MASTER'S DEGREE PROGRAM IN

Computer Science

College of Engineering,
Design and Computing
University of Colorado Denver

These degree requirements are in effect starting from 2020-2021 Admission.

The Department of Computer Science and Engineering (CSE) offers a Master of Science degree in Computer Science as part of the Computer Science and Engineering Graduate Program. The CSE department also offers several graduate certificates, doctorate degrees and undergraduate degrees. For a complete list of degrees, please visit the CSE website at cse.ucdenver.edu

Research areas of emphasis include: algorithms, automata theory, artificial intelligence, big data management and mining, bio-informatics, cloud computing, communication networks, combinatorial geometry, computational geometry, computer graphics, computer security, computer systems, cyber physical systems, cyber security, database, distributed computing, graph theory, high performance computing, information theory, internet, mobile computing, mobile health systems, machine learning, parallel processing, simulation, and software engineering.

MS in Computer Science Degree Requirements

For students interested in our master's degree program, please see the College of Engineering, Design and Computing Graduate Admissions website for admission requirements and deadlines.

Upon admission into the MS program, students are required to show adequate preparation for their degree plan. Depending on their educational background, students may be required to complete up to 12 credit hours of core foundational courses in addition to the required 30 graduate credit hours. (Qualified applicants with no CS background who are interested in graduate studies in CS may need more foundational courses.)

Master's degree candidates are required to complete a program of study consisting of a minimum of 30 semester hours of graduate level computer science courses while maintaining a cumulative grade point average of at least 3.0. Graduate courses with grades below B- cannot be applied towards the completion of the graduate degree.

Students who do not enroll for any course work for three consecutive semesters (including summer) will be discontinued and need to reapply to the program. Students are expected to finish the MS degree program within 5 years. Students who wish to receive credit for a course taken longer than five years before their graduation date will need CSE graduate committee approval.

In their final semester, students must **apply for graduation through UCD Access before census date, complete an application for candidacy and** meet with their for a **graduation check.**

MSCS Graduate Course Categories

MS courses are divided into 3 categories: A, B and C. The number of credit hours required by category vary by a student's plan (thesis, project or course only). Students must consult with their advisor to develop a MS Plan of Study during their first semester. This plan should be modified and updated during their studies. The student must choose a plan (thesis, project or course only) before the end of their first year. Each semester a MS Course List with A, B and C courses is communicated to students and available at the CSE front desk each semester. Students should consult with their faculty advisor for course selection and to update their plan of study.

Category A (Core Courses)

- CSCI 5446 Theory of Automata
- CSCI 5451 Algorithms
- CSCI 5593 Advanced Computer Architectures
- CSCI 5573 Operating Systems

Category B (Breadth Courses)

In addition to the core courses (Category A), students will take breadth courses taught by the full-time graduate faculty in the CSE Department. The availability of the courses vary from semester to semester.

Category C

Category C courses consist of thesis, project, independent study and courses taught by part time or non-computer science faculty. Students must choose a MS Plan (Plan I, II or III) before taking Category C courses.

Students may take courses from Mathematics and other Engineering departments as Category C courses with prior approval of the CSE Graduate Committee. In order to get approval, the student must meet with their advisor and supply a syllabus for the course. If their advisor supports the request, they will then forward the request to the CSE Graduate Committee. The decision of the CSE Graduate Committee will be communicated via email and is final.

Transfer of Credit:

A maximum of nine semester hours of graduate course work may be transferred into the program based on department approval. These courses are individually evaluated by the CSE Graduate Committee. Core courses must be taken from the CSE department at CU Denver.

MS Plans

Students may choose Plan I (thesis), Plan II (project), or Plan III (course only). Both Plan I and II require successful defense of thesis or project in the student's graduating semester. Plan III requires successful completion of a final MS course project.

Plan I – Thesis: Students will write and defend a thesis**.** Students **MUST** have a thesis advisor chosen before their second year of study. Students in the thesis plan have priority in obtaining departmentalassistantships.

Students choosing to complete the Data Science and Biomedicine Track must follow the curriculum requirements in that track. Please refer to the section "Data Science in Biomedicine Track on the following page."

Students in Plan I will complete:

- A minimum of 9 credits in Category A.
- A minimum of 12 credits in Category B. [4th Category A courses credited in Cat. B]
- A maximum of 9 credits of Category C courses including 6 hours of MS thesis. Plan I students are allowed to complete up to 3 credits of Independent with approval of their faculty research advisor.

Plan II – MS Project: Students will write and defend a MS project. Students MUST have a project advisor chosen before their second year of study.

Students in Plan II will complete:

- 12 credits in Category A.
- A minimum of 12 credits in Category B.
- A maximum of 6 credits of Category C courses including 3 hours of MS project. Plan II students are allowed to complete up to 3 credits of Independent with approval of their faculty research advisor.

Academic Advisor

- A student, who is in **Plan I** (thesis), and **Plan II** (MS project), will need to choose a CSE full-time faculty member with a graduate faculty appointment as a Thesis/MS Project Advisor. The Thesis/MS Project Advisor will chair the Thesis/MS Project Committee. The Thesis/MS Project Committee will consist of at least three members, two of whom must be CSE graduate faculty members.

- Thesis/MS Project and Independent Study supervision:

1. Full-time faculty CSE faculty who are members of UCD Graduate School may supervise thesis, MS Project, and graduate independent studies.

2. Tenured/tenure-track faculty from outside of CSE department may co-advise MS thesis, MS Project, and graduate independent studies, along with the approval of the designated CSE faculty advisor.

3. Part-time CSE faculty, e.g., lecturers, honoraria, graduate students, may not supervise thesis and MS Project. They may, however, serve as informal supervisors of graduate independent studies, sponsored by a full-time tenured/tenure-track CSE faculty who is

a member of the UCD Graduate School faculty as the supervisor-of-record.

- Students in the thesis plan have priority in obtaining departmental assistantships.

Plan III – Course Only: Students must complete a MS course project. Students may complete their MS course project after completing 9 credits in Category A. Students must declare their MS course project in the first two weeks of the semester in which they desire to complete it. A list of approved courses for the MS course project will be available in the CSE department each semester before registration begins. The MS course project is an individually written final report documenting research, implementation, results, analysis, and mastery of the subject. It must demonstrate scholarly/scientific knowledge acquired over the course of their MS studies.

Students in Plan III will complete:

- 12 credits in Category A.
- A minimum of 12 credits in Category B.
- A maximum of 6 credits of Category C.

Final Project MS course:

- List of approved final project MS courses will be available in the CSE department.

- The final MS course project may be taken after completing at least three (3) "category A" courses.
- Students will notify the department [chair of the Graduate Committee] of their course selection by the second (2^{nd}) week of the semester.
- The instructor of final MS project course submits his/her evaluation along with the completed course project report to the Graduate Committee by the end of each semester.
- Final course project must meet the following requirements:
    1. Must be an individual semester term project.
    2. Must demonstrate the mastery of the subject.
    3. Must demonstrate scholarly/scientific knowledge acquired over the course of their MS studies.
    4. Must require significant research and implementation.
    5. Must produce a written a final report documenting research, implementation, results, analysis, and bibliography.

Note: In Plans II and III, all four Category A courses (12 credits) must be taken. However, students who receive lower than a B- in **one** Category A courses may take an additional Category B course and apply it as a Category A course.

Data Science in Biomedicine Track (Plan I)

The Data Science in Biomedicine Track is offered under the Computer Science Master of Science degree program for students who choose Plan I - Thesis. It is best to plan out the track starting the first year to ensure timely graduation and availability of electives.

Track Requirements

- 36 Credit hours Total.
- In addition to Plan I requirements, the student will complete an additional 9 credits of electives from a list of courses related to Biomedical Computing and Informatics, Bioinformatics, Health Informatics, etc. (meet with an advisor for current course offerings).
- Category B courses must be selected among CS courses focused on data science and engineering and be approved by the program director.
- Write a thesis with a focus on Data Science in Biomedicine.

Graduate Certificates

Graduate Certificate in Software Engineering

Students interested in the Graduate Certificate in Software Engineering should follow Plan III- Course Only option.

Certificate Objectives

To provide working or career-oriented students with knowledge and practice of the applied skills needed to become successful software engineers. The learning outcomes are:

- Learn basic knowledge for software requirements analysis and development.
- Learn advanced skills for various techniques in software requirement analysis.
- Learn how to design large scale complex systems and enterprise data systems
- Master skills for development and management of large complex systems: software planning, estimations, staffing, and scheduling.

Process to Attain Certificate Objectives

Students are required to take the following courses:

1. Software Architecture (CSCI 5010) AND
2. Software Project Management (CSCI 5011) AND
3. Either CSCI 5573 (Operating Systems) or CSCI 5593 (Advanced Computer Architectures

Students must take and pass each course with a grade of B- or better and earn a GPA of at least 3.0 to obtain the Software Engineering Certificate.

Graduate Certificate in Cyber Security and Defense

The Graduate Certificate in Cyber Security and Defense prepares computer science professionals to identify, analyze and mitigate technical cybersecurity related vulnerabilities, exploits and attacks against network and critical cyber infrastructure. The coursework emphasizes practical technical skills, analysis and research focused on current cybersecurity issues

Certificate Objectives

This certificate program focuses on both the technical and analytical aspects of advanced cyber security and defense. The learning outcomes are:

- Learn how to mitigate known cyber-related attaches against multiple network and infrastructure devices.
- Learn how to design secure solutions, analyze new cyber-attacks.
- Provide solutions that balance risk, security, privacy, cost and operations.

Program Learning Outcomes

1. Demonstrate an in-depth understanding of cybersecurity principles and practices.
2. Identify and analyze various types of cyber and infrastructure threats and apply basic cybersecurity defense concepts to develop and assess defensive solutions against them.
3. Apply cybersecurity knowledge and skills to maintain operations in the presence of risks.
4. Understand the national needs in the area of cybersecurity and learn the necessary skills to advance their careers as practicing cybersecurity professionals.
5. Understand their professional responsibilities and make informed judgments in their cybersecurity practices based on legal and ethical principles.

Process to Attain Certificate Objectives

Students will need to complete a sequence of four graduate-level courses:

1. CSCI 5742 (3 credits) – Cybersecurity Programming and Analysis
2. CSCI 5743 (3 credits) – Cyber and Infrastructure Defense
3. CSCI 5573 (3 credits) – Operating Systems
4. CSCI 5765 (3 credits) – Computer Networks

Students must take and pass each course with a grade of B- or better and earn a GPA of at least 3.0 to obtain the Cyber Security and Defense Certificate.

Contact Information:

Please contact the CSE Department for information, appointments, and inquiries:

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