

# DEPARTMENT OF COMPUTER SCIENCE

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## About

### Chair

Peter A. Cooper (cooper@shsu.edu)

## Mission

The Department of Computer Science is a community of faculty, staff, and students centered in the computer science disciplines. The Department of Computer Science is dedicated to providing the highest quality education possible to its graduate and undergraduate students through excellence in teaching and excellence in research. The department is committed to furthering the pursuit of knowledge and meeting the needs of a diverse society.

The Department of Computer Science seeks to provide an environment that encourages innovative thinking, academic rigor, and the pursuit of scholarship in an atmosphere that promotes high ethical and moral values and mutual respect, embracing diversity and working towards a goal of instilling a life-long love of learning.

### Contact Information

(936) 294-3846

### Website

Computer Science: (<http://cs.shsu.edu>) <http://cs.shsu.edu/>

Digital Forensics: <http://df.shsu.edu>

## Highlights

Sam Houston State University provides a comprehensive computing environment for students. The Computer Services Department operates a large number of computing laboratories containing desktop computers and workstations. A variety of operating systems, network protocols, programming languages and application packages are available. Students have full access to the Internet and E-mail facilities when on campus and through dial-up facilities from off-campus. In addition to the institutional facilities, the Department of Computer Science operates a range of lab facilities to support its mission and programs, including network robotics and Unix labs, a data recovery lab, and a network security lab. The department operates a 40-node symmetric multiprocessing system for use in parallel processing, digital forensics, cryptanalysis, and steganographic research. The department also has access to state of the art visualization facilities. As part of its operations, the Department of Computer Science houses the Sam Houston State University Center of Excellence in Digital Forensics, a center dedicated to the development of digital forensics training for law enforcement personnel and research opportunities into forensics and security issues.

## Career Opportunities

Computing professionals support many scientific, governmental, and commercial enterprises through network and communication systems management, application (computer program) development and maintenance, and hardware design. The management of computing resources within organizations is typically a mission critical activity and computing professionals occupy key organizational roles as network and database administrators, software engineers, systems analysts and programmers. Of key concern in today's modern environment is the protection, assurance, and recovery of computing resources, providing opportunities for those wanting to work in the information assurance and digital forensics fields.

## Student Organizations and Activities

Sam Houston Association of Computer Scientists - The club sponsors field trips, campus visits by guest speakers, and occasional student/faculty outings.

## Internships

The Computer Science department does not operate internships as part of its degree programs.

## Scholarships

The Department of Computer Science offers the following scholarship:

- The Kailas and Becky Rao Scholarship in honor of Mr. Albert Kidd: awarded to full time graduate or undergraduate students in good standing and majoring in Computer Science.

This scholarship requires a minimum GPA of 3.0 and registration in courses leading to a degree in Computer Science. Other criteria are also pertinent to individual scholarships. More information can be obtained through the department.

- Master of Science in Computing and Information Science ([catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/computing-information-science-ms](http://catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/computing-information-science-ms))

- Master of Science in Digital Forensics ([catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/digital-forensics-ms](http://catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/digital-forensics-ms))
- Master of Science in Information Assurance and Security ([catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/information-assurance-security-ms](http://catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/information-assurance-security-ms))
- Graduate Certificate in Cyber Security ([catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/cyber-security-certificate](http://catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/cyber-security-certificate))
- Graduate Certificate in Data Assurance ([catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/data-assurance-certificate](http://catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/data-assurance-certificate))
- Graduate Certificate in Digital Investigation ([catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/digital-investigation-certificate](http://catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/digital-investigation-certificate))
- Graduate Certificate in Educational Technology ([catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/educational-technology-certificate](http://catalog.shsu.edu/archives/2016-2017/graduate/college-departments/sciences/computer-science/educational-technology-certificate))

## Computer Science

### **COSC 5301. Quantitative Foundations of CS. 3 Hours.**

This course provides the fundamental quantitative methods needed in the area of computer science (CS). Topics include numbering systems, propositional logic, digital logic, combinatorics, probability and statistics, and automata theory, focusing on their application to computing and information science. This course serves graduate students without an undergraduate degree in a quantitative field by providing necessary stem work. This course may not be counted toward the requirements for a graduate degree in Computer Information Science, Digital Forensics, or Information Assurance and Security.

**Prerequisite:** Approval by the graduate advisor.

### **COSC 5302. Computer Science Core Topics. 3 Hours.**

This course provides a solid foundation of Computer Science core concepts, fundamental principles, generalizations, and theories essential to pursuing the CS graduate program. Topics include computer programming, database systems, and computer networks. This course provides stem work for those graduate students whose undergraduate degrees are not in CS and thus have little exposure to core CS topics. This course may not be counted toward the requirements for a graduate degree in Computer Information Science, Digital Forensics, or Information Assurance and Security.

**Prerequisite:** Approval by the graduate advisor.

### **COSC 5310. Cryptography & Steganography. 3 Hours.**

This course is designed to cover the theoretical and practical aspects of cryptography and steganography including specification, design, and programming. Topics include digital signatures, symmetric and asymmetric (public key) algorithms, hash functions, cryptographic algorithms, cost to break algorithms including key safety, Diffie-Hellmann, RSA, key stores, Secure Socket Layers, Virtual Private Networks (VPN), Certificate Authorities, and important cryptanalysis and steganalysis strategies.

### **COSC 5313. Artificial Intelligence. 3 Hours.**

A survey of topics in artificial intelligence. Topics include: history of AI, knowledge representation, knowledge acquisition, search techniques, control strategies, and AI languages. Applications include natural language processing, neural nets, and expert systems.

### **COSC 5318. Database Systems. 3 Hours.**

A survey of contemporary topics in database systems. Topics include: relational database theory, database design issues, cryptography, security integrity issues, data recovery, concurrency problems, optimization, distributed database systems, the client/server model, object-oriented databases, stenography, data compression, data warehouse, data mining, logic/knowledge based systems, and other related topics.

### **COSC 5319. Algorithm Design and Analysis. 3 Hours.**

A number of important concepts and algorithms, with emphasis on correctness and efficiency, are reviewed. The advanced treatment of sorting, searching, hashing, and dynamic storage management is provided. Advanced data structures, such as advanced tree structures, graphs, and networks, are introduced. Applications to distributed file structures, database management systems, internet/intranetworks are covered.

### **COSC 5320. Comp Architecture & Organizatn. 3 Hours.**

An introduction into Computer Architecture and Organization. Topics include computer evolution and performance issues, the computer systems including system buses, internal and external memory, input/output, and operating system support, CPU issues including computer arithmetic, instruction sets, addressing modes, RISC and superscalar organization, control unit issues, microprogramming, and parallel organization.

### **COSC 5321. Parallel Computing. 3 Hours.**

This course is a study of large-scale parallel processing systems. The central themes are theoretical models, machine architecture, computer algorithms, and programming languages that model, support, describe and implement parallel processing.

**Prerequisite:** COSC 5319.

### **COSC 5322. Real-Time and Embedded Systems. 3 Hours.**

This course emphasizes real-time and fault-tolerant computing systems. Topics include interrupt processing, real-time programming and scheduling, fault-tolerant architectures and systems, and robotic programming. Extensive programming will be done.

**COSC 5325. Operating System Security. 3 Hours.**

This course will provide the rationale and necessity for a full range of security concepts and techniques and how to apply them to multiple operating systems. The course will cover methodologies for the design of operating system security and forensic techniques for operating systems. Also covered will be the identification of best practices in the administration, testing and security for operating systems.

**COSC 5326. Networks & Data Communications. 3 Hours.**

An introduction to the basic techniques for interconnecting computers and peripherals for decentralized Computer. Network components, digital communications, interconnection architectures, communications protocols for geographic and local area networks and interprocess communications are covered.

**COSC 5327. Operating Systems. 3 Hours.**

A comprehensive study of computer operating systems. Topics include: computer architecture, concurrent processes, multi-threaded systems, scheduling, memory management, I/O management, file systems, networking and the client/server model, distributed systems, and computer security.

**COSC 5330. Malware. 3 Hours.****COSC 5332. Computer Graphics. 3 Hours.**

A study of modern Computer Graphics programming techniques. Topics include: representations, transformations, and analysis of 2-dimensional and 3-dimensional objects; techniques for hidden surface/edge removal, illumination and shading, volume rendering, animation, and image data compression; and practical experience in graphics software libraries and applications.

**COSC 5335. Database Security. 3 Hours.**

Database security has an immense impact on the design of today's electronic information systems. This course will provide an overview of database security concepts and techniques and discuss new directions of database security in the context of a connected commercial world. This course provides the information needed to develop, deploy and maintain a secure database solution. It exposes the pitfalls of database design, their means of identification and the methods of exploiting vulnerabilities.

**COSC 5340. Special Topics. 3 Hours.**

Topics and courses are selected to suit individual needs of students. The course may be repeated for additional credit.

**Prerequisite:** Approval by the graduate advisor.

**COSC 6049. Thesis. 1-3 Hours.****COSC 6312. Multimedia Forensics. 3 Hours.**

This course examines the theory and practice of multimedia security and forensics. Topics include image processing, JPEG compression, audio compression (MP3, Advanced Audio Coding, and VOIP), MPEG compression, multimedia source identification, biometrics, steganography, steganalysis, multimedia forgery detection, and pattern recognition techniques for multimedia analysis, multimedia forensics software, and advances in multimedia forensics.

**Prerequisite:** Approval by the graduate advisor.

**COSC 6313. Neural Networks. 3 Hours.**

An introduction into Neural Networks. Topics include discussion of variety of standard neural networks, with architecture, training algorithm, and applications; and development of neural network expert systems.

**COSC 6315. Machine Learning. 3 Hours.**

This course provides the principles, design, and implementation of a broad range of machine learning algorithms. Topics include computational learning theory, machine learning algorithms, and algorithm assessment techniques. Both a computational aspect (how to compute the answer) and a statistical aspect (how to ensure that future predictions are accurate) of each machine learning algorithm are discussed.

**Prerequisite:** COSC 5319.

**COSC 6318. Language and Compiler Design. 3 Hours.**

A comprehensive study of computer programming languages. Topics include: language design principles, formal grammars, procedural operating environment, language standardization, and language support for parallel and distributed programming. Language paradigms to be discussed will include procedural programming, logical programming, functional programming, and object-oriented programming.

**COSC 6319. Software Engineering. 3 Hours.**

This course emphasizes strategies, techniques, and methodologies that deal with the complexity in developing large-scale information systems. Methods for Software engineering methodologies, conventional as well as object-oriented, are discussed. Software measurement and management are discussed. Formal mechanisms for system specification, software development, and project management are introduced.

**Prerequisite:** Approval by the graduate advisor.

**COSC 6347. Programming Practicum. 3 Hours.**

The practicum provides the student an opportunity to develop their programming and analytical skills by applying concepts and techniques learned in organized classes to real world projects under the supervision of faculty and/or supervisory Computer professionals. Prerequisite: Eighteen hours of Computer and Information Science graduate level coursework. Student must register for this course every semester the practicum is in progress but only three hours of practicum will apply to the student's degree plan.

**Prerequisite:** Student must register for this course every semester the practicum is in progress but only three hours of practicum will apply to the student's degree plan.

**COSC 6348. Thesis. 3 Hours.**

**COSC 6414. Data Mining/Knowledge Discovery. 4 Hours.**

An introduction into Data Mining and Knowledge Discovery. Topics include discussion of variety of mining techniques. Mining of complex data such as multimedia database, text database, and world-wide-web will be introduced. The applications and trends in data mining will also be discussed.

**Prerequisite:** COSC 5318.

## Computer Science Technology

**CSTE 5319. Critical Analysis-Instruc Sftwr. 3 Hours.**

This course examines the instructional and educational value of commercially available software for the pre-k through 12th grade. The course builds upon a foundation of instructional theory to identify appropriate characteristics of instructional software and explores the effectiveness of instructional software in the classroom. This course may not be counted toward the M.S. in Computer and Information Science, Information Assurance and Security or Digital Forensics.

**Prerequisite:** CSTE 5336.

**CSTE 5336. Educational Multimedia. 3 Hours.**

This course explores the uses of multimedia in the classroom and extends the teachers skill base in the development of appropriate multimedia examples to support and enhance the middle school and high school curricula. Throughout the course students will gain experience in still and motion digital editing, audio and animation production. This course may not be counted toward the M.S. in Computer and Information Science, Information Assurance and Security or Digital Forensics.

**Prerequisite:** CSTE 5319 and Graduate standing.

**CSTE 5337. Design Instrctnl Mat For Web. 3 Hours.**

This course examines the development of web sites for instructional purposes. The course looks at the systematic design of instruction, a process that examines the development of appropriate course goals, the identification of measurable objectives that meet those goals and intelligent approaches to assessing student performance. This design approach is then applied to the development of web-based materials, providing opportunities for skills acquisition in a variety of multimedia applications and their incorporation into a web site. The course culminates in the development of a geometry web site for use in schools. This course may not be counted toward the M.S. in Computer and Information Science, Information Assurance and Security or Digital Forensics.

**Prerequisite:** CSTE 5336.

**CSTE 5338. Dev Of Tech Infrastructre-Schl. 3 Hours.**

**Prerequisite:** CSTE 5337.

**CSTE 7315. Educational Network Design. 3 Hours.**

This course examines the technical, environmental, and policy issues involved in the development of educational technology infrastructures, focusing on network design and evaluation.

**CSTE 7325. Technology Sustainability. 3 Hours.**

This course will examine the potential and the challenges associated with initiating and maintaining green and cost-efficient technology infrastructures based on environmental awareness initiatives.

**CSTE 7335. Mgmt Application Analysis. 3 Hours.**

This course provides a systematic and rational approach to the analysis, evaluation, and implementation of course management systems from the standpoints of pedagogical success, user friendliness, and cost effectiveness.

**CSTE 7336. Instructional Design Assmt. 3 Hours.**

This course applies instructional design theory to the development, analysis, evaluation, and assessment of various digital instructional designs.

**CSTE 7380. Inst Tech Research Methods. 3 Hours.**

This course focuses on the research questions, approaches, and measures typically employed by instructional technology researchers.

## Digital Forensics

**DFSC 5310. Principle& Policy-Info Assuranc. 3 Hours.**

An investigation into the development of security planning and policy formation, risk management, security education, training and awareness programs. This course examines physical and electronic approaches to data protection and derives appropriate assessment strategies for determining the assurance quality of target systems.

**DFSC 5315. Network and Cyber Security. 3 Hours.**

This course provides the framework and procedures for securing computer systems and data networks. Topics include the methodologies for the design of security systems, establishing security protocols, and the identification of best practices in administration, testing, and response protocols for secure communications systems.

**DFSC 5316. File System Forensics. 3 Hours.**

This course focuses on the important concepts associated with the structures, encoding, boot process and storage technologies of modern computers, and the implications of those concepts regarding the analysis of volumes and file systems for forensics purposes.

**DFSC 5317. Digital Security. 3 Hours.**

This course introduces the student to basic security needs. The course will include, but not be limited to examination of individual vs. government privacy issues, federal encryption standards, the different layers of security currently available, cryptography, and strategies for evaluation and selection of security methods.

**DFSC 5318. Cyber Law. 3 Hours.**

The focus will be on how the law impacts digital security in diverse ways. Discussion will emphasize the concept of criminal intent, the digital victim and address jurisdictional issues and provide an overview of legal terms and issues with which the security manager must address.

**DFSC 5325. Organization System Security. 3 Hours.**

This course provides advanced study of system security concepts as applied to the protection of organizational systems including (1) principles of security modeling, accountability and access control, (2) the ISO model for network infrastructure design and protection, (3) communication security and control management, (4) auditing and monitoring, (5) incident management, and (6) law, investigations and ethics.

**Prerequisite:** DFSC 5310.

**DFSC 5327. Digital Forensics Investigatn. 3 Hours.**

This course explores tools for the recovery of information on hardware or hidden within other formats. Topics also include cryptographic analysis, password recovery, the bypassing of specific target operating systems, and obtaining data from a digital device that has been destroyed.

**DFSC 5328. Software Forensic Evidence Mgt. 3 Hours.**

Analysis of investigative techniques and tools in the detection, investigation and analysis of digital crimes. This course examines the nature of cyberevidence and the tracking and identification of cybercriminals.

**DFSC 5336. Business Continuity Management. 3 Hours.**

This course examines identification and assessment of threat, risk, vulnerability and business continuity in case of disaster, as applied to enterprise IT systems. It incorporates the physical safeguards and policies necessary to meet the requirements for the protection of data in a fixed site. This course also discusses techniques and strategies designed to keep enterprise data in service under critical circumstances.

**DFSC 5340. Spcl Tpcs In Digital Forensics. 3 Hours.**

Topics and courses are selected to suit individual needs of students. The course may be repeated for additional credit.

**Prerequisite:** Approval by the graduate advisor.

**DFSC 6310. Cyber Warfare & Terrorism. 3 Hours.**

This course will focus on philosophies, tactics, and targets of cyber terrorist organizations. The course includes discussion of emerging cyber war trends and the roles of the private sector and U.S. Government in responding to, mitigating and preventing electronic offensive actions.

**DFSC 6312. Multimedia Forensics. 3 Hours.**

This course examines the theory and practice of multimedia security and forensics. Topics include image processing, JPEG compression, audio compression (MP3, Advanced Audio Coding, and VOIP), MPEG compression, multimedia source identification, biometrics, steganography, steganalysis, multimedia forgery detection, and pattern recognition techniques for multimedia analysis, multimedia forensics software, and advances in multimedia forensics.

**DFSC 6313. Wireless Network Security. 3 Hours.**

This course provides advanced study of the full range of algorithms, mechanisms, and technologies in securing various types of wireless communication networks, such as cellular networks, Wireless Local Area Networks, Bluetooth Networks, Mobile Ad Hoc Networks, and Wireless Sensor Networks. Research and applications will be explored.

**DFSC 6347. Directed Mgt & Development Prj. 3 Hours.**

This course will provide the rationale and necessity for a full range of security concepts and techniques and how to apply them to multiple operating systems. The course will cover methodologies for the design of operating system security and forensic techniques for operating systems. Also covered will be the identification of best practices in the administration, testing and security for operating systems. Continuous enrollment in DFSC 6347 is required until graduation.

**Prerequisite:** 24 hours graduate coursework.

Chair: **Peter A. Cooper**

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