

MASTER OF SCIENCE IN COMPUTER SCIENCE

The program for the Master of Science in Computer Science (MSCS) prepares students for more highly productive careers in industry. Graduates receive the MSCS for completing one of three options in the program as described in this section. Students may apply to the program if they possess a bachelor’s degree in computer science from an accredited institution. Students without a bachelor’s degree in computer science are encouraged to apply as well, with the understanding that they will be required to complete remedial coursework appropriate to their background in addition to the requirements of the MSCS degree. All applicants are evaluated according to their prior academic record, scores on the Graduate Record Examination, a personal statement, and letters of recommendation. Applicants are selected for fall semester admission only. The application deadline is February 1. However, all applicants are encouraged to apply as early as possible because the selection process may begin well before the deadline.

Students entering the program must demonstrate a core competency in computing equivalent to undergraduate-level courses in the following areas:

- systems, design and analysis of algorithms,
- formal languages and automata theory,
- databases,
- networking and communications,
- computer architecture, and
- human-computer interaction.

This requirement can be satisfied by having taken undergraduate courses as a part of an undergraduate degree, taking remedial courses in the MS CS program, or by examination. Students may specialize in areas of their choice. Every student must complete at least one specialization as a part of their degree program. The current eleven specialization areas are:

- Computer Graphics, Computing Systems
- High-Performance Computing, Human-Computer Interaction
- Interactive Intelligence
- Machine Learning
- Modeling and Simulations
- Scientific Computing
- Social Computing
- Visual Analytics.

A student who is enrolled in another graduate program of the Institute may pursue an MSCS while that student is also pursuing their degree in the other major. To be granted permission to pursue the MSCS, a student must submit to the MS program coordinator of the College of Computing the material required for admission to the MSCS program. This includes transcripts, letters of recommendation, and GRE General Test. If the student is approved by the College to pursue the MSCS, the student will be notified in writing. At no time will a student outside the College be

allowed to pursue a concurrent degree without prior permission of the MS program coordinator of the College of Computing.

A student enrolled in the MS degree program in computer science who wishes to be admitted to the PhD program in computer science should apply via the same process as external students. It is expected that such a student will have at least two letters of recommendation from College of Computing faculty.

For more information about the MS CS program, visit www.cc.gatech.edu.

Program of Study

The College’s master’s degree requirements supplement the Institute’s master’s requirements listed in this catalog:

- Students must achieve a grade-point average of at least 3.0 to graduate, and no course grades below C will count toward graduation. Students must take all master’s degree coursework on a letter-grade basis.
- Undergraduate courses required for the BSCS degree may not be used toward the MSCS degree. In addition, no graduate credit will be given for 3000 level courses or lower-level courses.
- No course may be used to satisfy the requirements of two degrees. In addition, no graduate credit will be given for CS courses with a number lower than 4140.
- A maximum of 6 hours may be taken at the 4000-level and/or with a subject code other than CS or CSE. See exceptions under the Project and Thesis options below.
- The maximum total credit hours of Special Problems (CS or CSE 89xx) that may be applied toward the MSCS degree is 3. These courses must be within the CoC.
- There is no maximum number of Special Topics (CS or CSE 88xx) courses that may be used towards the degree.
- Each student must complete the requirements for one specialization. [Click here for specialization requirements.](#)
- Students may choose from one of three options in pursuing the MSCS degree, including:

Course Option

This option requires the student to complete 30 hours of coursework.

Code	Title	Credit Hours
Total Course Credit Hours (no MS project or thesis hours)		30
CS and CSE (minimum 24 credit hours)		24
CS and CSE 6000-8000 Level Courses (minimum 24 credit hours)		24
6000/8000 Level Courses (minimum 24 credit hours)		24

Project Option

This option requires the student to complete 21 credit hours of coursework and a 9 credit hour project. The project requires approval by a faculty advisor and the MS program coordinator in the semester prior to its inception.

Code	Title	Credit Hours
Total Coursework Credit Hours		21
MSCS Project hours (CS 6999)		9
Total Credit Hours		30
CS and CSE Courses (minimum of 15 credit hours) ¹		15

CS and CSE 6000-8000 Level Courses (minimum of 15 credit hours)¹ 15

¹ May not include MS project or thesis hours.

Thesis Option

This option requires the student to complete 18 credit hours of coursework and a 12 credit hour thesis. The thesis process is defined elsewhere in this catalog.

Code	Title	Credit Hours
Total Coursework Credit Hours		18
MS Thesis Credit Hours ²		12
Total Credit Hours		30
CS and CSE Courses (minimum of 15 credit hours) ¹		15
CS and CSE 6000-8000 Level Courses (minimum of 15 credit hours) ¹		15

¹ May not include MS project or thesis hours.

² The student must obtain advance approval of the thesis proposal by the faculty advisor and MSCS coordinator. See your academic advisor for more information about the thesis process.

Specializations

Computational Perception and Robotics

Code	Title	Credit Hours
Core Courses		
Algorithms: Pick one (1) of:		3
CS 6505	Computability, Algorithms, and Complexity	
CS 6515	Introduction to Graduate Algorithms	
CS 6520	Computational Complexity Theory	
CS 6550	Design and Analysis of Algorithms	
CS 7520	Approximation Algorithms	
CS 7530	Randomized Algorithms	
CSE 6140	Computational Science and Engineering Algorithms	
And, pick one (1) of:		3
CS 6601	Artificial Intelligence	
CS 7641	Machine Learning	
Electives		
Pick three (3) courses from Perception and Robotics, with at least one from each:		9
Perception		
CS 6475	Computational Photography	
CS 6476	Introduction to Computer Vision GR	
CS 7499	3D Reconstruction and Mapping in Computer Vision, Robotics, and Augmented Reality	
CS 7636	Computational Perception	
CS 7639	Cyber Physical Design and Analysis	
CS 7644	Machine Learning for Robotics	
CS 7650	Natural Language	
CS 8803	Special Topics (Multiview Geometry in Computer Vision)	

Robotics		Credit Hours
CS 7630	Autonomous Robotics	
CS 7631	Autonomous Multi-Robot Systems	
CS 7633	Human-Robot Interaction	
CS 7638	Artificial Intelligence Techniques for Robotics	
CS 7648	Interactive Robot Learning	
CS 7649	Robot Intelligence: Planning	
Total Credit Hours		15

Computer Graphics

Code	Title	Credit Hours
Core Courses		
CS 6491	Foundations of Computer Graphics	3
CS 6505	Computability, Algorithms, and Complexity	3
or CS 6515 Introduction to Graduate Algorithms		
Electives: select three (3) of:		9
CS 6457	Video Game Design and Programming	
CS 6475	Computational Photography	
CS 6476	Introduction to Computer Vision GR	
CS 6485	Visualization Methods for Science and Engineering	
CS 6764	Geometric Modeling	
CS 7490	Advanced Image Synthesis	
CS 7491	3D Complexity Techniques for Graphics, Modeling, and Animation	
CS 7492	Simulation of Biological Systems	
CS 7496	Computer Animation	
CS 7497	Virtual Environments	
Total Credit Hours		15

Computing Systems

Code	Title	Credit Hours
Core Courses		
CS 6505	Computability, Algorithms, and Complexity	3
or CS 6515 Introduction to Graduate Algorithms		
And, pick two (2) of:		6
CS 6210	Advanced Operating Systems	
CS 6241	Design and Implementation of Compilers	
CS 6250	Computer Networks	
CS 6290	High-Performance Computer Architecture	
CS 6300	Software Development Process	
CS 6390	Programming Language Design	
CS 6400	Database Systems Concepts and Design	
Electives: pick three (3) of: ^{1,2}		9
CS 6035	Introduction to Information Security	
CS 6200	Graduate Introduction to Operating Systems	
CS 6220	Big Data Systems and Analytics	
CS 6235	Real-Time System Concepts and Implementation	
CS 6238	Secure Computer Systems	
CS 6260	Applied Cryptography	

CS 6262	Network Security
CS 6263	Intro to Cyber-Physical Systems Security
CS 6291	Embedded Software Optimizations
CS 6310	Software Architecture and Design
CS 6340	Advanced Topics in Software Analysis and Testing
CS 6365	Intro Enterprise Comput.
CS 6422	Database System Implementation
CS 6550	Design and Analysis of Algorithms
CS 6675	Advanced Internet Computing Systems and Applications
CS 7210	Distributed Computing
CS 7260	Internetworking Architectures and Protocols
CS 7270	Networked Applications and Services
CS 7280	Network Science: Methods and Applications
CS 7290	Advanced Topics in Microarchitecture and organization of high-performance processors.
CS 7292	Reliability and Security in Computer Architecture
CS 7560	Theoretical Foundations of Cryptography
CS 8803	Special Topics (Foundations of Programming Languages)
CSE 6220	High Performance Computing

Total Credit Hours 18

- ¹ Any Core Courses in excess of the 9 hour requirement may be used as Computing Systems Electives
- ² Any Special Topics (CS 8803) course that is being taught by a School of Computer Science faculty member may also count as a Computing Systems elective. The definition of "School of Computer Science faculty member" is a faculty member who appears on the School of Computer Science website <https://scs.gatech.edu/people/faculty>.

High-Performance Computing

Code	Title	Credit Hours
Core Courses		
CSE 6140	Computational Science and Engineering Algorithms	3
CSE 6220	High Performance Computing	3
Electives		
Pick three (3) of:		9
CSE 6221	Multicore Computing: Concurrency and Parallelism on the Desktop	
CS 6230	High-Performance Parallel Computing: Tools and Applications	
	or CSE 6230 High Performance Parallel Computing: Tools and Applications	
CS 6241	Design and Implementation of Compilers	
CS 6290	High-Performance Computer Architecture	
CS 8803	Special Topics (Parallel Numerical Algorithms) or CSE 8803 Special Topics	
CSE 6236	Parallel and Distributed Simulation	

CSE 8803	Special Topics (Hot Topics in Parallel Computing)
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Total Credit Hours 15

Human-Centered Computing

Code	Title	Credit Hours
Core Courses		
CS 6451	Introduction to Human-Centered Computing	3
CS 6452	Prototyping Interactive Systems	3
CS 7455	Issues in Human-Centered Computing	3
Electives		
Pick two (2) of:		6
CS 6455	User Interface Design and Evaluation	
CS 6456	Principles of User Interface Software	
CS 6460	Educational Technology: Conceptual Foundations	
CS 6465	Computational Journalism	
CS 6470	Design of Online Communities	
CS 6474	Social Computing	
CS 6476	Introduction to Computer Vision GR	
CS 6601	Artificial Intelligence	
CS 6750	Human-Computer Interaction	
CS 6795	Introduction to Cognitive Science	
CS 7450	Information Visualization	
CS 7460	Collaborative Computing	
CS 7470	Mobile and Ubiquitous Computing	
CS 7476	Advanced Computer Vision	
CS 7610	Modeling and Design	
CS 7637	Knowledge-Based AI	
CS 7620	Case-Based Reasoning	
CS 7650	Natural Language	
CS 7695	Philosophy of Cognition	
CS 7697	Cognitive Models of Science and Technology	
CS 7790	Cognitive Modeling	
CS 8803	Special Topics (Computational Creativity)	
CS 8803	Special Topics (Expressive AI)	
CS 8803	Special Topics (Game AI)	
CS 8803	Special Topics (Human Robot Interaction)	
CS 8803	Special Topics (Computers, Communications & International Development)	
CS 8803	Special Topics (Computational Social Science)	

Total Credit Hours 15

Human-Computer Interaction

Code	Title	Credit Hours
Core Courses		
CS 6456	Principles of User Interface Software	3
CS 6750	Human-Computer Interaction	3
Electives		
Pick three (3) from the two sub-areas below, including one from each sub-area:		9

Sub-area: Design and evaluation concepts	
CS 6010	Principles of Design
CS 6320	Software Requirements Analysis and Specification
CS 6455	User Interface Design and Evaluation
CS 6457	Video Game Design and Programming
CS 6460	Educational Technology: Conceptual Foundations
CS 6465	Computational Journalism
CS 6470	Design of Online Communities
CS 6795	Introduction to Cognitive Science
CS 7465	Educational Technology: Design and Evaluation
CS 7467	Computer-Supported Collaborative Learning
CS 7790	Cognitive Modeling
Sub-area: Interactive technology	
CS 6440	Information to Health Informatics
CS 6763	Design of Design Environments
CS 6770	Mixed Reality Experience Design
CS 7450	Information Visualization
CS 7460	Collaborative Computing
CS 7470	Mobile and Ubiquitous Computing
Total Credit Hours	15

Interactive Intelligence

Code	Title	Credit Hours
Core Courses		
Take one (1) of:		3
CS 6300	Software Development Process	
CS 6301	Advanced Topics in Software Engineering	
CS 6505	Computability, Algorithms, and Complexity	
CS 6515	Introduction to Graduate Algorithms	
Take two (2) of:		6
CS 6601	Artificial Intelligence	
CS 7620	Case-Based Reasoning	
CS 7637	Knowledge-Based AI	
CS 7641	Machine Learning	
Electives		
Pick two (2) courses from:		6
Interaction		
CS 6440	Information to Health Informatics	
CS 6460	Educational Technology: Conceptual Foundations	
CS 6465	Computational Journalism	
CS 6471	Computational Social Science	
CS 6603	AI, Ethics, and Society	
CS 6750	Human-Computer Interaction	
CS 7632	Game Artificial Intelligence	
CS 7634	AI Storytelling in Virtual Worlds	
CS 7650	Natural Language	
CS 8803	Special Topics (Advanced Game AI)	
Cognition		
CS 6795	Introduction to Cognitive Science	

CS 7610	Modeling and Design	
CS 8803	Special Topics (Computational Creativity)	
Total Credit Hours		15

Machine Learning

Code	Title	Credit Hours
Core Courses		
Algorithms		
Pick one (1) of:		3
CS 6505	Computability, Algorithms, and Complexity	
CS 6515	Introduction to Graduate Algorithms	
CS 6520	Computational Complexity Theory	
CS 6550	Design and Analysis of Algorithms	
CS 7510	Graph Algorithms	
CS 7520	Approximation Algorithms	
CS 7530	Randomized Algorithms	
CSE 6140	Computational Science and Engineering Algorithms	
Pick one (1) of:		3
CS 7641	Machine Learning	
CSE 6740	Computational Data Analysis: Learning, Mining, and Computation	
Electives		
Pick three (3) of:		9
CS 6220	Big Data Systems and Analytics	
CS 6476	Introduction to Computer Vision GR	
CS 6603	AI, Ethics, and Society	
CS 7535	Markov Chain Monte Carlo Algorithms	
CS 7540	Spectral Algorithms and Representations	
CS 7545	Theoretical Foundations of Machine Learning	
CS 7616	Pattern Recognition	
CS 7626	Introduction to Behavioral Imaging	
CS 7642	Reinforcement Learning and Decision Making	
CS 7643	Deep Learning	
CS 7644	Machine Learning for Robotics	
CS 7646	Machine Learning for Trading	
CS 7650	Natural Language	
CS 8803	Special Topics (Probabilistic Graph Models)	
CSE 6240	Web Search and Text Mining	
CSE 6242	Data and Visual Analytics	
CSE 6250	Big Data Analytics for Healthcare	
ISYE 6416	Computational Statistics	
ISYE 6420	Introduction to Theory and Practice of Bayesian Statistics	
ISYE 6664	Stochastic Optimization	
Total Credit Hours		15

Modeling and Simulations

Code	Title	Credit Hours
Core Courses		
CSE 6730	Modeling and Simulation: Foundations and Implementation	3
Pick one (1) of:		3
CSE 6220	High Performance Computing	
ISYE 6644	Simulation	
MATH 6640	Introduction to Numerical Methods for Partial Differential Equations	
Electives		
Pick three (3) of:		9
CSE 6220	High Performance Computing	
CSE 6236	Parallel and Distributed Simulation	
CSE/CHBE 8803	Special Topics (Quantum Information, Computation, and Simulation)	
INTA 6742	Modeling, Simulation and Military Gaming	
ISYE 6644	Simulation	
MATH 6640	Introduction to Numerical Methods for Partial Differential Equations	
Total Credit Hours		15

Scientific Computing

Code	Title	Credit Hours
Core Courses		
CSE/MATH 6643	Numerical Linear Algebra	3
Pick one (1) of:		3
CSE/MATH 6644	Iterative Methods for Systems of Equations	
MATH 6640	Introduction to Numerical Methods for Partial Differential Equations	
Electives		
Pick three (3) of:		9
CS/CSE 6230	High-Performance Parallel Computing: Tools and Applications	
CS/CSE 8803	Special Topics (Parallel Numerical Algorithms)	
CSE 6140	Computational Science and Engineering Algorithms	
CSE 6220	High Performance Computing	
CSE/MATH 6644	Iterative Methods for Systems of Equations	
CSE 8803	Special Topics (Algorithms for Medical Imaging and Inverse Problems)	
CSE 8803	Special Topics (Computational Chemistry)	
MATH 6640	Introduction to Numerical Methods for Partial Differential Equations	
Total Credit Hours		15

Social Computing

Code	Title	Credit Hours
Core Courses		
Pick one (1) of:		3
CS 6470	Design of Online Communities	
CS 6474	Social Computing	
Pick one (1) of:		3
CS 6465	Computational Journalism	
CS 6471	Computational Social Science	
CS 7460	Collaborative Computing	
Electives		
Pick three (3) classes including additional classes from above and:		9
CS 6238	Secure Computer Systems	
CS 6250	Computer Networks	
CS 6456	Principles of User Interface Software	
CS 6505	Computability, Algorithms, and Complexity	
CS 6515	Introduction to Graduate Algorithms	
CS 6675	Advanced Internet Computing Systems and Applications	
CS 6750	Human-Computer Interaction	
CS 7210	Distributed Computing	
CS 7270	Networked Applications and Services	
CS 7450	Information Visualization	
CS 7467	Computer-Supported Collaborative Learning	
CS 7650	Natural Language	
CS 8893	Special Topics in Cognitive Science (Cognition and Culture)	
Total Credit Hours		15

Visual Analytics

Code	Title	Credit Hours
Core Courses		
CS 7450	Information Visualization	3
Pick one (1) of:		
CSE 6740	Computational Data Analysis: Learning, Mining, and Computation	
CSE 6242	Data and Visual Analytics	
Electives		
Pick three (3) from:		9
CS 6456	Principles of User Interface Software	
CS 6465	Computational Journalism	
CS 6485	Visualization Methods for Science and Engineering	
CS 6750	Human-Computer Interaction	
CS 6795	Introduction to Cognitive Science	
CS 7451	Human-Centered Data Analysis	
CSE 6242	Data and Visual Analytics	
CS 8803	Special Topics (Visual Data Analytics)	
Total Credit Hours		12

The Master of Science in Computer Science is also offered online.

For more information, visit: [Online Master of Science in Computer Science](#).