APPLIED AND COMPUTATIONAL MATHEMATICS

The Applied and Computational Mathematics (ACM) Master's program provides graduate-level education in applied mathematics. The program develops the principles of applied mathematics and statistics, and provides students with the skills to employ those principles in industrial or scientific settings. It has three central themes: general principles and theories of applied mathematics and statistics, the construction and analysis of mathematical and statistical models, and the development and efficient execution of computational mathematical algorithms. Effective use of advanced applied mathematical techniques has become increasingly important in industrial and scientific settings as the amount of sophisticated simulation software and specialized open-source packages has greatly increased. Professionals are needed to assist engineers, scientists and managers in the precise formulation of complex problems and in selecting the analytical methods and software appropriate for their solutions. These professionals should understand the algorithms underlying mathematical software and be able to implement additional mathematical algorithms knowledgeably and efficiently in the framework of existing software. Finally, these professionals need to interpret the results of computations for others. It is the goal of the program to equip students with these skills so that they will become professionals in the needed fields.

The Program

The key components of this evening/late-afternoon program involve the integration of applied mathematics, mathematical modeling, numerical analysis and statistics. The ACM program provides not only coursework in various areas of applied mathematics, but also opportunities for independent or collaborative work. These approaches to learning contribute to a student's outlook and depth of understanding. The program supports the development and enhancement of students' skills in high-demand industrial and scientific careers, and in other careers that primarily focus on applied mathematics. It is geared toward three groups of prospective students: individuals in established careers who want or require further training for their current positions, individuals in the workforce who wish to retrain for new career directions, in some cases preparing for a more mathematically-oriented assignment with their current employer, and recent graduates who desire a deeper understanding of applied mathematics to help in launching a career.

Admission and Prerequisites

Admission to the ACM program as a regular student requires a B.A. or a B.S. degree in mathematics, statistics, computer and information science, engineering, a physical science or a life science, earned in a program at an accredited institution with an average grade of *B* or better. Individuals with degrees in other fields not listed above or with grades less than a *B* average may be considered for conditional admission and may be required to submit evidence of potential for success in the ACM program. An entering student must have completed three courses in Calculus, including multivariate Calculus, plus an introductory course in Linear Algebra (or a combined course in Differential Equations with Linear Algebra) and an introductory course in Probability or Statistics. In exceptional cases, an applicant may be admitted without some prerequisite courses. If an applicant is admitted to the program without some prerequisite courses, the applicant must make up the missing prerequisites after entrance to the Graduate Program. However, credits received in courses elected to make up the missing prerequisites do not count toward the degree.

See the application instructions for information in how to apply (https://umdearborn.edu/admissions-aid/graduate-admissions/how-apply/).

A complete application consists of the following:

1. Official transcripts from all universities and colleges attended.
2. A one-page statement of purpose stating the applicant's career goals and personal objectives in pursuing the program.
3. Two letters of recommendation are required. At least one letter must address the applicant's academic background.
4. Students whose native language is not English are also required to satisfy the English Language Requirements for Admission which can be found in the General Information section of this catalog.

For more information, visit the ACM website (https://umdearborn.edu/casl/graduate-programs/programs/master-science-applied-and-computational-mathematics/) or call 313-583-6321.

Undergraduate students admitted to the Applied and Computational Mathematics 4+1 option may count 16 credits in the graduate program toward their undergraduate Mathematics degree. At least one additional year of graduate work after completing their undergraduate degree would be needed to complete the rest of the ACM's degree requirements. Undergraduate students interested in the 4+1 option are strongly encouraged to apply in their sophomore year and start the program in their junior year.

Advanced Standing

Up to 9 credit hours, or their equivalent, toward the degree may be granted by the Graduate Program Committee to a student through the transfer of credit for approved graduate-level courses. These courses must have been completed within the past five years with a grade of B or better at an accredited institution with graduate degree programs and not have been applied in whole or in part toward another degree or certificate.

Graduate credit may be transferred from other University of Michigan campuses (Flint or Ann Arbor) for up to half of the credits required for the degree.

Major Requirements

Minimum of 30 semester hours of graduate course work with a cumulative grade point average of B or better.

The minimum of 30 hours must be selected from approved courses listed below and be approved by the student's graduate advisor. At least 15 credit hours of the courses must be in Mathematics and Statistics.

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In addition to the specific degree requirements listed here, the general Master's degree policies and requirements (http://catalog.umd.umich.edu/academic-policies-graduate/) also apply.

Code	Title	Credit Hours
Core Courses		
All of the following are required (9 credits):		
MATH 525	Statistical Inference [1,2]	3
or STAT 530	Applied Regression Analysis	
MATH 562	Mathematical Modeling [1]	3
MATH 572	Introduction to Computational Mathematics [1]	3
Total Credit Hours		**9**

Code	Title	Credit Hours
Electives		
Select four courses from the following (12-13 credits):		12-13
MATH 504	Dynamical Systems [3]	
MATH 520	Stochastic Processes [1]	
MATH 523	Applied Linear Algebra [1]	
MATH 525	Statistical Inference [1]	
MATH 551	Advanced Calculus [1]	
MATH 554	Fourier Series and Boundary Value Problems [2]	
MATH 555	Functions of a Complex Variable with Applications [2]	
STAT 530	Applied Regression Analysis [2]	
STAT 531	Machine Learning and Computational Statistics [2]	
STAT 540	Design and Analysis of Experiments [2]	
STAT 560	Time Series Analysis [2,3]	
Total Credit Hours		**12-13**

1 Students enrolled in the 4+1 option can double count Math 520, MATH 523, MATH 525, MATH 551, Math 562, and Math 572 toward both undergraduate math degree and ACM degree.

2 Students enrolled in the 4+1 option can double count toward both undergraduate math degree and ACM degree one course from Math 554 and Math 555, and one course from Stat 530, STAT 531, Stat 540, and Stat 560. Alternatively, two courses from Stat 530, STAT 531, Stat 540, and Stat 560 can be double counted.

3 Offered infrequently.

Code	Title	Credit Hours
Independent Research Project		
Three credits from one of the following:		3
MATH 599	Independent Research Project	
or STAT 599	Independent Research Project	
Total Credit Hours		**3**

Code	Title	Credit Hours
Cognate Courses		
Two courses or 6 credit hours of cognates outside the Department of Mathematics and Statistics should be selected from the list of preapproved courses below. Some of these courses have additional prerequisites. Other cognates are possible with the approval of the graduate director [4]		6

Computer and Information Science	
CIS 505	Algorithm Analysis and Design
CIS 511	Introduction to Natural Language Processing
CIS 515	Computer Graphics and Visual Computing
CIS 527	Computer Networks
CIS 536	Text Mining and Information Retrieval
CIS 537	Advanced Networking and Distributed Systems
CIS 544	Computer and Network Security
CIS 545	Data Security and Privacy
CIS 551	Advanced Computer Graphics
CIS 552	Information Visualization with Parallel Computing
CIS 553	Software Engineering
CIS 556	Database Systems
CIS 5570	Introduction to Big Data
CIS 560	Electronic Commerce
CIS 568	Data Mining
CIS 5700	Advanced Data Mining
CIS 572	Object Oriented Systems Design
CIS 574	Compiler Design
CIS 575	Software Engineering Mgmt
CIS 579	Artificial Intelligence
CIS 583	Deep Learning
CIS 585	Advanced Artificial Intelligence
CIS 586	Advanced Data Management
CIS 652	Advanced Information Visualization and Virtualization
CIS 658	Research Advances in Data Management
Economics	
ECON 5015	Introduction to Econometrics
Electrical and Computer Engineering	
ECE 500	Math Mthds for Elec & Comp Eng
ECE 5001	Analytic and Comp Math
ECE 507	Intro to Multimedia Sys
ECE 524	Interactive Media
ECE 527	Multimedia Secur & Forensics
ECE 528	Cloud Computing
ECE 537	Data Mining
ECE 542	Intr to Pwr Mgmt & Reliability
ECE 545	Intro Robot Syst
ECE 552	Fuzzy Systems
ECE 5544	Intro. to CPS Security
ECE 555	Stochastic Processes
ECE 560	Modern Control Theory
ECE 565	Digital Control Systems
ECE 567	Nonlinear Control Systems
ECE 579	Intelligent Systems
ECE 580	Digital Signal Processing
ECE 583	Artificial Neural Networks
ECE 5831	Pat Rec & Neural Netwks
ECE 585	Pattern Recognition
ECE 589	Multidimen Digital Signal Proc
ECE 665	Optimal Control Systems

Industrial and Manufacturing Systems Engineering	
IMSE 500	Models of Oper Research
IMSE 505	Optimization
IMSE 510	Probability & Statistical Mod
IMSE 511	Design and Analysis of Exp
IMSE 514	Multivariate Statistics
IMSE 520	Managerial Decision Analysis
IMSE 550	Data Management
IMSE 564	Applied Data Analytics and Modeling for Enterprise Systems
IMSE 567	Reliability Analysis
IMSE 586	Big Data Aanal & Visuliztn
IMSE 605	Advanced Optimization
IMSE 606	Advanced Stochastic Processes
Management	
DS 570	Prescriptive Business Analytics
OM 521	Operations Management
OM 660	Supply Chain Analytics
Mechanical Engineering	
ME 510	Finite Element Methods
ME 518	Advanced Engineering Analysis
ME 525	Computational Fluid Mechanics and Heat Transfer
Physics	
PHYS 503	Electricity & Magnetism
PHYS 553	Quantum Mechanics
Total Credit Hours	**6**

[4] Exceptions can be made to use a course not from the above list as a cognate course. For such an exception, the student is required to receive an approval from the ACM Program Advisor by petition **prior to** registering the course.

Learning Goals

1. Comprehension of the principles and theories of applied mathematics and statistics.
2. Skill in the construction and analysis of mathematical models.
3. Skill in the analysis and development of efficient computational mathematical algorithms
4. Ability to apply the first three items in industrial and scientific settings.