Master Degree Program in Computer Science (CS)

Students holding Bachelor's degree in Computer Science are accepted as graduate students, after meeting the general requirements stated below.

Applicants NOT holding a degree in Computer Science are also accepted as graduate students, after meeting the general requirements and successful completion of the leveling courses described below.

General requirements for graduate study in Computer Science are as follows:

1. An undergraduate degree from an accredited higher education institution
2. A minimum GPA of 2.75 on a 4.0 scale
3. A minimum TOEFL score of 90 or ITLES score of 6.5 (for applicants whose native language is not English)
4. A minimum Graduate Record Examination (GRE) General Test score of 293 (combine verbal and quantitative); for more information refer to: www.gre.org

A student with a Bachelor of Science in Computer Science, with a GPA greater than 2.45 but less than 2.75, a GRE score above 270 but less than 293, may first receive provisional admission to the MS degree program. Upon completion of the requirements (i.e., minimum GPA of 3.0 by the end of first year in the graduate program), the student's status will change from provisional to regular graduate student.

A student with a Bachelor's degree in a discipline other than Computer Science must possess a computer science background equivalent to the following CSUDH courses:

- CSC 311– Data Structures
- CSC 321 – Programming Languages Concepts
- CSC 331– Computer Organization
- CSC 341 – Operating Systems
- MAT 281– Discrete Mathematics
- MAT 361– Finite Automata
- Proficiency in a programming language (or CSC 123 – Computer Science II)

A student without this background may be admitted conditionally and must enroll in these leveling courses before being accepted as a regular student in the graduate Computer Science program.

Master Degree Program in Computer Science (CS)

Prospective Graduate Students

Send Application Package To:
Graduate Coordinator
Department of Computer Science
California State University, Dominguez Hills
NSM A-132
1000 East Victoria
Carson, CA 90747

Application Information and Forms
- Apply on line through Cal State Apply: https://www2.calstate.edu/apply

Contact Information
- **Dr. Jack Han**, Graduate Coordinator, Email: jhan@csudh.edu
- **Dr. Mohsen Beheshti,** Chair, Email: mbeheshti@csudh.edu
- **Computer Science Dept.**, Email: csc@csudh.edu
Phone: (310) 243-3398

FACULTY

- Mohsen Beheshti
- Jianchao Han
- Marek Suchenek
- Bin Tang
- Amlan Chatterjee
- Liudong Zuo
- Alireza Isaddoost
- Brad Holister

ADMISSION TO PROGRAM
Admission requirements for the Master of Science in Computer Science program:

1. An undergraduate degree from an accredited higher education institution.
2. A minimum GPA of 2.75 on a 4.0 scale.
3. A minimum TOEFL score of 550 (new scoring is 81) (for applicants whose native language is not English).
4. A minimum GRE General Test score of (combined verbal and quantitative) 293.

Provisional Admission:

Students may be awarded provisional graduate degree status admission if they satisfy the following requirements:

1. Have a minimum cumulative Grade Point Average (GPA) of 2.45 on a 4.00 scale.
2. Have a minimum GRE General Test score of 270 (combined verbal and quantitative).

Students must petition the Dean of Natural and Behavioral Sciences for full status in the graduate program during the term in which the first 12 graduate semester credit hours will be completed. To be considered for full degree status provisional students must have earned a minimum GPA of 3.0 in all courses recommended by the faculty advisor and the head of the graduate program, and submit satisfactory official scores on the GRE examination to the Office of Graduate Programs.

Non-Degree Admission:

A student who has a bachelor's degree (minimum GPA of 2.45) and wishes to take graduate courses without qualifying for a degree may be awarded non-degree status admission.

Special Student Admission:

Applicants who wish to take graduate courses but who do not meet the minimum GPA for admission as degree, provisional, or non-degree status may apply for special student status admission to the University in order to enroll in the required computer science background courses. These students must have been highly recommended based upon evidence of scholarly potential.

A student with a bachelor's degree in a discipline other than computer science must possess a computer science background equivalent to the following CSUDH courses before being admitted to the MS in Computer Science program:

- CSC 311– Data Structures
- CSC 321 – Programming Languages Concepts
- CSC 331– Computer Organization

- CSC 341 – Operating Systems
- MAT 281– Discrete Math
- MAT361- Finite Automata
- Proficiency in a Programming Language (or CSC123- Computer Science II)

ADVANCEMENT TO CANDIDACY
The Application for Candidacy form must be approved by the chair of the Computer Science department and submitted to the Dean of the Graduate School for approval. The student's advisory committee must approve the research project or thesis before the student applies for candidacy.

DEGREE REQUIREMENTS
The curriculum for the Master of Science in Computer Science has both a thesis and a project option. A minimum of 36 semester hours of graduate course work is required for either option (including 6 semester hours of master's thesis courses or 3 semester hours of master's project courses). The 36 credit hours must be earned in courses numbered 5000 and above offered by the Computer Science Department. Core course grade should be B and above.

List of all the courses:
CSC 500 – Research Methods
CSC 501 - Design and Analysis of Algorithms
CSC 511 - Artificial Intelligence and Expert Systems
CSC 521 - Fundamentals and Concepts of Programming Languages
CSC 531 - Advanced Computer Architectures
CSC 541 - Advanced Operating Systems
CSC 546 - Human Computer Interaction and Interface Design
CSC 553 - Advanced Database Management Systems
CSC 551 - Data Communications and Computer Networks
CSC 552 - Distributed Computing and Parallel Processing
CSC 555 - Information Assurance and Network Security
CSC 561 - Advanced Computer Graphics
CSC 564 - Numerical Analysis
CSC 565 - Theory of Computation
CSC 581 – Advanced Software Engineering
CSC 582 - Object-Oriented Analysis and Design Methodology
CSC 583 - Software Engineering Processes
CSC 584 - Software Project Planning and Management
CSC 585 - Advanced Software Quality Assurance
CSC 590 - Master's Project
CSC 594 - Independent Study
CSC 595 - Special Topics in Computer Science
CSC 599 - Master's Thesis
CSC 600 – Graduate Continuation Course

List of Required (Core) Courses: (15 units)
CSC 500 – Research Methods
CSC 501 - Design and Analysis of Algorithms
CSC 521 - Fundamentals and Concepts of Programming Languages
CSC 581 - Advanced Software Engineering
CSC 584 - Software Project Planning and Management

General CS Electives: (15 units + Thesis, or 18 units + Project)
CSC 511 - Artificial Intelligence and Expert Systems
CSC 531 - Advanced Computer Architectures
CSC 541 - Advanced Operating Systems
CSC 546 - Human Computer Interaction and Interface Design
CSC 553 - Advanced Database Management Systems
CSC 551 - Data Communications and Computer Networks
CSC 552 - Distributed Computing and Parallel Processing
CSC 555 - Information Assurance and Network Security
CSC 561 - Advanced Computer Graphics
CSC 564 - Numerical Analysis

CSC 565 - Theory of Computation
CSC 582 - Object-Oriented Analysis and Design Methodology
CSC 583 - Software Engineering Processes
CSC 585 - Advanced Software Quality Assurance
CSC 594 - Independent Study
CSC 595 - Special Topics in Computer Science

Master's Thesis: (6 units) or Master's Project (3 units)

g. If any formal options, concentrations or special emphasis are planned under the proposed major, explain fully.

Thesis Option
1. 30 semester credit hours of graduate coursework.
   a. Required graduate core courses (15 credit units)
   b. Elective graduate courses (15 credit units)

2. Master's Thesis (6 semester credit units)

Project Option
1. 33 semester credit hours of graduate coursework.
   a. Required graduate core courses (15 credit units)
   b. Elective graduate courses (18 credit units)

2. Master's Project (3 semester credit units)

Students may choose to obtain the degree either with a specialization in Software Engineering **(SE Track)** or with a specialization in Distributed Systems and Networking **(DSN Track)**. Table 1 shows the semester credit unit requirements for the program (courses are not double counted).

Table 1. Degree Requirements

Category	Semester Credit Units	
	Thesis Option	**Non-Thesis Option**
A. Courses required for all students (Core)	15	15
B. Concentration Courses	12	12
C. General CS Elective Courses	3	6
D. Others - Thesis	6	-
- Project	-	3
Total	**36**	**36**

List of Required (Core) Courses: (15 units) [A]
CSC 500 – Research Methods
CSC 501 - Design and Analysis of Algorithms
CSC 521 - Fundamentals and Concepts of Programming Languages
CSC 581 - Advanced Software Engineering
CSC 584 - Software Project Planning and Management

Concentration Courses: (12 units) [B] (no double counting)
Select 12 units from each track

Software Engineering (SE) Track:
CSC 541 - Advanced Operating Systems
CSC 583 - Software Engineering Processes
CSC 585 - Advanced Software Quality Assurance
CSC 546 - Human Computer Interaction and Interface Design
CSC 582 - Object-Oriented Analysis and Design Methodology

Distributed Systems Networking (DSN) Track:
CSC 531 - Advanced Computer Architecture
CSC 551 - Data Communications and Computer Networks
CSC 552 - Distributed Computing and Parallel Processing
CSC 541 - Advanced Operating Systems
CSC 555 - Information Assurance and Network Security

General Electives: (3-6 units) [B and C] (no double counting)
6 units for the project option and 3 units for thesis option

General CS Elective Courses: [A, B and C]
CSC 511 - Artificial Intelligence and Expert Systems
CSC 531 - Advanced Computer Architectures
CSC 541 - Advanced Operating Systems
CSC 546 - Human Computer Interaction and Interface Design
CSC 553 - Advanced Database Management Systems
CSC 551 - Data Communications and Computer Networks
CSC 555 - Information Assurance and Network Security
CSC 552 - Distributed Computing and Parallel Processing
CSC 561 - Advanced Computer Graphics
CSC 564 - Numerical Analysis
CSC 565 - Theory of Computation
CSC 582 - Object-Oriented Analysis and Design Methodology
CSC 583 - Software Engineering Processes
CSC 585 - Advanced Software Quality Assurance
CSC 594 - Independent Study
CSC 595 - Special Topics in Computer Science

Below shows the Master's program and its tracks from another point of view:

Required Courses for All Tracks and Options (15)

    CSC 500 – Research Methods
    CSC 501 - Design and Analysis of Algorithms
    CSC 521 - Fundamentals and Concepts of Programming Languages
    CSC 581 - Advanced Software Engineering
    CSC 584 - Software Project Planning and Management

Software Engineering (SE)

Thesis Option

    CSC 599   Master's Thesis (6)
    Track Electives   12 hours from the Software Engineering Electives
    CS Electives   3 hours from the list of CS Electives (no double counting)

Non-Thesis Option

    CSC 590   Master's Project (3)
    Track Electives   12 hours from the Software Engineering Concentration Electives
    CS Electives   6 hours from the list of CS Electives (no double counting)

Distributed Systems and Networking *(DSN)*

Thesis Option

    CSC 599   Master's Thesis (6)
    Track Electives   12 hours from the DSN Electives
    CS Electives   3 hours from the list of CS Electives (no double counting)

Non-Thesis Option

    CSC 590   Master's Project (3)
    Track Electives   12 hours from the DSN Concentration Electives
    CS Electives   6 hours from the list of CS Electives (no double counting)

TWO-YEAR DEGREE PLAN

SEMESTER-BY-SEMESTER CURRICULUM
(THESIS OPTION)

FIRST YEAR

FIRST SEMESTER		SECOND SEMESTER	
Course	Hours	Course	Hours
CSC 500 Rsch. Methods	3	CSC Concentration1	3
CSC 501 Dsn. & analysis of ALg.	3	CSC 521 Fund. CPL	3
CSC 581 Advanced Soft. Eng.	3	CSC 584 Soft. Proj. & Mang.	3
Total	9	Total	9

SECOND YEAR

FIRST SEMESTER		SECOND SEMESTER	
Course	Hours	Course	Hours
CSC 599 Master's Thesis	3	CSC 599 Master's Thesis	3
CSS Concentration-2	3	CSS Concentraion-4	3
CSS Concentration-3	3	CSC Elecective	3
Total	9	Total	9

SEMESTER-BY-SEMESTER CURRICULUM
(PROJECT OPTION)

FIRST YEAR

FIRST SEMESTER		SECOND SEMESTER	
Course	Hours	Course	Hours
CSC 500 Rsch. Methods	3	CSC Concentration-1	3
CSC 501 Dsn. & analysis of ALg.	3	CSC 521 Fund. CPL	3
CSC 581 Advanced Soft. Eng.	3	CSC 584 Soft. Proj. & Mang.	3
Total	9	Total	9

SECOND YEAR

FIRST SEMESTER		SECOND SEMESTER	
Course	Hours	Course	Hours
CSC Conc-2	3	CSC 590 Master's Project	3
CSS Concentration-3	3	CSS Concentraion-4	3
CSS Elective	3	CSC Elective	3
Total	9	Total	9

COURSE DESCRIPTIONS

CSC 500 – Research Methods (credit 3 semester hours). Students attend a series of lectures given by faculty and visiting computer scientists. Students also conducts literature search in selected topics, apply information to computer science related projects, generate reports and presents results. Prerequisite: Graduate Standing Consent of Instructor. Prerequisite: Graduate standing and consent of instructor

CSC 501 - Design and Analysis of Algorithms (credit 3 semester hours). Methods for the design of efficient algorithms: divide and conquer, greedy method, dynamic programming, backtracking, brand and bound, problem in string matching, polynomials and matrices, graph theory, NP-problems. Prerequisite: CSC 401

CSC 511 - Artificial Intelligence and Expert Systems (credit 3 semester hours). Introduction to in-depth engineering approach to the field of artificial neural networks. Topics include different types of network architectures and applications, and their properties and behavior. Particular emphasis on general concepts of network topology. Prerequisite: CSC 411

CSC 521 - Fundamentals and Concepts of Programming Languages (credit 3 semester hours). Study of the principles that form the basis of programming language design. Research topics in high-level languages including: data abstraction, parameterization, scooping, generics, exception handling, parallelism and concurrency. Alternative language designs; imperative, functional, descriptive, object-oriented and data flow; overview of interface with support environments. Prerequisite: CSC 321

CSC 531 - Advanced Computer Architecture (credit 3 semester hours). Covering new technological developments, including details of multiprocessor systems and specialized machines. The main focus is on the quantitative analysis and cost-performance tradeoffs in instruction-set, pipeline, and memory design. Description of real systems and performance data also are presented. Topics covered: quantitative performance measures, instruction set design, pipeline, vector processing, memory organization, input/output, and an introduction to parallel processing. Prerequisite: CSC 331

CSC 541 - Advanced Operating Systems (credit 3 semester hours). Theoretical and practical aspects of operating systems: overview of system software, time-sharing and multiprogramming operating systems, network operating systems and the Internet, virtual memory management, inter-process communication and synchronization, file organization, and case studies. Giving advanced topics and examples, and simulation techniques used in performance evaluation. Prerequisite: CSC 341

CSC 546 - Human Computer Interaction and Interface Design (credit 3 semester hours). Research-oriented course; in-depth analyses of selected current topics with emphasis on problems related to computer systems, artificial intelligence, and human computer information interaction and interface design. Prerequisite: CSC 481

CSC 551 - Data Communications and Computer Networks (credit 3 semester hours). Topics related to the development of client-server based application, including two-tiers and multi-tiers Client-Server concepts and programming. Concurrency issues in the design of client and server programs. Trade-off of different architectures and usage of remote procedure calls. Broadcasting and multicasting. Prerequisite: CSC 451

CSC 552 - Distributed Computing and Parallel Processing (credit 3 semester hours). Comprehensive introduction to the field of parallel and distributed computing systems: Algorithms, architectures, networks, systems, theory and applications. The distributed parallel computation models, design and analysis of parallel algorithms will be discussed. Prerequisite: COMP 451, CSC 401

CSC 553 - Advanced Database Management Systems (credit 3 semester hours). This course provides an in-depth treatment of one or more advanced topics in the management of information systems. The field of information systems consists of three major components: information systems technology, information systems development and information systems management. This advanced topic course deals with the latter area. Because of the many advances in information technology and the corresponding development techniques, new business opportunities are constantly emerging and with them the need to manage these applications effectively. This course explores these new application areas and the management approaches needed to make them successful. Prerequisite: CSC 453

CSC 555 – Information Assurance and Network Security (credit 3 semester hours). Topics related to communications and IT infrastructures, their vulnerabilities as well as the size and complexity of security threats faced by enterprises, development of security practices, policies, awareness and compliance programs, and legal and regulatory issues will be examined. Fundamental encryption algorithms and systems supported in today's IT and secure communications networks Virtual Private Networks , Tunneling, Secure Socket Layer , SSH, and PGP will also be examined. Prerequisite: CSC 451, CSC 401 and/or consent of instructor

CSC 561 - Advanced Computer Graphics (credit 3 semester hours). Solid modeling Euler operators, finite element methods. Rendering: filling, shading, ray tracing. Natural modeling: L-systems, fractals. Image processing: filtering anti-aliasing, enhancement. Color: physics, graphics, physiology. Prerequisite: CSC 461

CSC 564 - Numerical Analysis (credit 3 semester hours). Topics include numerical solution of partial differential equations by finite difference and finite element algorithms. Focus on direct and iterative methods for solving large, sparse linear systems and related Eigen value and vector problems. Emphasis is placed on robust mathematical software and its interaction with computer hardware and languages. Prerequisite: MAT 361

CSC 565 - Theory of Computation (credit 3 semester hours). Models of computation, complexity theory, intractable problems, complete problems, recursive function theory, incompleteness, formal theory of program semantics and correctness, logics of programs. Prerequisite: CSC 401, MAT361

CSC 581 – Advanced Software Engineering (credit 3 semester hours). This course focuses on defining software requirements and provides an overview of Advanced analysis and design techniques that can be used to structure applications. Topics of software requirements include interacting with end-users to determine needs and expectations, identifying functional requirements and identifying performance requirements. Analysis techniques include prototyping, modeling and simulation. Design topics include design in the system lifecycle, hardware vs. software trade-offs, subsystem definition and design, abstraction, information hiding, modularity and reuse. Prerequisite: CSC 481

CSC 582 - Object-Oriented Analysis and Design Methodology (credit 3 semester hours). Object-oriented analysis and design is essential in developing high-quality object-oriented systems. Topics will include object-oriented classes, attributes, methods and relations to other classes, objects, classifications and inheritance, encapsulation, polymorphism, object-oriented analysis, design and programming. Prerequisite: CSC 481

CSC 583 - Software Engineering Processes (credit 3 semester hours). The course focuses on the engineering of complex systems that have a strong software component. Topics include deriving and allocating requirements, system and software architectures, system analysis and design, integration, interface management, configuration management, quality, verification and validation, reliability, and risk. Prerequisite: CSC 581

CSC 584 - Software Project Planning and Management (credit 3 semester hours). The main topics of this course address the successful management of a software development project. This includes planning, scheduling, tracking, cost and size estimating, risk management, quality engineering, and process improvement. The course is centered on the concept of a software engineering process and includes discussion of life cycle models for software development. Prerequisite: COMP 581

CSC 585 - Advanced Software Quality Assurance (credit 3 semester hours). The relationship of software testing to quality is examined with an emphasis on testing techniques and the role of testing in the validation of system requirements. Topics include module and unit testing, integration, code inspection, peer reviews, verification and validation, statistical testing methods, preventing and detecting errors, selecting and implementing project metrics and defining test plans and strategies that map to system requirements. Testing principles, formal models of testing, performance monitoring and measurement also are examined. Prerequisite: CSC 581

CSC 590 - Master's Project (credit 3 semester hours). Offered on the letter-grade basis only. The equivalent of three lecture hours a week. Prerequisite: Graduate standing and consent of the graduate adviser.

CSC 594 - Independent Study (credit 1-3 semester hours). Individual studies in advanced computer science and technology. Prerequisite: Graduate standing and consent of instructor.

CSC 595 - Special Topics in Computer Science (credit 3 semester hours). Exposes students to new and emerging concepts and technologies. Prerequisite: Graduate standing and consent of instructor.

CSC 599 - Master's Thesis (credit 3-6 semester hours). Offered on the letter-grade basis only. The equivalent of three lecture hours a week. Prerequisite: Graduate standing and consent of the graduate adviser.

CSC 600 – Graduate Continuation Course (Credit 0) Graduate students who have completed their course work but not their thesis, project, or comprehensive examination, or who have other requirements remaining for the completion for their degree, may maintain continuous attendance buy enrolling in this course. Signature of graduate program coordinator required.