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 2024-2025 Admission.

The Department of Computer Science and Engineering (CSE) offers a Master of Science (MS) degree in Computer Science as part of the Computer Science and Engineering Graduate Program. The CSE department also offers several graduate certificates, doctorate and undergraduate degrees. For a complete list of degrees, please visit the CSE website. The CSE Department is housed in the College of Engineering, Design, and Computing (CEDC).

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. Applicants for graduate study in computer science must hold a B.S. or B.A. degree or equivalent, have considerable computing experience, sufficient mathematical background and show promise of the ability to pursue advanced study and research.

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. The MS in Computer Science is a two-year degree. Students should expect to take classes over a period of two years (e.g., 2 fall and 2 spring semesters). Students needs to know that graduate courses are not guaranteed in Summer semesters, therefore they must not plan their degree based on summer courses. Master's degree candidates are required to complete a Plan 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. **If a student receives lower than a B- they cannot retake the same course; they must take a different course to satisfy the Category requirements.**

Students are responsible for completing all requirements towards graduation. Regular visits with a CSE advisor are expected and will help to verify satisfactory progress towards a degree in

computer science. Students should start their MS Plan of Study during their first semester of study and update it consistently. It is recommended that students get to know CSE faculty well enough that they can serve as future references.

The **MS plan study** is a one-page form outlining a student's past, present (current) and future course enrollments through the graduation. Both student and the assigned academic advisor will fill the form together. Although other than the coming semester, it is not possible to pinpoint exact courses to put in for future semesters in the plan of study form, but still the form can put placeholders for those, and help both student and advisor forecast the semester the student will be graduating. This plan of study must be signed by both the student and the advisor, printed and are to be submitted to the department and should be brought back each semester during the scheduled advising session to reflect on the status towards the planned graduation, whether any deviation of the plan happened and make changes with the assigned advisor, if necessary.

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 require evaluation and CSE graduate committee approval.

In their final semester, students must **apply for graduation through UCD Access before the census date, complete an MS Application for Candidacy** and meet with their advisor for a **graduation check.**

Foundational Courses

For students that satisfy the admissions criteria, but are lacking some CS Foundational Courses, a specific plan of study is devised in your admission plan specifying the CS courses to be completed. You will receive information regarding assigned Foundational Courses in your admissions letter. Students must complete all Foundational Courses with a <u>minimum grade of B</u>. To register for Foundational Courses, you will need to submit a <u>course permissions request</u> for **each** course. In addition to these courses, you will need to complete a minimum of 30 credit hours of graduate coursework to satisfy the program requirements. **Foundational Courses cannot be waived and <u>must be completed before</u> beginning graduate coursework**. However, the foundational Courses that are assigned, <u>**do not**</u> count towards the overall 30 credit hours of graduate coursework requirement.

<u>MSCS Graduate Courses</u>

MS courses are divided into 3 categories: A, B and C. The number of credit hours required in each category depends on the 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. Students should consult with their faculty advisor for course selection and update their plan of study as needed. Each semester a MS Course List with the A, B and C courses being offered is posted on the <u>CSE Student Resources website</u>.

Category A (Core Courses)

Category A courses are offered on a rotation with two taught each semester. Students will need to complete at least 3 Category A courses as part of their degree.

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

Category B (Breadth Courses)

Breadth courses are taught by full-time faculty in the CSE Department. Category B courses offered vary from semester to semester. Students are advised to regularly check the CSE student's resources webpage to check the list of courses for coming semester. Also, a list of full-time faculty can be found at the back of this handbook.

Category C (Other breadth courses)

Category C courses include CSCI 5010, CSCI 5011 and courses taught by part-time or faculty members from outside our computer science department. Students must choose a MS Plan (Plan I, II or III) before taking Category C courses. Students are advised to regularly check the CSE student's resources webpage to check the list of courses for coming semester. Also, a list of full-time faculty can be found at the back of this handbook.

Students can request approval to take courses from another department with prior approval of the CSE Graduate Committee; retroactive requests will not be reviewed. Only Engineering Department and Math courses are considered; the department will not consider requests for ISMG courses. There are no exceptions to this policy. If you would like to request to take a course from another department, you must obtain a syllabus and submit a petition through your advisor. In the petition, you will need to submit: (1) the course syllabus, (2) an updated and approved MS Plan of Study, and (3) a justification for your request. The justification to take courses from another department must be academic. If the advisor supports the request, they will then forward it to the CSE Graduate Committee. The decision of the CSE Graduate Committee will be communicated via email and is final. Students should expect a decision for the petition in 2-3 weeks.

Transfer Credits

A maximum of 9 (nine) semester hours of graduate course work may be transferred into the program based on department approval. Transfer credits must be requested before beginning their CU Denver coursework. These courses are individually evaluated by the CSE Graduate Committee. Core courses must be taken from the CSE department at CU Denver.

Internships

Internships are available to students who have completed at least **2 category A courses** and have a cumulative GPA of **3.0.** International students must register for CSCI 5939 Internship in order

to qualify for CPT. Internship credit will **not** be counted towards MSCS degree requirements.

MS Plans of Study

Students may choose Plan I (thesis), Plan II (project), or Plan III (course only). Plans I and II require successful defense of thesis or project respectively, in the student's graduating semester. Students in Plan I and II are responsible for selecting their committee members (in consultation and approval of their advisor), scheduling their oral exam and submitting their exam request two weeks before the posted deadline. Plan III requires successful completion of a final MS course project. These activities in each of the three plans are suggested to organize within their 30 credit hours boundary to satisfy the degree requirement. More details can be found below.

Plan I – Thesis

Students will write and defend a thesis**.** Students **MUST** be accepted by a research advisor, who is a full-time CSE faculty, to supervise their thesis before their second year of study. Students in the thesis plan have priority in obtaining departmental assistantship opportunities.

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 (Plan I)" on page 6.

Students in Plan I will complete the following:

- A minimum of 9 credits in Category A.*
- A minimum of 9 credits in Category B.
- 6 credits of MS thesis.

A maximum of 6 credits of Independent Study can be applied with the approval of their faculty research advisor. It is recommended that students complete at least one semester of Independent Study before beginning their thesis credits.

* Students can choose to complete all 4 Category A courses, or take an additional Category B to support their research if needed to reach the 30 graduate level credits required.

Plan II – MS Project

Students will write and defend an MS Project. Students **MUST** be accepted by a research advisor, a full-time CSE faculty, to supervise their project before their second year of study.

Students in Plan II will complete the following:

- A minimum of 9 credits in Category A. ‡
- A minimum of 12 credits in Category B.
- 3 credits of MS project.

A maximum of 3 credits of Independent Study can be applied with the approval of their faculty research advisor.

‡ students can choose to complete all 4 Category A courses, or take an additional Category B to support their research if needed to reach the 30 graduate level credits required.

Plan III – Course Only

Students in this plan must enroll in CSCI 6970 and complete an MS Course Project. Students should plan to enroll in their CSCI 6970 MS Course Project <u>after</u> completing 9 credits in Category A. If a student wishes to enroll in their final Category A course concurrently with CSCI 6970, they must obtain advisor approval and submit this approval to the Graduate Coordinator.

Students in Plan III will complete the following:§
- A minimum of 9 credits in Category A.
- A minimum of 12 credits in Category B.
- Successful completion of CSCI 6970 MS Course Project (0 credit hours)

Independent Study is **not** allowed for Plan III.

§ students can satisfy all 30 credits by taking all credits needed in Category A and B or elect to take the final credits in Category C. (For example; students completing their Software Engineering certificate.)

Final MS Course Project

- The MS course project is an **<u>individually written final report documenting research, implementation, results, analysis, and mastery of the subject.</u>** In the report, a student must demonstrate scholarly/scientific knowledge acquired over the course of their MS studies.
- A list of approved MS courses to complete the course project will be made available on the CSE department [CSE Student Resources website](#) each semester before registration begins.
- Students must register for CSCI 6970 the semester they complete their MS course project. All work related to the MS course project will be submitted to CSCI 6970 on Canvas.

The final course project must meet the following requirements:
1. Must be an individual semester term project.
2. Must demonstrate mastery of the subject area of the respective course.
3. Must demonstrate scholarly/scientific knowledge acquired over the course of their MS studies.
4. Must require defining a pressing problem relevant to the course which is connected with CSCI-6970, and conducting a comprehensive literature review, clearly identifying research gaps, planning with the respective course instructor on how to mitigate the gaps, implementing the plan, experimenting to produce results with analysis, lastly identifying the limitations of the work with hints to future work..
5. Must prepare all the components listed in #4 as a structured scientific report strictly following the department report template. The template, and suggestions on each of the components can be obtained from the CSCI-6970 course page.

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

- Students must complete 36 credit hours including Plan I requirements (as outlined on page 4: Section "Plan I – Thesis").
- Students 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, Dr. Banaei-Kashani.
- Write a thesis with a focus on Data Science in Biomedicine.

MS Advising

Each student is assigned an academic advisor at the beginning of their studies. Students in Plan III may not change academic advisors.

Students in Plan I and Plan II will need to find a full-time faculty advisor to conduct their thesis/project before the end of their first year. Students must submit a request to change advisors to the Graduate Coordinator before their second year of study.

A Research Advisor must be full-time Computer Science and Engineering faculty member with a graduate faculty appointment. Research Advisors will supervise thesis, project, and independent study coursework. Research Advisors will chair their students' defense committees. Students' defense committees must consist of at least three members, two of whom must be CSE full-time faculty members. Part-time CSE faculty, non-tenure track CSE faculty or tenured/tenure-track faculty from outside of the CSE department may co-advise and/or serve on the defense committee with the approval of the Research Advisor.

Graduate Certificates

Graduate Certificate in Software Engineering

Students interested in completing a [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 of 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 obtain the Certificate

Students are required to take the following courses:

- Software Architecture (CSCI 5010)
- Software Project Management (CSCI 5011)
- 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 attacks against multiple network and infrastructure devices.
- Learn how to design secure solutions and 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 obtain the Certificate

Students are required to take the following courses:

- CSCI 5742 —3 credits - Cybersecurity Programming and Analysis
- CSCI 5743 —3 credits – Cyber and Infrastructure Defense
- CSCI 5573 —3 credits – Operating Systems
- 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.

Department Policies and Student Responsibilities

If you believe you qualify for an exemption to any department policies due to an extenuating circumstance, you must meet with your advisor and submit a petition to the Graduate Committee for review. All petitions must be submitted in a timely manner, and are subject to Graduate Committee approval. Students can expect a decision on their petition within 2-3 weeks.

Students should review the [College of Engineering, Design, and Computing's policies and procedures](#). The CSE Department follows all of these policies.

Students should check the [Student Resources](#) website for all necessary forms, documents, course lists, etc.

Failure to follow the plans of study may delay your graduation. All students are responsible for adhering to the Academic Calendar, the Computer Science MS Handbook, as well as any specific Graduate student dates and deadlines published each semester.

ALL new MS students must attend the orientation that is held during the week before the start of every semester. The date and venue of the orientation will be finalized, sent out via email.

Students must meet with their assigned advisor to prepare their MS Plan of Study by the end of their first semester. Plans of Study must be submitted to the department by Week 10 of your first semester.

- Changes can be made to the plan of study if needed during the course of study.
- All changes must be approved by the advisor.

 All department policies and procedures and the decisions made therein are **final**.

Things to do in graduating semester:

In their final semester, students must do the following items in a timely manner:

1. **Apply for Graduation** through UCD Access before census date the semester they are graduating.
2. **MSCS Application for Candidacy**- This form is available in the department as well as on our [Student Resources page](#) and must be turned in before census date the semester they are graduating.
   a. This **MUST** be completed with advisor approval before submitting it to the department.
   b. Students on the MS Thesis or Project track must submit the request for Examination by the announced deadline.

Attendance Policy

The attendance policy for the College of Engineering, Design, and Computing states: Successful

work in the College of Engineering, Design and Computing is dependent upon regular attendance in all classes. Students who are absent should make arrangements with instructors to make up the work missed. Students who for illness or other good reason miss any examination must notify the instructor no later than the end of the day on which the examination is given. Failure to do so may result in an F in the course.

You can review the complete [CU Denver Attendance Policy here](), which details excused and unexcused absences, required documentation for absences, and more.

Attendance for International Students

International students must be enrolled in a full-time schedule to maintain Visa status. Attendance beginning on the first day of classes is mandatory for all in-person components; this is a CU Denver policy and an F-1 VISA requirement. No one in the department can permit you to be out of the country while enrolled for in-person courses. Violating this policy puts your Visa and student status in serious jeopardy.

CU Denver Academic Integrity and Honor Code

As a member of the University of Colorado Denver community, I pledge to:

- Act with honesty and ethics in academia and in society by building mutual trust and responsibility as a foundation for lifelong integrity;
- Advance learning, knowledge, generation, and the free exchange of views and ideas as the lifeblood of academic freedom and of democracy;
- Embrace diversity and practice inclusion, showing civility, respect, and care toward ALL persons, standing up for the essential worth and dignity of every individual;
- Take responsibility for the consequences of my own actions and share responsibility for the well-being and safety of the community by also holding others similarly responsible.

I will honor these commitments in every part of my life.

What is Academic Integrity and why is it so important?

Academic Integrity is defined by the International Center for Academic Integrity (ICAI) as "a commitment to six fundamental values: honesty, trust, fairness, respect, responsibility, and courage." (ICAI, 2021 p. 4). By adopting these fundamental values CU Denver's scholarly community will thrive.

You can learn more about [CU Denver's policy on Academic Integrity here.]()

You can learn more about the [College of Engineering, Design, and Computing's policy on Academic Integrity here.]()

Student Code of Conduct

CU Denver strives to make the campus community a place of study, work, and residence where

people are treated, and treat one another, with respect and civility. As members of the CU Denver community, students are expected to uphold university standards that assist in promoting a safe and welcoming community. Every CU Denver student assumes responsibility for knowing and understanding the various local, state, federal, and university laws, policies, and regulations as well as the Student Code of Conduct. The Student Code of Conduct outlines student right & responsibilities, behavioral expectations and the university conduct process.

For answers to more frequently asked questions, please refer to our FAQ page on our website; [engineering.ucdenver.edu.](engineering.ucdenver.edu)

Contact Information

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

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