

# CSE

## Computer Science

### CSE 101 Introduction to Computers and Information Technologies

An introduction to the basics of personal computing and information technologies intended primarily for students majoring in humanities, social and behavioral sciences, or business management. Topics include principles of personal (single-user) computer systems, office automation, and information in a modern, networked (multi-user) computing environment. Emphasis is on conceptual understanding of personal computing rather than use of specific hardware or software. Required participation in computer laboratories. May not be taken for credit in addition to EST 100 or after any CSE or ISE course.

*Prerequisite:* Satisfaction of entry skill in mathematics requirement (Skill 1) or satisfactory completion of D.E.C. C  
3 credits

### CSE 102 Introduction to Web Design and Programming

An introduction to the design of Web pages, specifically the development of browser and device independent HTML, with an emphasis on the XHTML standards. Includes the use of style sheets (CSS) and tools for page layout and verification. HTML is presented as a mark-up language, exploring the rules of HTML elements and attributes. Students learn the separation of page viewing information from the HTML through CSS style sheets as well as the use of block layout without using HTML tables. Addresses HTML display properties including text, color, image, and graphic elements as well as approaches to HTML validation and techniques.

*Advisory Prerequisite:* CSE 101 or basic computer skills  
3 credits

### CSE 110 Introduction to Computer Science

An introduction to fundamentals of computer science. Topics covered include algorithmic design, problem-solving techniques for computer programming, fundamentals of digital logic and computer organization, the role of the operating system, introductory programming methodology including variables, assignment statements, control statements and subroutines (methods), programming paradigms, the compilation process, theoretical limits of computation, social and ethical issues. Intended for students who have not taken any college-level computer science course containing programming assignments in a high-level programming language.

*Prerequisite:* Level 3 or higher on the mathematics placement examination  
3 credits

### CSE 114 Computer Science I

An introduction to procedural and object-oriented programming methodology. Topics include program structure, conditional and iterative programming, procedures, arrays and records, object classes, encapsulation, information hiding, inheritance, polymorphism, file I/O, and exceptions. Software debugging and testing techniques are emphasized including an introduction to formal verification methods. Includes required laboratory.

*Prerequisite:* one of the following: CSE 110 or CSE 130 or ESE 124 or ESG 111 or MEC 111 or MEC 112  
4 credits

### CSE 130 Introduction to Programming in C

Introduces programming concepts using the C language. Variables, data types, and expressions. Conditional and iterative statements, functions, and structures. Pointers, arrays, and strings. Scope of variables and program organization. Includes programming projects of an interdisciplinary nature. Suitable as an introductory programming course for non-CSE

majors.

*Prerequisite:* Level 3 or higher on the mathematics placement examination  
3 credits

### CSE 150 Foundations of Computer Science: Honors

Introduction to the logical and mathematical foundations of computer science for computer science honors students. Topics include functions, relations, and sets; recursion and functional programming; basic logic; and mathematical induction and other proof techniques.

*Prerequisites:* One MAT course that satisfies DEC category C or score of level 4 on the math placement exam; admission to the Computer Science Honors Program or the Honors College or WISE or permission of the instructor  
4 credits

### CSE 160 Computer Science A: Honors

First part of a two-semester sequence, CSE 160 and CSE 260. Emphasizes a higher-level, object-oriented approach to the construction of software. Focus on software engineering issues such as programming style, modularity, and code reusability. Includes the way in which software tools can be used to aid the program development process. First considers the construction of small programs, continues by treating the design and implementation of program modules, and culminates in an introduction to object-oriented design techniques suitable for larger programs.

*Prerequisite:* CSE 110 or 114 or MEC 112 or ESG 111  
4 credits

### CSE 214 Computer Science II

An extension of programming methodology to data storage and manipulation on complex data sets. Topics include: programming and applications of data structures; stacks, queues, lists, binary trees, heaps, priority queues, balanced trees and graphs. Recursive programming is heavily utilized. Fundamental sorting and searching algorithms are examined along with informal efficiency comparisons.

*Prerequisite:* C or higher in CSE 114  
3 credits

### CSE 215 Foundations of Computer Science

Introduction to the logical and mathematical foundations of computer science. Topics include functions, relations, and sets; recursion and functional programming; elementary logic; and mathematical induction and other proof techniques.

*Prerequisite:* AMS 151 or MAT 125 or MAT 131  
3 credits

### CSE 219 Computer Science III

Development of the basic concepts and techniques learned in CSE 114 Computer Science I and CSE 214 Computer Science II into practical programming skills that include a systematic approach to program design, coding, testing, and debugging. Application of these skills to the construction of robust programs of 1000 to 2000 lines of source code. Use of programming environments and tools to aid in the software development process.

*Prerequisite:* C or higher in CSE 214  
3 credits

### CSE 220 Computer Organization

Explores the physical structure of a computer; internal representation of information; processor organization, instruction cycle, and memory hierarchy. Introduces assembly/machine language programming and its relation to execution of high level language programs. Elementary digital logic design and its application to design of arithmetic and logic unit, and simple data paths. Input and output devices and their interface with processor and memory.

*Prerequisite:* CSE 160 or 214  
3 credits

### CSE 230 Intermediate Programming in C and C++

Intermediate programming concepts using the C language in a UNIX environment. Files, systems calls, stream I/O, the C preprocessor, bitwise operations, the use of makefiles, advanced formatting of input and output, conversions. Introduction to object-oriented programming using C++; classes, objects, inheritance, aggregation, and overloading. Suitable for all majors.

*Prerequisite:* CSE 130 or ESE 124 or ESG 111 or MEC 112  
3 credits

### CSE 260 Computer Science B: Honors

Second part of a two-semester sequence, CSE 160 and CSE 260. Further development of the object-oriented design strategies presented in CSE 160. Continues with introductions to event-driven programming, graphical user interfaces, and design patterns. Includes an extended design and programming project.

*Prerequisite:* CSE 160  
4 credits

### CSE 300 Writing in Computer Science

See Requirements for the Major in Computer Science, Upper-Division Writing Requirement.

*Prerequisites:* WRT 102; CSE major; U3 or U4 standing  
1 credit

### CSE 301-H History of Computing

A study of the history of computational devices from the early ages through the end of the 20th century. Topics include needs for computation in ancient times, development of computational models and devices through the 1800's and early 1900's, World War II and the development of the first modern computer, and early uses in business. Creation of programming languages and the microchip. Societal changes in computer usage due to the microcomputer, emergence of the Internet, the World Wide Web, and mobile computing. Legal and social impacts of modern computing. Cannot be used as a technical elective for the CSE major or minor.

*Prerequisite:* U2 standing or higher  
*Advisory Prerequisite:* one course in computing  
3 credits

### CSE 302 Professional Ethics for Computer Science

Familiarizes students with professional practice in Information Technology. Enables them to identify ethical conflicts, their responsibilities and options, and to think through the implications of possible solutions to ethical conflicts.

*Prerequisite:* CSE 219 or CSE 260 or ISE 305  
1 credit

### CSE 303 Introduction to the Theory of Computation

An introduction to the abstract notions encountered in machine computation. Topics include finite automata, regular expressions, and formal languages, with emphasis on regular and context-free grammars. Questions relating to what can and cannot be done by machines are covered by considering various models of computation, including Turing machines, recursive functions, and universal machines.

*Prerequisites:* CSE 214 and (CSE 213 or CSE 215)  
3 credits

### CSE 304 Compiler Design

Topics studied include formal description of programming languages, lexical analysis, syntax analysis, symbol tables and memory allocation, code generation, and interpreters. Students undertake a semester project that includes the design and implementation of a compiler for a language chosen by the instructor.

*Prerequisites:* CSE 219 or CSE 260, CSE 220, and CSE 303  
3 credits

## COURSE DESCRIPTIONS

**CSE 305 Principles of Database Systems**

The design of database management systems to obtain consistency, integrity, and availability of data. Conceptual models and schemas of data: relational, hierarchical, and network. Students undertake a semester project that includes the design and implementation of a database system. May not be taken for credit in addition to ISE 305.

*Prerequisites:* CSE 219 or CSE 260; CSE 220  
3 credits

**CSE 306 Operating Systems**

Students are introduced to the structure of modern operating systems. Topics include virtual memory, resource allocation strategies, concurrency, and protection. The design and implementation of a simple operating system are performed.

*Prerequisites:* CSE 219 or CSE 260; CSE 220 or ESE 380  
3 credits

**CSE 307 Principles of Programming Languages**

Presents examples of important programming languages and paradigms such as LISP, ALGOL, ADA, ML, Prolog, and C++. Students write sample programs in some of the languages studied. The languages are used to illustrate programming language constructs such as binding, binding times, data types and implementation, operations (assignment data-type creation, pattern matching), data control, storage management, parameter passing, and operating environment. The suitability of these various languages for particular programming tasks is also covered.

*Prerequisites:* CSE 219 or CSE 260; CSE 220  
3 credits

**CSE 308 Software Engineering**

Introduces the basic concepts and modern tools and techniques of software engineering. Emphasizes the development of reliable and maintainable software via system requirements and specifications, software design methodologies including object-oriented design, implementation, integration, and testing; software project management; life-cycle documentation; software maintenance; and consideration of human factor issues. This course is offered as both CSE 308 and ISE 308.

*Prerequisite:* CSE 219 or CSE 260 or ISE 305  
3 credits

**CSE 310 Data Communication and Networks**

Study of communication networks. Local area networks (LAN), integrated voice and data systems (IVDS), and wide area networks (WAN). Their topologies: bus, token passing, tree, point to point. Protocols, speed, and distance limitations: RS232, TCP/IP, MAP/TOP, ONS, OSI. Network design and management will be studied in various environments. May not be taken by students with credit for CSE/ESE 346.

*Prerequisites:* CSE 214 or CSE 260; CSE 220  
*Advisory Prerequisite:* AMS 310  
3 credits

**CSE 311 Systems Administration**

This course covers practical techniques to manage information systems, also known as IT Systems Administration. Students will learn how to install computers for assorted hardware and software platforms (Windows, Unix/Linux, OS-X). Install networking equipment and configure it. Install server software on several systems (e.g. web, database, mail) and configure it. Secure the network, hosts, and services, and apply system patches. Set up redundant computing services, virtual machines/services, and hardware so that services can survive some hardware/software failures. Evaluate the performance, reliability, and security of the overall system.

*Prerequisites:* CSE 214 or CSE 230 or CSE 260 or ISE 208  
3 credits

**CSE 315 Database Transaction Processing Systems**

Theory and practice of design for applications involving transactional access to a database. Transaction design, schema design, restart and recovery, journaling, concurrency control, distributed databases. Student groups perform design and implementation of significant database application. This course is offered as both CSE 315 or ISE 315.

*Prerequisite:* CSE/ISE 305  
3 credits

**CSE 320 Computer Architecture**

Covers the detailed physical implementation techniques for floating-point data path, advanced pipeline control, multi-level memory hierarchy, I/O and disk subsystem, architectural support for operating systems and programming languages, and multiprocessor/multicomputer architectures.

*Prerequisite:* CSE 220  
3 credits

**CSE 323 Human-Computer Interaction**

A survey course designed to introduce students to Human-Computer Interaction and prepare them for further study in the specialized topics of their choice. Students will have the opportunity to delve deeper in the course through a course project, and through a two-three week special topic selected at the instructor's discretion.

*Prerequisites:* CSE 214 or CSE 230 or CSE 260  
3 credits

**CSE 325 Computers and Sculpture**

This multidisciplinary class surveys how computer science and computer technology are used in sculpture. Case studies with slides, videos, and software demonstrations illustrate a range of approaches of sculptors incorporating computers in their creative process. Various state-of-the-art fabrication technologies are studied (with site visits if available on campus). Mathematical foundations are emphasized so students can recognize them when analyzing sculpture and choose the right tool when designing. In the weekly laboratory, these ideas are reinforced with projects using a range of available software and inexpensive construction materials, e.g., paper, cardboard, and foamcore. *Prerequisites:* CSE 110 or permission of instructor 3 credits

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3 credits

**CSE 326 Fundamentals of Digital Image Processing**

Covers fundamentals of image transforms, image enhancement, image restoration, image compression, segmentation, representation and description, recognition and interpretation.

*Prerequisites:* CSE 214 or CSE 230 or CSE 260; AMS 210 or MAT 211  
3 credits

**CSE 327 Fundamentals of Computer Vision**

Introduces fundamental concepts, algorithms, and techniques in visual information processing. Covers image formation, binary image processing, image features, model fitting, optics, illumination, texture, motion, segmentation, and object recognition.

*Prerequisites:* CSE 214 or CSE 230 or CSE 260; AMS 210 or MAT 211  
3 credits

**CSE 328 Fundamentals of Computer Graphics**

An introduction to computer graphics including graphics application programming; data structures for graphics; representing and specifying color; fundamental hardware and software concepts for calligraphic and raster displays; two-dimensional, geometric transformations; introduction to three-dimensional graphics; graphics standards; and input devices, interaction handling, and user-computer interface.

*Prerequisites:* CSE 219 or CSE 260; CSE 220; permission of instructor  
3 credits

**CSE 332 Introduction to Visualization**

Visualization of scientific, engineering, medical, and business data sets. Mechanisms to acquire sampled, computed, or synthetic data and methods to transform symbolic into the visual. Topics include classic visualization process; visual perception; volume and surface visualization; methods for visualizing sampled, simulated, and geometric objects; and visualization systems. Emphasis on applications and case studies. This course is offered as both CSE 332 and ISE 332.

*Prerequisites:* CSE 219; MAT 211 or AMS 210  
3 credits

**CSE 333 User Interface Development**

Survey of user interface systems, including topics such as command language, windowing, multiple input/output devices, architecture of user interface management systems, and tool kits for designing user interfaces. Additional topics may include human factors, standards, or visual languages. Students participate in a project involving the design and implementation of a user interface system.

*Prerequisite:* CSE 219 or CSE 260  
*Advisory prerequisite:* PSY 103  
3 credits

**CSE 334 Introduction to Multimedia Systems**

Survey of technologies available for user interfaces. Discussion of hypertext; voice, music, and video together with tools and models for capturing, editing, presenting, and combining them. Capabilities and characteristics of a range of peripheral devices including devices based on posture, gesture, head movement, and touch. Case studies of academic and commercial multimedia systems including virtual reality systems. Students participate in laboratory exercises and build a multimedia project. This course is offered as both CSE 334 and ISE 334.

*Prerequisites:* U2, U3 or U4 standing  
3 credits

**CSE 336 Internet Programming**

Introduces the design and development of software for Internet commerce. Topics include extended markup language, servlets, cookies, sessions, Internet media types, Web protocols, digital signatures, certificates, encryption, and the wireless Internet.

*Prerequisite:* CSE 219 or CSE 260  
3 credits

**CSE 346 Computer Communications**

Basic principles of computer communications. Introduction to performance evaluation of protocols. Protocols covered include those for local, metropolitan, and wide area networks. Introduction to routing, high speed packet switching, circuit switching, and optical data transport. Other topics include TCP/IP, Internet, web server design, network security, and grid computing. Not for credit in addition to CSE/ISE 310. This course is offered as both CSE 346 and ESE 346.

*Pre- or corequisite for ESE and ECE majors:* ESE 306  
*Pre- or corequisite for CSE majors:* AMS 310 or 311  
*Prerequisite for CSE majors:* CSE 220  
3 credits

**CSE 350 Theory of Computation: Honors**

Introduces the abstract notions of machine computation for honors students. Includes finite automata, regular expressions, and formal languages, with emphasis on regular and context-free grammars. Explores what can and cannot be computed by considering various models of computation including Turing machines, recursive functions, and universal machines. *Prerequisites:* CSE 150; CSE Honors Program or Honors College or WISE or permission of instructor 4 credits

**CSE 352 Artificial Intelligence**

Topics covered include critique of artificial intelligence research; state-space problem representations and search algorithms; game-playing programs; theorem-proving programs; programs for the study and simulation of cognitive processes and pattern recognition. Further topics in current research as time permits.

*Prerequisites:* CSE 219 or CSE 260; CSE 303  
3 credits

**CSE 355 Computational Geometry**

The design and analysis of efficient algorithms to solve geometric problems that arise in computer graphics, robotics, geographical information systems, manufacturing, and optimization. Topics include convex hulls, triangulation, Voronoi diagrams, visibility, intersection, robot motion planning, and arrangements. This course is offered as both AMS 345 and CSE 355.

*Prerequisites:* AMS 301; programming knowledge of C or C++ or Java  
3 credits

**CSE 364 Advanced Multimedia Techniques**

Digital media production techniques for high-bandwidth applications such as electronic magazine illustration, broadcast television, and motion picture special effects. Students explore techniques such as 3D modeling and character animation, video compositing, and high-resolution image processing in a state-of-the-art multimedia computing laboratory. High-capacity multimedia storage, high-speed networks, and new technologies such as DVD, HDTV, and broadband will be reviewed. This course is offered as both CSE 364 and ISE 364.

*Prerequisites:* CSE/ISE 334 and permission of the instructor  
3 credits

**CSE 366 Introduction to Virtual Reality**

An introduction to the practical issues in the design and implementation of virtual environments. Topics covered include the fundamentals of systems requirements, transformations, user-interaction models, human vision models, tracking systems, input/output devices and techniques, and augmented reality. The topics covered are explained through the use of real-life applications of virtual-reality systems in engineering, science, and medicine.

*Prerequisites:* CSE 328, CSE/ISE 332, 333  
3 credits

**CSE 370 Wireless and Mobile Networking**

The fundamentals of wireless communication. Link, network and transport layer protocols for wireless and mobile networking. Cellular networks. Wireless LANs. Wireless multihop networks. Mobile applications.

*Prerequisites:* CSE 310 or 346  
3 credits

**CSE 371 Logic**

A survey of the logical foundations of mathematics: development of propositional calculus and quantification theory, the notions of a proof and of a model, the completeness theorem, Gödel's incompleteness theorem. This course is offered as both CSE 371 and MAT 371.

*Prerequisite:* CSE 150 or CSE 215 or MAT 200  
3 credits

**CSE 373 Analysis of Algorithms**

Mathematical analysis of a variety of computer algorithms including searching, sorting, matrix multiplication, fast Fourier transform, and graph algorithms. Time and space complexity. Upper-bound, lower-bound, and average-case analysis. Introduction to NP completeness. Some machine computation is required for the implementation and comparison of algorithms. This course is offered as CSE 373 and MAT 373.

*Prerequisites:* MAT 211 or AMS 210; CSE 214  
3 credits

**CSE 375 Concurrency**

The concurrent execution of asynchronous processes in the abstract using state diagrams and a related language. The concurrent aspects of Java are discussed as a practical implementation of these issues and program logic is introduced to describe them formally. Examples are drawn from operating systems, database systems, and communication systems.

*Prerequisite:* CSE 305 or 306 or ESE 333  
3 credits

**CSE 376 Advanced Systems Programming in UNIX/C**

Focuses on several aspects of producing commercial-grade system software: reliability, portability, security, and survivability. Uses Unix and C, heavily used in industry when developing systems and embedded systems code. Emphasizes techniques and tools to produce reliable, secure, and highly portable code. Requires substantial programming as well as a course project.

*Prerequisite:* CSE 214 or 230 or 260  
3 credits

**CSE 377 Introduction to Medical Imaging**

An introduction to the mathematical, physical, and computational principles underlying modern medical imaging systems. Covers fundamentals of X-ray computer tomography, ultrasonic imaging, nuclear imaging, and magnetic resonance imaging (MRI), as well as more general concepts required for these, such as linear systems theory and the Fourier transform. Popular techniques for the visualization, segmentation, and analysis of medical image data are discussed, as well as applications of medical imaging, such as image-guided intervention. The course is appropriate for computer science, biomedical engineering, and electrical engineering majors.

*Prerequisites:* AMS 161 or MAT 127 or 132 or 142; AMS 210 or MAT 211  
3 credits

**CSE 378 Introduction to Robotics**

Introduces basic concepts in robotics including coordinate transformation, kinematics, dynamics, Laplace transforms, equations of motion, feedback and feed-forward control, and trajectory planning. Covers simple and complex sensors (such as cameras), hybrid and behavior based control and path planning. Concepts are illustrated through laboratories using the LEGO Robot Kit.

*Prerequisites:* AMS 161 or MAT 127 or 132 or 142; AMS 210 or MAT 211 or MEC 262  
3 credits

**CSE 380 Computer Game Programming**

An introduction to the fundamental concepts of computer game programming. Students design and develop original games for PCs applying proven game design and software engineering principles.

*Prerequisite:* CSE 214 or CSE 230 or CSE 260  
3 credits

**CSE 381 Advanced Game Programming**

This course explores the concepts and technologies behind making 3D, networked games. This will include the examination of game engine creation as well as the use of middleware to build graphically sophisticated game systems.

*Prerequisite:* CSE 328 or CSE 380  
3 credits

**CSE 390, 391, 392, 393, 394 Special Topics in Computer Science**

A lecture or seminar course on a current topic in computer science. Semester supplements to this *Bulletin* contain specific description when course is offered. May be repeated as the topic changes, but cannot be used more than twice to satisfy CSE major requirements.

*Prerequisites:* CSE or ISE major; U3 or U4 standing  
3 credits

**CSE 408 Network Security**

Principles and practices of computer network security. Cryptography, authentication protocols, digital signatures, IP/E-commerce security, VPNs, firewalls, and network intrusion detection. CSE 408 cannot be taken for credit in addition to ESE 360.

*Prerequisite:* CSE/ISE 310 or CSE/ESE 346  
3 credits

**CSE 409 Computer System Security**

Principles and practices of computer system security. Operating system security, authentication and access control, capabilities, information flow, program security, database security, cryptographic key management, auditing, assurance, vulnerability analysis and intrusion detection.

*Prerequisite:* CSE 306 or 376, or ESE 333  
3 credits

**CSE 475 Undergraduate Teaching Practicum**

Students assist faculty in teaching by conducting a recitation or laboratory section that supplements a lecture course. The student receives regularly scheduled supervision from the faculty instructor. May be used as an open elective only and repeated once.

*Prerequisites:* U4 standing as an undergraduate major within the college; a minimum g.p.a. of 3.00 in all Stony Brook courses and the grade of B or better in the course in which the student is to assist; or permission of department  
3 credits

**CSE 487 Research in Computer Science**

An independent research project with faculty supervision. Only three credits of research electives (AMS 487, CSE 487, BME 499, ESE 499, ESM 499, ISE 487, and MEC 499) may be counted toward technical elective requirements. May not be taken for more than six credits.

*Prerequisites:* Permission of instructor and department  
0-6 credits

**CSE 488 Internship in Computer Science**

Participation in local, state, national, or international private enterprise, public agencies, or nonprofit institutions. Students are required to submit a written proposal, progress reports, and a final report on their experience to the client and to the department. May be repeated up to a limit of 12 credits but CSE and ISE 488 cannot be used as electives to satisfy CSE major requirements.

*Prerequisites:* CSE major, U3 or U4 standing; permission of department  
3 credits, S/U grading

**CSE 495, 496 Senior Honors Research Project I, II**

A two-semester research project carried out under the supervision of a computer science faculty member. Students who enroll in CSE 495 must complete CSE 496 in the subsequent semester and receive only one grade upon completion of the sequence.

*Prerequisite:* Admission to the Computer Science Honors Program  
3 credits