Graduate Student Handbook

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Network Engineering

Table of Contents

Foreword

As part of the Department of Computer Science at the University of Colorado Boulder, the Professional Master's in Network Engineering (MSNE) program accepts students from a broad range of backgrounds and offers curriculum and coursework that creates bridges across disciplinary boundaries. The program prepares students to design, construct, and operate data communication systems by teaching network engineering from an interdisciplinary, hands-on perspective. Among the goals of the MSNE are to accelerate both critical thinking and learning in areas of networking, programming, and system administration; to provide relevant content with experiential learning; and to prepare students to be future leaders in these critical areas.

Honor Code

The University of Colorado Boulder is dedicated to maintaining the highest standards of intellectual honesty. Commitment to these standards is the responsibility of every student, faculty and staff member. Here is a link to the **Honor Code** which was designed to uphold CU Boulder's standards of academic integrity and intellectual honesty. All students of the University of Colorado Boulder are subject to the Honor Code for academic matters.

MISSION

The mission of the Honor Code at the University of Colorado Boulder is to secure an environment where academic integrity can flourish.

VALUES

The Honor Code recognizes the importance of honesty, trust, fairness, respect, and responsibility and aims to instill these principles as essential features of the University of Colorado Boulder campus. The Honor Code allows all students to have responsibility for, and the ability to attain, appropriate recognition for their academic and personal achievements.

Colorado Creed

The **Colorado Creed** is a social responsibility code developed by past generations of CU students. It is a way of life and a reminder to act with honor, integrity, and respect.

"As a member of the Boulder community and the University of Colorado Boulder, I agree to:

- *Act with honor, integrity, and accountability in my interactions with students, faculty, staff, and neighbors.*
- *Respect the rights of others and accept our differences.*
- *Contribute to the greater good of this community.*

I will strive to uphold these principles in all aspects of my collegiate experience and beyond."

MSNE Curriculum Overview

MSNE is a coursework-only professional master's program. Students will take at least 30 credit hours in the following categories.

Category	Credit Hours
Fundamentals	6
Core	6
Advanced Electives	9
Electives	9
Total	30

Fundamentals Courses

The courses in the Fundamentals category are designed to provide students with the background they need to succeed in this degree. Courses in this category cover the fundamental concepts of how the Internet operates; how to develop network systems; and how to administer the machines (both physical and virtual) that deploy them.

- CSCI 5010: Fundamentals of Data Communication
- CSCI 5020: Fundamentals of Network Programming
- CSCI 5030: Fundamentals of System Administration and Virtualization

Students are required to take two courses (6 credit hours) from the Fundamentals category unless they can demonstrate that they have acquired the necessary skills and knowledge via their undergraduate degree or prior work experience. Such students can petition to take two extra Elective or Advanced Elective courses instead.

Core Courses

The courses in the Core category begin to lay the foundation for exploring network engineering topics in depth. All aspects of network engineering from the management of network systems to the policies that govern traffic on the Internet to the wireless systems that deliver information to devices on the edge are all covered.

- CSCI 5113: Linux System Administration
- CSCI 5160: Introduction to Enterprise Networks
- CSCI 5170: IP Routing Protocols and Policies
- CSCI 5180: Network Management and Automation
- CSCI 5200: Introduction to Wireless Systems
- CSCI 5220: Wireless Local Area Networks
- CSCI 5230: Wireless Systems Lab

Students are required to take two courses (6 credit hours) from the Core category to help set the stage for taking courses in the Advanced Electives category. Students can be guided in their choice of Core courses by using the suggested focus areas at the end of this document to craft a set of coursework that best meets their academic goals (Appendix A).

If a student feels that they need to take more courses from the Core category, they can certainly do so by choosing to take additional Core classes and applying those credits towards meeting the credits associated with the Electives category. Core courses may not be offered every term. Students are encouraged to review classes.colorado.edu to get a general perspective of historical course offerings. Some Advanced Elective courses have prerequisite requirements of certain Core courses. For example, CSCI 5280 Software-Defined Networking requires a grade of ‘B’ or higher in CSCI 5180 Network Management & Automation.

Advanced Electives

The courses in the Advanced Electives category go in depth on a variety of network engineering topics. Students are required to take three courses (9 credit hours) of Advanced Electives to graduate.

- CSCI 5190: Voice Over IP: Voice Network Design and Implementation
- CSCI 5260: Datacenter Networks
- CSCI 5270: IP Network Design
- CSCI 5280: Software-Defined Networking
- CSCI 5360: Internet Service Provider Networks
- CSCI 5380: Network Virtualization and Orchestration
- CSCI 5620: Advanced Wireless Lab
- CSCI 5630: Wireless and Cellular Systems
- CSCI 5840: Advanced Network Automation
- CSCI 5XXX: Cloud Technologies / CSCI 7000: Special Topics in Cloud Technologies

Electives

The three courses (9 credit hours) associated with the Electives category allow students to customize the MSNE degree to meet their academic goals. These credits can include any of the following options:

- Any of the remaining Core courses
- Any of the remaining Advanced Electives courses
- Any CSCI 5000-level course approved by petition
    - Exactly three (3) credit hours of the Professional Internship class (CSCI 6930) can count as an Elective course.
        - Students who complete less than 3 credit hours of CSCI 6930 may not count it as an Elective course.
        - Students who complete more than 3 credit hours of CSCI 6930 may not count any additional credit hours towards the degree.
    - MSNE students cannot count CSCI 5000, CSCI 5100, CSCI 6000, CSCI 6100, or CSCI 6200 towards their degree requirements.
- No more than three graduate-level courses (9 credit hours) of approved, non-CSCI graduate level coursework offered at CU Boulder.
    - Students may count no more than 9 total credit hours of non-CSCI classes towards their degree requirement.
    - Non-CSCI courses must be at graduate level (5000-level or above) and must be offered at CU Boulder.
    - MSNE students may not take courses for students in the MS Data Science (DTSC) program:
        - DTSC subject code courses (e.g., DTSC 5501 Cybersecurity for Data Science)
        - DTSC-specific courses with a CSCI-subject code (e.g., CSCI 5122 Neural Networks and Deep Learning for Science, CSCI 5612 Machine Learning for Data Science)
        - DTSC-reserved sections of CSCI-scheduled courses (e.g., example, section 872 of CSCI 5502)
        - DTSC-reserved sections are typically numbered with 872, 873, etc. and will clarify that they are reserved for DTSC students in their class notes

For the last two options, students are encouraged to submit petitions to the CS graduate committee BEFORE taking the courses they want to apply to the Electives category.

Timeline

All students must complete the degree requirements within four years from the date of commencing coursework. The option to petition for an additional fifth year is available. The MSNE degree is primarily residential and courses are, by default, offered in-person on varying days and meeting times to allow flexibility for full- or part-time students. Some courses are available online. Electives are regularly available in the Summer so students can maintain progress throughout the year.

- **Full-time students typically complete the degree in two years**. To graduate in two years students are encouraged to complete the Fundamentals and Core courses in the first Fall and Spring semesters and must complete the Core Courses by the end of the third semester (excluding Summer sessions).
- **Part-time students can pursue the degree at their own pace**. Students with graduation paths longer than 2 years are encouraged to complete the Fundamentals and Core courses before enrolling in Advanced Electives courses.

International Students should consult with International Student and Scholar Services to ensure that they are meeting the requirements for studying at CU Boulder: http://www.colorado.edu/isss.

Advising

Plan of Study

Students are expected to submit the **Plan of Study** form by the end of their first semester in consultation with their advisor. Students may resubmit the Plan of Study form as often as they would like.

- When planning your course of study, consult your advisor and the faculty co-directors.
- Admissions and application questions should be routed to **csgradinfo@colorado.edu**.
- For a template plan of study, refer to Appendix C.

Academic Advisor

Students in the MSNE program are advised by Daniel Adams. Your advisor serves as the academic advisor for current MSNE students throughout their entire academic program. You can contact your advisor by **clicking here**.

Transfer Credits

Master's students may request a maximum of nine semester hours taken at another University or within CU (either taken as a non-degree student OR taken as a non-CS student) to be transferred to count towards their degree.

- All transfer requests must have departmental approval.
- Please reach out to your graduate advisor for information on how to request departmental review of transfer credits.
- You will need a syllabus for each course, an unofficial copy of your transcript with the final grade, and confirmation that the classes have not been used towards any other degree (Bachelor's or higher).

To learn more, please review the Graduate School Rules for Transfer Credits.

Academic Standards

Minimum Grades and GPA Requirements

Students must complete a total of 30 credit hours of approved graduate level course work with a grade of C or better and a cumulative GPA of at least 3.00. Any student, who fails to maintain a 3.00 grade point average or to make adequate progress toward completing a degree, as assessed by the student's academic/research advisor, will be subject to suspension or dismissal from the Graduate School upon consultation with the major department. The final decision on suspension or dismissal will be made by the Dean of the Graduate School. See the **Graduate School Rules** for additional information.

Incomplete (I) Grades

An incomplete (I) grade is given only when students, for documented reasons beyond their control, have been unable to complete course requirements in the semester enrolled. A substantial amount of work must have been satisfactorily completed before approval of such a grade is given. The final grade (earned by completing the course requirements or by retaking the course) does not result in deletion of the (I) from the transcript. A second entry is posted on the transcript to show the final grade for the course. At the end of one year, (I) grades for courses that are not completed or repeated are regarded as (F) and are shown as such on the student's transcript. Courses with grades of (I) are not included in computation of grade point averages until a final letter grade has been awarded in that course. Click **here** to learn more about Incomplete Grades.

Graduation Checklist

The following Graduate School forms must be submitted to the MSNE Program for approval. **IMPORTANT**: Check the **Graduate School deadlines** prior to the start of the semester.

- **Apply to Graduate**. Students must apply through **CU BuffPortal** to graduate. This notifies the Graduate School and your department that you intend to graduate. If you do not complete the requirements for graduation, you must log back in and re-apply to graduate for the new graduation date. *You must apply to graduate online whether or not you plan to attend the ceremony.*
- You must also complete the **Candidacy Application for Advanced Degree, which you will submit to the Graduate Program Advisor. Click here** for more information**.**

Contact Persons

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Appendix A – Suggested Focus Area Combinations

The following sets of courses represent common focus areas that students can take to target a particular area of network engineering in depth.

Network Design and Configuration

- CSCI 5160: Introduction to Enterprise Networks
- CSCI 5260: Datacenter Networks
- CSCI 5360: Internet Service Provider Networks

Network Programmability and Automation

- CSCI 5180: Network Management and Automation
- CSCI 5280: Software-Defined Networking
- CSCI 5380: Network Virtualization and Orchestration
- CSCI 5840: Advanced Network Automation

Wireless Networking

- CSCI 5200: Introduction to Wireless Networks
- CSCI 5220: Wireless Local Area Networks
- CSCI 5620: Advanced Wireless Lab
- CSCI 5630: Wireless and Cellular Systems

Comprehensive Networking Solutions

- CSCI 5160: Introduction to Enterprise Networks
- CSCI 5170: IP Routing Protocols and Policies
- CSCI 5190: Voice Over IP: Voice Network Design and Implementation
- CSCI 5200: Introduction to Wireless Networks
- CSCI 5270: IP Network Design

Appendix B – Example Plan of Study - Course Sequences

The outline below shows an example course sequence for students enrolled in the MSNE degree. There are a wide variety of course sequences that are possible, and many students elect to take additional credits above the 30-credit degree minimum. To accommodate this, the program is designed to be flexible and aims to meet the needs of students.

Example Plan of Study for students without a Computer Science background wanting to focus on the areas of **Network Design and Configuration** and **Network Programmability and Automation:**

Semester 1 (9 credit hours) 2 of these courses count for the degree

CSCI 5010	Fundamentals of Data Communication
CSCI 5020	Fundamentals of Network Programming
CSCI 5030	Fundamentals of System Administration and Virtualization

Semester 2 (9 credit hours)

CSCI 5160	Introduction to Enterprise Networks
CSCI 5170	IP Routing Protocols and Policies
CSCI 5180	Network Management and Automation

Semester 3 (6 credit hours)

CSCI 5260	Datacenter Networks
CSCI 5280	Software-Defined Networking

Semester 4 (9 credit hours)

CSCI 5270	IP Network Design
CSCI 5360	Internet Service Provider Networks
CSCI 5380	Network Virtualization and Orchestration

Appendix C - Network Engineering (MSNE)
PLAN OF STUDY Template

Student Name: _____ Student ID: _____

Fundamentals – 6 credit hours (2 courses)				
The courses in the Fundamentals category are designed to provide students with the background they need to succeed in this degree. Courses in this category cover the fundamental concepts of how the Internet operates; how to develop network systems; and how to administer the machines (both physical and virtual) that deploy them.				
Course Number	**Course Title**	**Semester to Be Taken**	**Semester Actually Taken**	**Grade**

Core – 6 credit hours (2 courses)				
The courses in the Core category lay the foundation for exploring network engineering topics in depth. Core courses cover all aspects of network engineering from the management of network systems to the policies that govern traffic on the Internet to the wireless systems that deliver information.				
Course Number	**Course Title**	**Semester to Be Taken**	**Semester Actually Taken**	**Grade**

Advanced Electives – 9 credit hours (3 courses)				
The courses in the Advanced Electives category go in-depth on a variety of network engineering topics. Students are required to take three courses of Advanced Electives to graduate.				
Course Number	**Course Title**	**Semester to Be Taken**	**Semester Actually Taken**	**Grade**

Electives – 9 credit hours (3 courses)				
The three courses associated with the Electives category allow students to customize the MS in Network Engineering degree to meet their academic goals.				
Course Number	**Course Title**	**Semester to Be Taken**	**Semester Actually Taken**	**Grade**

Student Signature: _____ Date: _____

Graduate Advisor Signature: _____ Date: _____