

COMPUTER SCIENCE, MS

Degree: Master of Science (MS)
Field of Study: Computer Science

Program Overview

MS in CS has three tracks: a Course-Focused track, a Project-Focused track, and a Thesis-Focused track. Although all of the three options require 30 semester hours of credit, they are structured differently to achieve different objectives. The Course-Focused track prepares students for advanced industry employment and should be treated as a terminal MS degree in CS. The Project-Focused track is for students who seek opportunities for completing an applied project, for example within the context of an established collaboration with industry. The Thesis-Focused track is mainly for students who have interests in research. Therefore, the three tracks have different requirements in admission, advising, and course work.

Admission

Graduate students shall be admitted to the MS degree program upon recommendation of the faculty of the CS program. Requirements for admission include a strong record of scholarship in a completed bachelor's degree program in computer science and related areas, and fluency in written and spoken English. The University requires all foreign applicants to show English proficiency by achieving a TOEFL score of at least 90 on the internet-based exam for the thesis-focused or the project-focused track. For the course-focused track, a minimum TOEFL score of 80 is required. For students who are expected to have any professional student to student interaction, e.g., as a teaching assistant, a lab instructor, or a tutor, a minimum TOEFL score of 90 is required. It is required that all students submit original copies of GRE scores, with the exception of CWRU students applying to the BS/MS program.

The MS program requires students to have substantial knowledge of undergraduate computer science material. Applications from students with a bachelor's degree in fields other than computer science may be granted admission on a provisional basis. Students should have knowledge equivalent to that in the courses:

- CSDS 233
- CSDS 310
- Any one course listed as an undergraduate Computer Science Breadth Requirement

Students deficient in one or more of these areas (admission with provision) may be required to satisfy this requirement by taking the corresponding courses listed above. These courses cannot be counted towards their MS requirement. However, a student taking and passing a course that subsumes one of the requirements automatically demonstrates knowledge of the material in the required course; e.g. taking CSDS 410 demonstrates knowledge of the material in CSDS 310. Such graduate level courses will be used to satisfy their MS requirement.

Applicants lacking the required background are encouraged to explore the Computer Science pathway options. Additional information on the Computer Science pathway can be obtained by contacting the department.

Registration

Course registration can be performed through the SIS system. Each semester before registration, students should update any personal information that may have changed by logging onto the SIS and editing the appropriate information. All registration holds must be lifted in order to successfully complete the registration process.

Advising

Each MS student will be assigned an academic advisor, who will assist the student in formulating an academic program. A student in the thesis-focused or project-focused track is expected to pick a research advisor in the program by the end of their first semester. The research advisor will supervise the student's thesis or project and also serves as the academic advisor. A student whose research advisor is a faculty member not in the CDS department must maintain an academic advisor in the CS program. Each student, in consultation with their advisor(s), must submit a Planed Program of Study preferably before completing 9 credit hours of coursework. This should specify all courses and thesis/project work that will be counted toward the 30 credit hour requirement.

Graduate Policies

For graduate policies and procedures, please review the School of Graduate Studies section of the General Bulletin.

Program Requirements

The Course-Focused MS degree program requirements consist of the completion of 30 hours of approved coursework, satisfactory completion of a comprehensive exam, i.e., passing the course ENGR 600 with a grade of "P". ENGR 600 consists of Comprehensive Exam questions that are administered in CSDS 410 Analysis of Algorithms, CSDS 425 Computer Networks I, CSDS 440 Machine Learning, CSDS 444 Computer Security, and CSDS 493 Software Engineering. Students must take and pass questions in at least two of these classes. Students who fail one exam in a course may retake that exam one more time but are not required to retake the associated course.

The Project-Focused track requires 24 semester hours of coursework credit and 6 semester hours of project (CSDS 695 Project M.S.).

The Thesis-Focused track requires 18 semester hours of coursework credit and 12 hours of thesis (CSDS 651 Thesis M.S.). A BS/MS student is required to choose the thesis-focused track initially.

Both the Thesis-Focused and the Project-Focused track require a formal written report, as well as a final oral examination by a committee of at least three faculty members, two of whom must be primarily affiliated with the CS program. The academic advisor is normally one of the committee members. For Project-Focused track students, the oral examination fulfills the Comprehensive Examination requirement of the School of Graduate Studies.

If a student wishes to switch from one track to another, the following requirements apply:

- **Deadline.** In each semester, students must request to switch track one week before the date at which Drop/Add ends, as stated in the academic calendar.
- **Course-only or Project to Thesis.** A course-only student may request to switch to the thesis track only if she (1) has already taken at least 9 credit hours of letter graded CSDS courses and (2) has a GPA of 3.5

or higher and (3) has a TOEFL score of 90 or higher and (4) has the recommendation of a CDS advisor or (co)advisor.

- Course-only to Project. A course-only student may request to switch to the thesis track only if she (1) has a TOEFL score of 90 or higher and (2) has the recommendation of a CDS advisor or (co)advisor.
- Thesis to Project, or Thesis or Project to Course-only. Such a transfer needs approval from the student's advisor and the department chair.
- Petition. If a student fails to satisfy the transfer requirements, a petition may be submitted by a CDS advisor or (co)advisor to the department chair. In no case, petitions may be submitted by non-CDS faculty members or by students.

Students should consult with their academic advisor and/or department to determine the detailed requirements within this framework.

Course Requirements

For all three tracks, at least 18 hours of coursework must be at the 400 level or above. All students are required to have specialized knowledge in at least one of the following depth areas, by taking at least three graduate-level classes from that area. The list of acceptable classes is shown below. For research or project-focused tracks, the chosen area should correspond to the student's thesis research area or project in general. CSDS 600 Special Topics classes will also qualify in this category with approval from the student's advisor. The remaining classes can be (i) any other class from the classes listed below, or (ii) any letter graded CSDS class (see note below), or (iii) at most two graduate-level classes other than those in category (i) and (ii) (such as non-letter-graded graduate CSDS classes or graduate classes in other departments).

(Note: The Graduate School and the School of Engineering limit the number of undergraduate courses that can be taken for credit by Master students.)

Students should discuss their courses with their advisor every semester prior to registration. Students must achieve a grade point average of 3.0 or higher; it is computed for all of the letter-graded courses on the student's academic program.

List of depth areas and corresponding courses

a. Algorithms & Theory:

- i. CSDS 410 Analysis of Algorithms
- ii. CSDS 440 Machine Learning
- iii. CSDS 455 Applied Graph Theory
- iv. CSDS 456 Data Privacy
- v. CSDS 477 Advanced Algorithms
- vi. MATH 408

b. Artificial Intelligence:

- i. CSDS 440 Machine Learning
- ii. CSDS 442 Causal Learning from Data
- iii. CSDS 455 Applied Graph Theory
- iv. ECSE 484 Computational Intelligence I: Basic Principles
- v. CSDS 491 Artificial Intelligence: Probabilistic Graphical Models
- vi. CSDS 496 Artificial Intelligence: Sequential Decision Making
- vii. CSDS 497 Artificial Intelligence: Statistical Natural Language Processing
- viii. CSDS 499 Algorithmic Robotics
- ix. CSDS 465 Computer Vision

c. Bioinformatics:

- i. CSDS 410 Analysis of Algorithms
 - ii. CSDS 435 Data Mining
 - iii. CSDS 440 Machine Learning
 - iv. CSDS 456 Data Privacy
 - v. EECS 458
 - vi. EECS 459
 - vii. SYBB 412
- d. **Computer Networks and Systems:**
- i. CSDS 427 Internet Security and Privacy
 - ii. ECSE 414 Wireless Communications
 - iii. CSDS 425 Computer Networks I
 - iv. CSDS 428 Computer Communications Networks II
 - v. CSDS 438 High Performance Data and Computing
 - vi. CSDS 444 Computer Security
- e. **Databases and Data Mining:**
- i. CSDS 405 Data Structures and File Management
 - ii. CSDS 433 Database Systems
 - iii. CSDS 435 Data Mining
 - iv. CSDS 439
 - v. CSDS 440 Machine Learning
 - vi. STAT 426 Multivariate Analysis and Data Mining
 - vii. PQHS 471 Machine Learning & Data Mining
- f. **Security and Privacy:**
- i. CSDS 427 Internet Security and Privacy
 - ii. CSDS 444 Computer Security
 - iii. CSDS 448 Smartphone Security
 - iv. CSDS 456 Data Privacy
 - v. CSDS 493 Software Engineering
 - vi. MATH 408 Introduction to Cryptology
- g. **Software Engineering:**
- i. CSDS 425 Computer Networks I
 - ii. CSDS 433 Database Systems
 - iii. CSDS 438 High Performance Data and Computing
 - iv. CSDS 442 Causal Learning from Data
 - v. CSDS 444 Computer Security
 - vi. CSDS 448 Smartphone Security
 - vii. CSDS 493 Software Engineering