



Department of Computer Science

Graduate Handbook

MS in Computer Science

Fall 2008 Edition



**California State University, Fullerton
Fullerton, CA 92834-6870**

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Revised Spring 2002, Fall 2005 by Allen Holliday
Revised Fall 2006 by The Graduate Committee –
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Introduction

Computer Science began as an interdisciplinary program at Cal State Fullerton in 1971, and the master's degree program was established a couple of years later. In Spring 2005, 351 students were enrolled in the master's program in computer science.

The program objectives of the master's degree in Computer Science are:

- To prepare you for the increasingly sophisticated application of computers to the needs of industry and society;
- To prepare you for research, teaching, and further graduate programs in computer science;
- To prepare you for leadership roles in your industry career.
- To provide you graduate level course work in computer science that supplements the curriculum in other disciplines.

The program currently offers courses in seven special tracks:

1. Software Engineering
2. Databases & Web Programming
3. Computer Networks & Security
4. Distributed Systems
5. Machine Intelligence
6. Bioinformatics
7. Computer Graphics & Multimedia

If you wish to take courses without a degree objective, and meet the prerequisites, you may enroll through Extended Education on a space-available basis.

Computer Science Department

The faculty and staff of the Computer Science Department welcome you into our program. We sincerely wish you good luck on your journey into higher education, and continued success in your career.

If you have questions at any time or need clarification on anything concerning the Computer Science Department, its policies, curriculum, or your progress, feel free to contact us.

In person: Room CS-522

Telephone: (714)278-3700

Fax: (714)278-7168

E-mail: csoffice@ecs.fullerton.edu

Website: <http://www.fullerton.edu/ecs/>

Mailing address:

California State University, Fullerton

Department of Computer Science

P.O. Box 6870

Fullerton, CA 92834-6870

Applying For Admission

To apply to the MS in Computer Science program, submit an application and pay the \$55 application fee online at <http://www.csumentor.edu>. If you cannot access the application online you can print out a hard copy from the same website. Mail the application and \$55 check or money order (in US currency) made out to CSUF to:

Elfie Abril
Graduate and International Admissions Coordinator
College of Engineering and Computer Science
California State University, Fullerton
P.O. Box 6870
Fullerton, California 92834-6870

Your application will be received faster and therefore processed more quickly if you apply and pay online. Your application cannot be processed until payment has been received.

Transcripts

You must arrange for the institution where you previously studied to send an official transcript to the address above. If your transcript does not indicate that you have received your bachelor's degree, a degree certificate showing proof that you have received your bachelor's degree is also required. Transcripts and degree certificates issued in languages other than English must be accompanied by a certified English translation. They must show a Grade Point Average of at least 2.5 in the last 60 semester units (90 quarter units) attempted; your application will be denied if your GPA is lower.

Graduate Record Examination (GRE)

You do not have to take the GRE to be admitted to the Computer Science Graduate Program.

Evaluation

After your application and its supporting documents (transcripts, TOEFL score, and so forth) have been received, it usually takes 3–4 weeks for us to evaluate your application. The Graduate Coordinator will determine whether the prerequisite courses you have taken are equivalent to those that we offer. For courses offered by other departments, such as Mathematics, the appropriate department will make the determination. This step may take a couple of weeks.

The final recommendation, including any prerequisite deficiencies, is sent by the Graduate Coordinator to The Graduate and International Admissions Coordinator, who will inform you of those results.

Admission Deadlines

There are not official deadlines for application. However, your application must be received by the Computer Science Department early enough for it to be evaluated and the result given to you

so that you can register for classes. You are strongly encouraged to submit your application before the following dates:

Fall semester: May 31.

Spring semester: October 31.

International Students

If your native language is not English, you are required to present scores for the Test of English as a Foreign Language (TOEFL) unless you have attended for at least three years, full-time, an educational institution at the secondary level or above where English is the principal language of instruction. If you've taken the written test, the score must be 550 or better; if you've taken the computerized version of the test, the score must be 213 or better; if you've taken the Internet-based test, the score must be 80 or better.

The TOEFL score report must be sent directly to CSU Fullerton from Educational Testing Service (ETS). The institution code for CSU Fullerton is 4589.

Transcripts and degree certificates issued in languages other than English must be accompanied by a certified English translation.

You should contact the International Education Office (UH-244) and the University Admissions and Records Office (LH-114) for further information on University requirements.

The Computer Science Department has no additional requirements beyond those of the University.

Graduate Standing

Prerequisites

You must have taken a fundamental core of undergraduate courses before being admitted to classified standing. They are required for classified standing and for admission to 500-level courses. Appendix A shows the worksheet used to assess, plan, and record your prerequisites.

If you have received a Bachelor's Degree in Computer Science from a university in the United States whose program is accredited by the Accreditation Board for Engineering and Technology, all prerequisites except the University Writing Requirement are waived.

Undergraduate Prerequisite Courses

You may be required to take one or more prerequisite courses listed below, unless you have taken courses that are equivalent to them.

Computer Science Courses

CPSC 121 (Programming Concepts)

CPSC 131 (Data Structures Concepts)

CPSC 240 (Computer Organization and Assembly Language)

CPSC 323 (Programming Languages and Translation)

CPSC 335 (Problem Solving Strategies)

CPSC 351 (Operating Systems Concepts)

CPSC 362 (Software Engineering)

Mathematics Courses

MATH 150A and 150B (Analytic Geometry and Calculus)

MATH 270A and 270B (Discrete Math and Linear Algebra)

MATH 338 (Statistics)

University Writing Requirement

Before you can be classified as a graduate student, you must demonstrate your ability to write proficiently in the English language—usually by taking and passing the Examination in Writing Proficiency (EWP). You may use CPSC 311 Technical Writing to substitute for this examination, in either of these two cases:

1. If you have already taken CPSC 311 and passed with a grade of B or better.
2. If you have taken the EWP and did not pass, you may take CPSC 311 and pass with a grade of B or better. If you receive a grade of B- or lower, you may take CPSC 311 again.

There is no limit on the number of times you can take CPSC 311 to satisfy the University Writing Requirement and no limit on the number of times you can take the EWP.

Classification

Conditionally Classified Standing

If you have not completed the prerequisite courses, you will be admitted to the program as conditionally classified. You will remain conditionally classified until all requirements for Classified Standing are satisfied.

Classified Standing

When you successfully complete all of the prerequisite courses and meet the University Writing Requirement, you may be classified. You must make an appointment with an advisor and prepare a formal study plan. Classified Standing is subject to Study Plan approval by the Computer Science faculty advisor, the Graduate Coordinator and the CSUF Graduate Studies office.

Probation

You must maintain a 3.0 Grade Point Average (GPA) if you have Conditionally Classified or Classified Standing. If you have a GPA lower than this, you will be placed on probation. If you are on probation for more than two consecutive semesters, you are subject to disqualification from the program. The University requires a 3.0 GPA for all 400- and 500-level courses taken here. You must also maintain a 3.0 GPA in all courses on your Study Plan.

This GPA requirement applies only after you have been admitted to Conditionally Classified or Classified Standing. To be admitted to the Graduate Program, you must have a GPA of at least 2.5 in the most recent 60 semester units (or 90 quarter units).

Graduate Study Plan

Before completing more than 9-units of study plan eligible course work (not including any prerequisite courses), you must have a 30-unit Study Plan approved. Each course on the study plan must be completed with a grade of “C” or better. Appendix B shows the study plan form.

Required Courses

These four courses are required on your Study Plan:

- CPSC 440 Computer System Architecture
- CPSC 462 Software Design
- CPSC 589 Seminar in Computer Science
- CPSC 597 Project or CPSC 598 Thesis

One of the following software engineering courses must appear on your Study Plan:

- CPSC 541 Systems and Software Standards and Requirements
- CPSC 542 Software Verification and Validation
- CPSC 543 Software Maintenance
- CPSC 544 Advanced Software Process
- CPSC 545 Software Design and Architecture
- CPSC 546 Modern Software Management
- CPSC 547 Software Measurement
- CPSC 548 Professional, Ethical and Legal Issues for Software Engineers

Your Study Plan cannot include any course that was already credited toward your bachelor’s degree. If you have taken any of the above required courses as an undergraduate, you must take other courses in their place.

Graduate Seminar

You are encouraged to take the Graduate Seminar (CPSC 589) when you take your first 500-level course. It will expose you to a wide range of current topics in the field and enable you to select a project or thesis topic.

Project / Thesis

To complete the graduate program, you must complete either CPSC 597 Project or CPSC 598 Thesis. A project is a significant development undertaking that shows originality and independent thinking. A thesis is a written description of the systematic study of a significant problem, covering the gathering and analysis of information and including a conclusion or recommendation.

Before enrolling in CPSC 597 or 598, you must submit a CPSC 597 / 598 Project Proposal form to the Computer Science Department Office. This form must be signed by a supervising full-time faculty member and by a second faculty reviewer no later than the last day of instruction of the preceding semester. Permission to enroll in CPSC 597 or 598 will be withheld if you submit a proposal after this deadline.

You will not be able to register on-line for these courses until the Computer Science Department Office grants permission to do so. You should call to verify that this has been done.

Elective Courses

You must take five additional courses; at least three of these courses must be at the 500-level. The elective courses are grouped to seven tracks. You are strongly encouraged to have at least two different tracks included on the Study Plan. Listed below are the seven tracks:

1. Software Engineering:
 - a. CPSC 463 Software Testing or
CPSC 464 Software Architecture
 - b. CPSC 54x Software Engineering related courses
2. Databases & Web Programming:
 - a. CPSC 431 Database and Applications or
CPSC 473 Web Programming and Data Management
 - b. CPSC 531 Design of Database Management Systems
3. Computer Networks & Security:
 - a. CPSC 433 Data Security and Encryption Techniques or
CPSC 471 Computer Communications
 - b. CPSC 558 Advanced Computer Networking
4. Distributed Systems:
 - a. CPSC 474 Distributed Computing using Web Service and .NET Remoting
 - b. CPSC 551 Operating Systems Design
5. Machine Intelligence:
 - a. CPSC 481 Artificial Intelligence or
CPSC 483 Data Mining and Pattern Recognition
 - b. CPSC 583 Expert Systems Design Theory or
CPSC 585 Artificial Neural Networks
6. Bioinformatics
 - a. CPSC 485 Computational Bioinformatics
 - b. CPSC 583 Expert Systems Design Theory or
CPSC 585 Artificial Neural Networks
7. Computer Graphics & Multimedia:
 - a. CPSC 484 Principles of Computer Graphics
 - b. CPSC 566 Advanced Computer Graphics

When selecting a track, make sure you have the proper prerequisite courses satisfied for each individual course. It is recommended that at least 50% of the electives and at least 50% of all 500 level electives be taken from the Computer Science Department at CSUF.

Independent Graduate Research

You may take CPSC 599 Independent Graduate Research to fulfill part of your electives. This course allows you to pursue topics of special interest beyond those of a regular course. It cannot cover the same topic as your project or thesis.

You must submit an Application For Independent Study to the department office, which will supply the form. The application must include a study plan and objectives, and must be approved by a supervising full-time faculty member and by the department chair.

You may take up to three units per semester, and apply a maximum of three units towards the degree. The University allows a maximum of six units, but the Computer Science Department allows only three units.

You will not be able to register on-line for this course until the Computer Science Department Office grants permission to do so. You should call to verify that this has been done.

Transfer Credit

At least 21 semester units must be taken in residence. Transfer credits and Cal State Fullerton extension credits are not residence units.

No more than nine units of transferable course work can be accepted from another institution and applied to the thirty required units on the Study Plan.

Internships

Learning takes place in many settings, not just the classroom. When you complete your educational career and are entering the professional job market for the first time, extensive professional experience can be highly beneficial. For this reason, CSUF and the Computer Science Department maintains an active internship program as a service to all students interested in obtaining employment while still in school.

Benefits of the internship program in Computer Science include:

- Paid work experience in the computer field.
- Job placement assistance from the Internship Office.

To do so, follow these steps:

1. Visit the Center for Internships and Cooperative Education located in LH-209.
2. Wait for a position. This wait is three months on *average*, so be sure to plan in advance!
3. Visit the Computer Science office and request enrollment in CPSC 495. This class may be repeated any number of times, for up to three units.

If you are already employed in a position involving a significant amount of computer work, contact the Center for Internships and Cooperative Education in order to certify your position as suitable for internship credit. You may then enroll in CPSC 495 as in step 3 above.

You may take CPSC 495 in order to obtain the assistance of the Internship Office in obtaining a job. International students are encouraged to enroll for a one-unit course in order to be eligible for this assistance. Any credit earned by completing CPSC 495 may not be included among the thirty units appearing on a Study Plan.

Duration of Study

All study plan courses should be completed within 10 semesters. If you find that this is not possible, you must file for a two-year extension.

Grade Point Average

You must maintain a 3.0 Grade Point Average (GPA). If you have a GPA lower than this, you will be placed on probation. If you are on probation for more than two consecutive semesters you are subject to disqualification from the program. Each course on the study plan must be completed with a grade of “C” or better while maintaining a 3.0 GPA.

Continuous Enrollment

You must remain enrolled for every semester of your graduate program. If circumstances require, you may apply for a Leave of Absence. The form may be obtained from Admissions and Records, and is submitted to the University Graduate Office.

If you don't enroll for courses each semester of your graduate program, and you haven't been granted a Leave of Absence, you will be dropped from the graduate program and you will have to reapply for admission.

Scheduling Guidelines

Some 400-level and 500-level classes are offered every semester, while others are offered only every second semester. You should always check the official schedule or contact the Computer Science Department Office to make sure that a particular course is actually being offered when you want to take it.

Applying For Graduation

You should file a Request for Graduation Check with the University Graduate Office (MH-103) one semester before your expected date of graduation. The Graduation Check and your Graduate Study Plan will be sent to the Computer Science Department in the latter half of that semester.

The Graduate Coordinator will determine if your study plan has been satisfactorily completed, and will send a recommendation to the University Graduate Office, who will then inform you of the results.

If you change your study plan, you must file a Change of Graduate Study Plan form, which you can obtain from the Computer Science Department. If you don't keep your study plan up to date, your graduation could be delayed.

Student Activities and Services

Many activities and services exist for students at CSUF; ranging anywhere from job placement to the Pub! You may refer to the CSUF Catalog for information about many of the campus wide student activities and services. Described below are a few of the activities and services available specifically for Computer Science students.

Open Computer Labs

The Computer Science Department maintains a computer lab, which remains open for most of the standard campus operating hours. Signs posted on the doors of the lab show the operating days and hours. The labs are located in CS-200/CS-202 and contain PCs with WEB access.

In addition, there is a campus-wide Computer Center located in the basement of the Library. This lab contains computers running the Windows and Macintosh operating systems. For more information about the campus Computer Center, drop by or call the library at (714) 278-2633.

Computer Accounts

As a Computer Science student, you may get a special *Titan* computer account. Titan is a Unix based server used throughout the Computer Science Department and connected to the Internet. All functionality from email to surfing the World Wide Web is available through this account. To get a Titan account, visit the Computer Science office in room CS-522 with a photo ID.

Wireless Access

The computer science building is covered by two wireless networks. The university wireless network is the default wireless connection you can use. To be connected to the department wireless network, you need to register the MAC address of your wireless card with the department. You can fill out a request form in the department office.

Scholarship Information

First, we all know what scholarships are: free money! Second, we all *like* free money! All right, so maybe there is a little more to it than just free money. Most scholarships have specific requirements based on your GPA, citizenship, or affiliation with a minority group. Frequently, some sort of essay is also required. Additionally, the money is to be used only for educational expenses.

The Office of the Assistant Dean for Student Services, College of Engineering and Computer Science, maintains current scholarship information and application forms for students majoring within this college. Check with the Dean's office for information and applications. It is located in room CS-501 and can be reached by phone at (714) 278-2887.

The Computer Science Clubs

Association for Computing Machinery (ACM)

ACM (founded 1947) is an international scientific and educational organization dedicated to advancing the art, science, engineering, and application of information technology, serving both professional and public interests by fostering the open interchange of information and by promoting the highest professional and ethical standards. The ACM at CSUF provides a continuing forum for the exchange of ideas and announcements for all the students on campus that share an interest in the diversified aspects of computing. Activities include field trips, programming contests, workshops, symposiums, games and tournaments.

For information on the club, you are welcome to drop by the office in room CS-209, call (714) 278-7165, or send email to acm@ecs.fullerton.edu. In addition, ACM operates a home page at <http://ecs.fullerton.edu/~acm>. The ACM home page contains many services and maintains links to other student services. Surf on over and see what's there!

The ACM computer club is a student-run organization and its activities are open to all interested students. The club is successful only to the extent that students support it and participate in its activities. We encourage you to get involved!

The Upsilon Pi Epsilon (UPE)

Upsilon Pi Epsilon is the first and only international honor society in the Computing and Information Disciplines. It has received endorsements from the two largest computer organizations in the world, the Association for Computing Machinery (ACM) and the IEEE Computer Society (IEEE-CS). UPE is a member of the Association of College Honor Societies (ACHS). Members in this club share ideas and experience with other motivated computer science students, learn from computer scientists and professionals from other disciplines, and gain exposure to diverse and advanced computing and information science topics. As an honors society, UPE only grants membership to students at the top of their class. Some of the activities and benefits of being a member include:

- a) Field trips to major companies and research facilities
- b) Guest speakers from industry and academic organizations
- c) Share information about graduate schools (with M.S. or Ph.D. degree programs)
- d) Share knowledge and techniques among members
- e) Develop close relationships with faculty members for research and projects
- f) Meet with other outstanding computer science students from our own university and from other universities
- g) And much more

In addition, every member will receive the membership certificate, carat-clad key pin, and a free one-year ACM student membership (current ACM members receive a one-year extension).

For more info on UPE and the eligibility, please visit: <http://www.o-upe.com>.

Full-Time Faculty

The following is an alphabetical listing of all full-time faculty in the Computer Science Department, with their educational background, their areas of interest, and contact information. Faculty members with (FERP) after their names are participating in the Faculty Early Retirement Program. They teach a reduced load, don't serve on committees, and don't advise students.

Susamma Barua — Ph.D., University of Cincinnati, Cincinnati, OH

Computer architectures and performance evaluation, neural networks, web-based database development, computer networking.

E-mail: sbarua@fullerton.edu

Website: <http://ecs.fullerton.edu/~sbarua>.

Ning Chen — Ph.D., Colorado State University, Fort Collins, CO

Embedded systems, digital signal processing, robotics, real-time systems, distributed systems.

E-mail: nchen@fullerton.edu

Website: <http://ecs.fullerton.edu/~nchen>

James Choi — Ph.D., University of Southern California, Los Angeles, CA

Software engineering, reverse software engineering, process modeling, configuration management.

E-mail: jchoi@fullerton.edu

Website: <http://ecs.fullerton.edu/~sjchoi>

Bin Cong — Ph.D., University of Texas, Dallas, TX

Computer network, parallel processing, neural networks, and heuristic search, software process models, network security.

E-mail: bcong@ecs.fullerton.edu

Website: <http://ecs.fullerton.edu/~bcong>

Spiros H. Courellis, Ph.D., University of Southern California, Los Angeles, CA

Wireless and Mobile Computing, Neural Computing, Ubiquitous Computing, Embedded Systems, and Computer Security.

E-mail: shc@ecs.fullerton.edu

Website: <http://ecs.fullerton.edu/~shc>

David Falconer — Ph.D., University of Texas at Austin, TX

Artificial Intelligence, programming languages, and technical communications.

E-mail: falconer@fullerton.edu

Website: none yet

Allen Holliday — M.S. West Coast University, Los Angeles, CA

Software engineering, high-assurance systems, operating systems, data communication, and computer security.

E-mail: aholliday@fullerton.edu

Website: <http://ecs.fullerton.edu/~allenh>

Floyd Holliday — M.A., California State University, Long Beach, CA

OOP software engineering, embedded systems and web-based application.

E-mail: holliday@ecs.fullerton.edu

Website: none yet

Chang-Hyun Jo - Ph.D., Oklahoma State University, OK

Programming languages, software engineering, and Internet/Web Technologies.

E-mail: jo@ecs.fullerton.edu

URL: <http://ecs.fullerton.edu/~jo>

Barbara Laguna — M.S., California State University, Fullerton, CA

Fractal geometry, data structures, analysis of algorithms, and social issues of computer technology.

E-mail: laguna@ecs.fullerton.edu

Website: <http://ecs.fullerton.edu/~laguna>.

Demetrios Michalopoulos - Ph.D., University of Southern California, Los Angeles, CA

Pattern recognition, image processing, graphics, intelligent systems, artificial intelligence application and web application.

E-mail: dimitri@fullerton.edu

Website: <http://ecs.fullerton.edu/~dimitri>.

Mariko Molodowitch — Ph.D., University of California, Irvine, CA

Design and analysis of algorithms, parallel algorithms, graph algorithms and probabilistic analysis.

E-mail: mariko@ecs.fullerton.edu

Website: <http://ecs.fullerton.edu/~mariko>

Tae Wan Ryu — Ph.D., University of Houston, Houston, TX

Databases, data/text mining, time-series forecasting, Internet computing, evolutionary computation.

E-mail: tryu@fullerton.edu

Website: <http://ecs.fullerton.edu/~tryu>

Shafae, Michael – Ph.D., University of California, Irvine

Computer graphics & computer games

Email: see website

Website: <http://mshafae.ecs.fullerton.edu/>

Xiong Wang — Ph.D., New Jersey Institute of Technology, Newark, NJ

Databases, knowledge discovery and data mining, pattern matching, bioinformatics.

E-mail: xwang@fullerton.edu

Website: <http://ecs.fullerton.edu/~wang>.

Course Descriptions

Computer Science Courses

Prerequisites for computer science courses may be waived only by Department petition. Prerequisite courses must be passed with a grade of "C" or better.

CPSC 121 Programming Concepts (3 units)

Prerequisite: CPSC 120 or sufficient score on the Computer Science Placement Exam.

Introduction to programming of digital computers; subroutines, functions, and structure of algorithms; elementary input/output; arrays; strings and data types; documentation. (2 hours lecture, 2 hours laboratory)

CPSC 131 Data Structures Concepts (3 units)

Prerequisites: CPSC 121

Data structures: list, stacks, queues, linked structures, binary search trees, hashing, graph, sorting and searching. Implementation and use of basic data structures.

CPSC 223H Visual BASIC Programming (3 units)

Prerequisite: CPSC 131.

Elements of Visual Basic, forms and controls, mouse events, properties, multiple-document interface, processing files, accessing databases, dynamic data exchange, object linking and embedding. (2 hours lecture, 2 hours laboratory)

CPSC 223J Java Programming (3 units)

Prerequisite: CPSC 131.

Characteristics of Java: portable, robust, secure, object-oriented, high performance; using Java environment; server administration; types, expressions, and control flow; classes, interfaces, and packages; threads; exceptions; class libraries; Java for the Internet; tools; the Java Virtual Machine.

CPSC 223N C# Programming (3 units)

Prerequisite: CPSC 131.

Characteristics of C#, object-oriented design concepts, control structures, methods, arrays, classes, objects, inheritance, polymorphism; exception handling; class graphic user interfaces, multithreading, characters, strings, files, streams. Software development assignments (2 hours lecture, 2 hours laboratory)

CPSC 240 Computer Organization and Assembly Language (3 units)

Prerequisites: CPSC 131 and either Mathematics 270A or Mathematics 280.

Digital logic and architecture of a computer system, machine level representation of data, memory system organization, structure of low-level computer languages. machine, assembly, and macro language programming. principles of assembler operation, input-output programming, interrupt/exception handling. Laboratory programming assignments. (2 hours lecture, 2 hours laboratory)

CPSC 253U Workshop in UNIX (1 unit)

Prerequisite: CPSC 131.

Introduction to the UNIX operating systems.

CPSC 301 Programming Practicum (2 units)

Prerequisite: CPSC 131 and 253U.

Intensive programming covering concepts learned in lower division courses. Includes procedural and object-oriented design, documentation, arrays, classes, file input/output, recursion, pointers, dynamic variables, data and file structures.

CPSC 303 Multimedia Concepts (3 units)

Prerequisites: 121 and completion of the General Education Critical Thinking requirement.

Components and issues associated with multimedia technology, applications of multimedia and its evolution. Laboratory activities will include developing a multimedia application using a PC-based authoring tool. (2 hours lecture, 2 hours laboratory)

CPSC 311 Technical Writing for Computer Science (3 units)

Prerequisites: ENGL 101 and CPSC 131.

Practice in developing documentation skills as used in the computer field. Topics include proposals, feasibility studies, user guides and manuals, business communication and technical presentation. Case studies in professional ethics. Both written and oral reports required.

CPSC 313 The Computer Impact (3 units)

Prerequisite: Upper division standing, one course from GE section III.A.2.

Effect of computer use on individuals and organizations. Side effects of innovative technology and the resulting changes to organizations, social institutions, and human perceptions of events. Students will learn e-mail and the World Wide Web. Emphasis on personal responsibility, legal ramifications, and educational implications.

CPSC 315 Social and Ethical Issues in Computing (1 unit)

Prerequisite: CPSC 311.

The course will cover relevant issues that responsible professionals will face in a complex technological society. Issues covered are professional ethics, computer control, intellectual property, privacy, computer crimes, benefits and downside of computers.

CPSC 322L Introduction to Computer Aided Design (3 units)

Prerequisite: Adviser Approval.

Introduction to modeling, assembly, design documentation and analysis using typical commercial CAD/CAE software such as Mechanical Desktop, Pro/ENGINEER and ANSYS. Use of online resources in the collaborative design process. Design file transfer protocols. Design project using a technology based team environment. CAD/CAE system selection criteria. (1 hour lecture, 6 hours laboratory). (Same as Computer Science 322L)

CPSC 323 Programming Languages and Translation (3 units)

Prerequisites: EPP (see page 25).

Introduce both basic concepts of programming languages and principles of translation. The topics include the history of programming languages and various programming paradigms, language design issues and criteria, developing practical translator for modern programming languages.

CPSC 332 File Structures and Database Systems (3 units)

Co-requisites: EPP (see page 25).

The fundamental theories and design of database systems, the Structural Query Language (SQL), and basic concepts and techniques on data organization in secondary storage. Topics include introduction to database systems, ER model, relational model, index structures, and hashing techniques.

CPSC 335 Problem Solving Strategies (3 units)

Prerequisites: EPP (see page 25), Math 270B, and Math 338.

Complexity classes, including undecidable and NP-complete problems. Problem solving strategies applied to parallel and distributed processing, numerical computation, and artificial intelligence. Greedy methods, divide-and-conquer, dynamic programming, approximation, and search methods.

CPSC 351 Operating Systems Concepts (3 units)

Corequisite: EPP (see page 25).

Resource management, memory organization, input/output, control; process synchronization and other concepts as related to the objectives of multi-user operating systems.

CPSC 362 Software Engineering (3 units)

Prerequisites: CPSC 223, EPP (see page 25), and CPSC 311.

Basic concepts, principles, methods, techniques and practices of software engineering. All aspects of software engineering fields will be covered briefly. Software engineering tools are recommended to use.

CPSC 376 Client / Server Systems with Java (3 units)

Prerequisites: CPSC 223J and CPSC 351.

Introduction to concepts and architecture of client-server systems using Java. The course covers the techniques for building client-server systems, multi-threading, network programming, and Java-based Web services.

CPSC 386 Introduction to Game Design & Production (3 units)

Prerequisites: CPSC 131.

Introduce the current and future technologies and market trend in the game design and production. In this class students will also learn game technologies, basic building tools of games, and the process of game design, development, and production.

CPSC 431 Database and Applications (3 units)

Prerequisite: CPSC 332 and EPP (see page 28).

Advanced database design concepts and application development techniques. Topics include advanced database design including schema refinement and physical database design, query processing and optimization, tuning, transaction concepts, real-world database programming techniques, and comprehensive database application development techniques.

CPSC 433 Data Security and Encryption Techniques (3 units)

Prerequisites: CPSC 311, CPSC 351, and MATH 270B.

System security and encryption. Current issues in security, encryption and privacy of computer based systems.

CPSC 440 Computer System Architecture II (3 units)

Prerequisites: CPSC 240.

Computer performance, price/performance, instruction set design and examples. Processor design, pipelining, memory, hierarchy design, and input/output subsystems.

CPSC 451 Advanced Operating Systems (3 units)

Prerequisite: CPSC 351.

The course covers internal structures of a modern operating system. The specific topics include processing, process communication, file systems, networking, and the I/O system. There are several programming assignments which include system calls, and other low level interfaces.

CPSC 459 Micro-Computer Software Systems (3 units)

Prerequisite: CPSC 351.

The design and implementation of software. Analysis of a micro-computer operating system and work on a team to implement a significant programming assignment.

CPSC 462 Software Design (3 units)

Prerequisites: CPSC 362.

Introduce basic concepts of software modeling, software process and some tools. Object-oriented analysis and design and Unified Process will be covered. Some computer-aided software engineering (CASE) tools will be recommended to use for doing homework assignments. (2 hours lecture, 2 hours laboratory)

CPSC 463 Software Testing (3 units)

Prerequisites: CPSC 362.

Introduce software testing techniques, reporting problems effectively and planning testing projects. Students apply what they learned, throughout the course, to a sample application that is either commercially available or under development.

CPSC 464 Software Architecture (3 units)

Prerequisites: CPSC 362.

Introduce basic principles and practices of software design and architecture. It will cover high-level design, software architecture, documenting software architecture, software architecture evaluation, software product lines, and some considerations beyond software architecture.

CPSC 466 Software Process (3 units)

Prerequisites: CPSC 362.

Introduce practical guidance for improving the software development and maintenance process. Students will learn how to establish, maintain, and improve software processes. They will also be exposed to some common process models, such as CMM, CMMI, PSP, and TSP.

CPSC 471 Computer Communications (3 units)

Prerequisite: CPSC 351.

Introduction to digital data communications. Terminology, networks and their components, common-carrier services, telecommunication facilities, terminals, error control, multiplexing and concentration techniques.

CPSC 473 Web Programming and Data Management (3 units)

Prerequisite: CPSC 431

Various techniques for developing Web-based database applications using software engineering methodology. Introduce concept and architecture of Web servers, Web database design techniques, client/server side programming, and Web application tools and techniques.

CPSC 474 Distributed Computing using Web Service and .NET Remoting (3 units)

Prerequisites: CPSC 473.

Introduces the concepts of distributed computing and Web services, the applications of XML and Web services, distributed applications development techniques with Web services and .NET Remoting.

CPSC 476 Java Enterprise Application Development (3 units)

Prerequisites: CPSC 223J and 351.

Introduces concepts and architecture of the J2EE platform, component technologies, platform roles, platform services, services technologies, communication technologies, Enterprise Java Beans (EJBs), and Java enterprise application development using Web logic or Web sphere.

CPSC 481 Artificial Intelligence (3 units)

Prerequisite: CPSC 335.

Use of computers to simulate human intelligence. Topics include production systems, pattern recognition, problem solving, searching game trees, knowledge representation, and logical reasoning. Programming in AI environments.

CPSC 483 Data Mining and Pattern Recognition (3 units)

Prerequisites: CPSC 335.

Classification techniques, discriminant functions, training algorithms, potential function theory, supervised and unsupervised learning, feature selection, clustering techniques, multidimensional rotations and rank ordering relations.

CPSC 484 Principles of Computer Graphics (3 units)

Prerequisite: EPP (see page 25), Math 270B, and Math 150B.

Examination and analysis of computer graphics; software structures, display processor organization, graphical input/output devices, display files. Algorithmic techniques for clipping, windowing, character generation and viewpoint transformation.

CPSC 485 Computational Bioinformatics (3 units)

Prerequisite: Upper division standing, BIOL 101, and CPSC 131 or consent of instructor.

Algorithmic approaches to biological problems. Motif finding, genome rearrangement, DNA sequence comparison, sequence alignment, DNA sequence, repeat finding, and gene expression analysis.

CPSC 486 Game Programming (3 units)

Prerequisites: CPSC 386.

Corequisite: CPSC 484.

Introduce foundations of game programming (basically 2D game development techniques) and multimedia entertainment techniques (sound, animation, etc.).

CPSC 487 Advanced Game Programming (3 units)

Prerequisites: CPSC 486.

Intermediate and advanced game programming techniques including 3D game development, real-time rendering, physics simulation, etc.

CPSC 489 Game Development Project (3 units)

Prerequisites: CPSC 487

Corequisite: CPSC 481.

Individual or team develops realistic games based on the theories and techniques, present and demonstrate their work regularly.

CPSC 491T Variable Topics in Computer Science (1-3 units)

Prerequisites: Junior/Senior standing and consent of the instructor.

Lectures and/or workshops covering various current Computer Science topics. Course may repeat for up to 3 units. Course topics may be taken only once.

CPSC 495 Internship in Computer Science (1 - 3 units)

Prerequisite: Computer Science or related major, and consent of instructor.

Practical experience and service learning relevant to computer science in industry or organizations. Written and oral reports are required.

CPSC 531 Advanced Database Management Systems (3 units)

Prerequisite: CPSC 431.

Database design and implementation techniques for query processing. Transaction management. Introduction to different databases such as object-oriented databases, temporal databases, real-time databases, parallel databases, distributed databases, spatial databases, multimedia databases, deductive databases, active databases plus recent database technology such as data warehousing, OLAP, Data mining.

CPSC 541 Systems and Software Standards and Requirements (3 units)

Prerequisite: CPSC 362 or equivalent work experience.

This class serves as the foundation for other process-oriented classes by outlining the benefits of Software Engineering Standards. The students will be introduced to the SESC framework and the IEEE Software Engineering Standards. The course will cover establishing of the following standards: Software Life Cycle Processes, Work Product Standards, Process Standards, Requirement Analysis and Management, and System Integration. Additionally, the framework of CMMI will be introduced, and a number of practical lessons discussed.

CPSC 542 Software Verification and Validation (3 units)

Prerequisite: CPSC 362 or equivalent work experience.

The students will learn how to ensure that a high quality software product is developed. The course will cover the theory and practice of V&V methods such as walkthroughs, inspections, and CleanRoom. It will show how to create functional test cases, using boundary value analysis and equivalence classes, and how to create structural test cases, determine degrees of coverage, and perform data flow analysis.

CPSC 543 Software Maintenance (3 units)

Prerequisite: CPSC 362 or equivalent work experience.

The Student will learn the principles of generating maintainable software. The course will also cover Theory and practice of maintaining large scale software and application of maintenance metrics In this course, we will cover the problems in maintaining software systems, building software in view of the maintenance problems, the activity of maintenance and some management issues in maintenance.

CPSC 544 Advanced Software Process (3 units)

Prerequisite: CPSC 362 or equivalent work experience.

This course provides practical guidance for improving the software development and maintenance process. We focus on understanding and managing the software process because this is where software organizations encounter the most serious problems. In the class, students will learn how to establish an effective software process for an organization, and how to make existing process better.

CPSC 545 Software Design and Architecture (3 units)

Prerequisites: CPSC 362 or equivalent work experience.

The students will learn how to analyze and design large scale software and apply different architecture styles to software design. Case studies and projects are assigned as a practical component of the course.

CPSC 546 Modern Software Management (3 units)

Prerequisite: CPSC 362 or equivalent work experience.

The students will learn how to plan and control the development activities of a project. The course will cover schedule and cost (staffing) estimation. It will show how to develop a master program plan, define task interrelationships, identify the critical path, and track the progress of a project using methods such as Earned Value Analysis.

CPSC 547 Software Measurement (3 units)

Prerequisite: CPSC 362 or equivalent work experience.

This course explores current software measurement practices. Topics include measuring software specifications and designs; measuring software code and implementation; measuring software testing and evaluation. The course stresses a practitioner-based approach to systematic measurement process model and outlines major paradigms for selecting measures.

CPSC 548 Professional, Ethical and Legal Issues for Software Engineers (3 units)

Prerequisite: CPSC 362 or equivalent work experience.

This course explores professional, legal and ethical issues pertaining to software engineering. Topics include professional codes of ethics, intellectual property laws, computer privacy, and human-computer interaction. The course presents relevant regulatory documents and their applications in analyzing case studies.

CPSC 551 Operating Systems Design (3 units)

Prerequisite: CPSC 351.

Design and evaluation techniques for controlling automatic resource allocation, providing efficient programming environments and appropriate user access to the system, and sharing the problem solving facilities.

CPSC 558 Advanced Computer Networking (3 units)

Prerequisite: CPSC 471.

System-oriented view of computer network design, protocol implementation, networking, high-speed networking, network management, computer network performance issues.

CPSC 566 Advanced Computer Graphics (3 units)

Prerequisite: CPSC 484.

Three dimensional reflective models, shading techniques, rendering process, parametric representation, ray tracing, radiosity, texture, anti-aliasing, animation, color science.

CPSC 583 Expert Systems Design Theory (3 units)

Prerequisite: CPSC 481.

Knowledge representation and search strategies for expert systems; logic programming; expert system tools. Project.

CPSC 585 Artificial Neural Networks (3 units)

Prerequisite: CPSC 481.

Principles of neural networks, neural networks paradigms with supervised and unsupervised learning laws. Software implementations and applications. Project.

CPSC 589 Seminar in Computer Science (3 units)

Prerequisites: At least one 400-level course in computer science and the Examination in Writing Proficiency (EWP).

Research methods in computer science. Student presentations covering current topics in research, updating of concepts and verifications of principles of computer science. (Examples: graphic user interface design, database systems, computer networks, wireless communication, Web based application development, Web application framework, distributed systems, large-scale parallelism, security, modeling and analysis techniques, neural networks, expert systems, pattern recognition, Petri nets.)

CPSC 597 Project (3 units)

Prerequisites: classified graduate standing, approval of the computer science graduate adviser and CPSC 589. (Project definition proposal must be approved prior to the last day of class instruction of the preceding semester.)

CPSC 598 Thesis (3 units)

Prerequisites: classified graduate standing, approval of the computer science graduate adviser and CPSC 589. (Thesis definition proposal must be approved prior to the last day of class instruction of the preceding semester.)

CPSC 599 Independent Graduate Research (1–3 units)

Prerequisites: classified graduate standing, approval of the Computer Science Department Chair.

Special topic in computer science, selected in consultation with and completed under supervision of a full-time faculty member.

Related Prerequisite Math Courses**MATH 150A, B Analytic Geometry and Calculus (4,4)**

Prerequisite: the equivalent of four years of high school mathematics including trigonometry, a passing score or an exemption from the ELM (Entry Level Mathematics Exam), and a passing score on the MQE (Mathematics Qualifying Examination). 150A is the only prerequisite for 150B.

Analytic geometry, functions, limits, differentiation, the definite integral, techniques of integration, applications, infinite series, Taylor's theorem.

MATH 270A Mathematical Structures I (3)

Prerequisite: Four years high school mathematics.

First of two semesters of fundamental discrete mathematical concepts and techniques needed in computer-related disciplines. Logic, truth tables, elementary set theory, proof techniques, and combinatorics.

MATH 270B Mathematical Structures II (3)

Prerequisite: Mathematics 270A.

Second of two semesters of fundamental discrete mathematical concepts and techniques needed in computer-related disciplines. Graph theory, Boolean algebra, algebraic structures, linear algebra.

MATH 338 Statistics Applied to Natural Sciences (4)

Prerequisite: Math 130 or 150B or consent of instructor.

An introduction to the theory of statistics and statistical applications with an emphasis on data analysis techniques. Topics include elementary probability theory, estimation, hypothesis testing, correlation and regression, analysis of variance, and non-parametric tests. (2 hours lecture, 2 hours laboratory).

Examination in Programming Proficiency (EPP)

All Computer Science undergraduate students must pass the programming proficiency test **before taking any 400-level Computer Science course except for CPSC 440 (Computer System Architecture)**. The purpose of the Examination in Programming Proficiency is to ensure that students taking upper division courses have the basic programming skills needed. The exam focuses on the concepts and skills covered in CPSC 121 and CPSC 131. It will be given at the start of the Fall and Spring semesters in conjunction with **CPSC 301, Programming Lab Practicum**. Students wishing to take it should sign up for a section of CPSC 301, and plan on attending the first two weeks of the course. After an orientation meeting at the first class meeting, students will take the two-part exam during the second and third scheduled class meetings. Students will be notified at the fourth meeting whether they have passed the exam. Those who have passed may then drop the course before the end of the second week of classes. Those who did not pass are expected to continue in CPSC 301 and work on their programming skills. Passing the CPSC 301 course will be accepted as equivalent to passing the Examination in Programming Proficiency.

Appendix A. Prerequisite Worksheet

This worksheet is used to plan and record the prerequisite course of study leading to classified graduate standing, shown on the next page.

GRADUATE PREREQUISITE WORKSHEET

This worksheet is used to plan and record the prerequisite course of study leading to classified graduate standing.

Course	Met By
<input type="checkbox"/> CPSC 121 Programming Concepts	
<input type="checkbox"/> CPSC 131 Data Structure Concepts	
<input type="checkbox"/> CPSC 240 Computer Architecture and Assembly Language	
<input type="checkbox"/> CPSC 323 Programming Languages and Translation	
<input type="checkbox"/> CPSC 335 Problem Solving Strategies	
<input type="checkbox"/> CPSC 351 Operating System Concepts	
<input type="checkbox"/> CPSC 362 Software Engineering	
<input type="checkbox"/> MATH 270A Mathematical Structures I (Discrete Math)	
<input type="checkbox"/> MATH 270B Mathematical Structures II (Linear Algebra)	
<input type="checkbox"/> MATH 338 Statistics	
<input type="checkbox"/> MATH 150A Calculus I	
<input type="checkbox"/> MATH 150B Calculus II	
<input type="checkbox"/> Examination in Writing Proficiency or CPSC 311 Technical Writing for Computer Science	

Appendix B. Graduate Study Plan

The standard form for creating a Graduate Study Plan is shown on the next page.

Study Plan Master of Science in Computer Science

 Name _____ Student ID No. _____ Date _____
 Address _____ Home Phone: _____
 _____ ZIP _____ Work Phone: _____

The following preclassification requirements have been met:

1. BA BS Other from _____ Month/Year _____
 Undergraduate major _____
2. Minimum 2.5 GPA in last 60 semester units attempted OR
 Deficiencies removed by completion of 6 or more units in adviser-approved courses w/3.0 GPA
3. Satisfactory completion of the following courses or equivalent including prerequisites:
 CPSC 121 CPSC 323 CPSC 362 MATH 270A
 CPSC 131 CPSC 335 MATH 270B
 CPSC 240 CPSC 351 MATH 338
4. Writing Requirement has been met by (option and Date): _____

ALL STATE AND UNIVERSITY REQUIREMENTS ARE TO BE MET INCLUDING FIVE-YEAR LIMIT

<i>Study Plan Requirements</i>	<i>Units</i>	<i>Grade</i>	<i>Sem/Yr</i>	<i>Ext.</i>	<i>Comments</i>
REQUIRED CORE COURSES (9 Units)					
*CPSC 440 Computer Systems Architecture	3				
*CPSC 462 Software Design	3				
One of : CPSC 541, 542, 543, 544, 545, 546, 547, 548	3				
ELECTIVE COURSES (15 units 400/500—Minimum 9 units at 500-level)					
SEMINAR/PROJECT/THESIS (6 units)					
CPSC 589 Seminar in Computer Science	3				
CPSC 597 Project or 598 Thesis	3				
Total Units Required	30				

Minimum 15 units Computer Science; minimum 18 units 500-level.

*Elective units will increase if course work was completed as an undergraduate.

Adviser _____ Date _____ Student _____ Date _____

