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 I) 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; and 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 113-C Foundations of Computer Science I

A rigorous introduction to the conceptual and mathematical foundations of computer science with special emphasis on recursion and its applications in functional programming as well as reasoning techniques based on propositional logic and mathematical induction.

Prerequisite: One MAT course that satisfies D.E.C. category C or score of level 4 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 ESE 111 or MEC 111 or MEC 112

3 credits

CSE 125 Computer Science and Sculpture

A multidisciplinary class that 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 (including campus site-visits). Mathematical foundations are emphasized so that students can recognize them when analyzing sculpture and choose the correct tool when designing. These ideas are reinforced with projects using a range of available software and inexpensive construction materials such as paper, cardboard, and foamcore.

Prerequisite: Level 3 on Math Placement Exam or MAP 103

3 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.

Prerequisite: 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

3 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 an overview of situations 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

3 credits

CSE 213 Foundations of Computer Science II

A continuation of CSE 113 focusing on the descriptive formalisms relevant to computing, including set theory and its application to quantifiers, relations and graphs, combinators, and finite state machines. 

Prerequisite: CSE 113

3 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 used. Algorithms for sorting and searching algorithms are examined along with informal efficiency comparisons.

Prerequisite: C or higher in CSE 114

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 1,000 to 2,000 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: C or higher in CSE 214

3 credits

CSE 230 Intermediate Programming in C and C++

Intermediate programming concepts using the C language in a UNIX environment. Files, system 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 programing, graphical user interfaces, and design patterns. Includes an extended design and programming project.

Prerequisite: CSE 160

3 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 1800s and early 1900s, 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 or ISE major, or the CSE 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
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 213 and 214
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, 220, and 305
3 credits

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. This course is offered as both CSE 305 and ISE 305. Prerequisites: CSE 219 and 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 of the design and implementation of a simple operating system are performed. Prerequisites: CSE 219; 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 these languages including LISP. 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 and 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
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. This course is offered as both CSE 310 and ISE 310. Prerequisites: CSE 219 and 220
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 and ISE 315. Prerequisite: CSE/ESE 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 subsystems, architectural support for operating systems and programming languages, and multiprocessor/multicomputer architectures. Prerequisites: CSE 220
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 220; 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 220; 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 and 220; permission of instructor
3 credits

CSE 332 Introduction to Scientific 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. This course is offered as both CSE 333 and ISE 333. Prerequisite: CSE 219
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: CSE or ISE major; 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 interface types, Web protocols, digital signatures, certificates, encryption, and the wireless Internet. This course is offered as both CSE 336 and ISE 336. Prerequisite: CSE 219
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/ESE 310. This course is offered as both CSE 346 and ISE 346. Pre- or corequisite for CSE 346: 336.
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 357 Artificial Intelligence
Topics covered include critique of artificial intelligence research; state-space problem representations and search algorithms; game-playing programs; theorem-proving programs; problems for the study and simulation of cognitive processes and pattern recognition. Further topics in current research as time permits. Prerequisites: CSE 219 and 303
3 credits

CSE 358 Advanced Data Structures
Visualizations of classic data structures including binary trees, search trees, heaps, binomial queues, and hash tables. Modeling of operations and behavior, implementation problems, and analysis of efficiency. Prerequisites: CSE 219, 220, and 305
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 animation/computer graphics 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 implementations of virtual reality systems in engineering, science, and medicine.
Prerequisites: CSE 328, CSE/ISE 332, 333
3 credits

CSE 370 Wireless and Mobile Networking
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.
Pre- or Corequisite: MAT 200 or CSE 213
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 both 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 250
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. Not for credit in addition to MEC 460.
Prerequisites: AMS 161 or MAT 127 or 132 or 142; AMS 210 or MAT 211 or MEC 262
Advisory prerequisite: CSE 130 or equivalent
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 230
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 for credit 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 per course

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.
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.
Prerequisites: 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. 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, SU/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 must submit a written project report and make a presentation to the department at the year-end Honors Project Colloquium. 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 to CSE 495: Admission to the Computer Science Honors Program
Prerequisite to CSE 496: CSE 495
3 credits per course