SOFTWARE ENGINEERING

This degree program is available both on campus and online.

Admission

Applicants for the MS in Software Engineering are required to meet the following requirements:

1. A bachelor's degree from an accredited institution with a grade point average of *B* or better. An applicant with a lower GPA may be granted conditional. Preference will be given to applicants with backgrounds in computing, engineering, mathematics, or science.
2. Satisfactory completion of the following:
   a. Calculus I & II
   b. One course in probability and statistics or linear algebra)
   c. Programming Language (Preferably C/C++ I & II)
   d. One course in data structures with algorithm analysis
   e. One course in microprocessors
   f. One course in computer architecture
   g. One course in operating systems

Note: Students may be admitted conditionally to make up deficiencies in 2(A-G). above. The software engineering prerequisites may be completed after admission into the program on a "conditional lack of preparation" basis **or substituted by two or more years of full-time professional experience in sizeable software development projects.** The program committee will determine any decision on substitutions. The applicant will be required to complete the appropriate courses within two years from the date of entrance. Prerequisite courses will not earn credit towards the MS – Software Engineering degree.

3.Two letters of recommendation, with at least one from a person familiar with the candidate's academic performance, are required. Copies of the applicant's undergraduate transcripts and degree must be submitted.

Degree Requirements

The MS degree in Software Engineering is a 30-credit hour graduate program. Students admitted to the program are required to complete the approved graduate courses with a cumulative grade point average of *B* or better. The program of study consists of core courses, concentration courses, and the thesis/project/coursework option.

Please contact the Computer and Information Science Department about the policy on the minimum grade for a course to satisfy graduation requirements.

Advanced Standing

Up to six graduate credit hours (grade of *B* or better) may be transferred from another accredited institution. Students may transfer up to one-half (1/2) the minimum number of credit hours required for their master's or professional degree from University of Michigan campuses (including Dearborn, Ann Arbor, Flint).

A student is expected to complete all work within five years from the date of first enrollment in the master's program. A student who fails to complete requirements within five years may be withdrawn and required to apply for readmission. Students exceeding this limit must submit a petition (https://umdearborn.edu/students/academic-advising/student-petitions/)requesting additional time to complete the program. Petitions must describe in detail the amount of work remaining and a timeline for completion. You can review this policy and more on the Graduate Academic Policies page: http://catalog.umd.umich.edu/academic-policies-graduate/

Program Requirements

The 30 semester hours of required coursework are distributed as follows:

Code	Title	Credit Hours
Core Courses		15
Application Courses		9
Coursework/Project/Thesis		6
Total Credit Hours		**30**

Code	Title	Credit Hours
Core Courses		
All of the following ECE courses:		
ECE 554	Embedded Systems	3
ECE 574	Adv Sftwr Techng in Eng Appl	3
Three (3) out of the following six (6) CIS courses:		9
CIS 549	Software Security	
CIS 553	Software Engineering	
CIS 565	Software Quality Assurance	
CIS 566	Software Architecture and Design Patterns	
CIS 575	Software Engineering Mgmt	
CIS 580	Data Analytics in Software Engineering	
Application Courses		
Choose three courses from one of the following application areas:		9
Web Engineering:		
CIS 525	Web Technology	
CIS 534	Semantic Web	
CIS 536	Text Mining and Information Retrieval	
CIS 540	Foundation of Information Security	
CIS 544	Computer and Network Security	
CIS 549	Software Security	
CIS 559	Principles of Social Network Science	
CIS 562	Web Information Management	
CIS 565	Software Quality Assurance	
CIS 566	Software Architecture and Design Patterns	
CIS 571	Web Services	
CIS 577	S/W User Interface Dsgn&Analys	
CIS 580	Data Analytics in Software Engineering	
CIS 584	Advanced Computer and Network Security	
CIS 589	Edge Computing	
CIS 678	Research Advances in Software Engineering	
ECE 528	Cloud Computing	
ECE 570	Computer Networks	
Game Engineering:		
CIS 515	Computer Graphics	
CIS 552	Information Visualization and Virtualization	
CIS 553	Software Engineering	
CIS 575	Software Engineering Mgmt	

CIS 577	S/W User Interface Dsgn&Analys
CIS 579	Artificial Intelligence
CIS 580	Data Analytics in Software Engineering
CIS 587	Computer Game Design and Implementation
CIS 588	Computer Game Design II
CIS 652	Advanced Information Visualization and Virtualization
CIS 678	Research Advances in Software Engineering
ECE 524	Interactive Media
ECE 579	Intelligent Systems
ECE 5251	MM Design Tools I
ECE 5252	MM Design Tools II
Data Engineering and Analytics:	
CIS 536	Text Mining and Information Retrieval
CIS 540	Foundation of Information Security
CIS 545	Data Security and Privacy
CIS 549	Software Security
CIS 556	Database Systems
CIS 5570	Introduction to Big Data
CIS 562	Web Information Management
CIS 568/ ECE 537	Data Mining
CIS 579	Artificial Intelligence
CIS 5700	Advanced Data Mining
CIS 580	Data Analytics in Software Engineering
CIS 583	Deep Learning
CIS 585	Advanced Artificial Intelligence
CIS 586	Advanced Data Management
CIS 658	Research Advances in Data Management
CIS 678	Research Advances in Software Engineering
ECE 525	Multimedia Data Stor & Retr
ECE 576	Information Engineering
ECE 579	Intelligent Systems
Information and Knowledge Engineering:	
CIS 511	Introduction to Natural Language Processing
CIS 536	Text Mining and Information Retrieval
CIS 540	Foundation of Information Security
CIS 549	Software Security
CIS 5570	Introduction to Big Data
CIS 559	Principles of Social Network Science
CIS 562	Web Information Management
CIS 568/ ECE 537	Data Mining
CIS 5700	Advanced Data Mining
CIS 574	Compiler Design
CIS 579	Artificial Intelligence
CIS 580	Data Analytics in Software Engineering
CIS 581	Computational Learning
CIS 583	Deep Learning
CIS 585	Advanced Artificial Intelligence
CIS 586	Advanced Data Management
CIS 678	Research Advances in Software Engineering
CIS 679	Research Advances in Computational Game Theory and Economics
ECE 5251	MM Design Tools I
ECE 527	Multimedia Secur & Forensics
ECE 531	Intelligent Vehicle Systems
ECE 537	Data Mining
ECE 552	Fuzzy Systems
ECE 576	Information Engineering
ECE 577	Engineering in Virtual World
ECE 579	Intelligent Systems
ECE 583	Artificial Neural Networks
ECE 588	Robot Vision
Mobile and Cloud Computing:	
CIS 535	Wireless Technologies and Pervasive Computing
CIS 537	Advanced Networking and Distributed Systems
CIS 546	Security and Privacy in Wireless Networks
CIS 548	Security and Privacy in Cloud Computing
CIS 550	Object-Oriented Programming and Its Applications
CIS 553	Software Engineering
CIS 565	Software Quality Assurance
CIS 566	Software Architecture and Design Patterns
CIS 589	Edge Computing
CIS 647	Research Advances in Networking and Distributed Systems
CIS 676	Soft Arch Des & Analysis
ECE 528	Cloud Computing
ECE 535	Mob Dev & Ubiqys Comp Sys
ECE 570	Computer Networks
ECE 5701	Intro to Wireless Comm
Embedded Systems	
CIS 525	Web Technology
CIS 527	Computer Networks
CIS 535	Wireless Technologies and Pervasive Computing
CIS 537	Advanced Networking and Distributed Systems
CIS 546	Security and Privacy in Wireless Networks
CIS 566	Software Architecture and Design Patterns
CIS 569	Wireless Sensor Networks
CIS 575	Software Engineering Mgmt
CIS 589	Edge Computing
ECE 505	Intro to Embedded Systems
ECE 535	Mob Dev & Ubiqys Comp Sys
ECE 5541	Embedded Networks
ECE 5542	Embedded Sig Proc and Control
ECE 5752	Reconfigurable Computing
Coursework/Project/Thesis Option	
Select six credit hours	6
Total Credit Hours	**30**

A student may elect the application area of his or her choice from CIS or ECE courses with the approval of the advisor. A course cannot be used as both core and application courses.

A student must choose one of the three options:

Option 1: Coursework. Students desiring to obtain deep/broad knowledge are encouraged to take two elective courses (6 credits) listed above that are not used to satisfy your core or application requirements.

Option 2: Project. Students desiring to obtain project experience are encouraged to elect the directed studies ECE 591/CIS 591 (3 credit hours), or Project Course ECE 695/CIS 695 (3 credit hours) to work under the supervision of a faculty advisor, and take one additional 3-credit course listed in the Core Courses section and the Application Courses section , or any other CIS/ECE course related to the students' project and approved by the graduate program advisor.

Option 3: Thesis. Students desiring to obtain research experience are encouraged to elect the thesisECE 699/CIS 699 (6 hours) and work under the supervision of a faculty advisor.

Master's Thesis Committee

A Master's thesis committee consists of three full-time CIS or ECE faculty members, one of whom is the thesis advisor and requires the approval of the Software Engineering graduate committee. When deemed appropriate, the chair of the graduate committee may request the presence of an additional member from outside CIS or ECE.

Preparatory Courses

Students with inadequate background in CIS or CE may be required to meet with the department graduate advisor to determine the need for preparatory courses and to determine what courses to take prior to consideration into the Masters program.

For further information contact:

Department of Computer and Information Science
University of Michigan-Dearborn, 4901 Evergreen Road
Room 105 CIS, Dearborn, MI 48128-2406
Tel: 313-436-9145 Fax: 313-593-4256
E-mail: umd-cisgrad@umich.edu

Software Engineering provides a systematic, disciplined, and quantifiable approach to the development, operation, and maintenance of software. The program includes core engineering courses plus electives chosen from a graduate introduction to software engineering, software reliability, management, interface design, and case studies. (12 credit hours)

Certificate offered on Campus and via Distance Learning

Program Requirements

Core Courses

Code	Title	Credit Hours
CIS 553	Software Engineering	3
ECE 554	Embedded Systems	3

Additional Coursework

Code	Title	Credit Hours
Complete 2 courses from the following (6 credits):		
CIS 505	Algorithm Analysis and Design	3
CIS 565	Software Quality Assurance	3
CIS 575	Software Engineering Mgmt	3
CIS 577	S/W User Interface Dsgn&Analys	3
CIS 580	Data Analytics in Software Engineering	3
ECE 537	Data Mining	3
ECE 552	Fuzzy Systems	3
ECE 574	Adv Sftwr Techng in Eng Appl	3
ECE 576	Information Engineering	3
ECE 5831	Pat Rec & Neural Netwks	3

Learning Goals

1. Students will be able to use mathematical and scientific techniques to solve software engineering problems.
2. Students will be able to formulate problems, design experiments, collect, verify, validate, analyze, and interpret data and use this knowledge to design a reliable system, component, or process to meet requirements.
3. Students will be able to use the techniques, skills, and modern software tools necessary for reliable and robust software engineering practice.
4. Students will be able to recognize a problem, evaluate different methods and use software engineering principles to derive a feasible solution.