

# DEPARTMENT OF COMPUTER SCIENCE

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The Department of Computer Science offers two degree options for students - a Bachelor of Arts (B.A.) and a Bachelor of Science (B.S.). The Bachelor of Science in Computer Science degree program is accredited by the Computing Accreditation Commission of ABET, <http://www.abet.org>. The department offers courses in computer architecture, data structures and algorithms, automata theory, compilers, operating systems, object-oriented design and programming, software engineering, computer graphics, computer networks, parallel programming, computer security, software engineering, database design, artificial intelligence, data mining, machine learning, computer vision, human computer interaction, green computing, and several programming languages including C++, Java, Python, and Assembly. Computer Science graduates can further their studies in graduate schools or enter the workforce in fields like hardware manufacturing, software development, cyber security, computer applications, and secondary school teaching.

## Mission Statement

The mission of the Department of Computer Science is to advance the knowledge of computer science and technology through education, research, and service for the betterment of society.

## Computer Science Goals

1. Graduating students with strong technical backgrounds and communication skills.
2. Graduating students who understand the values and requirements of responsible professionalism and lifelong learning.
3. Building a sustainable research program.
4. Developing international visibility for our research.
5. Providing quality service to the university, the profession, and the community.

## Bachelor of Arts (B.A.)

- Major in Computer Science (<http://mycatalog.txstate.edu/undergraduate/science-engineering/computer/computer-science-ba/>)

## Bachelor of Science (B.S.)

- Major in Computer Science (<http://mycatalog.txstate.edu/undergraduate/science-engineering/computer/computer-science-bs/>)
- Major in Computer Science (Computer Engineering Concentration) (<http://mycatalog.txstate.edu/undergraduate/science-engineering/computer/computer-science-concentration-engineering-bs/>)

## Minor

- Computer Science (<http://mycatalog.txstate.edu/undergraduate/science-engineering/computer/computer-science-minor/>)

## Courses in Computer Science (CS)

### CS 1308. Computer Literacy and the Internet.

A study of the uses of computers and their effects on society. Text processing, spreadsheets, databases, and Web programming. Does not count for computer science credit towards a minor, a BS, or a BA in computer science.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**TCCN:** COSC 1301

### CS 1319. Fundamentals of Computer Science.

Provides fundamental knowledge of the six layers of computer science as per the ACM CS0 curriculum. The information, hardware, programming, operating system, applications, and communications layers are presented plus appropriate open computer laboratory exercises. Does not count for computer science credit towards a minor, BS, or BA in computer science.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**TCCN:** COSC 1336

### CS 1342. Programming for Scientists and Engineers.

This course is an introduction to computer science and problem solving techniques with applications in engineering and the physical sciences. Topics include an introduction to computer organization, data representation, algorithm development, and computer programming in a high-level language.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

### CS 1428. Foundations of Computer Science I.

Introductory course for computer science majors, minors and others desiring technical introduction to computer science. Contains overview of history and structure of the digital computer, including binary data representation. Problem solving, algorithm development, structured programming, good coding style, and control structures of C++ are emphasized. Prerequisite: [MATH 1315 or MATH 1317 or MATH 1319 or MATH 1329 or MATH 2417 or MATH 2471 with a grade of "C" or better] or [ACT Mathematics score of 24 or better] or [SAT Mathematics score of 520 or better] or [SAT Math Section score of 550 or better] or [Accuplacer College Mathematics score of 86 or better] or [Compass College Algebra score of 46 or better] or [Next-Generation Advanced Algebra and Functions Test of 263 or better].

**4 Credit Hours. 3 Lecture Contact Hours. 2 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Lab Required

**Grade Mode:** Standard Letter

**TCCN:** COSC 1437

**CS 2308. Foundations of Computer Science II.**

The course is an introduction to Abstract Data Types (ADTs) including lists, stacks, and queues. Searching and sorting, pointers and dynamic memory allocation, and simple classes and objects also will be covered. The course is a continuation of CS 1428. Prerequisite: CS 1428 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**TCCN:** COSC 2336

**CS 2315. Computer Ethics.**

This course is primarily for computer science majors, focusing on the ethical codes of the professional societies, the philosophical bases of ethical decision-making, and the examination of several contemporary case studies. (WI) Prerequisites: CS 1428 and [COMM 1310 or COMM 2338] and [ENG 1310 or ENG 1320 or ENG 1321 or ENG 3303] and [PHIL 1305 or PHIL 1320] all with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**CS 2318. Assembly Language.**

A course covering assembly language programming, including instruction sets, addressing modes, instruction formats, looping, logic, data representation, subroutines and recursion; and the interface between hardware and software. Prerequisites: CS 2308 and MATH 2358 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**TCCN:** COSC 2325

**CS 3320. Internet Software Development.**

A course providing foundations for the construction and design of static and dynamic Web pages with database applications. This will include server-side and client-side software development. Prerequisite: CS 2308 with a grade of "C" or better or instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 3339. Computer Architecture.**

Use of fundamental hardware components. Topics include ALU's, single and multiple cycle datapath and control, RISC vs. CISC, pipelining, caches, I/O, virtual memory and related performance issues. Prerequisite: CS 2318 or EE 3420 either with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 3354. Object-Oriented Design and Programming.**

The course covers object-oriented design principles and programming for students with prior programming experience. The topics include inheritance and polymorphism, object-oriented design process, UML diagrams, design patterns, exception handling and multithreading. Students will design and implement programs in Java. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 3358. Data Structures and Algorithms.**

This is a course that covers classic data structures and the analysis of algorithms. Prerequisites: CS 2308 and MATH 2358 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 3360. Computing Systems Fundamentals.**

This course covers fundamental concepts underlying the design and implementation of computing systems. It introduces students to problems that reoccur in computing systems and the tools and algorithms used to solve them. Topics include performance evaluation, resource management and scheduling, concurrency and synchronization, and communication and networks. Prerequisite: CS 2318 and CS 3358 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 3369. Embedded Computer Systems.**

This course studies the architecture of embedded systems, micro-controllers, their peripherals, languages, and operating systems and the special techniques required to use them. Prerequisite: CS 2318 or EE 3420 either with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 3378. Theory of Automata.**

An introduction to automata theory, computability, and formal languages. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 3393. Software Testing.**

This course introduces basic concepts and techniques for testing software and finding bugs. Topics include test design, test process, unit, integration and system testing, manual and automatic techniques for generation of test inputs and validation of test outputs, and coverage criteria. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 3398. Software Engineering.**

The study of software design, implementation, and validation techniques through team projects. Structured analysis, programming style, and project documentation are emphasized in large software projects. (WI)  
Prerequisite: CS 3354 and CS 3358 and [CS 2315 or EE 2400] all with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**CS 4100. Computer Science Internship.**

Provides on-the-job training supervised by computer scientists in industry internship programs approved by the department.

**1 Credit Hour. 0 Lecture Contact Hours. 20 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Credit/No Credit

**CS 4298. Undergraduate Research I.**

Supervised individual research project in a mentor-student relationship with a computer science faculty member. Cannot be given degree credit until the satisfactory completion of CS 4299. Prerequisites: Minimum 3.00 Major GPA and instructor approval.

**2 Credit Hours. 1 Lecture Contact Hour. 2 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering

**Grade Mode:** Credit/No Credit

**CS 4299. Undergraduate Research II.**

Supervised individual research projects in a mentor-student relationship with a computer science faculty member. Prerequisites: CS 4298 with a grade of "C" or better and instructor approval.

**2 Credit Hours. 1 Lecture Contact Hour. 2 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4310. Computer Networks.**

This course covers the fundamental concepts in the design of computer networks and networking protocols with emphasis on the Internet (TCP/IP) architecture. The covered topics include: protocol layering, media access, internet routing, transport protocols and applications. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4315. Introduction to Data Mining and Information Retrieval.**

This course covers fundamental concepts and techniques in data mining and information retrieval. Data mining topics include classification, cluster analysis and pattern mining. Information retrieval topics include Boolean retrieval, vector space model, and Web search. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4318. Compiler Construction.**

This course investigates theoretical and practical issues in the design and construction of modern compilers. Topics covered include lexical and syntactic analysis, syntax-directed translation, type checking, intermediate representation, code generation, and runtime systems. A major portion of the course involves implementing a compiler from scratch for a C-like programming language. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4326. Human Factors of Computer Systems.**

Principles and methods in human factors and ergonomics applied to the design and use of computer systems. Prerequisite: CS 3358 with a grade of "C" or better. (WI).

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering|Writing Intensive

**Grade Mode:** Standard Letter

**CS 4328. Operating Systems.**

This course covers the principles of operating systems design. The covered topics include: process management, CPU scheduling algorithms, inter-process communication and synchronization, memory management, virtual machines and I/O device management. Prerequisites: CS 3339 and CS 3358 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4332. Introduction to Database Systems.**

Introduction to database concepts, data models, file structures, query languages, database management systems. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4337. Introduction to Computer Vision.**

This course covers fundamental topics of computer vision. Topics include elementary image operations and transformations, template matching, feature extraction, object recognition, classification and tracking, deep learning, camera models and stereo vision, and image searching. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Grade Mode:** Standard Letter

**CS 4346. Introduction to Artificial Intelligence.**

An introduction to the basic concepts of artificial intelligence; search techniques, knowledge representation, problem solving. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4347. Introduction to Machine Learning.**

This course provides systematic introduction to machine learning, covering basic theoretical as well as practical aspects of the use of machine learning methods. Topics include learning theory, learning methods, and recent learning models. Application examples include multimedia information retrieval, text recognition, and computer vision. Prerequisite: CS 3358 and MATH 3305 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4350. Unix Systems Programming.**

Fundamentals of Unix operating systems, Unix file system and environment, C memory allocation, development tools, processes and signals, threads, device drivers, and programming for security. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4353. Introduction to Graphical User Interfaces.**

This course covers abstract and practical foundations of graphical user interface design, evaluation, and implementation. Students will learn the fundamentals of computer graphics and interactive computer/human interfaces. The course includes a survey of usability measures, the major GUI standards, and GUI tools. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4368. Survey of Computer Languages.**

A survey of computer languages. Criteria for choosing languages to be covered include history, important development paradigms and environments, and language implementations. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4371. Computer System Security.**

Course covers practical aspects of computer system security including managing and producing code for secure systems. Theory, such as cryptography, is introduced as needed. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4372. Introduction to Digital Multimedia.**

The course covers concepts, problems and techniques in digital multimedia. Topics include digital representation and data compression of text, speech, audio, natural and synthetic images, and video, as well as multimedia applications, transmission, and standards. In addition, the course introduces perceptual aspects of multimedia signals and sources. Prerequisite: CS 3358 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4379D. Distributed Ledger Systems and Blockchains: Theory and Applications.**

This course covers fundamental concepts underlying the design, implementation, research, and applications of Distributed Ledger Technology (DLT) systems (e.g., blockchains). It introduces implementations, applications, and performance evaluation of DLT systems. Topics include cryptographic encryption, security, anonymity, cryptographic data structures, DLT performance evaluation, DLT applications, and current DLT research. Prerequisite: CS 3358 with grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Topics

**Grade Mode:** Standard Letter

**CS 4379Q. Introduction to Recommender Systems.**

This course covers the basic concepts of recommender systems, including personalization algorithms, evaluation tools, and user experiences. We will discuss how recommender systems are deployed in e-commerce sites, social networks, and many other online systems. Additionally, we will review current research in the field. Prerequisite: CS 3358 with a grade of "C" or better or instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**CS 4379V. Fundamentals of Algorithm Design and Analysis.**

This course covers classic algorithms in computer science and their applications, with emphasis on algorithm design, algorithm analysis, and problem formulation. Topics include disjoint sets and union-find algorithms, tree and graph algorithms, sorting algorithms, greedy algorithms, dynamic programming, and string processing algorithms. Prerequisite: CS 3358 with grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**CS 4379Y. Introduction to Green Computing.**

Reducing energy consumption of mobile devices, cloud computing platforms, and supercomputers is a paramount but daunting problem. This course covers fundamental concepts and techniques in green computing, including a hardware energy efficiency roadmap; energy efficient software design, resource management, and storage solutions; and green data centers and mobile computing. Prerequisites: CS 3339 and CS 3358 both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering|Topics

**Grade Mode:** Standard Letter

**CS 4380. Parallel Programming.**

This course teaches practical aspects of parallel programming. The covered topics include multi-core processors and shared-memory programming, hardware accelerator programming, and distributed-memory machines and message-passing programming. The students will gain the knowledge and skills needed for developing parallel software by writing programs for a variety of parallel computers. Prerequisite: CS 3339 and CS 3358 both with grades of "C" or better or instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4381. Practical Game Development.**

This course teaches practical aspects of computer game design and implementation. Topics include graphics game engines, game physics, AI methods applied to games, and software architectures for computer games. Students will gain knowledge and skills needed for game development via team projects. Prerequisite: CS 3398 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4388. Computer Graphics.**

This course is a study of the hardware and software used in graphic representation and interpretation of data. Prerequisite: CS 3358 and [MATH 1317 or MATH 2321 or MATH 2417 or MATH 2471 or MATH 2472] both with grades of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter

**CS 4395. Independent Study in Computer Science.**

Open to undergraduate students on an independent basis by arrangement with the faculty member concerned. Prerequisite: Instructor approval.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Exclude from 3-peat Processing|Dif Tui- Science & Engineering

**Grade Mode:** Credit/No Credit

**CS 4398. Software Engineering Project.**

Students undertake a software development project. They work in teams, developing requirements and designs which they will implement and test. Prerequisite: CS 3398 with a grade of "C" or better.

**3 Credit Hours. 3 Lecture Contact Hours. 0 Lab Contact Hours.**

**Course Attribute(s):** Dif Tui- Science & Engineering

**Grade Mode:** Standard Letter