

**COMPUTER SCIENCE UNDERGRADUATE PROGRAM
DEPARTMENT OF COMPUTER SCIENCE
TEXAS A&M UNIVERSITY**

CURRICULUM. The curriculum in computer science is designed to prepare students to enter into the rapidly expanding computer field. It is based upon the IEEE Computer Society and Association for Computing Machinery recommendations for curricula and courses. A major in computer science at Texas A&M University includes a 12-hour supporting field in another department of the University. This allows students to design a course of study which takes advantage of opportunities offered by other departments within the colleges of the University.

The four-year undergraduate curriculum in computer science includes a sound preparation in science, mathematics, English, statistics and computing. Students select three senior electives from twelve courses. The most popular are offered in multiple sections and semesters. Elective courses are available in the areas of: languages and compilers; software systems; computer systems and architecture; artificial intelligence and cognitive modeling; graphics and robotics; and computational science and engineering. Graduate courses in these areas may be taken by advanced undergraduates.

FACILITIES. The Department of Computer Science has significant computer resources of its own, shares resources with other departments, and makes use of University systems. The department has 180 workstations available to students around the clock in instructional and open access laboratories and maintains numerous servers from Sun, Dell, and NetApp that are available to our students. All students have access to several web servers and the department's multiprocessor computational servers. These include three multiprocessor Sun servers running Solaris and a multiprocessor Linux server running Red Hat Enterprise. In addition, each student is allocated storage on the department's 10 TB file server. Wireless network access is provided throughout the department as is remote access via VPN.

UNIVERSITY AND AREA. Texas A&M University is located in the Bryan/College Station area.(pop. 137,000, 100 miles north of Houston. The Bryan/College Station area has been recognized as one of the leading growth areas in the nation. A growing industrial base, excellent housing, strong public school systems, and many recreational and entertainment activities characterize the area.

Texas A&M University, a land-grant, sea-grant, and space-grant university, was established in 1876 as the state's first public institution of higher education. The campus covers 5,142 acres and is within easy driving distance of the four largest cities in Texas. Enrollment is more than 44,000 students, and Texas A&M University has one of the largest enrollments in the nation in engineering, veterinary medicine as well as architecture and environmental design.

FINANCIAL AID. Presently, the Computer Science Department has no scholarship funds for supporting undergraduates. However there are many sources of support through the TAMU Financial Aid Office for students enrolled in Texas A&M University. In addition, university research projects often require the assistance of programmers, and many Computer Science students are hired to fill these jobs. The Computer Services Center hires some students as student operators, programmers, and analysts. Texas A&M University also has an active Co-operative Education Program with many openings for Computer Science students.

DEGREE PLAN INSTRUCTIONS FOR COMPUTER SCIENCE MAJORS

2006-2007 Academic year

The instructions contained in this packet are to be used as a guide in preparing the Departmental Computer Science Degree Plan Form for the Bachelor's Degree in Computer Science. After the student completes filling out the degree plan **FROM the Web Page (<http://www.cs.tamu.edu/academics/undergraduate>)**, it is to be submitted to the Computer Science Undergraduate Advisor for approval. When the degree plan is approved by the Undergraduate Advisor, it will be returned to the student via an email message and a copy will be placed in the Computer Science Undergraduate Student's file in the Advising Office.

An upper division evaluation form needs to be submitted by the student and approved by the undergraduate advisor **prior** to enrollment in upper division computer science courses. Students enrolling in upper division courses without CPSC/CECN designation will be removed from the courses. Computer Science courses at the 300 level or above are the designated upper level courses.

Degree audits are produced by the Registrar's Office after a student has 95 credit hours. Copies of this audit are available in the advisor's office, and the audits should be carefully reviewed by the student and his/her advisor, to determine one's progress toward a degree. A final audit will be mailed to the student the semester of anticipated graduation. Additionally, an audit can be done at any time upon request to the Registrar's Office for a fee of \$1.00, or without charge at myrecord.tamu.edu.

Hours & Technical Electives

The total hours on the degree plan must be at least **128**. **If**, for example, the choice of supporting area includes required courses, then other courses must be chosen so that the hour total will be at least 128. These other courses can be in departments other than CPSC or the supporting area, but they should complement the student's degree plan and must be approved by the Undergraduate Advisor. **"Please note that the 128 total hours do not include a required foreign language. It is the student's responsibility to meet the University's foreign language requirement."**

Comments and Observations

Before visiting the Undergraduate Advisor about a degree plan, the student should make as many decisions as possible. One problem area is transfer credits, in that it is sometimes difficult to know which courses may be used. Efforts are made to allow 'reasonable' substitutions. A student **must** submit a copy of his/her transcript evaluation along with the degree plan form if credit for transferred courses is desired. To approve courses that transfer "By Title" to TAMU documentation of the courses content, such as a catalog description, will be required.

It is the student's responsibility to have a degree plan meet minimum requirements. Everyone involved will check, but if a graduating senior's degree plan is not acceptable (e.g. only 127 hours), the student will not graduate.

Computer Science Courses

Thirty (30) hours are required as follows: **CPSC 121-4, 181-1, 221-4, 222-3, 312-4, 313-4, 314-3, 315-3, 481-1, and 484-.** These courses must each be passed with a grade of at least "C".

Supporting Fields

- (A) Complete an official university recognized minor in an **AREA APPROVED BY A CS ADVISOR.** The student will be required to complete the courses mandated by the department offering the **MINOR** which will likely require **15+ credits** to complete. Not all official minors can be used to complete the supporting
- (B) Complete the 12 hour supporting area requirement on your degree plan. The **CS ADVISOR MUST APPROVE THE SUBJECT AREA AND THE COURSES SELECTED.** The minor must include 300 and 400 level courses and may be selected from the physical sciences, engineering, mathematics, business or liberal arts.

Note: An official minor (A) will be noted on your **Transcript**, the 12 hour supporting area (B) will not. Taking the first 12 credits of an official minor does not automatically satisfy the 12 hour requirement in (B).

The following are guidelines for satisfying the supporting area (B) for the most frequently selected departments:

MATH

Complete the required MATH sequence shown on the degree plan with MATH 308 as the elective. Select one of the following: (MATH 304--MATH 311--MATH 222). Nine (9) hours to be selected from (MATH 312, CPSC 442, or any 400 level MATH class (NO MATH 403, NO MATH 417 if choosing CPSC 442,).

BUSINESS

Only two options are available through the College of Business:

- A. The official COB Minor (Students must take 15 credits, Do NOT take INFO 209). Extra class can be used for "General Elective."
- B. Information Systems Classes (12 credits required).

NOTE: See handouts on the Business option. Pre-reqs listed and policy of needing forces for some INFO classes are the Info department's regulations and must be followed.

Mathematics and Statistics

Fourteen hours of Mathematics and three hours of Statistics are required. The courses listed inside the box must each be passed with a grade of at least "C". The elective

mathematics course must be either MATH 304 or 308. The choice of a supporting area often dictates this elective.

NOTE: MATH 151 has a prerequisite of algebra, trigonometry and analytical geometry. If MATH 150, 102, 103, or 104 are taken to meet these requirements, they may not be used for credit on the degree plan's requirement of 130 hours.

Science Courses

16 hours of science coursework are required; choose from any two of the following four options.

Only ONE option B may be used to satisfy this requirement.

1. Chemistry: CHEM 101 and 102
2. Physics: PHYS 218 and 208
3. Life Sciences:
 - i. Option A: BIOL 111 and BIOL 112
 - ii. Option B: any two of: BIOL 111, BOTN 101, ZOO 107
4. Earth Sciences:
 - i. Option A: GEOL 101 and GEOL 106
 - ii. Option B: any two of: GEOG 203, ATMO 201/202, RENR 205/215

Computer Science Upper-Level Track System (See Classes & Rules pg 2)

General Elective Course

Three (3) hours of general electives are required and should be chosen from the approved list from the Academic Advisors.

DIRECTED ELECTIVES

Humanities Elective Course

ENGR 482 (PHIL 482) is a required course.

Visual and Performing Arts

Three (3) hours of visual and performing arts electives must be selected from the list of College of Engineering directed electives for visual and performing arts - please refer to Page 18 of the undergraduate catalog.

Social Science Elective Course

Three (3) hours of social science electives are required which must be selected from the list of College of Engineering directed electives for social science courses - please refer to Page 18 of the undergraduate catalog.

Cultural and International Diversity Courses:

Six hours (two courses) of cultural and international diversity are required. The list of courses that satisfy this requirement can be found on page 19 of the catalog. There are some courses on this list that also satisfy the social science (eg. Engl 251) or visual and perf. Arts (eg. Arts 150) requirements. If you select such courses you may satisfy two requirements with a single course. The total of 130 hours for this degree is based on the assumption that students will choose courses that satisfy two requirements to avoid the additional six hours of course work.

CITIZENSHIP

History Courses

Six (6) hours of American history are required of which three hours may be in Texas history and three semester hours in American history, or the entire six hours may be in American history. Students in ROTC may substitute 6-hours of advanced military science courses for 3-hours of American history.

Political Science Courses

Six (6) credit hours of political science are required which should include **POLS 206-3** and **207-3**. Students in ROTC may substitute 6-hours of advanced military science courses for POLS 207.

Physical Education Courses

Two (2) hours of KINE courses are required. One (1) hour of **KINE 198 -- Health and Fitness** (these courses may be taken pass fail or for a grade); and one (1) hour of **KINE 199 -- Activity** (these courses must be taken pass/fail).

English, Speech and Writing Courses

Nine (9) hours of English, Speech and Writing courses are required which includes **ENGL 104-3** and one of **ENGL 210-3, 301-3, SCOM 203-3, or 205-3**. Students transferring into the program having already taken other English courses may be

allowed to use them as approved by the Undergraduate Advisor. English 104 must be passed with a grade of at least "C".

Foreign Language Requirement

Proficiency in a foreign language is also required to graduate from Texas A&M University. This requirement can be met by:

Completing two units (two full years) of high school course work in the same foreign language.

Completing two semesters (one full year) of course work at the college level in the same foreign language, or

Demonstrating proficiency in a foreign language by examination. See catalog for additional requirements under graduation requirements and Foreign Language.

CATALOG DESCRIPTIONS OF COMPUTER SCIENCE COURSES

CPSC 110. Programming I. (3-2). Credit 4. I, II, S Basic concepts, nomenclature and historical perspective of computers and computing; internal representation of data; software design principles and practices; structured programming in a high-level language; use of terminals, operation of editors and execution of student-written programs. Prerequisite: None.

CPSC 111. Introduction to Computer Science Concepts and Programming. (3-2). Credit 4. I, II Introduction to computer science concepts including principles of program design, plus practice in object-oriented programming. Prerequisite: CPSC 110 or passing grade on qualifying exam.

CPSC 181: Introduction to Computing. (1-0). Credit 1. Seminar to introduce freshman level students to the broad field of computing. Achieved through presentations from industry and academia about how computer science concepts are used in research and end products, as well as through general lectures on computing. Includes a major writing component.

CPSC 121: Introduction to Program Design and Concepts. Credit 4. Computer programming and design concepts; use of primitive types, control structures, vectors, strings, structs, classes, functions, file I/O, exceptions, and other programming constructs for problem solving with computers; introduction to program structure, design and development, plus the use of class libraries. Includes the execution of student written programs in C++.

CPSC 203. (COSC 1317, 1417, ENGR 2304) Introduction to Computing. (3-0). Credit 3. I, II, S Algorithms, programs and computers; basic programming and program structure; data representation; computer solution of numerical and non-numerical problems using a high-level programming language, FORTRAN.

CPSC 206. Structured Programming in C. (3-0). Credit 3. I, II, S Basic concepts, nomenclature and historical perspective of computers and computing; internal representation of data; software design principles and practices; structured programming in C; use of terminals, operation of editors and execution of student-written programs.

CPSC 211. Data Structures and Their Implementations. (3-2). Credit 4. I, II S. Specification and implementation of basic data structures, performance tradeoffs of different implementations. Analyses of run time and space usage. Compares and contrasts object-oriented vs. structured programming. Prerequisite: CPSC 111 or instructor's permission.

CPSC 221. Data Structures and Algorithms. (4.0). Credits 4. Specification and implementation of basic abstract data types and their associates algorithms – stacks, queues, lists; sorting and selection; searching; graphs; hashing. Performance tradeoffs of different implementations; asymptotic analysis of running time and memory usage. Includes the execution of student written programs in C++. Prerequisite: CPSC 121; Corequisite: CPSC 222.

CPSC 222. Discrete Structures. (3-0). Credit 3. Provide mathematical foundations from discrete mathematics to allow the students to analyze algorithms, both for correctness and performance. Introduction to models of computation (finite state machines and Turing machines). Prerequisite: Math 151.

CPSC 291. Research. Credit 1 to 4. Research conducted under the direction of faculty member in computer science. May be repeated 2 times for credit. Prerequisites: Freshman or sophomore classification and approval of instructor.

CPSC 310. Database Systems. (3-0). Credit 3. I, II, S File structures and access methods; database modelling, design and user interface; components of database management systems; information storage and retrieval, query languages, high level language interface with database systems. Prerequisite: CPSC 210 or CPSC 211.

CPSC 311. Analysis of Algorithms. (3-0). Credit 3. I, II, S Design of computer algorithms for numeric and non-numeric problems; relation of data structures to algorithms; analysis of time and space requirements of algorithms; complexity and correctness of algorithms. Prerequisites: CPSC 210 or CPSC 211, MATH 302.

CPSC 312. Computer Organization. (4.0). Credit 4. Introduces computer systems from a programmer's perspective, providing a complete view of the hardware and interface to system software. The course covers data representations, processor architecture, assembly code, machine level representations of C++ programs, program optimizations, the memory hierarchy, linking exceptional control flow (exceptions, interrupts, processes, and signals), performance measurement, virtual memory and memory management and system-level I/O. These concepts are supported by series of hands-on lab assignments.

Prerequisite: CPSC 221

CPSC 313. Introduction to Computer Systems. (4.0). Credit 4. Provide students with a general understanding of what system software support is necessary for an application program to run, both on a single node and over a network. Prepare students to do simple system-level and network programming. How to use (instead of design) system components such as memory, file systems, process control, interprocess communication, and networking. Students will have an understanding of the problems and pitfalls typically encountered in multithreaded and network systems and application design.

Prerequisite: CPSC 312.

CPSC 314: Programming Languages. (4.0). Credit 4. The course explores the design-space of programming languages via an in-depth study of two programming languages, on object-oriented (Java), on functional (Haskell). With both languages, the course focuses on idiomatic uses of the languages, and language features characteristic for each language. Programming language concepts covered include different forms of polymorphism, concurrency static typing, higher-order functions and closures, and pattern matching. Prerequisite: CPSC 221.

CPSC 315: Programming Studio. (3-0). Credit 3. Provide an intensive programming experience that integrates core concepts from the preceding computer science course, and also exposes the students to a variety of programming/development tools. Students learn to design and write programs of higher complexity. Introduction to software development (including tools, multi-component coding style). Several team projects incorporating a variety of programming topics. Oral and written reporting required. Prerequisite: CPSC 312, CPSC 314. Corequisite: CPSC 313.

CPSC 321. Computer Architecture. (3-2). Credit 4. I, II, S Basic hardware/software components, assembly language, and functional architecture of computers; syntax and semantics of a typical microprocessor assembly language; instruction sets, construction and execution of an assembly program; the design of I/O modules, memory, control unit and arithmetic unit. Prerequisites: ELEN 220 or 248.

CPSC 332. Programming Language Design. (3-0). Credit 3. I, II Design of high-level languages; criteria for language selection; specification techniques for syntax and semantics; trends in high-level language design and introduction to programming in LISP. Prerequisite: CPSC 211.

CPSC 410. Operating Systems. (3-0). Credit 3. I, II, S Hardware/software evolution leading to contemporary operating systems; basic operating systems concepts; methods of operating systems design and construction; algorithms for CPU scheduling, memory and general resource allocation; process coordination and management; case studies of several operating systems. Prerequisite: CPSC 321.

CPSC 420. Artificial Intelligence. (3-0). Credit 3. I, II, S Fundamental concepts and techniques of intelligent systems; representation and interpretation of knowledge on a computer; search strategies and control; active research areas and applications such as notational systems; natural language understanding, vision systems, planning algorithms, intelligent agents and expert systems. Prerequisite: CPSC 311.

CPSC 431. Software Engineering. (2-2). Credit 3. I, II, S Application of engineering approach to computer software design and development; life cycle models software requirements and specification; conceptual model design; detailed design; validation and verification; design quality assurance; software design/development environments and project management. Prerequisite: Junior classification.

CPSC 433. Formal Languages and Automata. (3-0). Credit 3. I Basic types of abstract languages and their acceptors, the Chomsky hierarchy; solvability and recursive function theory; application of theoretical results to practical problems. Prerequisite: CPSC 311.

CPSC 434. Compiler Design. (3-0). Credit 3. II Programming language translation: functions and general organization of compiler design and interpreters; theoretical and implementation aspects of lexical scanners; parsing of context free languages; code generation and optimization; error recovery. Prerequisite: CPSC 311.

CPSC 435. Structured Programming in Ada. (3-0). Credit 3. The Ada programming language; history and motivation; scalar and composite types; type and object attributes; control constructs; subprograms; packages and abstract types; numeric types; I/O; program structure; overloading and visibility; tasking; generics; programming style using Ada, Ada Programming Support Environments; bindings to common utilities, including GKS, SQL. Prerequisite: CPSC 210 or CPSC 211 or approval of instructor.

CPSC 436. Computer-Human Interaction. (3-0). Credit 3. Comprehensive study of the Computer-Human Interaction (CHI) area; includes history and importance of CHI; CHI design theories; modeling of computer users and interfaces; empirical techniques for task analysis and interface design; styles of interaction and future directions of CHI including hypermedia and computer-supported collaborative work. Prerequisites: CPSC 310, 420, 321.

CPSC 437. Engineering Software Products. (3-0). Credit 3. Links theory and practice in providing hands-on experience in development of growth-oriented new software products; student teams prepare and present a plan for a new software product; skills conducive to new software product success are developed including team building; organizing; planning; integrating and persuading. Prerequisites: Senior classification and approval of instructor.

CPSC 438. Distributed Objects Programming. (3-0). Credit 3. Principles of distributed computing and programming with current paradigms, protocols, and application programming interfaces including Sockets, RMI, CORBA, IDL, Servlets, Web Services; security issues with public/private keys, digital signatures, forms and GUI based applications with multi-tier components, database connectivity and storing/streaming data structured using XML. Prerequisites: CPSC 332 or approval of instructor; junior or senior classification.

CPSC 440. Quantum Algorithms. (3-0). Credit 3. Introduction to the design and analysis of quantum algorithms; basic principles of the quantum circuit model; gives a gentle introduction to basic quantum algorithms; reviews recent results in quantum information processing. Prerequisites: Junior or senior classification and MATH 302.

CPSC 441. Computer Graphics. (3-0). Credit 3. I, II, S Principles of interactive computer graphics; systems organization and device technologies for raster and vector displays; 2D and 3D viewing, clipping, segmentation and interaction handling. 3D geometrical transformations, projections and hierarchical data structures for graphics modeling. Prerequisite: CPSC 210 or CPSC 211; Junior classification.

CPSC 442. Scientific Programming. (3-0). Credit 3. II Introduction to numerical algorithms fundamental to scientific and engineering applications of computers; elementary discussion of error; algorithms, efficiency; polynomial approximations, quadrature and systems of algebraic and differential equations. Prerequisites: CPSC 120, MATH 308.

CPSC 452. Robotics and Spatial Intelligence. (3-0). Credit 3. II Algorithms for executing spatial tasks; path planning and obstacle avoidance in two and three dimensional robots--configuration space, potential field, free-space decomposition methods; stable grasping and manipulation; dealing with uncertainty; knowledge representation for planning--geometric and symbolic models of the environment; task-level programming; learning. Prerequisite: CPSC 420.

CPSC 462. Microcomputer Systems. (2-2). Credit 3. II Microcomputers as components of systems; VLSI processor and co-processor architectures, addressing and instruction sets; I/O interfaces and supervisory control; VLSI architectures for signal processing; integrating special purpose processors into a system. Prerequisite: CPSC 410 or concurrent enrollment.

CPSC 463. Networks and Distributed Processing. (3-0). Credit 3. I, II Basic hardware/software, architectural components for computer communications; computer networks, switching, routing, protocols and security; multiprocessing and distributed processing; interfacing operating systems and networks; case studies of existing networks and network architectures. Prerequisite: CPSC 410.

CPSC 469. Advanced Computer Architecture. (3-0). Credit 3. Introduction to advanced computer architectures including memory designs, pipeline techniques, and parallel structures such as vector computers and multiprocessors. Prerequisite: CPSC 321 or ELEN 350. Cross-listed with ELEN 469.

CPSC 470. Information Storage and Retrieval. (3-0). Credit 3. Representation of, storage of and access to very large multimedia document collections; fundamental data structures and algorithms of current information storage and retrieval systems. Prerequisites: CPSC 310 and 311; junior or senior classification.

CPSC 481. Seminar. (0-2). Credit 1. I, II, S Investigation and report by students on topics of current interest in computer science. Prerequisite: Senior classification.

CPSC 483. Computer Systems Design. (1-6). Credit 3. Engineering design; working as a design-team member, conceptual design methodology, design evaluations, total project planning and management techniques, design optimization, systems manufacturing costs considerations; emphasis placed upon students' activities as design professionals. Prerequisites: CPSC 431 and CPSC 462 and senior classification.

CPSC 484: Senior Capstone. (3.0). Credit 3. A project-oriented course aimed at developing system integration skills. Students work in medium-sized groups to complete a significant software project. Every project requires design, implementation, documentation and demonstration. The focus is not only on the final product but also on design methodology, management process and teamwork. Prerequisite: Senior classification, CPSC 313, CPSC 315, and at least two courses from on track.

CPSC 485. Problems. Credit 1 to 6. I, II, S Permits work on special project in computer science. Project must be approved by the department. Prerequisite: Senior classification.

CPSC 489. Special Topics in ... Credit 1 to 4. Special topics in computer science that are new or unique that are not covered in existing courses.

CPSC 491. Research. Credit 1 to 4. Research conducted under the direction of faculty member in the computer science department. May be repeated 2 times for credit. Prerequisites: Junior or senior classification and approval of instructor.