

# Computer Science and Information Systems

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The Department offers graduate programs leading to the degrees of Master of Science in computer science and Master of Science in computer information systems. These courses of study are designed to prepare students for professional careers in the field of computing and information processing or for further study and research.

Computer scientists are developers of basic computer technology such as operating systems, language translators, data management software and other programming, processing, and operating aides to be used in conjunction with computer hardware. They are usually employed by computer manufacturers and software houses specializing in systems software. Computer information systems specialists are principally users of computer technology, usually in systems projects for applications in business, industry, or government.

In addition to satisfying all the Graduate School requirements for the degree, all candidates for the master's degree must satisfy the following departmental requirements:

1. At least 36 hours of graduate-level coursework.
2. No "D" grades can be counted in the completion of requirements for the degree.
3. Every student must pass a written comprehensive examination that will be based on the core requirements for the program pursued.
4. The Department of Computer Science and Information Systems has instituted a programming examination which all its graduate students must pass as part of their degree requirements. It is to be administered before the student has completed nine hours of graduate work. The students who fail are advised to take appropriate undergraduate courses before attempting the exam again. Students are to be given three opportunities to pass the examination. It is given early in the program in order to function as an effective diagnostic.

Interested and qualified students are offered the option of writing a master's thesis. Students selecting this option are encouraged to choose an advisor and topic as early as possible in order to plan the thesis development and any needed supporting coursework. The following policies apply to these:

1. A minimum grade point average of 3.5 in computer science and computer information systems graduate courses is required for students enrolling in CS 699 (Thesis).
2. No student may register for CS 699 until 18 hours of graduate courses have been completed in the department.

3. Six credit hours of CS 699 are required and, upon completion, the thesis must be defended in an oral examination. No grade will be given for CS 699 until after the oral defense.
4. A written outline of the thesis project and a tentative schedule must be submitted to and approved by the graduate coordinator and the chair prior to the registration for CS 699.

Admission requirements and graduation requirements specific to computer science and computer information systems are given below. Note that prospective students who do not meet the conditions for admission may be admitted conditionally, in which case the department will prescribe a program for the removal of such admission conditions. Conditional status must be removed prior to graduation.

## Computer Science

In addition to meeting all the general requirements of the Graduate School and of the department as stated above, candidates for the master's degree in computer science must satisfy the following requirements.

1. At least 30 of the 36 hours required must be in computer science courses. At most, six hours may be earned in approved courses other than those labeled CS.
2. The following core requirements must be satisfied (either by taking the course or showing evidence of the completion of an equivalent course elsewhere): CS 503 or CS 615, CS 516, CS 518, CS 519, CS 550 or CS 643, CS 682, CS 609, CS 521 or CS 514.
3. Two of the following two-course sequences must be completed: CS 500 and CS 530, CS 615 and CS 616, CS 514 and CS 614, CS 521 and CS 522, CS 510 and CS 511, CS 519 and CS 570, CS 609 and CS 505.

For admission into the computer science program, a student must have completed discrete mathematics, at least two semesters of calculus, matrix or linear algebra, and at least one semester of calculus-based statistics; must have at least 15 hours of computer science coursework including knowledge of one structured or object-oriented programming language such as C/C++, elementary data structures, assembly language, advanced data structures, and introductory computer architecture; and must have approval of the Department.

## Computer Information Systems

In addition to meeting all the general requirements of the Graduate School and of the department as stated above, candidates for the master's degree in computer information systems must satisfy the following requirements:

1. At least 21 of the 36 hours required must be in computer information systems or computer science courses.
2. A minimum of 12 hours must be taken in courses outside the department. These courses must form a coherent program in an applications area and must be approved by the graduate coordinator.

3. The following core requirements must be met (either by taking the course or by showing evidence of having completed an equivalent course elsewhere): CIS 571, CIS 572, CIS 588, CIS 607, CIS 608, and CS 609. (CS 615 and CS 643 are recommended).

The admission requirements for the computer information systems program are one semester of calculus, one semester of calculus-based statistics, two semesters of accounting, one semester of finance, two semesters of programming and data structures in a structured or object-oriented programming language such as C/C++, and one semester of data communications.

## Course Descriptions

### Computer Information Systems

#### CIS 571 Computer Law

**3 hrs.**

Ethical considerations of computer scientists and computer-related security and privacy issues; copyright, patent, trademark, and trade secret issues, deceptive trade practices, computer crime, contract issues, venture capitalists, tax issues, computer torts, constitutional issues, and international trade considerations. Prerequisite: one semester of programming.

#### CIS 572 Computing Services Management

**3 hrs.**

Management of computing resources: planning for computing services; operational considerations; evaluation of service. Prerequisites: CS 310 or equivalent.

#### CIS 588 Introduction to Expert Systems and Artificial Intelligence

**3 hrs.**

Knowledge-based systems design and implementation; expert systems shells and programming environments; validation and implementation of expert systems; case studies/laboratories. Cross-listed as IME 568. Prerequisites: two semesters of programming and one semester of statistics, or consent of instructor.

#### CIS 606 Software Systems Design

**3 hrs.**

Planning, writing, debugging, and documenting large software systems. Consult with instructor for details on programming language to be used. Prerequisite: a grade of C or better in CS 121 or equivalent.

#### CIS 607 File Organization and Management

**3 hrs.**

File organizations and access methods. Sort/merge operations; hashing schemes for storage and retrieval. Projects involve data validation; creation and updating of files; simulation and/or implementation of direct and indexed files. Prerequisite: CS 121 or equivalent.

#### CIS 608 System Specification and Development

**3 hrs.**

Techniques and tools of system specification and development. Case studies; problems. Prerequisite: a grade of C or better in CS 121 or equivalent.

## Computer Science

### **CS 500 JAVA Programming and Web Design** 3 hrs.

Introduction to JAVA programming and PERL. Internet and Web-based applications, design and building of multimedia systems, user interface design, Gateway Interface (CGI) scripting; VRML. Prerequisite: CS 121 or equivalent.

### **CS 503 Programming Methodology** 3 hrs.

Predicate calculus, Dijkstra's methodology of algorithm development. Algorithm development. Algorithmic language characteristics; syntax, semantics. Postconditions and preconditions. Verification of postcondition states satisfied by algorithmic programs executed from preconditions. Problems. Prerequisites: a grade of C or better in both MTH 120 and CS 121.

### **CS 505 Advanced Topics in Databases** 3 hrs.

Current trends in information technology. Hypertext navigation, intelligent navigation with expert systems and neural nets, multimedia, text management and retrieval, deductive and object-oriented databases, distributed databases, the integrated intelligent database. Prerequisites: CS 405 or equivalent.

### **CS 510 Numerical Methods I** 3 hrs.

Introduction to numerical and computational aspects of various mathematical topics: finite precision, solutions to nonlinear equations, interpolation, approximation, linear systems of equations, and integration. Cross-listed as MTH 510. Prerequisites: CS 104 or 106; MTH 207 and 223.

### **CS 511 Numerical Methods II** 3 hrs.

Continuation of CS/MTH 510: further techniques of integration, ordinary differential equations, numerical linear algebra, nonlinear systems of equations, boundary value problems, and optimization. Cross-listed as MTH 511. Prerequisites: MTH 224 or 345; CS 510.

### **CS 514 Algorithms** 3 hrs.

Design and analysis of algorithms. Dynamic structures maintenance and hashing. Searching, sorting, and traversal. Time and space requirements; simplification; computational complexity; proof theory and testing; NP-hard and NP-complete problems. Prerequisites: a grade of C or better in CS 302; one semester of statistics.

### **CS 516 Programming Languages** 3 hrs.

Design concepts of high-level languages. Description languages; grammars and syntax; expressions and data structures; selection and control structures; constructs for input and output; subprograms and parameter communications. Prerequisite: CS 302 or 310.

### **CS 518 Programming Language Translation** 3 hrs.

Overview of programming language translation with emphasis on modern compiler construction. Lexical analysis, parsing, syntax and semantic analysis, code generation, garbage collection, and optimization. Prerequisite: grade of C or better in CS 302. Corequisite: CS 516 or CS 216.

### **CS 519 Introduction to Operating Systems** 3 hrs.

Design principles of software for operation of computers. Storage, processor, device, and file management as an integrated system; input/output control. Prerequisite: a grade of C or better in CS 302.

### **CS 521 Introduction to Artificial Intelligence** 3 hrs.

Basic concepts and techniques of artificial intelligence: philosophical considerations, examples, pattern recognition, search strategies, game playing, knowledge representation, logic and resolution, planning, vision, natural language processing, programming in LISP. Prerequisites: a grade of C or better in CS 302.

### **CS 522 Neural Networks, Knowledge-based Systems, and Applications** 3 hrs.

Theorem proving, logic programming, expert systems, uncertainty, fuzzy logic, machine learning, neural networks, programming in PROLOG. Prerequisites: a grade of C or better in CS 302; one course in statistics.

### **CS 530 Client-Server Computing with JAVA** 3 hrs.

Continuation of CS 500. JAVA programming in client-server environment. JAVA distributed computing and distributed object computing protocols. Internet and object Web computing in JAVA. JAVA Enterprise computing technologies. Prerequisite: CS 500 or equivalent.

### **CS 535 Introduction to Computer Graphics** 3 hrs.

Mathematics and algorithms of computer graphics. Device differences, lines, arcs, curves, transformations, input and output primitives. Data structures for geometric entities. Prerequisites: MTH 207, 223; CS 302.

### **CS 550 Advanced Computer Architecture** 3 hrs.

Fundamental computer sub-systems: central processing unit; memory systems; control and input-output units. General purpose computing systems design. Examples from existing typical computers. Prerequisite: CS 350.

### **CS 570 Systems Performance and Modeling** 3 hrs.

Techniques of modeling processes and the resources they share: intuitive, simulation, and analytical approaches. Performance prediction, bench marking, and synthetic loading. Prerequisites: a grade of C or better in CS 302 or CS 310; one semester of statistics.

### **CS 609 Database Management Systems** 3 hrs.

Relational, hierarchical, and network database models. Conceptual and physical schema. Data definition and data manipulation languages. Normal forms and database design. Database administration, security, integrity, and backup recovery. Query optimization. Latest developments in databases. Prerequisite: a grade of C or better in CS 302 or CIS 607.

### **CS 610 Advanced Topics** 3 hrs.

Special projects under staff supervision on advanced problems in numerical or nonnumerical branches of computer science. May be taken more than once under different topics. Prerequisite: consent of instructor.

**CS 611 Directed Individual Studies****1-3 hrs.**

Individual study in an area of computer science relevant to the student's professional goals and not covered in a formal course offered by the department. May be repeated twice for a maximum of 6 hours credit. Prerequisites: consent of the department.

**CS 614 Parallel Algorithms****3 hrs.**

Parallel algorithms for multi-processor computer architectures: concurrent programming, SIMD and MIMD systems, and time complexity. Prerequisite: CS 514.

**CS 615 Software Engineering I****3 hrs.**

Software engineering: technical management; project management, estimation, and control; economics; environments; standards; products and their phases. Prerequisites: a grade of C or better in CS 302 or CS 310.

**CS 616 Software Engineering II****3 hrs.**

Background and overview of software production: requirements for engineering and analysis; software specifications, design, coding, qualification, manufacture, support, and standards. Emphasis on a specific topic in software engineering. Prerequisites: a grade of C or better in CS 302 or CS 310.

**CS 643 Data Communications and Distributed Computing****3 hrs.**

Introduction to communication technologies. Emphasis on application to computer networks, information and coding theory, design considerations, and architecture, including topologies, implementation techniques, and standard distributed computing architectures. Prerequisites: MTH 120, 325; CS 519.

**CS 682 Theory of Computation****3 hrs.**

Theory of formal languages and computability. Automata, Turing machines, grammars. Context-free and context-sensitive languages; parsing. Recursion theory; limits of effective computability. Unsolvability, reducibility, complexity. Prerequisites: a grade of C or better in CS 302.

**CS 699 Thesis****3-6 hrs.**

Computer science research and thesis preparation. Required of candidates choosing the thesis option. Total of 6 semester hrs. to be taken in one or two semesters. Prerequisite: consent of department chair.