

Computer Science (CSE)**Major and Minor in Computer Science****Department of Computer Science, College of Engineering and Applied Sciences**

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Minors of particular interest to students majoring in Computer Science: Business Management (BUS)

Department Information - Computer Science (CSE)

Computer science is the study of computer systems, including the architecture of computers, development of computer software, information processing, computer applications, algorithmic problem-solving, and the mathematical foundations of the discipline.

The Computer Science major provides professional education in computer science to prepare the student for graduate study or for a career in the computing field. Students learn concepts and skills needed for designing, programming, and applying computer systems while also learning the theoretical and mathematical foundations of computer science. They have sufficient freedom in the program to pursue other academic interests in the liberal arts, sciences, and engineering to complement their study of computer science. The Computer Science program is accredited by the Computing Accreditation Commission of ABET, <http://www.abet.org>.

Many students prepare for their professional careers through internships at local companies. Computer science graduates are recruited heavily, and career opportunities include developing software systems for a diverse range of applications such as: user interfaces; networks; databases; forecasting; web technologies; and medical, communications, satellite, and embedded systems. Many are employed in the telecommunication and financial industries, and some are self-employed as heads of software consulting companies.

The Department of Computer Science offers two undergraduate majors: Computer Science and Information Systems. Requirements and courses for the latter appear under the program title in the alphabetical listings of Approved Majors, Minors, and Programs. The two programs of study share a number of courses, particularly in the first two years, so that it is possible to follow a program that permits a student to select either major by the start of the junior year. The Department also offers a minor in computer science, a joint B.S./M.S. program, and an honors program.

Program Educational Objectives

Within five years of graduation, alumni of the Computer Science undergraduate program should be:

1. #Conducting successful careers in computer science-related disciplines and adapting to emerging markets and technologies.
2. #Contributing to the development of local, national, and global economies.
3. #Pursuing life-long learning opportunities, particularly graduate education.
4. #Leading interdisciplinary design teams in government, academic, or industrial settings.

Program Outcomes

On completion of the program, graduates of the program should be able to:

1. design, develop, test, and evaluate software systems;
2. recognize the need for, and expect to engage in, life-long learning for continued professional excellence;
3. apply their knowledge to the solution of practical and useful problems;
4. communicate effectively; and
5. work collaboratively.

In addition, undergraduates must:

6. have a solid understanding of computational theory and foundational mathematics;
7. have substantial exposure to advanced topics in software and computing systems;
8. have a comprehensive general education background;

9. be prepared to successfully enter the job market and/or graduate studies; and

10. understand professional responsibility.

More details about program educational objectives and outcomes can be found at <http://www.cs.sunysb.edu/admissions/undergrad.html>

Computing Facilities

Computing facilities for undergraduates are maintained by both the University Computing Center and the Department of Computer Science. For a description of the computing services provided by the University Computing Center, see the Student Services section of this Bulletin.

The Department of Computer Science provides additional laboratories to support undergraduate instruction and research. The laboratory facilities are regularly upgraded to keep pace with advances in technology. Current computing facilities include the Computer Science Undergraduate Computing Laboratory; the Programming Techniques Teaching Laboratory with facilities for classroom instruction; the Computer Associates Transactions Laboratory, used primarily for upper-level courses on databases, transaction processes, and Web applications; the Computer Science Advanced Programming Laboratory, also donated by Computer Associates, Inc., which provides computing support for upper-level courses on such topics as operating systems and user interfaces; and the Computer Science Multimedia Laboratory, used for courses on multimedia design. Most of the laboratories are connected to the Internet via the campus network and are easily accessible by students from campus residences or from off-campus via modem.

The Departmental research laboratories are available to undergraduate students working on supervised projects with computer science faculty.

Transfer Credits

Students who wish to transfer credits for courses equivalent to CSE 114, 214, or CSE 215 in order to use them as prerequisites for other CSE courses or toward the requirements for acceptance into the major must demonstrate proficiency in the course material by passing a proficiency examination, given during the first week of each semester.

Requirements for the Major and Minor in Computer Science (CSE)

Enrolling in CSE Courses

To enroll in CSE courses, students must:

Have completed all prerequisites with a grade of C or higher. (Pass/No Credit grades are not acceptable to meet prerequisites.) For transfer students, official transfer credit evaluations must have been completed and approved and the relevant proficiency examination for lower division courses, given during the first week of each semester, must have been taken and passed.

Failure to satisfy the prerequisites or to attend the first class may result in deregistration. The Pass/No Credit option is not available for CSE courses.

Acceptance into the Computer Science Major

Qualified freshman and transfer applicants may be accepted directly into the Computer Science major upon admission to the University. Currently enrolled students may apply for acceptance to the major after completing the following two courses with grades of C or higher and a grade point average of 3.0 or higher.

1. CSE 114 Computer Science I
 2. CSE 215 Foundations of Computer Science
- Requirements for the Major

The major in Computer Science leads to the Bachelor of Science degree. At least five upper-division courses from items 2 and 3 below must be completed at Stony Brook.

Completion of the major requires approximately 80 credits.

1. Required Introductory Courses

CSE 114 Computer Science I
CSE 214 Computer Science II
CSE 215 Foundations of Computer Science
CSE 219 Computer Science III
CSE 220 Computer Organization and Systems

2. Required Advanced Courses

-CSE 303 Introduction to the Theory of Computation and CSE 373 Analysis of Algorithms
-CSE 308 Software Engineering
-CSE 320 Computer Organization and Architecture
-Three courses chosen from: CSE 304, CSE 305, CSE 306, CSE 307, CSE 310/346, CSE 328. The three courses must include CSE 305 or CSE 306.

3. Computer Science Electives

Three upper-division CSE electives. Technical electives do not include teaching practica (CSE 475), internships (CSE 488), the senior honors project (CSE 495, 496), and courses designed as non-technical in the course description (such as CSE 301).

4. AMS 151, AMS 161 Applied Calculus I, II

Note: The following alternate calculus course sequences may be substituted for AMS 151, AMS 161 in major requirements or prerequisites: MAT 125, MAT 126, MAT 127, or MAT 131, MAT 132, or MAT 141, MAT 142 or MAT 171. Equivalency for MAT courses achieved through the Mathematics Placement Examination is accepted to meet MAT course requirements.

5. One of the following:

MAT 211 Introduction to Linear Algebra
AMS 210 Applied Linear Algebra
AMS 326 Numerical Analysis

6. Both of the following:

AMS 301 Finite Mathematical Structures
AMS 310 Survey of Probability and Statistics or AMS 311 Probability Theory or AMS 312 Mathematical Statistics

7. One of the following natural science sequences [Effective fall 2005]:

BIO 201, BIO 202, BIO 204 or BIO 201, BIO 203, BIO 204 or BIO 202, BIO 203, BIO 204 Fundamentals of Biology or CHE 131, CHE 132, CHE 133 or CHE 141, CHE 142, CHE 143 General Chemistry or PHY 131/PHY 133, PHY 132/PHY 134 or PHY 141, PHY 142 or PHY 125, PHY 126, PHY 127 Classical Physics

8. Four additional credits from the above natural science courses

[Effective fall 2005]

These courses can be in biology, chemistry, or physics. Advanced natural science courses may be substituted with the prior approval of the Department of Computer Science.

9. Professional Ethics

CSE 312 Legal, Social, and Ethical Issues in Information Systems

10. Upper-Division Writing Requirement: CSE 300 Technical Communications

All degree candidates must demonstrate technical writing skills at a level that would be acceptable in an industrial setting. To satisfy the requirement, students must pass CSE 300, a course that requires the completion of various writing assignments, including at least one significant technical paper.

Note: All students are encouraged to discuss their program with an undergraduate advisor. In Requirement 2 above, CSE/ESE double majors may substitute ESE 440, ESE 441 Electrical Engineering Design I, II for CSE 308 Software Engineering provided that the design project contains a significant software component. Approval of the Department of Computer Science is required.

Grading

All courses taken to satisfy Requirements 1 through 10 must be taken for a letter grade. The courses in Requirements 1-6, 9, and 10 must be passed with a letter grade of C or higher. The grade point average for the courses in Requirements 7 and 8 must be at least 2.00. A grade of C or higher is also required in prerequisite courses listed for all CSE courses.

Specialization in Human-Computer Interaction

The specialization in human-computer interaction emphasizes both the psychology aspects of effective human-computer interactions and the technical design and implementation of systems for those interactions. It requires four core course, two electives, and a project. Students may declare their participation in the specialization after completing the courses in 1a and 1b. All courses must be completed with a grade of C or higher.

1. Core Courses

- a. CSE 323 Human-Computer Interaction
- b. PSY 260 Survey of Cognition and Perception
- c. CSE 328 Fundamentals of computer Graphics or CSE 332 Introduction to Scientific Visualization
- d. CSE 333 User Interface Development or PSY 384 Research Lab: Human Factors

2. Two electives from the following, including at least one CSE course:

CSE 327 Fundamentals of Computer Vision
CSE 328 Fundamentals of Computer Graphics
CSE 332 Introduction to Scientific Visualization
CSE 333 User Interface Development
CSE 334 Introduction to Multimedia Systems
CSE 336 Internet Programming
CSE 352 Artificial Intelligence
CSE 364 Advanced Multimedia Techniques
CSE 366 Introduction to Virtual Reality
CSE 378 Introduction to Robotics

CSE 390-394 Special Topics in Computer Science*
 PSY 366 Human Problem Solving
 PSY 368 Sensation and Perception
 PSY 369 Special Topics in Cognition and Perception
 PSY 384 Research Lab: Human Factors
 *Special topic must be in human-computer interaction.
 3. Project

Completion of CSE 487 Research in Computer Science or CSE 488 Internship in Computer Science or CSE 495/CSE 496 Senior Honors Research Project I, II, on a topic in human-computer interaction.

Specialization in Game Programming

The specialization in game programming prepares students for a career as either a professional game developer or researcher. Game graphics and multiplayer network programming techniques are stressed. The specialization also emphasizes original game development, game design methodology, and team projects and presentations. It requires four core courses, two electives, and a project. Students may declare their participation in the specialization after completing the courses in 1a and 1b. All courses must be completed with a grade of C or higher.

1. Core Courses

- a. CSE 306 Operating Systems
 - b. CSE 310 Data Communication and Networks or CSE 346 Computer Communications
 - c. CSE 328 Fundamentals of Computer Graphics
 - d. CSE 380 Computer Game Programming
 - e. CSE 381 Advanced Game Programming
2. Two electives from the following:

CSE 304 Compiler Design
 CSE 320 Computer Architecture
 CSE 334 Introduction to Multimedia Systems
 CSE 352 Artificial Intelligence
 CSE 355 Computational Geometry
 CSE 364 Advanced Multimedia Techniques
 CSE 375 Concurrency
 CSE 408 Network Security
 3. Project

Completion of CSE 487 Research in Computer Science or CSE 488 Internship in Computer Science or CSE 495/CSE 496 Senior Honors Research Project I, II, on a topic in game programming.

Note: Students specializing in Game Programming are encouraged to complete the natural science sequence in physics, see part seven (7) of the Requirements for the Major in Computer Science.

Specialization in Information Assurance

The specialization in information assurance (IA) has been developed as part of the University's establishment of a Center for Cybersecurity and designation by the National Security Agency as a Center of Academic Excellence in Information Assurance Education. This is included in a multifaceted effort to expand and increase information assurance education and research. The specialization deals with the principles, design, development, and management of networks and software systems that provide high levels of assurance in the confidentiality, availability, and integrity of electronic information. It requires four core courses, two electives, and a project. Students may declare their participation in the specialization after completing the courses in 1a and 1b. All courses must be completed with a grade of C or higher.

1. Core Courses

- a. CSE 310 Data Communication and Networks or CSE 346 Computer Communications
 - b. CSE 306 Operating Systems or CSE 376 Advanced Systems Programming in UNIX/C
 - c. CSE 408 Network Security
 - d. CSE 409 Computer System Security
2. Two electives from the following:

CSE 305 Principles of Database Systems
 CSE 306 Operating Systems
 CSE 315 Database Transaction Processing Systems
 CSE 336 Internet Programming
 CSE 375 Concurrency
 CSE 376 Advanced Systems Programming in UNIX/C
 AMS 310 Survey of Probability and Statistics
 AMS 311 Probability Theory

AMS 312 Mathematical Statistics
 AMS 315 Data Analysis
 AMS 335 Game Theory
 AMS 341 Operations Research I: Deterministic Models
 AMS 342 Operations Research II: Stochastic Models
 EST 412 Intelligence Organizations, Technology, and Democracy
 3. Project

Completion of either CSE 487 Research in Computer Science or CSE 495, CSE 496 Senior Honors Research Projects I, II, on a topic in information assurance.

The Honors Program

The Honors Program in Computer Science, a highly selective academic program within the major in Computer Science, offers a specially designed curriculum to a limited number of exceptional students. The program is open to freshmen and to continuing students. To be admitted as a freshman, students must demonstrate overall academic excellence by achieving a combined SAT score of 1300, an unweighted high school average of at least 93, and high grade averages in mathematics and the natural sciences. Continuing Computer Science majors who have completed at least three CSE courses and have maintained a cumulative grade point average of 3.50 and an average of 3.50 in CSE courses may apply for admission to the honors program in the sophomore or junior year. Continued participation in the program requires that students maintain a grade point average of 3.50, both cumulative and in all CSE courses.

Honors course offerings include introductory course sequences in programming and in the foundations of computing, advanced courses on selected topics that reflect active research areas within the Department, and a two-semester senior honors project. Students will be able to take at least one honors course each semester throughout a four-year program of study. Honors program students must complete the regular requirements of the Computer Science major, but up to two-thirds of the required computer science courses (see items 1 to 3 in the above list of Requirements for the Major) can be covered by honors courses. Final conferral of honors is contingent upon successful completion of all required courses in the Computer Science major including a minimum of three honors courses, plus the two-semester honors project, with a cumulative grade point average of 3.50 and an average of 3.50 in all CSE courses.

Honors students in good standing at the end of the junior year will, on application, be approved for admission to the five-year joint B.S./M.S. program in Computer Science. B.S./M.S. applicants who successfully complete the honors program may be considered for a tuition waiver in the fifth year as well as for a graduate student assistantship. (It is recommended that these students complete an undergraduate teaching practicum in the junior or senior year.)

Requirements for the Minor

The minor in Computer Science is open to all students not majoring in either Computer Science or Information Systems or minoring in Information Systems. To declare the minor in Computer Science, students must complete CSE 114 and either CSE 214 or CSE 215 with grades of C or higher. The minor requires seven CSE courses totaling 22 to 24 credits as outlined below.

1. CSE 114 Computer Science I
2. CSE 214 Computer Science II
3. CSE 215 Foundations of Computer Science
4. CSE 219 Computer Science III or CSE 220 Computer Organization and Systems Programming
5. Three upper-division CSE courses totaling at least nine credits (excluding CSE 300, CSE 475, CSE 487, CSE 488).

Note: All of these courses must be passed with a letter grade of C or higher.

Joint B.S./M.S. Program

Computer Science majors may apply for admission to a special program that leads to a Bachelor of Science degree at the end of the fourth year and a Master of Science degree at the end of the fifth year. Students usually apply to the program in their junior year.

Students must satisfy the respective requirements of both the B.S. degree and the M.S. degree, but the main advantage of the program is that six credits may be simultaneously applied to both the undergraduate and graduate requirements. The M.S. degree can therefore be earned in less time than that required by the traditional course of study.

For more details about the B.S./M.S. program, see the undergraduate or graduate program director in the Department of Computer Science.

Sample Course Sequence for the Major in Computer Science

Freshman Fall	Credits	Spring	Credits
First Year Seminar 101		1 First Year Seminar 102	1
CSE 110		3 CSE 114	4
AMS 151		3 AMS 161	3
Natural Science Course		4 Natural Science Course	4
D.E.C. A		3 D.E.C.	3
Total	14	Total	15

Sophomore Fall	Credits	Spring	Credits
CSE 214	3	CSE 219	3
CSE 215	3	CSE 220	3
AMS 210	3	AMS 301	3
Natural Science Course	4-5	D.E.C.	3
D.E.C.	3	D.E.C.	3
Total	16-17	Total	15
Junior Fall	Credits	Spring	Credits
CSE 300	3	CSE 312	3
CSE Advanced Course	3	CSE 320	3
CSE 303	3	CSE 373	3
AMS 310	3	CSE Elective	3
D.E.C.	3	D.E.C.	3
Total	15	Total	15
Senior Fall	Credits	Spring	Credits
CSE 308	3	CSE Advanced Course	3
CSE Advanced Course	3	CSE Elective	3
CSE Elective	3	D.E.C.	3
D.E.C.	3	Elective	3
Elective	3	Elective	3
Total	15	Total	15

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: Level 4 or higher on the math placement exam

Advisory Prerequisite: CSE 110

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: Computer Science Honors Program or Honors College or WISE program or permission of instructor

4 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, combinatorics, 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 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 and CSE major or ECE major or permission of instructor

3 credits

CSE 220: Systems-Level Programming

Introduces systems-level programming concepts using the C language and assembly language and explores the relation of respective programs in these languages. Topics include internal data representation, basic instructions and control structures, arithmetic operations, pointers, function calls and parameter passing, memory allocation, logical and shift operations, linking and loading.

Prerequisites: CSE 160 or 114 and CSE major or permission of instructor.

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 CSE 220 or ESE 124 or ESG 111 or BME 120 or MEC 102

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: Technical Communications

Principles of professional technical communications for Computer Science and Information Systems majors. Topics include writing business communications, user manuals, press releases, literature reviews, and research abstracts. Persuasive oral communications and effective presentation techniques, to address a range of audiences, will also be covered. This course satisfies the upper-division writing requirement for CSE and ISE majors.

Prerequisites: WRT 102, CSE or ISE major, U3 or U4 standing

3 credits

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 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. This course is offered as both CSE 301 and ISE 301.

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.

Prerequisites: 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 215 and CSE major or permission of instructor.

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

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.

Prerequisites: CSE 219 or CSE 260; CSE 220; CSE major or permission of instructor

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 and CSE Major or ECE major or permission of instructor.

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; CSE major or permission of instructor.

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.

Prerequisites: CSE 219 or CSE 260 or ISE 305 and CSE major or permission of instructor.

3 credits

CSE 310: Computer Networks

Overview of computer networks and the Internet. Concept of end systems, access networks, clients and servers. Connection-oriented and connectionless services. Circuit switching and packet switching. Description of Internet protocol layers, including application layer, transport layer, network layer and link layer. Architecture of the current Internet and the World-Wide Web. TCP/IP protocol stack. Internet routing and addressing. Local area network protocols, Ethernet hubs and switches. Wireless LANs. Multimedia networking. May not be taken by students with credit for CSE/ ESE 346.

Prerequisites: CSE 214 or 260; CSE 220; CSE major or permission of instructor.

Advisory Pre- or Corequisite: 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 312: Legal, Social, and Ethical Issues in Information Systems

This course deals with the impact of computers on us as individuals and on our society. Rapid changes in computing technology and in our use of that technology have changed the way we work, play, and interact with other people. These changes have created a flood of new social and legal issues that demand critical examination. For example, technologies such as Gmail, Facebook, MySpace, along with music sharing sites and wikis create new social, ethical, and legal issues. This course is offered as both CSE 312 and ISE 312.

Prerequisites: U3 or U4 standing, one D.E.C. E course

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 or ISE 305

3 credits

CSE 320: Computer Organization and Architecture

Explores the physical structure and organization of a computer, the internal representation of information, and performance evaluation methodology. Introduces instruction set architectures and implementation techniques for computer arithmetic, control path design, pipeline control, memory hierarchy, storage devices, and I/O.

Prerequisite: CSE 220 and CSE major or permission of instructor.

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 or ISE 208

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

Prerequisite: CSE 110 or permission of instructor

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 or CSE 260; 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 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.

Prerequisite: 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 ISE 346.

Pre- or corequisite for ESE and ECE majors: ESE 306

Pre- or corequisite for CSE majors: AMS 310 or 311

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; AMS 210 or MAT 211; 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

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.

Prerequisite: 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, Goedel'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 or CSE 260

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 feedforward 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.

Prerequisites: CSE 328 or CSE 380
3 credits

CSE 390: 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
3 credits

CSE 391: 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
3 credits

CSE 392: 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
3 credits

CSE 393: 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
3 credits

CSE 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
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.

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: Senior Honors Research Project I

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

CSE 496: Senior Honors Research Project 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.

Prerequisite: CSE 495

3 credits