SOFTWARE ENGINEERING, MS

Banner Code: EC-MS-SWE

Academic Advising

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The MS in Software Engineering (MS-SWE) prepares students to become leaders in engineering high quality, large scale, computing solutions to real life problems. Software engineering spans all aspects of developing software, including requirements analysis, design, construction, testing, usability, security, maintenance, and economics. Software engineering spans all types of software, including mobile and web applications, software services, enterprise software, and large complex systems. We revise courses regularly to keep up with changes in software engineering.

The MS-SWE program emphasizes pragmatic problem solving that addresses reliability, usability, future growth, security, cost, and efficiency. Graduates go on to technical leadership positions such as engineering lead, software architect, director of engineering, and CTO, as well as managerial and executive positions. MS-SWE students come from a diversity of undergraduate backgrounds, including computer science, engineering, mathematics, sciences, and business. The DC area has one of the largest collections of software companies in the world and the workforce is constantly growing, making our graduates in very high demand. Many MS-SWE students work full-time at companies that are constantly hiring, making every class meeting a mini-job fair. All classes are scheduled in the late afternoon to accommodate part-time students.

Admissions & Policies

Admissions
Application Requirements

In addition to general admission requirements (https://www.gmu.edu/admissions-aid/apply-now/how-apply/graduate/) of the university, applicants must have earned a GPA of 3.00 or better on a 4.0 scale in the last 60 credits of their baccalaureate degree. Other requirements are as follows:

- A one-page statement of educational and career goals
- Current resume
- Internationally-educated students must submit their English Proficiency scores (https://www2.gmu.edu/admissions-aid/how-apply/graduate/standardized-test-information/)

Admissions Requirements

To succeed in graduate courses, applicant's baccalaureate degree must include the following subjects:

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. **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:

- 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. **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. **Object-oriented programming**
     - **GMU CS:** CS 211 Object-Oriented Programming
     - **GMU IT:** IT 206 Object Oriented Techniques for IT Problem Solving
     - **NVCC:** CSC 202
  c. **Data structures and algorithms**
     - **GMU CS:** CS 310 Data Structures
     - **GMU IT:** IT 306 Data Structures and Algorithms in Java or IT 309 Data Structures and Algorithms in Python
     - **NVCC:** None
  d. **Computer systems**
     - **GMU CS:** CS 367 Computer Systems and Programming or CS 465 Computer Systems Architecture.
     - **GMU IT:** IT 342 Operating Systems Fundamentals.
     - **NVCC:** None
  e. **Discrete mathematics**
     - **GMU Math:** MATH 125 Discrete Mathematics I (Mason Core) (http://catalog.gmu.edu/mason-core/)
     - **NVCC:** MATH 288
- Alternatively, students may take equivalent courses after their undergraduate program and before applying to the MSCS program, and submit appropriate transcripts. George Mason's School of Computing offers the following bridge foundation courses, which students can use to bridge into the MS SWE program:
  a. Introductory and object-oriented programming: COMP 501 Computer Programming Foundations I
  b. Data structures and algorithms: COMP 511 Computer Programming Foundations II
  c. Computer Systems: COMP 503 Computer Systems Foundations I
  d. Discrete mathematics: COMP 502 Mathematical Foundations of Computing I

  The bridge courses may be taken by students in provisional status, while enrolled in the Foundations of Computer (bridge) Certificate program, while in non-degree status, or while in another graduate program at Mason. Students who earn a B or better in all bridge courses they did not have in their undergraduate degree can then apply for full admission into the MS SWE program.

- Alternatively, students may attempt 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 join the Computing Foundations (bridge) Certificate program, and re-apply after completing the needed courses.

Policies

Program Requirements

In addition to the general requirements of the university, the MS in Software Engineering requires a minimum of 30 graduate credits. The coursework is divided into three categories: 12 credits of core courses, 9 credits of software engineering-related courses, and 9 credits of elective courses.

Advising

The department holds orientation meetings at the beginning of each semester to advise incoming 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 advising services to students. Initial and procedural inquiries can be submitted to csgrad@gmu.edu. Each student is assigned a faculty advisor with whom to confer on matters related to degree requirements.

Requirements

Degree Requirements

Total credits: 30

Students must complete 30 approved graduate credits (10 courses), divided into core (required) courses, software engineering related courses, and constrained electives.

Core Courses

Code	Title	Credits
SWE 619	Object-Oriented Software Specification and Construction	3
SWE 621	Software Design and Architecture	3
SWE 632	User Interface Design and Development	3
SWE 637	Software Testing	3
Total Credits		12

Software Engineering Related Courses

Code	Title	Credits
Students must take three courses from the following list:		9
Software Engineering		
Any SWE course at the 600-level or above. (http://catalog.gmu.edu/courses/swe/)		
Computer Science		
CS 540	Language Processors	
CS 550	Database Systems [1]	
CS 555	Computer Communications and Networking	
CS 571	Operating Systems	
CS 580	Introduction to Artificial Intelligence	
CS 584	Theory and Applications of Data Mining	
CS 675	Distributed Systems [2]	
CS 678	Advanced Natural Language Processing	
Information Security and Assurance		
ISA 562	Information Security Theory and Practice	
ISA 650	Security Policy	
ISA 673	Operating Systems Security	
Information Systems		
INFS 740	Database Programming for the World Wide Web	
Operations Research		
OR 542	Operations Research: Stochastic Models	
Applied Information Technology		
AIT 716	Advanced Human Computer Interaction (Applied Information Technology)	
Total Credits		9

[1]   Credit will not be given for both SWE 622 and CS 675.

Research Option

With the consent of a faculty sponsor and program director, students may complete a 6-credit thesis as part of the electives.

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.

Code	Title	Credits
List of allowed electives:		9
All Software Engineering (SWE) courses at the 600-level or above. (http://catalog.gmu.edu/courses/swe/)		
All Computer Science (CS) courses numbered 530 or above. (http://catalog.gmu.edu/courses/cs/)		
All Information Security and Assurance (ISA) courses at the 500-level or above. (http://catalog.gmu.edu/courses/isa/)		
All Information Systems (INFS) courses at the 600-level or above. (http://catalog.gmu.edu/courses/infs/)		
Any of the following Electrical and Computer Engineering courses:		
ECE 542	Computer Network Architectures and Protocols	

ECE 612	Real-Time Embedded Systems	
Any of the following Operations Research courses:		
OR 531	Introduction to Analytics and Modeling	
OR 541	Operations Research: Deterministic Models	
OR 542	Operations Research: Stochastic Models	
Any of the following Statistics courses:		
STAT 544	Applied Probability	
STAT 554	Applied Statistics I	
Any of the following Systems Engineering courses:		
SYST 560	Introduction to Air Traffic Control	
SYST 659	Topics in Systems Engineering	
SYST 680	Principles of Command, Control, Communications, Computing, and Intelligence (C4I)	
Any of the following Psychology courses:		
PSYC 530	Cognitive Engineering: Cognitive Science Applied to Human Factors	
PSYC 734	Seminar in Human Factors and Applied Cognition	
Total Credits		9

Accelerated Master's

Applied Computer Science, BS/Software Engineering, 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/) can complete both a BS-ACS and a Software Engineering, MS in five years through the BS-MS accelerated (BAM) program.

General BAM policies are in the catalog under AP.6.7 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 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-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	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 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.

Computer Science, BS/Software Engineering, Accelerated MS

Overview

Highly-qualified students in the Computer Science, BS (http://catalog.gmu.edu/colleges-schools/engineering-computing/school-computing/computer-science/computer-science-bs/) program can complete both a BS-CS and a Software Engineering, MS in five years through the BS-MS accelerated (BAM) program.

General BAM policies are in the catalog under AP.6.7 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 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-computing/school-computing/computer-science/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	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 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.

Information Technology, BS/Software Engineering, 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 Software Engineering, 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 criteria for admission to the Software Engineering, 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.