

COMPUTER SCIENCE, MS

Banner Code: EC-MS-CS

Academic Advising

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The Computer Science graduate program prepares students for research and professional practice in computer science and related technologies. The program includes both fundamentals and advanced work in the areas of artificial intelligence and databases, programming languages and software engineering, systems and networks, theoretical computer science, and visual computing. Graduate classes are divided into basic classes, which have no graduate course prerequisite, and advanced classes, which have a graduate class as a prerequisite. Graduate classes are generally offered in the late afternoon and evening. Financial aid in the form of graduate assistantships may be available for full-time degree-seeking students.

Admissions & Policies

Admissions

In addition to fulfilling Mason's admission requirements for graduate study, applicants must meet the following requirements:

- Hold a baccalaureate degree that includes:
 - Data Structures and Algorithms (CS 310 Data Structures)
 - Automata Theory and Formal Languages (CS 330 Formal Methods and Models)
 - Computer Architecture including Assembly Language (CS 367 Computer Systems and Programming)
 - Calculus I and II
 - A substantial course in discrete mathematics such as MATH 125 Discrete Mathematics I (Mason Core) (<http://catalog.gmu.edu/mason-core/>)
- Earned a cumulative GPA of 3.00 or higher for the last two years of undergraduate work, preferably with a major in a technical field such as computer science, mathematics, physical sciences, engineering, or information systems.
- Submit transcripts of all post secondary education, complete the online application, including a goals statement, resume, and two letters of recommendation.
- A valid GRE score is required for those who have not earned a Bachelor's degree or higher from a US institution.
- English Proficiency Exam Score (<https://www2.gmu.edu/admissions-aid/how-apply/graduate/standardized-test-information/>), if applicable.

Requirements

(Banner code updated on July 12, 2021. Formerly: VS-MS-CS)

Degree Requirements

Total credits: 30

Required Courses and Plan of Study

In addition to general university requirements, completion of the MS in CS requires 30 credits of graduate courses.

To ensure that students have uniform preparation for the core courses, all students are required to take CS 530 Mathematical Foundations of Computer Science and CS 531 Computer Systems and Fundamentals of Systems Programming as their first two courses in the program. Students with a strong academic background in computer science may have CS 530 and CS 531 substituted for other elective courses at the discretion of the program director. Students enrolled in PhD CS or the Bachelor's/Accelerated Master's program cannot take these courses for credit. Students also have the opportunity to indicate that they have the requisite knowledge corresponding to CS 530 and CS 531 by passing an exam. The exams are given before classes begin in January and August, and can only be taken once. Students failing either one of the exams must take the equivalent course in their first semester. Students who successfully test out of CS 530 or CS 531 will be required to fulfill the credit requirement with other coursework chosen under advisement.

Courses are grouped in the following five broad areas: Artificial Intelligence and Databases, Programming Languages and Software Engineering, Systems and Networks, Theoretical Computer Science, and Visual Computing. The list of pre-approved courses with their areas follows.

All the following requirements should be satisfied for the MS in CS degree:

- CS 583 Analysis of Algorithms (from the Theoretical Computer Science area) and two additional core courses from two other areas must be successfully completed with a grade of B- or higher. Students receiving lower than a B- must retake the course or face termination.
- At least four courses (12 credits) must be chosen from the advanced courses in the list of pre-approved courses from at least two different areas.
- At least six courses, including two advanced courses, must be designated CS.
- At least eight courses must be taken from the list of pre-approved courses. Up to two computer science-related courses that are not on the list of pre-approved courses may be taken with prior approval of the program director.

Plan of Study

Before the end of the first semester, students must have a plan of study approved by their academic advisor. This plan should be kept up to date by regular consultation with the academic advisor.

Core Courses by Area

Code	Title	Credits
Artificial Intelligence and Databases		
CS 550	Database Systems	
CS 580	Introduction to Artificial Intelligence	
CS 584	Theory and Applications of Data Mining	

Programming Languages and Software Engineering

CS 540	Language Processors
SWE 619	Object-Oriented Software Specification and Construction
SWE 621	Software Design and Architecture

Systems and Networks

CS 555	Computer Communications and Networking
CS 571	Operating Systems
ISA 562	Information Security Theory and Practice

Theoretical Computer Science

CS 583	Analysis of Algorithms ¹
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Visual Computing

CS 551	Computer Graphics
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¹ Must be successfully completed with a grade of B- or better

Preapproved Basic and Advanced MS CS Courses by Area

Code	Title	Credits
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Artificial Intelligence and Databases

Basic Courses:

CS 550	Database Systems
CS 580	Introduction to Artificial Intelligence
CS 584	Theory and Applications of Data Mining
INFS 623	Web Search Engines and Recommender Systems

Advanced Courses:

CS 595	Basic Topics in Computer Science
CS 650	Advanced Database Management
CS 657	Mining Massive Datasets with MapReduce
CS 667	Biometrics and Identity Management
CS 681	Instructable Cognitive Agents
CS 685	Autonomous Robotics
CS 687	Advanced Artificial Intelligence
CS 688	Machine Learning
CS 689	Planning Motions of Robots and Molecules
CS 747	Deep Learning
CS 782	Advanced Machine Learning
CS 787	Decision Guidance Systems
INFS 740	Database Programming for the World Wide Web
INFS 760	Advanced Database Management
INFS 772	Intelligent Agents and the Semantic Web
INFS 774	Enterprise Architecture

Programming Languages and Software Engineering

Basic Courses:

CS 540	Language Processors
SWE 619	Object-Oriented Software Specification and Construction
SWE 620	Software Requirements Analysis and Specification

SWE 621	Software Design and Architecture
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SWE 622	Distributed Software Engineering
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Advanced Courses:

CS 640	Advanced Compilers
ISA 681	Secure Software Design and Programming
SWE 631	Software Design Patterns
SWE 632	User Interface Design and Development
SWE 637	Software Testing
SWE 642	Software Engineering for the World Wide Web
SWE 645	Component-Based Software Development
SWE 721	Reusable Software Architectures
SWE 737	Advanced Software Testing
SWE 760	Software Analysis and Design of Real-Time Systems

Systems and Networks

Basic Courses:

CS 531	Computer Systems and Fundamentals of Systems Programming
CS 555	Computer Communications and Networking
CS 571	Operating Systems
CS 587	Introduction to Cryptography
ISA 562	Information Security Theory and Practice
ISA 564	Security Laboratory

Advanced Courses:

CS 635	Foundations of Parallel Computation
CS 655	Wireless and Mobile Computing
CS 658	Networked Virtual Environments
CS 672	Computer System Performance Evaluation
CS 673	Multimedia Computing and Systems
CS 675	Distributed Systems
CS 706	Concurrent Software Systems
CS 719	Scalable Internet Services
CS 756	Performance Analysis of Computer Networks
CS 773	Real-Time Systems Design and Development
CS 779	Topics in Resilient and Secure Computer Systems
CS 788	Autonomic Computing
ISA 656	Network Security
ISA 673	Operating Systems Security
ISA 674	Intrusion Detection
ISA 697	Topics in Information Security
ISA 763	Security Protocol Analysis
ISA 764	Security Experimentation
ISA 785	Research in Digital Forensics

Theoretical Computer Science

Basic Courses:

CS 530	Mathematical Foundations of Computer Science
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CS 583	Analysis of Algorithms
Advanced Courses:	
CS 600	Theory of Computation
CS 630	Advanced Algorithms
CS 633	Computational Geometry
CS 683	Parallel Algorithms
CS 684	Graph Algorithms
Visual Computing	
Basic Courses:	
CS 551	Computer Graphics
Advanced Courses:	
CS 662	Computer Graphics Game Technologies
CS 663	Computational Design
CS 667	Biometrics and Identity Management
CS 682	Computer Vision
CS 686	Image Processing and Applications
CS 752	Interactive Graphics Software
CS 774	Computational Vision
CS 777	Human-Computer Intelligent Interaction

Project or Thesis

Three to six credit hours of the advanced classes may be replaced by a project or thesis with consent of a faculty sponsor and faculty advisor. The project or thesis must be guided and approved by a committee of three appropriate faculty members and presented at an appropriate forum. The thesis must meet relevant university requirements.

Code	Title	Credits
Select one from the following:		
CS 798	Project Seminar (3 credits)	
CS 799	Thesis (6 credits)	

Additional Pre-approved CS Courses

These courses are not classified by area. Note that CS 695 Topics in Computer Science/CS 795 Advanced Topics in CS can be used to satisfy the breadth requirement if the area is listed in the syllabus for the course.

Code	Title	Credits
CS 595	Basic Topics in Computer Science	3
CS 695	Topics in Computer Science	3
CS 697	Independent Reading and Research	1-3
CS 795	Advanced Topics in CS	3
CS 798	Project Seminar	3
CS 799	Thesis	1-6
CS 895	Research Topics in CS	3

Concentration in Cyber Security (CYSC)

In addition to the existing program requirements, MS CS degree students must satisfy the following requirements.

Students must take 5 courses from the following categories:

Code	Title	Credits
Required:		
ISA 656	Network Security	3
ISA 562	Information Security Theory and Practice	3

Choose 2-3 elective courses:		6-9
CS 587	Introduction to Cryptography	
ISA 564	Security Laboratory	
ISA 673	Operating Systems Security	
ISA 674	Intrusion Detection	
ISA 681	Secure Software Design and Programming	
ISA 763	Security Protocol Analysis	
ISA 764	Security Experimentation	
Choose 0-1 related course:		0-3
CS 540	Language Processors	
CS 555	Computer Communications and Networking	
CS 571	Operating Systems	
CS 600	Theory of Computation	
CS 655	Wireless and Mobile Computing	

Thesis:

Students, with the consent of a faculty sponsor and faculty advisor, may also elect a 6-credit thesis (CS 799 Thesis). The thesis must be guided and approved by a committee of three appropriate faculty members and presented at an appropriate forum. If the faculty advisor and the program director agree that the thesis is appropriate for the concentration the students will need to complete the two courses from the category 1 and one course from the category 2 in addition to the thesis to complete the Concentration requirements.

Concentration in Machine Learning (ML)

In addition to the existing program requirements, MS CS degree students must satisfy the following requirements.

Students must take 5 courses from the following categories:

Code	Title	Credits
Required:		
CS 584	Theory and Applications of Data Mining	3
CS 688	Machine Learning	3
Choose 2-3 elective courses:		6-9
CS 657	Mining Massive Datasets with MapReduce	
CS 681	Instructable Cognitive Agents	
CS 747	Deep Learning	
CS 782	Advanced Machine Learning	
Choose 0-1 related course:		0-3
CS 580	Introduction to Artificial Intelligence	
CS 687	Advanced Artificial Intelligence	
CS 685	Autonomous Robotics	
CS 682	Computer Vision	

Thesis (optional):

Students, with the consent of a faculty sponsor and faculty advisor, may also elect a 6-credit thesis (CS 799 Thesis). The thesis must be guided and approved by a committee of three faculty members and presented to the committee. If the faculty advisor and the program director agree that the thesis is appropriate for the concentration the student will need to complete the two courses from category 1 and one course from category 2 in addition to the thesis to complete the concentration requirements.

Accelerated Master's

Applied Computer Science, BS/Computer Science, Accelerated MS

Overview

Highly-qualified students in the Applied Computer Science, BS (<http://catalog.gmu.edu/colleges-schools/engineering/computer-science/applied-computer-science-bs/>) can complete both a BS-ACS and a Computer Science, MS in five years through the BS-MS accelerated (BAM) program.

General BAM policies are in the catalog under AP6.7 Bachelor's/ Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>). Policies governing all graduate degrees are in the catalog under AP6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

Admission Requirements

Students in the Applied Computer Science, BS (<http://catalog.gmu.edu/colleges-schools/engineering/computer-science/applied-computer-science-bs/>) program are encouraged to apply to the BAM program after earning 60 undergraduate credits with an overall GPA of at least 3.30. Students must have successfully completed CS 310 Data Structures and CS 330 Formal Methods and Models.

Accelerated Option Requirements

Students accepted to the BAM program may earn up to 12 credits of graduate coursework that count towards both the BS and MS degrees. They may begin taking graduate courses after completing 75 undergraduate credits and successfully completing CS 367 Computer Systems and Programming.

The following graduate courses can replace the corresponding undergraduate courses.

Code	Title	Credits
CS 540	Language Processors (to replace CS 440)	3
CS 550	Database Systems (to replace CS 450)	3
CS 551	Computer Graphics (to replace CS 451)	3
CS 555	Computer Communications and Networking (to replace CS 455)	3
CS 571	Operating Systems (to replace CS 471)	3
CS 580	Introduction to Artificial Intelligence (to replace CS 480)	3
CS 584	Theory and Applications of Data Mining (to replace CS 484)	3
CS 583	Analysis of Algorithms (to replace CS 483)	3
CS 587	Introduction to Cryptography (to replace CS 487)	3
SWE 619	Object-Oriented Software Specification and Construction (to replace SWE 419)	3
SWE 637	Software Testing (to replace SWE 437)	3
SWE 642	Software Engineering for the World Wide Web (to replace SWE 432)	3

Notes:

- Students may not use both the graduate course and the undergraduate alternative for their BS degree.
- Students must satisfy all recommended and required prerequisites for the graduate courses they take.
- Students also have the option to take up to 6 additional credits of graduate coursework *on reserve*, which can be used for the MS degree only.

Degree Conferral

Students must apply for degree conferral the semester before they expect to complete their BS requirements. At the beginning of their final undergraduate semester, students must submit a completed Bachelor's-Accelerated Master's Transition form to the CS department office. The master's degree will be conferred after the student completes the MS requirements.

Computer Science, BS/Computer Science, Accelerated MS

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CS 555	Computer Communications and Networking (to replace CS 455)	3
CS 571	Operating Systems (to replace CS 471)	3
CS 580	Introduction to Artificial Intelligence (to replace CS 480)	3
CS 583	Analysis of Algorithms (to replace CS 483)	3

CS 584	Theory and Applications of Data Mining (to replace CS 484)	3
CS 587	Introduction to Cryptography (to replace CS 487)	3
SWE 619	Object-Oriented Software Specification and Construction (to replace SWE 419)	3
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