, gesture interaction, speech interaction, etc.). Discussion of the hardware-to-software NUI pipeline and key considerations when developing NUI software, including existing platforms, toolkits and APIs used to create NUI software.
Prerequisite: COP 3530 with minimum grade of C.

CEN 4914 Computer and Information Science and Engineering Design 2 3 Credits
Grading Scheme: Letter Grade
Involves completing a significant CEN-related project. Coordinate with the instructor and a project advisor, prepare a detailed technical report and deliver an oral presentation.
Prerequisite: CEN 3913.

CGS 2032 Math, Art and Computing 3 Credits
Grading Scheme: Letter Grade
Introduces interdisciplinary computer science topics. Logic, discrete structures, algorithms and automata. Exploration of topics relating mathematics and computing to art, music and nature. (M)
Prerequisite: MAC 1147.
Attributes: General Education - Mathematics

CGS 3063 Computers and Modern Society 3 Credits
Grading Scheme: Letter Grade
Impact of computers on society. Discussion includes specific cases from many areas, but does not include problem solution. Does not teach how to use the computer but gives an understanding of the implications of computers. (S) (WR)
Attributes: General Education - Social Science, Satisfies 6000 Words of Writing Requirement

CGS 3065 Legal and Social Issues in Computing 3 Credits
Grading Scheme: Letter Grade
Explores the history, the myth, the ethics, the law and the risks of computer-based technology in modern society. Emphasizes critical analysis of hypotheticals and case studies. Published material is supplemented with online references.
Prerequisite: previous experience in Unix environment.
CIS 2354 Introduction to Cybersecurity 3 Credits

Grading Scheme: Letter Grade
Introduces many issues in cybersecurity including ubiquity of processors and communications in modern society, vulnerabilities of computers, networks, data, and embedded systems; privacy, risk management, social engineering, various attacks on computers and networked systems, attacks on user authentication systems. Expect weekly discussion of current topics.

CIS 4204 Penetration Testing: Ethical Hacking 3 Credits

Grading Scheme: Letter Grade
Introduces principles and techniques associated with the cybersecurity practice known as penetration testing or ethical hacking. Covers planning, reconnaissance, scanning, exploitation, post-exploitation, and result reporting. Discover how system vulnerabilities can be exploited and learn to avoid such problems.
Prerequisite: COP 3530.

CIS 4301 Information and Database Systems 1 3 Credits

Grading Scheme: Letter Grade
First part of a two-course sequence that studies the essential concepts, principles and techniques of modern database systems. Topics include modeling and querying of data using conceptual data models as well as the development of a database application. (M)
Prerequisite: (COP 3504 or COP 3503) and COT 3100.

CIS 4360 Computer and Information Security 3 Credits

Grading Scheme: Letter Grade
Covers systematic threat and risk assessment; programmed threats and controls in hardware, software, and human procedures; security policies, models, and mechanisms; theoretical limitations and practical implementations; certification and accreditation standards; and case study reviews. Includes projects.
Prerequisite: COP 4600 or equivalent.

CIS 4362 Introduction to Cryptology 3 Credits

Grading Scheme: Letter Grade
Introduces classical and modern cryptography and cryptanalysis, including symmetric and asymmetric (public key) ciphers. Covers cryptographic hash functions, block and stream ciphers, as well as differential and linear cryptanalysis. Reviews applications of cryptography, cryptographic standards and protocols, and analyzes case studies of failed implementations.
Prerequisite: COT 3100 or the equivalent.

CIS 4905 Individual Study in CISE 1-4 Credits

Grading Scheme: Letter Grade
Problems in different areas of computer science.

CIS 4912C Integrated Product and Process Design 1 3 Credits

Grading Scheme: Letter Grade
First part of a two-course sequence where teams of engineering and business students partner with industry sponsors to design and build authentic products and processes. Working closely with an industry liaison engineer and a faculty coach, students gain practical experience in teamwork and communication, problem solving and engineering design, and develop leadership, management and people skills. Weekly workshop activities adapt lecture topics to individual projects. Learn firsthand how to develop products and processes that meet customer requirements on time and within budget.
Prerequisite: CDA 3101, COP 3530, COT 3100 and instructor permission.

CIS 4913C Integrated Product and Process Design 2 3 Credits

Grading Scheme: Letter Grade
Second part of a sequence where teams of engineering and business students partner with industry sponsors to design and build authentic products and processes.
Prerequisite: CIS 4912C.

CIS 4914 Senior Project 3 Credits

Grading Scheme: Letter Grade
Involves completing a significant CISE-related project. Coordinate with the instructor and a project advisor; prepare a detailed technical report and deliver an oral presentation. (M)
Prerequisite: senior CISE standing and approved project proposal.

CIS 4930 Special Topics in CISE 1-4 Credits

Grading Scheme: Letter Grade
Variable content provides an opportunity for in-depth study of topics not offered elsewhere and of topics of current significance.
Prerequisite: COP 3503 or instructor permission.

CIS 4940 Practical Work 1 Credit

Grading Scheme: S/U
One term practical software engineering work under industrial supervision as set forth in the Herbert Wertheim College of Engineering regulations. (S-U)

CIS 4949 Co-Op Work in CISE 1 Credit

Grading Scheme: S/U
Practical engineering work under industrial supervision, as set forth in the Herbert Wertheim College of Engineering regulations. (S-U)

CIS 4956 Overseas Studies 1 1-15 Credits

Grading Scheme: Letter Grade
Provides a mechanism by which coursework taken as part of an approved study abroad program can be recorded on the UF transcript and counted toward graduation.
Prerequisite: undergraduate advisor permission.

CNT 4007C Computer Network Fundamentals 3 Credits

Grading Scheme: Letter Grade
Fundamental concepts, principles and standards of computer networks. Topics are introduced in bottom-up approach, starting from physical layer in OSI system architecture with a stronger focus on data link, mac, network and transport layers. (M)
Prerequisite: COP 4600.

CNT 4409 Network and System Security 3 Credits

Grading Scheme: Letter Grade
Examines networked threats and vulnerabilities; trust, identification, authentication, and authorization in networked and distributed systems; secure network protocols and standards; certification of network products; firewall configurations, intrusion detection, and anomaly detection; security flaws in network protocols and distributed applications. Includes projects.
Prerequisite: CNT 4007C and COP 4600 or equivalent.

COP 2271 Computer Programming for Engineers 2 Credits

Grading Scheme: Letter Grade
Computer programming and the use of computers to solve engineering and mathematical problems. Emphasizes applying problem solving skills; directed toward technical careers in fields employing a reasonably high degree of mathematics. The programming language used depends on the demands of the departments in the college. Several languages may be taught each semester, no more than one per section. Those required to learn a specific language must enroll in the correct section. (M)
Prerequisite: MAC 2312 with minimum grade of C.
COP 2800 Computer Programming Using JAVA 3 Credits
Grading Scheme: Letter Grade
In-depth treatment of computer programming using JAVA. Problems related to a variety of disciplines are solved. Introduces the basic concepts of software and hardware; develop a variety of stand-alone applications and applets. For non-CISE majors only.
Prerequisite: MAC 1147 or the equivalent.

COP 3229 Computer Programming Using C++ 3 Credits
Grading Scheme: Letter Grade
Prerequisite: COP 3504 or COP 3503.

COP 3275 Computer Programming Using C 3 Credits
Grading Scheme: Letter Grade
Solve problems related to a variety of disciplines; introduces the basic concepts of software and hardware. (M)
Prerequisite: MAC 1147 or the equivalent.

COP 3502 Programming Fundamentals 1 3 Credits
Grading Scheme: Letter Grade
First course of a two-semester introductory sequence for those planning further study in computer science, digital arts and sciences or computer engineering. Concepts of computer science and the process of computer programming, including object-oriented programming, procedural and data abstraction and program modularity.
Corequisite: MAC 2311.

COP 3503 Programming Fundamentals 2 3 Credits
Grading Scheme: Letter Grade
Second course of a two-semester introductory sequence for those planning further study in computer science, digital arts and sciences or computer engineering. Concepts of computer science and the process of computer programming, including object-oriented programming, procedural and data abstraction and program modularity.
Prerequisite: (COP 3502 with a minimum grade of C or an AP exam in computer science with a minimum grade of 4) and MAC 2311 with a minimum grade of C.

COP 3504 Advanced Programming Fundamentals for CIS Majors 3 Credits
Grading Scheme: Letter Grade
Fast-paced introduction to computer science for those with prior programming experience. Explores major concepts of computer science and the process of computer programming, including object-oriented programming, procedural and data abstraction and program modularity. (M)
Prerequisite: (MAC 2311 or MAC 3472) and programming experience.

COP 3530 Data Structures and Algorithm 4 Credits
Grading Scheme: Letter Grade
Algorithm development using pseudo languages, basic program structures, program design techniques, storage and manipulation of basic data structures like arrays, stacks, queues, sorting and searching and string processing. Linked linear lists. Trees and multilinked structures. (M)
Prerequisite: (COP 3504 or COP 3503) and COP 3100 and (MAC 2234 or MAC 2312 or MAC 2512 or MAC 3473), all with a minimum grade of C.

COP 4020 Programming Language Concepts 3 Credits
Grading Scheme: Letter Grade
Introduces programming language principles, including language constructs, design goals, run-time structures, implementation techniques and exposure to a wide variety of programming paradigms.
Prerequisite: COP 3530.

COP 4331 Object-oriented Programming 3 Credits
Grading Scheme: Letter Grade
Fundamental conceptual models for programming languages illustrated with specific programming languages and application problems. Specific topics include class and object models, inheritance among classes, objects and static and dynamic systems and implementations.
Prerequisite: COP 3530.

COP 4600 Operating Systems 3 Credits
Grading Scheme: Letter Grade
Design and implementation of various components of a modern operating system, including I/O programming, interrupt handling, process and resource management, computer networks and distributed systems. (M)
Prerequisite: COP 3530.

COP 4620 Translators and Translator Writing Systems 3 Credits
Grading Scheme: Letter Grade
Translation of languages, scanning and parsing techniques. Translator writing systems. The implementation of a compiler. (M)
Prerequisite: COP 3530.

COP 4720 Information and Database Systems 2 3 Credits
Grading Scheme: Letter Grade
Part two of a two-course sequence. Provides a basic understanding of the internals of a modern database system. Topics include data storage, indexing, query processing and advanced concepts such as database tuning, alternate data models and emerging applications. (M)
Prerequisite: CIS 4301 and COP 3530.

COT 3100 Applications of Discrete Structures 3 Credits
Grading Scheme: Letter Grade
Covers the mathematics of discrete events; i.e., events that involve distinct elements, finite structures of distinct elements or finite sampled versions of continuous phenomena (such as movement). (M)
Prerequisite: MAC 2233 or MAC 2311 or MAC 3472;
Corequisite: COP 3504 or COP 3503.
Attributes: General Education - Mathematics

COT 4501 Numerical Analysis: a Computational Approach 3 Credits
Grading Scheme: Letter Grade
Numerical integration, nonlinear equations, linear and nonlinear systems of equations, differential equations and interpolation.
Prerequisite: (COP 3504 or COP 3503) and MAS 3114.

EGN 4912 Engineering Directed Independent Research 0-3 Credits
Grading Scheme: S/U
Provides firsthand, supervised research with a faculty advisor or postdoctoral or graduate student mentor. Projects may involve inquiry, design, investigation, scholarship, discovery or application. (S-U)

EGS 1005 Prep for Success 1-4 Credits
Grading Scheme: S/U
Freshman success course that includes academic preparation in calculus, chemistry, student success and technical communications. (S-U)
Prerequisite: EG student.