

# Department of Computer Science and Information Systems

**FACULTY** *Professors Haghghi, Liu, Nikolopoulos, Uskov; Associate Professors Batra, Miller (chair), Park; Assistant Professors Dolins, Patton; Lecturer Kasube.*

The department offers baccalaureate degree programs in computer science and in computer information systems.

Computer scientists are mainly concerned with software development and systems design. They are usually employed by computer manufacturers and software houses specializing in systems software and are expected to produce operating systems, language translators, data management software, and other programming, processing, and operating aids to be used in conjunction with computer hardware. As developers of basic computer technology, their preparation is highly mathematical and scientific in its orientation.

Computer information specialists are principally users of computer technology. They are usually employed as programmer/analysts, lead programmers, and systems project leaders for applications in business, industry, and government. Course work in this major emphasizes systems analysis and design, programming, applied computer science, systems implementation, and management.

For students not majoring in the department, we offer a minor which can be tailored to the individual's goals and needs.

Students intending to take only one course in the department should enroll in either CIS 102 or CS 104 if they desire a detailed treatment of a programming language, or CIS 300 if they desire a general discussion of computers and their impact on society.

## Computer Science

The department has course offerings of sufficient breadth to allow specialization in a number of areas including database concepts, software design, scientific programming, programming language concepts, and computer elements and architecture. Majors are encouraged to choose an area of specialization based upon their career goals and to select their electives, with guidance from their advisor, to support that choice. The general requirements for the computer science major are:

1. Computer Science:
  - a. 45 semester hours including CS 106, CS 121, CS 206, CS 216, CS 302, CS 350 or EE 311, CS 380, CS 406, and CS 519;
  - b. one course from each of the following groups of courses: CS 310 or CS 405; CS 514 or CS 521; CS 343 or CS 550;
  - c. at least 24 semester hours must be at or above the 300 level;
  - d. a grade of C or better is required in all computer science courses submitted in fulfillment of the major requirements.

2. Mathematics: MTH 120, MTH 121, MTH 122, MTH 207, MTH 223, and MTH 325.
3. Science:
  - a. a two-semester sequence (eight semester hours) in laboratory science for science majors;
  - b. two additional one-semester courses in science; one or both of these additional science courses may be replaced by one or both of the following courses emphasizing quantitative methods: IME 313, IME 314.

## Computer Information Systems

The general requirements for the computer information systems major are:

1. Computer Science and Computer Information Systems:
  - a. 33 semester hours including CIS 203, CS 106, CS 121, CS 206, CS 310, CS 343, CS 403, and CS 405. (CS 406 is strongly recommended.);
  - b. at least 21 hours must be at or above the 300 level;
  - c. a grade of C or better is required in all computer science and computer information systems courses presented in fulfillment of the major requirements.
2. Mathematics: MTH 105 (or equivalent) and either MTH 115 or MTH 121 (MTH 116 or MTH 121 is recommended), and MTH 120.
3. Statistics: QM 262 and QM 263 (or equivalents).
4. Accounting: ATG 157 and ATG 158.
5. Business: BMA 352.
6. Economics: ECO 221 (or ECO 100).
7. Finance: FIN 322.
8. Psychology: PSY 103 (or PSY 104).
9. Supporting Area: Each computer information systems major must select a minor, or at least 18 semester hours in an approved sequence of courses in a supporting area; at least 12 of these hours must be above the freshman level. A frequent choice is the business administration minor. Several other options exist and interested students should consult with their major advisor for assistance in selecting one suitable to their goals and needs. Students should also consult the department offering the minor. Students choosing the business administration minor must have that choice approved by the College of Business Administration.

## Computer Science and Information Systems Minor

The requirements for a minor in computer science and information systems are:

1. a total of 21 hours in computer science or computer information systems courses;
2. at least 12 of these hours must be in courses numbered 300 or above.

Non-majors interested in the minor should consult the department and develop an individualized plan.

For example, a student seeking to achieve a working competence in information systems might select CS 106, CS 121, CS 310, CS 343, CS 403, CS 405, and CS 406. Plans to meet other objectives can be worked out with a department advisor.

## Course Descriptions

### Computer Information Systems

#### **CIS 102 Introduction to Computer Information Systems with BASIC** **3 hrs.**

Fundamental concepts of computer programming and design of algorithms. Problem solving using BASIC. Introduction to flow chart language and use of software packages. Functional limitations and capacities of computers.

#### **CIS 203 Data Processing with COBOL** **3 hrs.**

Solution of data processing problems using COBOL. Introduction to file handling and use of computers in a business environment. Prerequisites: Previous high school or college programming courses.

#### **CIS 215 Introduction to Scripting Languages** **3 hrs.**

A non-technical introduction to the use of scripting languages in a web-based environment. An overview of current scripting languages such as Javascript, VBScript, and PERL. Cross-listed as MM 215. Prerequisites: one semester of programming, or MM 213 and MM 365, or equivalent.

#### **CIS 275 Business Applications with Visual Basic** **3 hrs.**

Object-oriented business application development using Visual Basic. Emphasis on object classes, events and properties, data structures, controls, and objects. Dual listed as BMA 275. Prerequisites: CIS 102, BMA 272, or consent of instructor.

#### **CIS 300 Computers and Society** **3 hrs. (Gen. Ed. TS)**

History of computers; their use, limitations, and impact on society; Internet and the World Wide Web; creation of Web content. Prerequisite: Junior standing or consent of instructor.

#### **CIS 377 Advanced COBOL Systems and Environments** **3 hrs.**

Design and implementation of production-oriented COBOL system projects. Environments for development and implementation of COBOL systems in both batch and interactive modes. JCL for resource management, file processing, and multi-key file processing. Comparison and portability issues in different COBOL system environments. Cross-listed as BMA 377. Prerequisite: CIS 203.

#### **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 computer resources; planning for computing services; operational considerations; evaluation of service. Prerequisite: CS 310 or equivalent.

**CIS 588 Introduction to Expert Systems****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 IE 588. Prerequisites: two semesters of computer programming and one semester of statistics, or consent of instructor.

## Computer Science

**CS 104 Computers and Programming with FORTRAN****3 hrs.**

Problem solving and algorithm implementation using FORTRAN: formatted I/O, arrays, character data, and subprograms. Assignments in numerical and non-numerical applications. Prerequisite: MTH 105 or 109 or equivalent.

**CS 106 Introduction to Programming and Computer Science****3 hrs.**

Problem solving, algorithm development, and implementation using modern structured programming language. Software design methodologies. Introduction to Bradley University computer science software development environment. Programming language features: primitive and structured data types, data description, data and sequence control mechanisms, subprograms. In-depth introduction to computer science. Prerequisite: MTH 109 or MTH 112 or equivalent.

**CS 121 Introduction to Data Structures****3 hrs.**

Continuation of CS 106: introduction to file processing, searching, sorting, and simple data structures. Emphasis on using software methodologies for large programs. Data abstraction, validation, verification, and analysis of programs. Prerequisite: a grade of C or better in CS 106 or equivalent.

**CS 206 Assembler Language I****3 hrs.**

Computer organization and assembler language programming. Prerequisite: CS 106 or 104.

**CS 216 Introduction to Programming Languages****3 hrs.**

Formal languages, BNF, and compiling. Unusual languages such as LISP, SNOBOL, and APL. Conventional languages such as FORTRAN, PL/I, and ADA. Prerequisites: CS 121, 206.

**CS 302 Advanced Data Structures & Algorithms****3 hrs.**

Extends coverage of CS 121 data structures. Applications include data structures for searching and sorting, memory management, graphs, and strings. Emphasis on understanding data abstraction and relationship to good programming practices in large programs. Implementation of data structures and evaluation of results. Prerequisites: a grade of C or better in CS 121. Corequisite: CS 206.

**CS 310 Information Structures 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 or indexed files. Prerequisite: CS 121.

**CS 320 Symbolic Logic****3 hrs.**

Logical systems; propositional and predicate calculi. Truth tables, proofs, tautologies, principles of inference, Boolean algebra, DeMorgan's Laws, quantifiers, representations, and set theory. Cross-listed as PHL 320. Prerequisite: MTH 120.

**CS 343 Data Communications and Communication Networks****3 hrs.**

Fundamentals of data communications: data transmission, data encoding, digital data communication techniques, data link control, and multiplexing. Introduction to switched and shared medium communication networks. Prerequisites: a grade of C or better in both MTH 120 and CS 121.

**CS 350 Computer Organization****3 hrs.**

Transfer and coding of information. Basics of logic design. Structure, organization, and operational principles of modern computer systems. Case study of a simple mini/microcomputer. Prerequisite: CS 206.

**CS 380 Foundations of Computer Science****3 hrs.**

Fundamental concepts of computer science related to programming. Models of computable functions, undecidable problems, recursive functions. Automata, languages, grammars, parsing, parallel architectures, and algorithms. Prerequisites: CS 121; MTH 120.

**CS 403 Systems Design and Analysis****3 hrs.**

Methodology of building a complete computer based system. Case studies. Prerequisite: CS 310 or 302.

**CS 405 Database Management Systems****3 hrs.**

Relational, hierarchical, and network database models. Conceptual and physical schema. Data definition and data manipulation languages. Database administration, security, integrity, and backup recovery. Query optimization. Normal forms and database design. Latest developments in databases. Prerequisite: CS 310 or 302.

**CS 406 Introduction to Software Engineering****3 hrs.**

Product engineering and control activities. Software engineering; relationship to other disciplines. Phases of software products and products of software engineering. Prerequisite: CS 216 or 310.

**CS 410 Directed Individual Studies****1-6 hrs.**

Individual project developed under supervision of a CS faculty member. May be repeated under a different topic once. Maximum of three semester hours per semester. Prerequisite: consent of department.

**CS 412 Topics in Computer Science**  
**3 hrs.**

Topics of special interest which may vary each time course is offered. Repeatable under a different topic for a maximum of six hours. Prerequisites: consent of instructor.

**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. Prerequisite: 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, and 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/MTH 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. Prerequisites: 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. Prerequisite: 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 mathematical approaches. Performance prediction, bench marking, and synthetic loading. Prerequisites: a grade of C or better in CS 310 or 302; one semester of statistics.