

APPLIED MATHEMATICS, MS

Graduate School Policies and Procedures (<http://catalog.ucdenver.edu/cu-denver/graduate/graduate-school-policies-procedures/>) apply to this program.

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Introduction

Our MS in Applied Mathematics program offers a general degree in applied mathematics along with specialization opportunities in many areas including:

- Applied probability
- Applied statistics
- Discrete mathematics
- Mathematics of engineering and science
- Numerical analysis
- Operations research

Students in all areas are exposed to a variety of coursework and have the opportunity to participate in real-world research and consulting through our innovative Math Clinic and Statistical Consulting. Whatever specialization students choose, graduates with an applied mathematics degree will be prepared for a multitude of careers.

See our degree requirements section for further information about our concentration areas.

These program requirements are subject to periodic revision by the academic department, and the College of Liberal Arts and Sciences reserves the right to make exceptions and substitutions as judged necessary in individual cases. Therefore, the College strongly urges students to consult regularly with their program advisor and CLAS advisor to confirm the best plans of study before finalizing them.

Program Requirements

A student may devote from up to 6 hours (of the 30 required hours) to the writing of a thesis. Following completion of course work, all candidates must make a one-hour oral presentation of a project or a thesis before a committee consisting of three graduate faculty members.

1. Students must complete a minimum of 30 MATH credit hours.
2. Students must complete a minimum of 27 graduate (5000-level or higher) credit hours.
3. Students must earn a minimum grade of B- (2.7) in all other courses taken at CU Denver and must achieve a minimum cumulative GPA of 3.0. All graded attempts in required and elective courses are calculated in the program GPA. Students cannot complete program or ancillary course requirements as pass/fail.
4. Students must complete all coursework with CU Denver faculty.

Program Restrictions, Allowances and Recommendations

1. The remaining 6 hours must be either mathematics courses numbered 5000 or above or approved courses outside the department numbered 4000 or above.
2. Up to 9 semester hours of prior course work may be transferred in (subject to approval); these must be at the 5000 level or above with a B- or better grade. Courses already applied toward another degree (graduate or undergraduate) cannot be used toward the MS degree in applied mathematics.
3. The following MATH courses will **not** count toward a graduate degree: MCKE 5000 Algebraic Patterns and Functions I-MCKE 5009 Math Modeling—Using and Applying Math, MATH 5010 History of Mathematics, MATH 5012 An Advanced Perspective on Number and Operation-MATH 5015 Capstone Course for Secondary Teachers, MATH 5017 Topics in Mathematics for Teachers, MATH 5198 Mathematics for Bioscientists, and MATH 5830 Applied Statistics.

Required Courses

Code	Title	Hours
<i>Take the following</i>		6
Analysis Core Requirement		
MATH 5070	Applied Analysis	3
	or MATH 6131 Real Analysis	
Linear Algebra Core Requirement		
MATH 5718	Applied Linear Algebra	3

The following course requirements must be satisfied by all students in the MS in Applied Mathematics Program.

Electives

Code	Title	Hours
<i>Take at least 24 additional graduate level semester hours of MATH coursework.</i> ¹		24

A student must either satisfy the course requirements for the MS degree without a concentration area or satisfy the requirements in one of the concentration areas listed below. Unless noted elsewhere, one course cannot be used to fulfill two requirements. Substitutions or changes to the requirements may be made with the written approval of a student's academic advisor and the Graduate Committee.

A student may devote from 4 to 6 hours (of the 30 required hours) to the writing of a thesis. Following completion of course work, all candidates must make a one-hour oral presentation of a project or a thesis before a committee consisting of three graduate faculty members.

¹ The following MATH courses will **not** count toward a graduate degree: MCKE 5000 Algebraic Patterns and Functions I-MCKE 5009 Math Modeling—Using and Applying Math, MATH 5010 History of Mathematics, MATH 5012 An Advanced Perspective on Number and Operation-MATH 5015 Capstone Course for Secondary Teachers, MATH 5017 Topics in Mathematics for Teachers, MATH 5198 Mathematics for Bioscientists, and MATH 5830 Applied Statistics.

MS Degree without a Concentration Area

Note that MATH 6131 Real Analysis can be used to satisfy both the analysis core requirement and may also count as one of the three courses satisfying this requirement.

Code	Title	Hours
<i>Students must complete at least three of the following courses:</i>		9
MATH 5135	Functions of a Complex Variable	3
MATH 5310	Probability	3
MATH 5320	Statistical Inference	3
MATH 5490	Network Flows	3
MATH 5593	Linear Programming	3
MATH 6023	Topics in Discrete Math	3
MATH 6101	Uncertainty Quantification	3
MATH 6131	Real Analysis	3
MATH 6330	Workshop in Statistical Consulting	3
MATH 6360	Exploratory Data Analysis	3
MATH 6376	Statistical Computing	3
MATH 6380	Stochastic Processes	3
MATH 6384	Spatial Data Analysis	3
MATH 6388	Statistical and Machine Learning	3
MATH 6395	Multivariate Methods	3
MATH 6398	Calculus of Variations and Optimal Control	3
MATH 6404	Applied Graph Theory	3
MATH 6595	Nonlinear Programming	3
MATH 6653	Introduction to Finite Element Methods	3
MATH 6735	Continuum Mechanics	3
MATH 6960	Research Methods in Mathematics and Statistics	3

Additional course options may be added later at the discretion of the Department of Mathematical and Statistical Sciences, e.g., as new courses are introduced to the graduate program.

Applied Statistics Concentration

Code	Title	Hours
<i>Take all of the following courses:</i>		15
MATH 5310	Probability	3
MATH 5320	Statistical Inference	3
MATH 5387	Applied Regression Analysis	3
MATH 6330	Workshop in Statistical Consulting	3
<i>And, take one of the following courses:</i>		3
MATH 5394	Experimental Designs	3
MATH 5792	Probabilistic Modeling	3
MATH 6101	Uncertainty Quantification	3
MATH 6376	Statistical Computing	3
MATH 6380	Stochastic Processes	3
MATH 6384	Spatial Data Analysis	3
MATH 6388	Statistical and Machine Learning	3
MATH 7384	Mathematical Probability	3
MATH 7386	Monte Carlo Methods	3
MATH 7393	Bayesian Statistics	3
MATH 7826	Topics in Probability and Statistics	3

Any additional course given prior approval by the student's advisor and the Director of the Program in Statistics.

Applied Probability Concentration

Code	Title	Hours
<i>Take all of the following courses:</i>		12
MATH 5310	Probability	3
MATH 5792	Probabilistic Modeling	3
MATH 6380	Stochastic Processes	3
<i>And, take one of the following courses:</i>		3
MATH 6101	Uncertainty Quantification	3
MATH 6131	Real Analysis	3
MATH 7386	Monte Carlo Methods	3

Discrete Mathematics Concentration

Code	Title	Hours
<i>Four of the following courses:</i>		12
MATH 5490	Network Flows	3
MATH 5793	Discrete Math Modeling	3
MATH 6404	Applied Graph Theory	3
MATH 7405	Advanced Graph Theory	3
MATH 7409	Applied Combinatorics	3
MATH 7410	Combinatorial Structures	3
MATH 7413	Modern Algebra I	3
MATH 7821	Topics in Projective Geometry	3
MATH 7823	Topics in Discrete Math	3

Mathematics of Engineering and Science Concentration

Code	Title	Hours
<i>Three of the following courses:</i>		9
MATH 5387	Applied Regression Analysis	3
MATH 5779	Math Clinic	3
MATH 5791	Continuous Modeling	3
MATH 5792	Probabilistic Modeling	3
MATH 5793	Discrete Math Modeling	3
MATH 5794	Optimization Modeling	3
MATH 6735	Continuum Mechanics	3
<i>And, take two of the following courses:</i>		6
MATH 5660	Numerical Analysis I	3
MATH 5661	Numerical Analysis II	3
MATH 5733	Partial Differential Equations	3
MATH 6101	Uncertainty Quantification	3
MATH 6653	Introduction to Finite Element Methods	3
MATH 7386	Monte Carlo Methods	3
MATH 7665	Numerical Linear Algebra	3

Numerical Analysis Concentration

Code	Title	Hours
<i>Take all of the following courses:</i>		6
MATH 5660	Numerical Analysis I	3
MATH 5661	Numerical Analysis II	3
<i>And, take three of the following courses:</i>		9
MATH 5593	Linear Programming	3

MATH 5733	Partial Differential Equations	3
MATH 6101	Uncertainty Quantification	3
MATH 6595	Nonlinear Programming	3
MATH 7386	Monte Carlo Methods	3
MATH 7665	Numerical Linear Algebra	3
MATH 8660	Mathematical Foundations of Finite Element Methods	3

Operations Research Concentration

Code	Title	Hours
<i>Take all of the following courses:</i>		6
MATH 5593	Linear Programming	3
MATH 5792	Probabilistic Modeling	3
	or MATH 6380 Stochastic Processes	
<i>And, take two of the following courses:</i>		6
MATH 5390	Game Theory	3
MATH 5490	Network Flows	3
MATH 5779	Math Clinic (with approval)	3
MATH 5794	Optimization Modeling	3
MATH 6595	Nonlinear Programming	3
MATH 7593	Advanced Linear Programming	3
MATH 7594	Integer Programming	3
MATH 7595	Advanced Nonlinear Programming	3
MATH 7825	Topics in Optimization	3

To learn more about the Student Learning Outcomes for this program, please visit our website (<https://clas.ucdenver.edu/mathematical-and-statistical-sciences/ms-applied-mathematics-program-goals-objectives/>).