

# INFORMATION SYSTEMS, MS (CS)

**Banner Code:** EC-MS-ISYS

## Academic Advising

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Modern information systems manage data, information and knowledge to support enterprise functions and decision-making as well as human social activity over the Internet. Increasingly, these systems involve big data and artificial intelligence, are distributed and collaborative, and housed in the cloud with built-in security.

The mission of the Information Systems MS program is to enable students of diverse baccalaureate and professional backgrounds to obtain a high-quality MS degree that:

- Provides the theoretical knowledge and hands-on project experience needed to analyze, design, build, deploy, maintain, manage and promote effective organizational use of modern information systems.
- Allows students to specialize in high demand concentration areas including human-centered computing, and cloud-based information systems.
- Prepares students for careers in information systems in large and small organizations in both industry and government.

Career paths open to graduates include database application developer, web- and cloud-based information systems designer and developer, systems analyst, database administrator, information architect, systems architect, decision support analyst, data warehouse administrator, information engineer, knowledge engineer, human-computer interaction engineer, machine learning engineer, chief information officer, chief knowledge officer, chief privacy officer, and project manager.

## Admissions & Policies

### Admissions

#### Application Requirements

Applicants must have earned a GPA of 3.00 or better in the last 60 credits of undergraduate study. Applicants also must submit the following:

- A one-page statement of educational and career goals
- A current resume
- Internationally-educated students must submit their English proficiency scores

### Policies

#### Foundation Requirements

To succeed in graduate courses, students entering the MS program must have coursework or equivalent knowledge in the following five foundation areas: (1) **introductory programming** in any programming language; (2) knowledge of an **object-oriented programming** language such as Java, C++, or C#; (3) **data structures** and algorithms; (4) machine organization such as those given in computer system architecture or assembly language courses; (5) and topics in **discrete mathematics**,

including sets, propositional and predicate logic, relations, functions, trees, graphs, and inductive proofs.

The level of knowledge required in these areas is equivalent to that taught in undergraduate courses and may be demonstrated in one of several ways:

1. Applicable undergraduate coursework: Such courses must appear on transcripts from the student's undergraduate university, or another accredited university. Applicable courses from George Mason University and Northern Virginia Community College (NVCC) are given here:
  - a. **Foundation:** Introductory programming
    - **GMU CS:** CS 112 Introduction to Computer Programming (Mason Core) (<http://catalog.gmu.edu/mason-core/>)
    - **GMU IT:** IT 106 Introduction to IT Problem Solving Using Computer Programming
    - **NVCC:** CSC 201
  - b. **Foundation:** OO programming
    - **GMU CS:** CS 211 Object-Oriented Programming
    - **GMU IT:** IT 206 Object Oriented Techniques for IT Problem Solving
    - **NVCC:** CSC 202
  - c. **Foundation:** Data structures
    - **GMU CS:** CS 310 Data Structures
    - **GMU IT:** IT 306 Data Structures and Algorithms in Java
    - **NVCC:** None
  - d. **Foundation:** Machine organization
    - **GMU CS:** CS 367 Computer Systems and Programming or CS 465 Computer Systems Architecture
    - **GMU IT:** IT 342 Operating Systems Fundamentals
    - **NVCC:** None
  - e. **Foundation:** Discrete math
    - **GMU Math:** MATH 125 Discrete Mathematics I (Mason Core) (<http://catalog.gmu.edu/mason-core/>)
    - **NVCC:** MATH 288
2. The School of Computing offers the following bridge foundation courses: (1-2) SWE 510 Object-Oriented Programming in Java or COMP 501 Computer Programming Foundations I or AIT 502 Programming Essentials, (3) INFS 519 Program Design and Data Structures or COMP 511 Computer Programming Foundations II or AIT 512 Algorithms and Data Structures Essentials, (4) INFS 515 Computer Organization Course and Operating Systems or COMP 503 Computer Systems Foundations I or AIT 542 Fundamentals of Computing Platforms, and (5) INFS 501 Discrete and Logical Structures for Information Systems or COMP 502 Mathematical Foundations of Computing I. These courses may be taken by students in provisional status, non-degree status, or while in another graduate program at Mason.
3. Passing appropriate testout exams: Students can self-prepare and attempt testout exams for each of the four foundation requirements (OO programming, data structures, machine organization, and discrete math). The exams are given before classes begin in January and August, and can only be taken once. Registration is not required; students need only be present at the date, time, and location specified and bring some form of photographic identification. Detailed information is available on the department web site (<https://>

cs.gmu.edu/). Students who do not pass an exam must take an equivalent course before enrolling in the core curriculum courses.

Eligible domestic students who lack one or more foundation may be admitted provisionally and required to take the appropriate preparatory course or pass the testout exam. Other students may be advised to learn the foundation material and re-apply.

## Advising

The MS-INFS program holds orientation meetings at the beginning of each semester to advise newly admitted and continuing students. Members of the faculty are present to answer questions and offer advice concerning programs of study. Detailed information is available on the program's web site (<https://cs.gmu.edu/current-students/ms-students/ms-in-information-systems/>).

The MS-INFS program also provides advising services to students. Initial and procedural inquiries can be submitted to [csgrad@gmu.edu](mailto:csgrad@gmu.edu). A plan of study form for the MS degree should be completed and submitted by the student soon after beginning the program. This plan serves as a guide for the student.

## Requirements

### Degree Requirements

Total credits: 30

Students must complete 30 approved graduate credits (10 courses), divided into core (required) courses and constrained electives. Optionally, students may choose a concentration, which further constrains their electives. Students may complete the program without choosing a concentration.

### Core Courses

To provide a common background in the fundamentals of information systems, the following core courses, which constitute the technical body of knowledge for the program, are required of all students. Students with strong academic background in mathematical foundations of computing may have COMP 502 Mathematical Foundations of Computing I substituted for another elective course at the discretion of the program director.

Code	Title	Credits
COMP 502	Mathematical Foundations of Computing I	3
CS 550	Database Systems	3
INFS 622	Information Systems Analysis and Design	3
INFS 580	Analytics: Big Data to Information	3
INFS 611	Rapid Information Systems Prototyping	3
Total Credits		15

### Concentration in Human-Centered Computing (HCCM)

In addition to the general program requirements, students must complete 4 courses to complete this concentration:

Code	Title	Credits
Students must complete four courses in total		12
Select at least two courses from the following:		
AIT 642	Interaction Design and Accessibility	

or COMP 642 Interaction Design and Accessibility

AIT 684	Interactive Visualization and Data Analytics	
AIT 716	Advanced Human Computer Interaction	
Select the remaining one or two courses from the following:		
AIT 724	Data Analytics in Social Media	
COMP 505	Ethical and Legal Challenges in Computing	
COMP 522	Accessibility and Assistive Technologies	
CS 777	Human-Computer Intelligent Interaction	
SWE 632	User Interface Design and Development	
Total Credits		12

### Concentration in Cloud-based Information Systems (CBIS)

In addition to the general program requirements, students must complete 4 courses to complete this concentration:

Code	Title	Credits
AIT 660	Cyber Security Fundamentals	3
AIT 670	Cloud Computing Security	3
SWE 642	Software Engineering for the World Wide Web	3
Select one from the following:		3
SWE 622	Distributed Software Engineering	
SWE 625	Software Project Management	
SWE 632	User Interface Design and Development	
SWE 645	Component-Based Software Development	
Total Credits		12

### Research Option

With the consent of a faculty advisor and program director, students may complete a 6-credit MS thesis (INFS 799 MS Thesis) as part of the electives. The thesis must be guided and approved by a committee of three appropriate faculty members and presented at an appropriate forum. This is primarily intended for students who intend to pursue a PhD.

### Electives

Students may select the remaining courses from the following list. Students may select courses not on this list with prior approval from the faculty advisor.

### Information Systems (INFS)

Code	Title	Credits
INFS 612	Principles and Practices of Communication Networks	3
INFS 623	Web Search Engines and Recommender Systems	3
INFS 640	Introduction to Electronic Commerce	3
INFS 697	Topics in Information Systems	1-6
INFS 740	Database Programming for the World Wide Web	3
INFS 760	Advanced Database Management	3
INFS 770	Knowledge Management for E-Business	3
INFS 772	Intelligent Agents and the Semantic Web	3
INFS 774	Enterprise Architecture	3

INFS 796	Directed Readings in Information Systems	3
INFS 797	Advanced Topics in Information Systems	1-6
INFS 799	MS Thesis	1-6

### Applied Information Technology (AIT)

Code	Title	Credits
AIT 526	Introduction to Natural Language Processing	3
AIT 636	Interpretable Machine Learning	3
AIT 660	Cyber Security Fundamentals	3
AIT 664	Information: Representation, Processing and Visualization	3
AIT 670	Cloud Computing Security	3
AIT 684	Interactive Visualization and Data Analytics	3
AIT 716	Advanced Human Computer Interaction	3
AIT 724	Data Analytics in Social Media	3
AIT 734	Advanced Web Analytics Using Semantics	3
AIT 736	Applied Machine Learning	3
AIT 746	Applied Deep Learning	3
AIT 726	Natural Language Processing with Deep Learning	3

### Information Security and Assurance (ISA)

Code	Title	Credits
ISA 562	Information Security Theory and Practice	3
ISA 564	Security Laboratory	3
ISA 650	Security Policy	3
ISA 652	Security Audit and Compliance Testing	3
ISA 656	Network Security	3
ISA 673	Operating Systems Security	3
ISA 674	Intrusion Detection	3
ISA 681	Secure Software Design and Programming	3
or SWE 681	Secure Software Design and Programming	
ISA 697	Topics in Information Security	1-6
ISA 763	Security Protocol Analysis	3
ISA 764	Security Experimentation	3
ISA 785	Research in Digital Forensics	3
ISA 797	Advanced Topics in Information Security	3

### Software Engineering (SWE)

Code	Title	Credits
SWE 620	Software Requirements Analysis and Specification	3
SWE 625	Software Project Management	3
SWE 626	Software Project Laboratory	3
SWE 631	Software Design Patterns	3
SWE 632	User Interface Design and Development	3
SWE 642	Software Engineering for the World Wide Web	3
SWE 645	Component-Based Software Development	3
SWE 699	Special Topics in Software Engineering	3

SWE 721	Reusable Software Architectures	3
SWE 681	Secure Software Design and Programming	3
or ISA 681	Secure Software Design and Programming	
SWE 763	Software Engineering Experimentation	3
SWE 795	Advanced Topics in Software Engineering	3
SWE 796	Directed Readings in Software Engineering	3
SWE 798	Research Project	3

### Computer Science (CS)

Code	Title	Credits
CS 531	Computer Systems and Fundamentals of Systems Programming	3
CS 540	Compilers	3
CS 580	Introduction to Artificial Intelligence	3
CS 583	Analysis of Algorithms	3
CS 584	Theory and Applications of Data Mining	3
CS 635	Foundations of Parallel Computation	3
CS 640	Advanced Compilers	3
CS 650	Advanced Database Management	3
CS 657	Mining Massive Datasets with MapReduce	3
CS 662	Computer Graphics Game Technologies	3
CS 663	Computational Design	3
CS 672	Computer System Performance Evaluation	3
CS 673	Multimedia Computing and Systems	3
CS 678	Advanced Natural Language Processing	3
CS 681	Instructable Cognitive Agents	3
CS 682	Computer Vision	3
CS 683	Parallel Algorithms	3
CS 684	Graph Algorithms	3
CS 685	Autonomous Robotics	3
CS 686	Image Processing and Applications	3
CS 687	Advanced Artificial Intelligence	3
CS 688	Machine Learning	3
CS 706	Concurrent Software Systems	3
CS 752	Interactive Graphics Software	3
CS 755	Advanced Computer Networks	3
CS 756	Performance Analysis of Computer Networks	3
CS 773	Real-Time Systems Design and Development	3
CS 777	Human-Computer Intelligent Interaction	3
CS 779	Topics in Resilient and Secure Computer Systems	3
CS 782	Advanced Machine Learning	3
CS 787	Decision Guidance Systems	3
CS 795	Advanced Topics in CS	3

**Electrical and Computer Engineering (ECE)**

Code	Title	Credits
ECE 611	Advanced Computer Architecture	3
ECE 612	Real-Time Embedded Systems	3
ECE 642	Design and Analysis of Computer Networks	3
ECE 643	Network Switching and Routing	3
ECE 646	Applied Cryptography	3
ECE 732	Mobile Communication Systems	3
ECE 746	Advanced Applied Cryptography	3

**Operations Research (OR)**

Code	Title	Credits
OR 541	Operations Research: Deterministic Optimization	3
OR 542	Operations Research: Stochastic Models	3
OR 635	Discrete System Simulation	3
OR 640	Global Optimization and Computational Intelligence	3
OR 641	Linear Programming	3
OR 642	Integer Programming	3
OR 643	Network Modeling	3
OR 644	Nonlinear Programming	3
OR 645	Stochastic Processes	3
OR 647	Queuing Theory	3
OR 681	Decision and Risk Analysis	3
OR 690	Optimization of Supply Chains	3

**Psychology (PSYC)**

Code	Title	Credits
PSYC 734	Seminar in Human Factors and Applied Cognition	3

**Statistics (STAT)**

Code	Title	Credits
STAT 544	Applied Probability	3
STAT 554	Applied Statistics I	3
STAT 652	Statistical Inference	3
STAT 656	Regression Analysis	3
STAT 662	Multivariate Analysis and Statistical Learning	3
STAT 663	Statistical Graphics and Data Visualization	3
STAT 674	Survey Sampling II	3

**Systems Engineering (SYST)**

Code	Title	Credits
SYST 520	System Engineering Design	3
SYST 530	Systems Engineering Management I	3
SYST 542	Decision Support Systems Engineering	3
SYST 560	Introduction to Air Traffic Control	3
SYST 573	Decision and Risk Analysis	3
SYST 611	System Methodology and Modeling	3
SYST 659	Topics in Systems Engineering	3

SYST 680	Principles of Command, Control, Communications, Computing, and Intelligence (C4I)	3
SYST 683	Modeling, Simulation, and Gaming	3

**Accelerated Master's****Applied Computer Science, BS/  
Information Systems, Accelerated MS****Overview**

Highly-qualified students in the Applied Computer Science, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/applied-computer-science-bs/>) program can complete both a BS-ACS and an Information Systems, MS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/information-systems-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-computing/school-computing/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 also 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	Compilers (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 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
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.

## Applied Computer Science, BS/ Information Systems, Accelerated MS

**Overview**

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## Information Technology, BS/Information Systems, Accelerated MS

**Overview**

Highly-qualified students in the Information Technology, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/information-technology-bs/>) have the option of obtaining an accelerated Information Systems, MS.

For more detailed information, see AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>). For policies governing all graduate degrees, see AP.6 Graduate Policies (<http://catalog.gmu.edu/policies/academic/graduate-policies/>).

**Admission Requirements**

Students in the Information Technology, BS (<http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/information-sciences-technology/information-technology-bs/>) program may apply



to this option if they have earned 60 undergraduate credits and take graduate level courses after completion of 75 credits with an overall GPA of at least 3.30. Criteria for admission are identical to the criteria for admission to the Information Systems, MS program.

### Accelerated Option Requirements

Students must complete all credits that satisfy requirements for the BS and MS programs, with a minimum of 3 credits (maximum 6 credits) overlapping from the following courses:

Code	Title	Credits
CS 550	Database Systems (satisfies IT 414 requirement in the BS INFT program)	3
SWE 619	Object-Oriented Software Specification and Construction (satisfies as one DTP concentration course in the BS INFT program)	3

Note:

Students must complete MATH 125 Discrete Mathematics I (Mason Core) (<http://catalog.gmu.edu/mason-core/>) as their discrete math requirement and IT 306 Data Structures and Algorithms in Java or IT 309 Data Structures and Algorithms in Python as part of their concentration requirements in the BS program.

Students must also satisfy all the CS foundation requirements prior to admission: <https://cs.gmu.edu/current-students/ms-students/foundation-courses/>.

### Degree Conferral

Students must apply the semester before they expect to complete the BS requirements to have the BS degree conferred. In addition, at the beginning of the student's final undergraduate semester, students must complete a Bachelor's/Accelerated Master's Transition form. At the completion of MS requirements, a master's degree is conferred.