



Department of
Computer Science

www.calstatela.edu/cs

cs.calstatela.edu

Graduate Student Handbook

(Updated: 3/17/2009)

Student's Name: _____

Student's CIN#: _____

Advisor's Signature: _____

Date: _____

Note: Although every attempt has been made to keep this handbook up to date and accurate, it is an advising tool and not an official University policy statement. Therefore, in cases where there are contradictions, the official university rules take precedence over statements in this handbook. Check our website for any updates. This handbook is also posted on the website. Carry this handbook with you for every major advisement visit.

Graduate Student Handbook

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I. INTRODUCTION

California State University at Los Angeles promises a variety of educational and professional, opportunities for its graduate students. The **Department of Computer Science** offers a graduate degree program to students seeking a Master of Science in computer science. The program is designed to prepare students for doctoral research, college teaching, public school teaching, or for careers in computer science. The department is well equipped with computer hardware, software, and modern computer laboratories.

The graduate enrollment in the computer science program currently exceeds 100 students. The graduate enrollment has gradually increased since the program's year of inception. The department has made special efforts to schedule evening classes to accommodate computing professionals who wish to continue their education. We encourage interested individuals to visit our campus and talk with the graduate advisor in the Department of Computer Science.

Don't hesitate to contact the Department of Computer Science at (323) 343-6690 for any information. A principal graduate advisor will be available to answer all your questions. Note that all the information you need is available at www.calstatela.edu/cs or cs.calstatela.edu

II. USEFUL WEB LINKS & FORMS

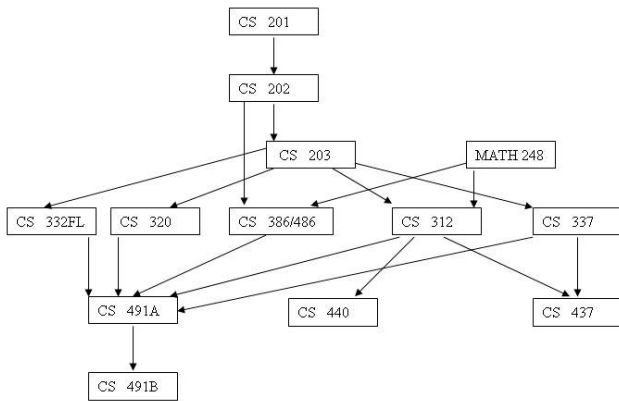
Web address	Description
http://www.calstatela.edu/cs http://cs.calstatela.edu	Department of Computer Science (Curriculum Faculty, and student information)
https://get.calstatela.edu	The Golden Eagle Territory (GET)
http://www.calstatela.edu/its/	Information Technology Services
http://www.calstatela.edu/	University main page
http://www.calstatela.edu/library	University Library
http://www.calstatela.edu/library/instruct7.htm	Graduate Thesis Workshops
http://www.calstatela.edu/academic/aa/gsr/	Graduate Studies Office
http://www.calstatela.edu/academic/registrar/grad_off.htm	Graduation Link
http://acm.calstatela.edu	Student Chapter of the Association for Computing Machinery
http://www.csumentor.com/admissionapp/grad_apply.asp	Graduate Application
http://www.csumentor.com/admissionapp/intl_apply.asp	International Application
http://www.calstatela.edu/univ/admiss/supinform.htm	Supplemental Application for Admission for International Applicants
http://www.calstatela.edu/univ/admiss/fin_affs.htm	Financial Affidavit for International Applicants.

FORMS

Web address	Forms Description
http://www.calstatela.edu/academic/ecst/cs/pdf/forms/Reduced_Load_Intl_Stud.pdf	Reduced Load for International Students (Cond. Classified)
http://www.calstatela.edu/academic/ecst/cs/pdf/forms/Reduce_load_Thesis_blank.pdf	Reduced Load for International Students (Thesis)
http://www.calstatela.edu/academic/ecst/cs/pdf/forms/Reduce%20load%20LAST%20COURSES.pdf	Reduced Load for International Students (General)
http://www.calstatela.edu/academic/aa/gsr/forms/ITW_application.pdf	Int. Graduate Student Tuition Waiver (One per College)
http://www.calstatela.edu/academic/aa/gsr/forms/06Transfer_course_level_evaluation_GS1A.pdf	Transfer Course Evaluation
http://www.calstatela.edu/academic/registrar/nongrade.pdf	Non Traditional Grading
http://www.calstatela.edu/academic/registrar/pet_leav.pdf	Leave of Absence
http://www.calstatela.edu/academic/registrar/grd_app.pdf	Graduation Application
http://www.calstatela.edu/academic/aa/gsr/forms/GA-PetitionforGraduateRequirements.pdf	General Academic Petition
http://www.calstatela.edu/academic/ecst/cs/pdf/forms/CPT_Draft_Ltr.pdf	Intl. Students CPT (Curricular Practical Training) Draft
http://www.calstatela.edu/academic/ecst/cs/pdf/forms/OPT_Draft_Ltr.pdf	Intl. Students OPT(Optional Practical Training) Draft

III. PREREQUISITES

All students will be considered as “Conditional” until evaluated for the following essential prerequisites as described in the flowchart below.



The subject areas for prerequisite evaluation are:

- (1) OOP & Data Structures: CS201-203
- (2) Web programming: CS320
- (3) Discrete Structures/Analysis of Algorithms: CS312
- (4) Programming Language Paradigms: CS332
- (5) Formal Language Theory: CS386/486
- (6) Operating Systems: CS440
- (7) Individual Project: CS491AB
- (8) Software Engineering: CS337/CS437
- (9) Others: CS120, CS122, CS245

The CS Department will conduct explicit ASSESSMENT TESTS/PRESENTATIONS (outlined below) of students admitted to determine which courses or possibly all of the above must be taken prior to beginning any courses for your graduate program. Check out the [SAMPLE ASSESSMENT TEST](#)

1. Object Oriented Programming in Java (2 hours - programming test at the level of [CS202](#) / [CS203](#))
2. Web Programming (3 hours - programming test at the level of [CS320](#))
3. Short answer competency test (1 hour – at the level of [CS312](#), [CS386](#))
4. Students are expected to have completed a large project and be prepared to make a (5 minutes/30 minutes) presentation at the level of CS491AB (<http://cs.calstatela.edu/abet/cs491/index.html>)

IV. GRADE POINT AVERAGE

It is expected that students enrolled in graduate courses demonstrate breadth and depth of understanding significantly beyond the undergraduate level.

- A grade of “A” designates that the graduate student’s performance has been superior, going above and beyond what is normally expected in a graduate class.
- A grade of “B” designates that a graduate student’s performance has been satisfactory and that the student has demonstrated the level of understanding normally expected in a graduate class.
- A grade of “C” designates that the graduate student’s performance has been poor and that the student has demonstrated significantly less understanding than normally expected in a graduate class.

Achievement of a minimum B (3.0) grade point average on all courses listed on the Course Requirements form is required through out the graduate studies.

Graduate students would be subjected to Academic Probation and Disqualification if the grade point average falls below 3.0. Students must note the university procedures and regulations as described in the catalog. If the GPA falls below 3.0, students are considered to be on probation, and if you do not bring your average up to 3.0 in the following two quarters in residence 16 units, whichever comes later, you will be disqualified from pursuing a M.S degree at Cal State LA.

V. CREDIT FOR TRANSFER WORK

- No courses taken as an undergraduate can be given credit for the M.S degree requirements.
- Up to 8 units of graduate level classes (5xx) may be given graduate credit only upon advisor’s approval.


VI. ADVISEMENT/GRADUATION STANDING

Academic Advisement is an essential component for a positive student experience and your success at Cal State L.A. Obtaining Academic Advisement in a timely way and on a regular basis increases your opportunity to succeed academically, to successfully progress toward your degree objective, and to graduate in a timely manner. Students must check with the advisor whenever they have any questions.

Students should discuss their academic program plan on every advisement visit. The advisor maintains a database of individual student plans. Updates or changes regarding Concentration and Electives can be made only with an approval of the graduate advisor.

GRADUATE STANDING

1. Students are generally admitted as "**Conditionally Classified Graduate**" standing. Students should have their undergraduate degree coursework evaluated to determine the prerequisites. Students must commit to a plan (and document it in the Individual Quarterly Planner on Page 11) for completing the prerequisites before being allowed to take any required courses for the graduate program.
2. Student's status will be changed to "**Classified Graduate**" standing upon completion of all the prerequisites.
 - Student should then plan on taking the "Core", "Concentration", and "Electives".
 - Note that the "Concentration" and the courses needed to satisfy the "Concentration" must be indicated to the graduate advisor before taking those courses.
 - The "Electives" must also be indicated prior to taking those courses.
 - Note: Please inform the Dept. that all prerequisites have been completed. The Dept. will then verify and change your standing to Classified.
3. Student's status will be changed to "**Candidacy**" standing upon
 - Completion of "Core" (12 Units) and
 - Completion of at least half of the remaining requirements (concentration/electives) and
 - Satisfying the Writing Proficiency Exam(WPE) requirement within the first three quarter of enrollment and
 - Declaring a thesis/project or a comprehensive exam option.
 - Note: Please inform the Dept. that Candidacy standing has been completed. The Dept. will then verify and change your standing to Candidacy.
4. Student with "**Candidacy**" standing

- Thesis/Project Option: Complete the necessary electives and a thesis/Project CS599AB (5 Units). The thesis/project must be sponsored by a faculty over a minimum of two quarters. Typically CS599B must be taken during the last quarter of graduation.
 - Comprehensive Exam (Non-Thesis) Option: Complete the necessary electives and satisfactorily complete the CS596 comprehensive exam. Typically, CS596 must be taken during the last quarter of graduation (offered only in Fall and Spring quarters).
5. Students should officially apply for a "**graduation check**" ([Graduation Application Form](#) ) at least two quarters before the graduating quarter. This entails paying a fee and checking with the graduate advisor to ensure that all courses listed on the Course Requirements for M.S degree in Computer Science have been completed with a GPA of more than 3.0. Students need to make an appointment with the Graduate Advisor.

VII. PROGRAM REQUIREMENTS

MSCS degree requires completion of 45 - 52 units as described in (i) through (iv) below.

- (i) Core (12 units)
 - a. CS512 Analysis and Design of Algorithms (4 units)
 - b. CS537 Advanced Software Engineering (4 units)
 - c. CS520 Web Programming (4)

- (ii) Three 500-level courses from one of the following three concentrations. Prior consent of the graduate advisor is required (12 units).
 - a. Application Software:
 - CS522 Advanced Database Systems (4)
 - CS540 Advanced Topics in Operating Systems (4)
 - CS550 Advanced Computer Graphics (4)
 - CS560 Advanced Topics in Artificial Intelligence (4)
 - CS570 Networks and Distributed Processing (4)
 - CS575 Human Issues in Computing (4)
 - CS581 Computer and Network Security (4)

 - b. System Software:
 - CS540 Advanced Topics in Operating Systems (4)
 - CS565 Reliable Computing (4)
 - CS570 Networks and Distributed Processing (4)
 - CS580 Computer Systems Security (4)
 - CS588 Languages and Translators (4)


 - c. Computer Theory:
 - CS522 Advanced Database Systems (4)
 - CS560 Advanced Topics in Artificial Intelligence (4)
 - CS565 Reliable Computing (4)
 - CS586 Theory of Computing (4)
 - CS588 Languages and Translators (4)

- (iii) Four Elective courses (16 units): Choose four other CS 400/500 level courses with the prior approval of the advisor. No more than 8 units from 400 level courses could be used as electives.

- (iv) Culminating Experience (5 or 12 units):
 - Thesis/Project Option: CS599AB (5 units)
 - OR
 - COMPREHENSIVE EXAM OPTION: (12 UNITS)
 - CHOOSE 12 ADDITIONAL UNITS OF 400/500 LEVEL COURSES (AT LEAST 8 UNITS MUST BE FROM 500 LEVEL COURSES)
 - CS 596 COMPREHENSIVE EXAM (0 UNITS)

VIII. THESIS/PROJECT

Students who chose a Thesis/Project option should choose an advisor/sponsor at some point soon after attaining classified standing. Students register for the 599AB sequence in order to complete this requirement. It is advisable to choose and discuss with the advisor to get started on doing preliminary research as soon as possible. Interaction with the thesis/project advisor is a key to complete this requirement in a timely manner. A few formalities are described below:

- a. Students must write a project report/thesis using the guidelines specified at <http://www.calstatela.edu/library/guides/thesbk.htm>
- b. Students do a formal presentation at the end of CS599A and CS599B to the advisor which is open to all other students and faculty. Presentations in CS599B should be done using a Poster Board (See sample: <http://www.calstatela.edu/academic/ecst/cs/pdf/posterboard.pdf>)
- c. It is quite common for students to extend the time line to more than the two quarters necessary for CS599AB. Students would then sign up for CS598 (as a Credit/No Credit option – [Nontraditional Grading](#)  in subsequent quarters to complete the thesis/project.
- d. Computer Science Department encourages all students to submit the results of their project/research to a conference or a journal. (Note the conferences listed at CS_Wiki.)
- e. Once the Thesis advisor is satisfied (the students must be getting feedback during CS599AB) of the work accomplished, the Thesis advisor will approve the thesis by signing the Approval Page. This form has to be signed by the student as well as any other committee members.
- f. Students need to complete the “ethesis” form. Contact thesis/project coordinator in the library Yvonne Hasegawa (yhasega@calstatela.edu or 323-343-4985). Workshops are usually conducted at the beginning of every quarter regarding project/thesis write up and submissions. Students must submit two printed copies. Ms. Hasegawa will approve the thesis after checking if the guidelines have been followed.
- g. Students need to complete the above approval process while being registered in CS599B or any other CS course. i.e., this process must be completed while still being a graduate student. If students are taking 599B as their last course, they should go through this process before the end of the quarter or register for a continuation course (CS598 Independent Study or any other CS course) every quarter until the thesis is finally approved at all levels.

IX. COMPREHENSIVE EXAM

Students taking the comprehensive exam must be advanced to “Candidacy” and have a current GPA of at least 3.0 on their program. Advancement to Candidacy requires that the student have completed at least 16 units of the master’s degree program and satisfactory completion of the GWAR. A student taking the comprehensive exam can have at most two courses remaining on his/her program, not counting those being taken in the same quarter as the comprehensive exam.

Registration: Students who elect to complete the comprehensive exam option will need to receive permission for CS 596 from the Computer Science Graduate Advisor. Registering in CS 596 is otherwise subject to the same deadlines and rules as for other classes. Students who are not otherwise taking classes may register for CS 596 only after paying the Comprehensive Exam Fee (currently \$10.00) at the Cashier’s Office. A student may not decide to change to a Thesis Option once he/she has attempted the examination.

Frequency: The Comprehensive Exam, assuming demand, will be offered every quarter. The exact time and date of each exam is set and posted by the graduate advisor. Exams are scheduled the Friday of the 8th week of the quarter. The exam is 3 hours in length.

Committee: The exam committee is set by the graduate advisor. The committee will have at least three members.

Content: The Comprehensive Exam will cover all courses listed as pre-requisites (Page 5) and Core Program Requirements (Page 9). The test may include a combination of multiple-choice and free-response questions. Students are not allowed to bring in any material (textbooks, notes, cell phones, laptops etc.) to the exam or take any paper work out of the exam room. The test will be conducted on “paper” and computer usage is not allowed.

Grading: The committee grades the exams as either Satisfactory or Unsatisfactory and reports them to the graduate advisor, who then advises the students of the results in writing. For transcript purposes, the grading symbol to be issued will be either CR or NC.

Re-examination: A student will be given three attempts (not in the same quarter) to pass the exam. If the student does not pass after the third attempt, the student will not be allowed a fourth attempt at the exam.

X. SCHEDULING

Tentative Scheduling layout on a yearly basis can be accessed from the department webpage. This gives a layout of all CS courses by time/quarter which should be the starting point for planning out your schedule. However, you should consult the GET system for an actual class listing for each quarter. Scheduling pattern for all courses is indicated below:

Tentative Scheduling Pattern

Courses	Summer	Fall	Winter	Spring
Core		CS512		CS512
	CS537		CS537	
	CS520	CS520		CS520
5xx Electives and Concentration	CS581	CS580	CS560	CS540
		CS522	CS575	CS550
		CS588		CS570
		CS596		CS596
				CS586

Individual Quarterly Plan (Make your own schedule)

**Department of Computer Science
College of Engineering, Computer Science, and Technology
California State University, Los Angeles**

**Course Requirements Form
(MS Degree in Computer Science)**

Course Name	Quarter			
Core Courses (12 Units)				
CS 512				
CS 537				
CS 520				
Concentration (12 Units): Application Software				
CS				
CS				
CS				
Elective Courses (Minimum 16 Units)				
CS				
CS				
CS				
CS				
Comprehensive Exam Option (Electives: 12 Units)		O R	Project/Thesis Option (5 Units)	
CS			CS 599A	
CS			CS 599B	
CS				
Comprehensive Exam (0 Units)				
CS 596				
WPE	0		WPE	0
Minimum Required Units: 52	52		Minimum Required Units: 45	45

XI. ACADEMIC STANDARDS

You are now joining an academic community. Along with the privileges of membership go certain obligations. Failure to meet established standards may result in various penalties. In extreme cases this could result in expulsion from the University.

We hope that behavior standards never become an issue, but it is important that you prove worthy of the trust we place in you. Honesty is extremely important both for the operation of the University and for your personal development.

XI. List of Courses

Prerequisite/4xx elective Courses

CS120 Introduction to Website Development (3)

Prerequisite: Computer Literacy. Development of client-sideweb pages using hypertext markup language ([d][x]html), Cascading Style Sheets (CSS). Javascript, and computer animation software. Lecture 2 hours, laboratory 3 hours. Graded ABC/NC.

CS 122 Using Relational Databases and SQL (3)

Prerequisite: Computer literacy. An introduction to relational databases and the SQL query language. Database modeling as collection of objects and their relationships; Entity-relationship model. SQL as a query language. Grouping and other advanced queries. Lecture 2 hours, laboratory 3 hours. Graded ABC/ NC.

CS 160 Introduction to Computers (3)

Prerequisite: GE mathematics requirement. History of computers; hardware, software including data base systems, word processors, spreadsheets, programming languages; social and ethical implications. Lecture 2 hours, laboratory 3 hours. Offered CR/NC only.

CS 190 BASIC Programming (2)

Prerequisite: One year of high school algebra. Introduction to computer programming using BASIC language. Applications will assume a minimal mathematics background. Does not fulfill mathematics major requirement. Lecture 1 hour, laboratory 3 hours.

CS 201 Introduction to Programming (5)

Prerequisite: [MATH 103](#) or consent of the instructor. Algorithm development for structured programming; designing, coding, debugging, and documenting programs. Laboratory activities on problem analysis and software development. Lecture 4 hours, laboratory 3 hours. Graded *ABC/NC*

CS 202 Introduction to Object Oriented Programming (5)

Prerequisite: [CS 201](#), recommended: [MATH 206](#). Algorithm development for Object Oriented Programming; designing, coding, and documenting programs. Laboratory activities on problem analysis and software development. Lecture 4 hours, laboratory 3 hours. Graded *ABC/NC*

CS 203 Programming with Data Structures (5)

Prerequisite: [CS 202](#), recommended: [MATH 207](#), [MATH 248](#). Advanced programming techniques; elementary data structures such as dynamic arrays, linked lists, stacks, queues, and trees, sorting and searching algorithms. Laboratory activities on problem analysis and software development. (Lecture 4 hours, laboratory 3 hours) Graded *ABC/NC*

CS 242 C Programming (4)

Prerequisites: [MATH 103](#) or consent of the instructor. Introduction to program design and problem solving using the C programming language. Programming topics include control structures, functions, arrays, pointers, and file I/O.

CS 245 Introduction to Computer Organization, Operating Systems and Networks (3)

Prerequisite: [CS 202](#). Essential information about computer organization, operating systems and computer networks for programmers. Topics include: computer organization, data representation, the Windows/UNIX/LINUX operating system; and computer networks. Lecture 2 hours, laboratory 3 hours. Graded ABC/NC

CS 290 Introduction to FORTRAN Programming (2)

Prerequisite: [MATH 206](#). Elementary computer programming using FORTRAN language. Lecture 1 hour, laboratory 3 hours. *No credit toward Computer Science major.*

Upper Division Courses

CS 301 Computer Ethics in the Information Age (1)

Prerequisite: [CS 203](#). Responsibilities of computer scientists as influenced by growth in computer use and networks. Professional and Ethical Responsibilities; Intellectual Property; Piracy, Hacking, Viruses, Liability, Privacy, Crime, and Civil liberties. Graded ABC/ NC.

CS 312 Data Structures and Algorithms (4)

Prerequisites: [CS 203](#), [MATH 208](#) and [248](#). Methods for the design and analysis of correct and efficient computer algorithms and advanced data structures. Applications to classical problems of searching, sorting, graph optimization and combinatorial optimization.

CS 320 Web and Internet Programming (3)

Prerequisites: [CS120](#), [CS 122](#), [CS 203](#). Server-side internet programming. Development of full-fledged Internet enterprise services and applications. Laboratory activities on application development (Lecture 2 hours, laboratory 3 hours).

CS 332C Object-Oriented Programming with C++. (2)

Prerequisite: [CS 203](#). Breadth and depth of C++ programming concepts; control statements, functions, pointers, classes, application development using the object-oriented paradigm. Advanced topics such as I/O, templates, exception handling, Standard Template Library (STL).

CS 332F Functional Programming (2)

Prerequisite: [CS 203](#). Programming in functional nonprocedural programming language such as Haskell. Programming in a language (a) in which functions are values, (b) without assignments, (c) with very strong typing, (d) with lazy evaluation, and with other features common to the functional programming paradigm.

CS 332L Logic Programming (2)

Prerequisite: [CS 203](#). Programming in a non-procedural logic programming language such as Prolog. Programming in a language that supports unification and backtracking and in which the execution of a program is the search for values that satisfy a declarative specification.

CS 337 Software Design (3)

Prerequisite: [CS 203](#). Methodologies and tools for requirements analysis and design of large complex software system; Process models, project planning, tracking, documentation, communication, and quality assurance; group laboratory project; oral and written presentations. Lecture 2 hours, laboratory 3 hours.

CS 340 Assembly Language and Systems Programming (4)

Prerequisite: [CS 245](#). Assembly language; addressing techniques; subroutines; macros; system input/output; interrupts and traps; assemblers; linkers; loaders; macroprocessors.

CS 342 Object Oriented Programming Using C++ (4)

Prerequisite: [CS 242](#). Concepts and techniques of object-oriented programming; structured design and modular construction; use of C to demonstrate structured programming; use of C++ to demonstrate fundamentals of object-oriented programming.

CS 345 UNIX and Shell Programming (4)

Prerequisites: CS 203. A theoretical and practical study of the UNIX operating system and shell programming. Topics: Shell commands and utilities, UNIX file system, UNIX shells, UNIX \ graphical user interfaces, and shell programming.

CS 350 Foundations of Computer Graphics (5)

Prerequisites: [CS 203](#), [MATH 208](#), and [MATH 255](#). Programming in an object oriented graphics environment implementing primitive operations in two and three dimensions. Emphasis on image modeling using affine transformations, polygonal meshes and other topics. Laboratory activities; lecture 4 hours, laboratory 3 hours.

CS 370 Parallel and Distributed Programming (4)

Prerequisites: [CS 203](#), [CS 245](#). Parallel programming techniques; abstract models of hardware and operating systems to support parallel programs.

CS 386 Introduction to Automata Theory (4)

Prerequisites: [CS 202](#), and [MATH 248](#). Formal approach to automata theory; finite state machines, regular expressions, regular languages. Develops mathematical foundation for computer science.

CS 398 Cooperative Education (1-4)

Prerequisites: Courses appropriate to the work experience: approval by major department Computer Science coordinator. Integration of work experience with academic program, individually planned through coordinator. Minimum of 10 hours per week required for each unit. May be repeated to maximum of 12 units.

CS 420 Web Applications Architecture (4 units)

Prerequisite: [CS 320](#). Covers architectural considerations, design patterns, and implementation techniques in the development of enterprise web applications, as well as technologies that address productivity, stability, flexibility, scalability, and security.

CS 422 Principles of Data Base Systems (4)

Prerequisites: [CS 122](#), and [312](#). Normal forms, database system architecture, query optimization, file structures, transaction management, data warehouses, object-oriented databases, databases for e-commerce.

CS 437 Software Engineering (5)

Prerequisites: [CS 312](#), [CS 337](#) and completion of the GWAR. Methodologies and tools for the development, implementation, integration, testing, evaluation, and maintenance of software systems. Software quality assurance; ethical issues in software development. Group laboratory project and oral and written presentations. This course satisfies the upper division writing requirement. Lecture 4 hours, laboratory 3 hours

CS 440 Introduction to Operating Systems (4)

Prerequisites: [CS 245](#), [312](#). Resource, memory and process management; concurrent processing; networking and distributed systems.

CS 447 Computer Networks Configuration and Management (4)

Prerequisite: [CS 440](#). Network topology, architecture, and related software. Topics covered include designing a LAN and an internetwork, developing access lists, configuring routing protocols, customize switch configurations and manage device configurations.

CS 450 Computer Graphics (4)

Prerequisites: [CS 312](#), [CS 350](#). An advanced course in computer graphics with emphasis on rendering. Polygonal meshes, bezier curves and surfaces, line and back face removal, shading, lighting, and texture algorithms.

CS 451 Multimedia Software Systems (4)

Perquisite: [CS312](#) or [CS 342](#). Introduction to multimedia information and processing. Topics: basic signal processing, color, space, formations of image, video, and audio data. Current standards and the state-of-the-art techniques for multimedia systems. Lecture 4 hours.

CS 454 Topics in Advanced Computer Science (1–4)

Prerequisites: As needed for specific topic. Current topics of special interest to students in computer science, as announced in Schedule of Classes. May be repeated to a maximum of 20 units of credit as topic changes.

CS 460 Artificial Intelligence (4)

Prerequisite: [CS 312](#). Knowledge representation; problem solving strategies and search algorithms; applications from such areas as theorem proving, expert systems, natural language processing, robotics, and pattern recognition.

CS 461 Machine Learning (4)

Prerequisite: [CS 312](#). Means that enable computers to perform tasks for which they were not explicitly programmed; learning paradigms include inductive generalization for examples, genetic algorithms, and connectionist systems such as neural nets.

CS 470 Computer Networking Protocols (4)

Prerequisite: [CS 245](#), [312](#). Study of computer network layered architecture and protocols. Topics to be covered include: network architecture, data link layer, addressing, LAN, network layer, transport layer and network applications.

CS 480 Cryptography and Information Security (4)

Prerequisites: [CS 245](#) and [CS 312](#). This course covers both principles and practice of cryptography and information security. Topics covered include basic concepts of cryptology, classical ciphers, modern symmetric ciphers (DES, IDEA, RC5), Advanced Encryption Standard (AES), public key cryptography, data integrity and digital signature schemes.

CS 486 Computability and Intractability (4)

Prerequisite: [CS 386](#). Theory of Computing; nondeterminisms, decidability and unsolvable problems; NP completeness and intractable computations.

CS 488 Compilers (4)

Prerequisites: [CS 312](#), [332](#), [386](#). Compiler construction; lexical analysis, including regular languages and finite-state acceptors; syntactic analysis, including parsing techniques and grammars; code generation and optimization.

CS 490 Computer Science Recapitulation (2)

Prerequisite/corequisites: [MATH 270](#), [CS 386](#), [CS 437](#), [CS 440](#), [EE 444](#). A recapitulation of the primary concepts of Computer Science in preparation for the Major Field Achievement Test.

CS 491A Software Design Laboratory (3)

Prerequisites: [CS 312](#), [320](#), [337](#), [386](#), and senior standing. Approaches to software design, including Design Patterns and other strategies for designing software systems. Each student will propose a substantial, individual software project, resulting in a preliminary report and project presentation. Laboratory 9 hours. Graded ABC/NC

CS 491B Software Design Laboratory (3)

Prerequisite: [CS 491A](#). Software design, including Design Patterns and other strategies for designing software systems. Each student will complete the project initiated in [CS 491A](#) resulting in a formal report and project presentation. Laboratory 9 hours. Graded ABC/NC

CS 499 Undergraduate Directed Study (1–4)

Prerequisite: Consent of an instructor to act as sponsor. Project selected in conference with sponsor before registration; progress meetings held regularly, and a final report submitted. May be repeated for credit.

Graduate Level Courses (CS)

CS 512 Design and Analysis of Algorithms (4)

Prerequisite: [CS 312](#). Design of complex algorithms. Algorithms for solving frequently occurring problems in computer applications. Computationally intractable problems, heuristics and partial solutions. Optimization techniques. Analysis of algorithms for specific problems of interest.

CS 520 Web Programming (4)

Prerequisite: [CS 320](#). Current issues in web programming. Topics include: semantic networks; architectures for web-based applications; dynamic and evolutionary system deployment.

CS 522 Advanced Database Systems (4)

Prerequisites: [CS 422](#), [CS 491AB](#). Current topics in database systems: distributed databases, transactions, and concurrency control; nested and long-running transactions; semantic and object-oriented data models; engineering design databases; temporal, multi-media, and real-time databases.

CS 537 Advanced Software Engineering (4)

Prerequisites: [CS 437](#), [CS 491AB](#). Managing software development projects; the capability maturity models and personal performance processes; software cost estimation; risk management; extreme programming. Engineering systems for survivability. Estimating system performance.

CS 540 Advanced Topics in Operating Systems (4)

Prerequisite: [CS 440](#). Asynchronous concurrent processes; mutual exclusion and deadlocks; virtual storage organization and management; multiprocessing; auxiliary storage management; distributed operating systems; performance measurement; operating systems security.

CS 550 Advanced Computer Graphics (4)

Prerequisite: [CS 450](#). Advance topics in computer graphics. Surfaces, curves, and textures; illumination, shading, shadows and transparency effects; ray tracing and other rendering techniques; color models; animation; compression techniques: fractals, JPEG, and MPEG.

CS 560 Advanced Topics in Artificial Intelligence (4)

Prerequisite: [CS 460](#). Examination of a sub field within artificial intelligence such as natural language processing, expert systems, robotics, data mining, computer vision, speech recognition, intelligent agents or others.

CS 565 Reliable Computing (4)

Prerequisites: [CS 312](#) and [386](#). Errors, faults, and failures. Software and system safety. Reliability metrics: mean time between failures. Techniques for fault tolerance: redundancy and robustness. Fault detection, isolation, correction, and recovery.

CS 570 Networks and Distributed Processing (4)

Prerequisites: [CS 470](#). Study of computer network architecture and protocols. Routing, congestion and flow control. Distributed algorithms, client-server models, remote procedure calls, load balancing, and security. Interprocess communication and protocols. Distributed transaction processing.

CS 575 Human Issues in Computing (4)

Prerequisites: [CS 386](#), [CS 491AB](#). Methods and techniques for maximizing the usability of computer systems and practices User centered design, designing for diverse users, physiological, psychological, and sociological issues. Human factors in software development.

CS 580 Internet Security Protocols (4)

Prerequisites: [CS 470](#) and [480](#). Protocols for internet security. Topics covered include IPV6 security, virtual private network, secure socket layer (SSL), secure electronic transaction (SET), public key infrastructure, secure election protocols and advanced digital signatures.

CS 581 Computer and Network Security (4)

Prerequisite: [CS 447](#) or [CS 470](#). This course exposes students to various techniques related to defending your computers and networks. Topics covered include Denial-Of-Service attacks, packet analyzers, host-based intrusion detection and honeypots etc.

CS 586 Theory of Computing (4)

Prerequisite: [CS 486](#). Mathematical models of computation. Recursive function theory and primitive recursion. Computability and logic. Church's Thesis, Wegner's interaction machines, and quantum computation.

CS 588 Languages and Translators (4)

Prerequisite: [CS 488](#). Advanced programming language and translator concepts. Language runtime systems such as the Java virtual machine. Term rewriting systems and XSL, Programming language semantics.

CS 590 Advanced Software Architecture (4)

Prerequisite: [CS 491AB](#). Design and development of large-scale, typically distributed, often multi-language, software systems. Integration of existing (legacy) systems. Multiple architectural views and their representation and documentation. Integrative and connective platforms, standards, and technologies.

CS 594 Graduate Seminar (4)

Prerequisite: instructor consent. Special course offering on topics of current interest in computer science. May be repeated to a maximum of 8 units on different topics.

CS 596 Comprehensive Examination (0)

Permission needed from department. Examination of student's ability to demonstrate mastery of the subject matter. Students should take the comprehensive exam during the quarter, in which they complete all Course work or shortly thereafter. Graded CR/NC.

CS 598 Graduate Directed Study (1-4)

Prerequisite: instructor consent. Independent investigation and study of an advanced topic in computer science under direct supervision of an instructor. May be repeated to maximum of 4 units.

CS 599A Thesis or Project (3)

Prerequisites: Completion of at least 20 units of 500 level CS courses and instructor consent to act as sponsor, department approval of topic prior to registration. Research project conducted in an area of advanced topics in computer science under direct supervision of an instructor. This research project shall be continued in CS 599B. Graded CR/NC.

CS 599B Thesis or Project (2)

Prerequisites: CS 599A. Instructor consent to act as sponsor, completion of all other requirements for an MS degree in Computer Science. Continuation of research project conducted in CS 599A. Each student shall orally present his/hers research result in a public forum. Graded CR/NC.