

# INFORMATION SYSTEMS, MS

**Banner Code:** VS-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 are distributed, collaborative, involve big data and hosted in the cloud.

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

- provides students with 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 further specialize in related areas of big data, data and knowledge engineering, decision support systems, web-based software engineering and information security assurance; and,
- prepares students for careers in information systems in large and small organizations in both industry and government.

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

## Admissions & Policies

### Admissions

#### Eligibility and Application Requirements

Applicants must hold a four-year (120-credit minimum) baccalaureate degree from an accredited institution and have earned a GPA of 3.00 or better in the last 60 credits. Applicants also must submit the following:

- A one-page goals statement
- A work resume.
- International 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:** OO programming
    - **GMU CS:** CS 211 Object-Oriented Programming
    - **GMU IT:** IT 106 Introduction to IT Problem Solving Using Computer Programming & IT 206 Object Oriented Techniques for IT Problem Solving
    - **NVCC:** CSC 201
  - b. **Foundation:** Data structures
    - **GMU CS:** CS 310 Data Structures
    - **GMU IT:** IT 306 Data Structures and Algorithms in Java
    - **NVCC:** None
  - c. **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
  - d. **Foundation:** Discrete math
    - **GMU Math:** MATH 125 Discrete Mathematics I (Mason Core) (<http://catalog.gmu.edu/mason-core/>)
    - **NVCC:** MATH 288
2. Preparatory coursework taken at GMU: The CS department offers the following bridge foundation courses: (1-2) SWE 510 Object-Oriented Programming in Java, (3) INFS 519 Program Design and Data Structures, (4) INFS 515 Computer Organization Course and Operating Systems, and (5) INFS 501 Discrete and Logical Structures for Information Systems. These courses may be taken by students in non-degree or provisional status.
3. Passing appropriate testout exams: Students can self-prepare and attempt testout exams for SWE 510 Object-Oriented Programming in Java, INFS 519 Program Design and Data Structures, INFS 515 Computer Organization Course and Operating Systems, and INFS 501 Discrete and Logical Structures for Information Systems INFS 501 Discrete and Logical Structures for Information Systems. 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. Students who fail any one of the exams must take the 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 department holds orientation meetings in January and August 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 department web site (<https://cs.gmu.edu/>).

The department also provides an advising function to students, as outlined in the student advising form available from the department. Each student is assigned a faculty advisor with whom to confer on matters related to degree requirements. A plan of study form for the MS degree should be completed and submitted by the student soon after admission to the program. This plan serves as a guide for the student.

## Requirements

### Degree Requirements

Total credits: 30

#### 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 computer science may have CS 530 Mathematical Foundations of Computer Science substituted for another elective course at the discretion of the program director.

Code	Title	Credits
CS 530	Mathematical Foundations of Computer Science	3
CS 550	Database Systems	3
INFS 612	Principles and Practices of Communication Networks	3
INFS 622	Information Systems Analysis and Design	3
INFS 740	Database Programming for the World Wide Web	3
Total Credits		15

#### Electives

Code	Title	Credits
Five courses selected from the lists which follow.		15
Total Credits		15

Electives are organized into the following emphasis areas: database management, data mining, electronic commerce, software engineering, knowledge management, and information security and assurance.

In addition to the core courses taken as part of the MS-ISYS curriculum, students may choose an emphasis within the program by taking five courses from one of the emphasis areas listed below. Students may also choose electives spanning several emphasis areas; they may also plan their electives so as to obtain certificates offered by the department. A list of approved electives is given within emphasis areas and by graduate program. A full list follows. Special topics courses may be used as electives with prior approval of the student's academic advisor and the graduate coordinator.

Students, with the consent of a faculty sponsor and faculty advisor, may also elect courses in individualized study, special topics, or a 6-credit thesis (INFS 799 Thesis), which is primarily intended for students planning to pursue a PhD in information technology with a concentration in information systems.

#### Database Management

Code	Title	Credits
CS 530	Mathematical Foundations of Computer Science	3
CS 787	Decision Guidance Systems	3
INFS 623	Web Search Engines and Recommender Systems	3
INFS 740	Database Programming for the World Wide Web	3
INFS 760	Advanced Database Management	3
INFS 772	Intelligent Agents and the Semantic Web	3
INFS 796	Directed Readings in Information Systems	3

#### Data Mining

Code	Title	Credits
CS 530	Mathematical Foundations of Computer Science	3
CS 657	Mining Massive Datasets with MapReduce	3
CS 782	Advanced Machine Learning	3
INFS 623	Web Search Engines and Recommender Systems	3
INFS 796	Directed Readings in Information Systems	3

#### Electronic Commerce

Code	Title	Credits
CS 530	Mathematical Foundations of Computer Science	3
INFS 640	Introduction to Electronic Commerce	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
ISA 656	Network Security	3

#### Software Engineering

Code	Title	Credits
CS 530	Mathematical Foundations of Computer Science	3
SWE 619	Object-Oriented Software Specification and Construction	3
SWE 621	Software Design and Architecture	3
SWE 622	Distributed Software Engineering	3
SWE 625	Software Project Management	3
SWE 631	Software Design Patterns	3
SWE 632	User Interface Design and Development	3
SWE 637	Software Testing	3

SWE 642	Software Engineering for the World Wide Web	3
SWE 721	Reusable Software Architectures	3
SWE 795	Advanced Topics in Software Engineering	3

### Knowledge Management

Code	Title	Credits
CS 530	Mathematical Foundations of Computer Science	3
CS 580	Introduction to Artificial Intelligence	3
CS 681	Instructable Cognitive Agents	3
INFS 623	Web Search Engines and Recommender Systems	3
INFS 740	Database Programming for the World Wide Web	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

### Information Security and Assurance

Code	Title	Credits
CS 530	Mathematical Foundations of Computer Science	3
CS 531	Computer Systems and Fundamentals of Systems Programming	3
ISA 562	Information Security Theory and Practice	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
ISA 763	Security Protocol Analysis	3
ISA 764	Security Experimentation	3
ISA 785	Research in Digital Forensics	3
ISA 796	Directed Readings in Information Security	3

### Certificates

Certificates may also be obtained in the following areas: Information Security and Assurance (<http://catalog.gmu.edu/colleges-schools/engineering/computer-science/information-security-assurance-graduate-certificate/>), and Software Engineering (<http://catalog.gmu.edu/colleges-schools/engineering/computer-science/software-engineering-graduate-certificate/#requirementstext>), with or without a concentration in Web-Based Software Engineering.

### Approved Electives

#### Elective Areas by Program

- Information Systems (INFS)
- Information Security and Assurance (ISA)
- Software Engineering (SWE)
- Computer Science (CS)
- Electrical and Computer Engineering (ECE)
- Operations Research (OR)

- Psychology (PSYC)
- Statistics (STAT)
- Systems Engineering (SYST)

### Information Systems (INFS)

Code	Title	Credits
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

### 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
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 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 530	Mathematical Foundations of Computer Science	3
CS 531	Computer Systems and Fundamentals of Systems Programming	3
CS 540	Language Processors	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 672	Computer System Performance Evaluation	3
CS 673	Multimedia Computing and Systems	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 700	Research Methodology in Computer Science	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 795	Advanced Topics in CS	3

**Electrical and Computer Engineering (ECE)**

Code	Title	Credits
ECE 511	Computer Architecture	3
ECE 521	Linear Systems and Control	3
ECE 528	Introduction to Random Processes in Electrical and Computer Engineering	3
ECE 535	Digital Signal Processing	3
ECE 545	Digital System Design with VHDL	3
ECE 584	Semiconductor Device Fundamentals	3

ECE 586	Digital Integrated Circuits	3
ECE 611	Advanced Computer Architecture	3
ECE 612	Real-Time Embedded Systems	3
ECE 620	Optimal Control Theory	3
ECE 621	Systems Identification	3
ECE 630	Statistical Communication Theory	3
ECE 633	Error Control Coding	3
ECE 635	Adaptive Signal Processing	3
ECE 642	Design and Analysis of Computer Communication Networks	3
ECE 643	Network Switching and Routing	3
ECE 645	Computer Arithmetic	3
ECE 646	Applied Cryptography	3
ECE 650		3
ECE 680		3
ECE 681	VLSI Design for ASICs	3
ECE 732	Mobile Communication Systems	3
ECE 734	Detection and Estimation Theory	3
ECE 741	Wireless Networks	3
ECE 746	Advanced Applied Cryptography	3

**Operations Research (OR)**

Code	Title	Credits
OR 540	Management Science	3
OR 541	Operations Research: Deterministic Models	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 Statistical Methods	3
STAT 663	Statistical Graphics and Data Exploration I	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 620	Discrete Event Systems	3
SYST 659	Topics in Systems Engineering	3
SYST 671	Judgment and Choice Processing and Decision Making	3
SYST 680	Principles of Command, Control, Communications, Computing, and Intelligence (C4I)	3
SYST 683	Modeling, Simulation, and Gaming	3

Code	Title	Credits
CS 583	Analysis of Algorithms	3
Select one of the following:		3
CS 540	Language Processors	
CS 550	Database Systems	
CS 551	Computer Graphics	
CS 555	Computer Communications and Networking	
CS 571	Operating Systems	
CS 580	Introduction to Artificial Intelligence	
CS 584	Theory and Applications of Data Mining	
Total Credits		6

**Note:**

Students complete all MS in Information Systems core courses and apply the two courses from above toward the elective requirements. Students also have the option to take up to 6 additional credits of graduate coursework, which serves as reserve graduate credit to be counted towards the MS degree only.

**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 that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.

**Computer Science, BS/Information Systems, Accelerated MS****Overview**

Highly-qualified students in the Computer Science, BS (<http://catalog.gmu.edu/colleges-schools/engineering/computer-science/computer-science-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 Computer Science, BS (<http://catalog.gmu.edu/colleges-schools/engineering/computer-science/computer-science-bs/>) program may apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30. Students must have successfully completed CS 310 Data Structures, CS 330 Formal Methods and Models and CS 367 Computer Systems and Programming.

**Accelerated Option Requirements**

Students have the opportunity to earn 3-6 credits in graduate coursework that count towards both the BS and MS degrees. Students may register for 3-6 credits of the following CS 500-level courses in place of the corresponding CS 400-level courses required for the BS degree.

**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/computer-science/applied-computer-science-bs/>) program have the option of obtaining an accelerated Information Systems, MS. See AP.6.7 Bachelor's/Accelerated Master's Degrees (<http://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7>).

Students in an accelerated degree program must fulfill all university requirements for the master's degree. For policies governing all graduate degrees, see AP.6 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 can apply to this option if they have earned 90 undergraduate credits with an overall GPA of at least 3.30. Students must have successfully completed:

Code	Title	Credits
CS 310	Data Structures	3
CS 330	Formal Methods and Models	3
CS 367	Computer Systems and Programming	4
Total Credits		10

**Accelerated Option Requirements**

Students have the opportunity to earn 3-6 credits in graduate coursework that count towards both the BS and MS degrees.

Students may register for 3-6 credits of the following CS 500-level courses in place of the corresponding CS 400-level courses required for the BS degree. Specifically, students must take

Code	Title	Credits
CS 540	Language Processors	3
CS 550	Database Systems	3
CS 551	Computer Graphics	3
CS 555	Computer Communications and Networking	3
CS 571	Operating Systems	3
CS 580	Introduction to Artificial Intelligence	3
CS 583	Analysis of Algorithms	3
CS 584	Theory and Applications of Data Mining	3

Note:

Students complete all MS in Information Systems core courses and apply the two courses from above toward the elective requirements. Students also have the option to take up to 6 additional credits of graduate coursework, which serve as reserve graduate credit to be counted towards the MS degree only.

### 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 that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.

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

### Overview

Highly-qualified students in the Information Technology, BS (<http://catalog.gmu.edu/colleges-schools/engineering/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/information-sciences-technology/information-technology-bs/>) program may apply to this option if they have earned 90 undergraduate 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 up to 6 overlapping credits chosen from the following two courses:

Code	Title	Credits
CS 550	Database Systems (satisfies IT 414 requirement in the BS program)	3

INFS 622	Information Systems Analysis and Design (satisfies as one DTP concentration course in the BS program)	3
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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 as part of their concentration requirements in the BS program.

### 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 that is submitted to the Office of the University Registrar and the VSE Graduate Admissions Office. At the completion of MS requirements, a master's degree is conferred.