

Computer and Information Sciences

Department Location

Albro Falconer Manley Science Center, Room 326

Special Entry Requirements

None

General Core Requirements

CIS 105 (Principles of Computing) or CIS 100 (Introduction to Computers) is generally used to satisfy the college computer literacy requirement for most Arts, Social Science, and Humanities majors. However, CIS 111 may be used as a more challenging substitute. Dual Degree Engineering, Environmental Science, Mathematics and Physics majors must use CIS 121 Computer Science I to satisfy this requirement. Health Sciences and Biology majors must use CIS 111 Discovering Computer Science or CIS 115 Introduction to Computing and Informatics. Computer Science Majors must take CIS 113.

Placement Examinations

A computer literacy examination is given each semester for the purpose of exempting students from CIS 105/CIS 100. The examination consists of both written and hands-on components. The examination may be taken only once. Students seeking exemption must take the examination no later than the end of the third year. Exemption from the course does not carry credit hours. The examination for CIS 105/CIS 100 will be given each semester during registration and early registration. Depending on the student's major, CS offers a course to satisfy the college computer literacy requirement. Please check with your major department.

Goals

The goals of the Computer and Information Sciences Department are to prepare students for graduate training in some specialized area of computer science, to prepare students for jobs in industry, business, or government, and to provide support courses for students in engineering, mathematics, and other fields requiring computing skills.

Objectives

Upon successful completion of a major in Computer and Information Science, students will be able to

1. Demonstrate proficiency in problem-solving techniques using the computer.
2. Demonstrate proficiency in at least two high-level programming languages and two operating systems.
3. Demonstrate proficiency in the analysis of complex problems and the synthesis of solutions to those problems.
4. Demonstrate comprehension of modern software engineering principles.
5. Demonstrate a breadth and depth of knowledge in the discipline of computer science.

International/Women's Studies Requirement

None

Teacher Certification

None

Departmental Honors

Students must achieve an overall GPA of at least 3.0 and a GPA in Computer Science of at least 3.4 with no Computer Science grade less than "C." Completion of an Honors Thesis or Independent Study project is required.

Departmental Honor Society

Zeta Chapter of Upsilon Pi Epsilon

Major Requirements

Forty-five to 48 semester hours are required for the Bachelor of Science in Computer Science, including 36 required core course hours and at least three additional elective courses chosen from any computer and information science courses at the 300 level or above. In addition to the credit-bearing courses, participation in first-year and senior seminars is required. Computer Science majors are required to take CIS 113 Discovering Computer Science: Python as a prerequisite to CIS 123 Computer Science I: Python. Each of the courses presented for the major must be completed with a grade of "C" or better.

The numbers following the course names indicate the credit hours, lecture hours, and laboratory hours, respectively.

Core Major Requirements (36 Hours)

Refer to the Core Major Requirements section at the follow link: <http://www.spelman.edu/academics/majors-and-programs/computer-and-information-sciences/major-requirements>

- CIS 113 Discovering Computer Science (4-3-2)
- CIS 123 Computer Science I (4-3-2)
- CIS 181, 182 First-Year Seminar (0-1-0)
- CIS 215 Data Structures and Theoretical Foundations of Computer Science (4-3-2)
- CIS 216 Computer Organization and Design (4-3-2)
- CIS 313 Data Structures and Algorithm Analysis (4-3-0)
- CIS 328 Introduction to Database Management Systems Design (4-3-0)
- CIS 343 Operating Systems and Computer Architecture (4-3-1)
- CIS 346 Theory of Programming Languages (4-3-0)
- CIS 481 Senior Seminar I (0-1-0)
- CIS 482 Senior Seminar II (1-1-0)

One of the following two courses:

- CIS 472 Software Engineering (4-3-0)
- CIS 485 Senior Design Project (4-0-3)

Note: Independent study/research hours may not be counted as required hours in computer science.

Major Cognate Courses

- MATH 231 Calculus I
- MATH 232 Calculus II
- MATH 233 Foundations of Mathematics OR MATH 205 General Statistics OR MATH 214 Linear Algebra and Application
- MATH 234 Discrete Mathematics

Two semesters of calculus-based Physics:

- PHY 151 and PHY 241 (or a student may substitute PHY241 for an alternative science course with approval of the Department Chair.)
- Each of these courses must be completed with a grade of "C" or better.

Minor Requirements

Computer Science Minor

The computer science minor is designed primarily for students with a science background. It consists of six courses. The three required courses for this option are CIS 111/113, CIS 121/123, and either CIS 215 or CIS 216. One elective may be chosen from CIS courses numbered 210 or above. The final two electives must be chosen from courses numbered 300 or above with consultation from the department. For example, students may choose courses from the set CIS 313, CIS 346, and CIS 465, or from the set CIS 302, CIS 328, CIS 413, CIS 401, and CIS 465.

Information Science Minor

The Information Science minor is designed for non-science majors and is oriented toward business and information science. MATH 107 is the required mathematics course, but MATH 115 or higher is acceptable. The minor consists of six courses, which must include CIS 111/ CIS 113, CIS121/CIS123, CIS 215, or CIS 216, and CIS 313 or CIS 328 or CIS 343. Two electives may be chosen from CIS courses listed as electives in the option above, or MGT 300, Principles of Management. Other substitutions may be made with approval by the department.

Course Descriptions

CIS 100 – Introduction to Computers (4-3-0)

This course is designed to give students an understanding of how a computer works, its capabilities, limitations, and applications. Includes system components, societal impact, applications, introduction to Web page development, and the hands-on use of software packages including word processing, spreadsheets, presentation software and databases. This course, CIS 111, CIS113, CIS 115 or CIS 121 is required of all students. Offered in Spring and Fall semester.

CIS 105 - PRINCIPLES OF COMPUTING (4-3-0)

Information technology plays an increasingly large role in both society and the individual lives of citizens. This course is designed to introduce computer literacy concepts and programming skills necessary to effectively use information and technology. Students will gain an understanding of how a computer works, its capabilities, limitations, and applications. Students will gain programming skills using the Python programming language. The course serves as the required computer literacy component of the general education curriculum. Offered in Spring and Fall Semester.

CIS 111- Discovering Computer Science (4-3-2)

This course is an introduction to Computer Science based on algorithmic problem solving. The course explores computer science in various facets with the algorithm as the common thread. The mathematical nature of algorithms is presented along with how algorithms are manifested in hardware, software and various application areas. This course is designed for Biology and Health Science majors, minors and double majors. This course includes a required lab. Offered in Spring and Fall semester.

CIS 113 - Discovering Computer Science: Python (4-3-2)

This course provides an introduction to the study of Computer Science and computer programming. The course begins with an overview of algorithm discovery and algorithmic analysis including pseudocode development, flowcharting, sequential, conditional and iterative processing. The course then focuses on developing computer executable code in Python to represent these algorithms. Python topics covered includes statements, variables, mathematical operations, conditional execution, iteration, functions, lists, tuples and an introduction to files. This course is designed for Computer Science Majors. This course includes a required lab. Corequisite: MATH 115. Offered in the Fall semester only.

CIS 115 - Computing and Informatics (4-3-2)

This course introduces students, particularly science majors, to informatics and computing programming in Problems introduced include applications to domains of interest. Common informatics tools such as Python and BLAST are introduced as well as basic visualization of data. The course satisfies the Spelman College Computer Literacy requirement and serves as a prerequisite for upper-level, domain specific informatics courses.

CIS 121 – Computer Science I (4-3-2)

This course is an introduction to programming using C++. It emphasizes problem-solving techniques, algorithm design and concepts of object oriented programming. Corequisite: MATH 115. This course includes a required lab.

CIS 123 - Computer Science I: Python (4-3-2)

This course provides students with advanced Python language skills. The course covers the following topics programming concepts and language features: string slicing, dictionaries, sets, classes, object-oriented programming, inheritance, polymorphism, files, object serialization and recursion. Additionally, students will be introduced to event-based GUI programming using Python's standard tkinter module. This course includes a required lab. Prerequisite: CIS 113.

CIS 131:Computer Science I: MATLAB (4-3-2)

Computer Science (MATLAB) is an introductory course for mathematics and engineering students who need to do computing using the MATLAB programming language. The course presents the fundamentals of computer programming that include the design, implementation, testing and debugging of MATLAB programs. In addition, the course explores how algorithms are used to solve problems in mathematics, engineering and computer science. This course includes a required lab. Corequisite: MATH 115.

CIS 181, 182 –First Year Seminar (0-1-0)

This course is an orientation to the Computer Science major and to the resources of the UNIX system and the Internet. It includes a survey of the nine basic areas of Computer Science, the role of the Computer Science professional, and an introduction to personal computer software. Also covers availability of opportunities for internships, co-ops, research programs, ethical issues affecting computer science, etc. CIS 181 is offered in the Fall semester. CIS 182 is offered in the Spring semester.

CIS 215 – Data Structures and Theoretical Foundations (4-3-2)

This course teaches students advanced language features such as recursion, linear and non-linear data structures, generic/template data structures, program correctness, internal search/sort methods, and intermediate algorithm analysis. In addition, students are introduced to the theoretical foundations of computer science with emphasis on topics such as finite state machines, formal languages, and combinatorics. Prerequisite: CIS 123 or CIS 121. This course includes a required lab.

CIS 216 – Computer Organization and Design (4-3-2)

This course provides an explanation of the basic workings of a computer, from the stored-program concept and the representation of code and data to the fetch-execute cycle and the design of the datapath hardware. It covers assembly language programming and the Instruction Set Architecture and introduces certain operating system concepts. It introduces the design of combinational and sequential logic gates and the internal operation of modern computer hardware. This course includes a required lab. Prerequisite: CIS 215. Offered in the Fall semester.

CIS 302 – Design and Management of Information Systems (4-3-0)

This course provides an introduction to the use of computers as a part of a decision support system (DSS) or a management information system (MIS). Includes information gathering and analysis, data organization and file management techniques, and information management issues. Application projects drawn from current practice and literature. Prerequisite: One high-level programming language. Prerequisite: CIS 215 or permission of the instructor for non-CS majors. Offered in the Spring semester; every other year.

CIS 313 – Data Structures and Algorithm Analysis (4-3-0)

This course covers advanced data structures and design and analysis of algorithms. Topics include balanced trees, sorting, heaps, selection, string matching, graph algorithms, algebraic problems and algorithmic complexity and computability. Algorithm design techniques include divide-and-conquer, dynamic programming and depth-first-search. It covers methods for solving common summations and recurrences. Prerequisite: CIS 215, MATH 231. (Formerly MATH 251). Offered in the Spring semester.

CIS 328 –Introduction to Database Management Systems Design (4-3-0)

This course covers the fundamental concepts underlying database system design, including design application using databases and implementation techniques used in database systems. Prerequisite: CIS 313. Offered in the Spring semester.

CIS 343 – Operating Systems and computer Architecture (4-3-1)

This course is an introduction to major concepts in the design of operating systems at the register-transfer level. It covers interrelationships between the operating system and the architecture of computer systems and includes a significant programming component, a required lab and a major project. Prerequisite: CIS 215 and CIS 216. Offered in the Spring semester.

CIS 346 – Organization of Programming Languages (4-3-0)

This course provides a study of the fundamental concepts and general principles underlying programming languages in current use. Run-time behavior of programs. Comparison of language features and programming techniques using several languages such as Ada, C, Java, Perl, LISP, C++, and PROLOG. Prerequisite: CIS 121 or CIS 123. Offered in the Fall semester.

CIS 366 –Numerical Analysis (4-3-0)

This course provides a study of and use of techniques for the numerical solution to the following types of problems: zeros of functions, linear systems, functional approximation, numerical integration/ differentiation, and eigen values. Error analysis will also be included for each technique studied. Prerequisite: MATH 214, MATH 212,

and MATH 232. Required: Must have computer programming skills.

CIS 381 /Math 381 – Introduction to Graph Theory Honors (4-3-0)

This course is an introduction to the mathematical field of graph theory. It explores fundamental graph theoretic concepts including connectivity, graph isomorphisms, trees, matchings, planarity, graph colorings, as well as Eulerian and Hamiltonian graphs. To understand these ideas, the use of both algorithms and proof techniques is emphasized throughout the course. Prerequisite: CIS 215.

CIS 390 - Directed Studies (Variable)

This course provides an in-depth study of a significant topic in computer science under the direction of a member of the computer science faculty. The student will conduct independent study/research and meet weekly with her advisor. Required: A written paper and public presentation. Prerequisite: Junior standing and consent of the department.

CIS 391 – Honors Thesis (Independent Studies) (4-0-0)

An intensive research project is required of all honors majors. Each honors major should enroll for the thesis during the second semester of the junior year. Details on the thesis can be obtained from the department's chair.

CIS 401 – Computer Graphics (4-3-2)

This course provides an introduction to the use of computers for manipulation and display of graphical information. It includes graphical input methods and interactive graphics, two- and three-dimensional transformations, and fundamentals of vector and raster graphics. This course includes a required lab. Prerequisite: CIS 215. Suggested: MATH 214.

CIS 428 – Advanced Database Management Systems Design (4-3-0)

This course teaches students advanced concepts in database systems design, including database design and implementation techniques used in database systems such as security, storage, query processing, query optimization, transactions, concurrency control and recovery. Prerequisites: CIS 328 and CIS 343 or consent of the department.

CIS 432 – Artificial Intelligence (4-3-2)

This course covers fundamental concepts, techniques and issues of artificial intelligence; state space search strategies; heuristic methods and programming techniques; and survey of applications in areas of problem solving, expert systems, natural language understanding, vision and learning. Prerequisite: CIS 313, CIS 346.

CIS 435 – Robotics (4-3-2)

This course will introduce students to programming mobile, autonomous robots. Students will be taught to utilize robot sensors and actuators and to program decision making abilities. Lectures will be combined with hands-on

classroom learning activities and complemented with several homework implementations of robot activities. Students will learn and use a robot programming platform. Prerequisite: CIS 313.

CIS 437 – Simulation (4-3-1)

An elective in the Computer Science major and the Environmental Science major, this course introduces students to the basics of Discrete Event Simulation and Continuous Simulation. It covers why simulation is used, how to model systems and how to ensure the correctness of the models. It explains how simulations are implemented on computers, discusses random variate generation, and describes the statistical analysis of results. Prerequisite: CIS 121 or CIS 123; MATH 205.

CIS 443 – Compiler Construction (4-3-0)

This course provides a definition and overview of a compiler, study of the basic techniques of compiler design and implementation; lexical analysis, parsing, syntax checking, and semantic analysis; and design of a sample compiler of moderate complexity. Prerequisite: CIS 343, CIS 346.

CIS445 – Information Retrieval

This course will cover algorithm design of search algorithms over the Internet. We consider web search for text, image and video content on single search engines and metasearch engines. Special emphasis will be placed on rank aggregation methods, data mining and web genres. Practical examples will be used to demonstrate the concepts and techniques. Students will receive hand-on experience with processing web content through a semester project. Prerequisite: CIS 313 or CIS 346. Offered in the Fall semester; every other year.

CIS 452 –Theory of Computation (4-3-0)

This course provides an introduction to properties of algorithmic computation, modules of computation, Turing computability, recursive functions, computability, and decidability. Prerequisite: CIS 313, MATH 234.

CIS 456 – Human Computer Interaction (1-3-0)

This course provides a study of various aspects of the human-computer interface; methods for designing and evaluating computer systems for increased usability and efficiency; and design of a sample system of moderate complexity. Prerequisite: CIS 343, Junior standing or consent of the department. Offered in the Fall semester; every other year.

CIS 463 – Computer Networks and Data Communications (4-3-2)

This course provides an introduction to basic communication concepts, distributed systems, network architectures, networks and protocols, digital communication links, overview of local area networks, and related software design. Prerequisite: CIS 215, CIS 216, or consent of the department.

CIS 465 – Computer Networks and Security (4-3-0)

This course provides an introduction to basic communication concepts, network architectures, networks and protocols, digital communication links, and overview of local area networks, and information security. Computer networks are the foundation for distributed computing. In this class students will study data communications, which enables computer networks. In addition, they will discuss information security. Prerequisite: CIS 313.

CIS 470 – Special Topics (4-3-0)

This course provides lectures on topics of current interest. Topics vary according to the needs and interests of students. Prerequisite: Consent of instructor.

CIS 472 – Software Engineering (4-3-0)

This course provides an introduction to software engineering principles and techniques which are used in the construction of large software systems; software life cycle and the methodologies to support the various phases; CASE (Computer Aided Software Engineering); software reuse, project planning and scheduling, software cost-estimation, and documentation. Participation in a group project with extensive programming in a high-level

CIS 485– Senior Design Project (4-0-3)

In this course, students develop a major project requiring the integration of material from across the computer science curriculum that culminates with a written report. Students should expect to spend a minimum of 10 hours per week on the project. Prerequisite: Consent of the department.

CIS 491 – Honors Thesis Research (4-3-0)

All honors majors are required to develop an intensive research project. Each honors major should enroll for the thesis during the first semester of the senior year. Details on the thesis can be obtained from the department chair.

programming language is required. Prerequisite: CIS 313. Suggested: CIS 343. Offered in the Fall semester.

CIS 475 – Special Topics (4-3-1)

This is a lecture-laboratory course in topics of current interest. Topics vary according to the needs and interests of students. Prerequisite: Consent of instructor. Offered in the Fall or Spring semester.

CIS 481 – Senior Seminar I (0-1-0)

This course provides supervised student preparation for career development and graduate study including assistance with resumes, applications for admission, and financial aid; survey of current software applications; and discussion of ethical and social issues in the discipline and gender issues in the discipline. Offered in the Spring semester.

CIS 482 – Senior Seminar II (1-1-0)

This course provides a discussion of issues and current topics in the discipline; exploration of literature of the discipline; exposure to advanced UNIX, scripting, and programming languages; and discussion of ethical and social issues in the discipline. A technical research paper is required. Offered in the Fall semester.