

# ECONOMICS MA/APPLIED MATHEMATICS MS DUAL DEGREE, WITH A FOCUS IN APPLIED STATISTICS

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

## Introduction

**Graduate Advisors:** Brian Duncan and Hani Mansour

The fields of mathematics and economics are inextricably linked. In economics, mathematics and statistics are used extensively in theory construction, tests of existing theories and discovery of regularities to inform new theories. Economics also gives mathematicians/statisticians new challenges, new outlets and new ideas to incorporate in mathematics. These complementarities have long been recognized and economics graduate students have always been advised to take advanced courses in statistics.

A "dual" degree means that students who complete the program earn two master's degrees: MA in economics and MS in applied mathematics. Students interested in completing the dual degree in economics and applied mathematics must apply separately to each program, meet the admission requirements of each program, and be accepted by each program. If one program accepts a student for the dual degree but the other program does not, then the student may not graduate under the dual degree program. Students may apply to both programs at the same time or apply to the economics program first, and then to the applied math program after their first semester, or vice versa. Both programs must be completed in the same semester to take advantage of the dual degree program. Further information about this program can be obtained from either the Department of Economics or the Math Department.

Click here (<http://catalog.ucdenver.edu/cu-denver/graduate/schools-colleges-departments/college-liberal-arts-sciences/economics/economics-ma/>) for admissions requirements for the MA program in Economics

Click here (<http://catalog.ucdenver.edu/cu-denver/graduate/schools-colleges-departments/college-liberal-arts-sciences/mathematical-statistical-sciences/applied-mathematics-ms/>) for admissions requirements for the MS program in Applied Mathematics

There are an increasing number of economics MA students wishing to obtain graduate training and a degree in statistics. Having an MA degree in economics and an MS degree in Applied Mathematics will make a student highly employable in the job market and provide them an edge in applying for elite PhD programs.

## Degree Requirements

1. The requirements for the dual degree in economics and applied mathematics include completing 21 credit hours in ECON and 21 credit hours in MATH (42 total credit hours).
2. Students are expected to meet all course prerequisites. ECON 5803 Mathematical Economics is a prerequisite for ECON 5073 Microeconomic Theory and ECON 5813 Econometrics I. This

prerequisite requirement is waived for students who are currently admitted to the MS Applied Mathematics program.

3. Students must complete all ECON and MATH credits at the graduate level (5000-level or higher).
4. Students must earn a minimum grade of B- (2.7) in all program courses taken at CU Denver and must achieve a minimum cumulative major 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. No course may be taken more than twice.
5. Students must complete all coursework with CU Denver faculty.

## Required Courses

### Economics Core

Code	Title	Hours
<i>Take the following</i>		<i>18</i>
ECON 5073	Microeconomic Theory	3
ECON 5083	Macroeconomic Theory	3
ECON 5813	Econometrics I	3
ECON 5823	Econometrics II	3
ECON 6053 or ECON 6054	Seminar In Applied Economics Seminar In Applied Economics II	3
ECON 6073	Research Seminar	3

### Economics Elective

Code	Title	Hours
<i>Take 3 credits of ECON at 5000 level or higher.</i>		<i>3</i>
ECON 5030	Data Analysis with SAS	3
ECON 5050	Special Economic Problems	1-8
ECON 5090	History of Economic Thought	3
ECON 5150	Economic Forecasting	3
ECON 5410	International Trade	3
ECON 5530	Economics of Natural Resources	3
ECON 5540	Environmental Economics	3
ECON 5660	Health Economics	3
ECON 5740	Industrial Organization	3
ECON 5800	Special Topics	1-3
ECON 5803	Mathematical Economics	3
ECON 6010	Advanced Microeconomic Theory	3
ECON 6020	Advanced Macroeconomic Theory	3
ECON 6060	Special Topics	1-3
ECON 6210	Public Finance	3
ECON 6410	International Trade	3
ECON 6420	International Finance	3
ECON 6610	Labor Economics	3
ECON 6666	The Economics of Health Behaviors	3
ECON 6770	Economic Growth and Development	3
ECON 6801	Advanced Mathematical Economics	3
ECON 6810	Econometrics and Forecasting	3
ECON 7073	Advanced Microeconomic Theory II	3
ECON 7661	Health Economics I	3
ECON 7662	Health Economics II	3

**Mathematics Core**

Code	Title	Hours
<i>Take the following courses:</i>		
		18
MATH 5070	Applied Analysis	3
MATH 5310	Probability	3
MATH 5320	Statistical Inference	3
MATH 5718	Applied Linear Algebra	3
MATH 6330	Workshop in Statistical Consulting	3
MATH 5394	Experimental Designs	3
	or MATH 6376 Statistical Computing	
	or MATH 6380 Stochastic Processes	
	or MATH 6384 Spatial Data Analysis	
	or MATH 6388 Statistical and Machine Learning	
	or MATH 7384 Mathematical Probability	
	or MATH 7826 Topics in Probability and Statistics	
An additional course given prior approval by the student's advisor and the Director of the Program.		

**Mathematics Electives**

Code	Title	Hours
<i>Take 3 credits of MATH at 5000 level or higher. <sup>1</sup></i>		
MATH 5010	History of Mathematics	3
MATH 5012	An Advanced Perspective on Number and Operation	2
MATH 5013	An Inquiry-based Approach to Geometry	1
MATH 5027	Topics in Applied Mathematics	3
MATH 5110	Theory of Numbers	3
MATH 5135	Functions of a Complex Variable	3
MATH 5337	Intro to Statistical and Machine Learning	3
MATH 5350	Mathematical Theory of Interest	3
MATH 5351	Actuarial Models	3
MATH 5387	Applied Regression Analysis	3
MATH 5388	Machine Learning Methods	3
MATH 5390	Game Theory	3
MATH 5394	Experimental Designs	3
MATH 5410	Modern Cryptology	3
MATH 5432	Computational Graph Theory	3
MATH 5446	Theory of Automata	3
MATH 5490	Network Flows	3
MATH 5576	Mathematical Foundations of Artificial Intelligence I	3
MATH 5593	Linear Programming	3
MATH 5610	Computational Biology	3
MATH 5660	Numerical Analysis I	3
MATH 5661	Numerical Analysis II	3
MATH 5674	Parallel Computing and Architectures	3
MATH 5733	Partial Differential Equations	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 5830	Applied Statistics	3

MATH 6023	Topics in Discrete Math	3
MATH 6101	Uncertainty Quantification	3
MATH 6131	Real Analysis	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
MATH 7101	Topology	3
MATH 7132	Functional Analysis	3
MATH 7376	Statistical Computing	3
MATH 7381	Mathematical Statistics I	3
MATH 7382	Mathematical Statistics II	3
MATH 7384	Mathematical Probability	3
MATH 7385	Stochastic Differential Equations	3
MATH 7386	Monte Carlo Methods	3
MATH 7393	Bayesian Statistics	3
MATH 7397	Nonparametric Statistics	3
MATH 7405	Advanced Graph Theory	3
MATH 7409	Applied Combinatorics	3
MATH 7410	Combinatorial Structures	3
MATH 7413	Modern Algebra I	3
MATH 7414	Modern Algebra II	3
MATH 7419	Mathematical Coding Theory	3
MATH 7421	Projective Geometry	3
MATH 7593	Advanced Linear Programming	3
MATH 7594	Integer Programming	3
MATH 7595	Advanced Nonlinear Programming	3
MATH 7663	Finite Difference Methods for Partial Differential Equations	3
MATH 7665	Numerical Linear Algebra	3
MATH 7667	Introduction to Approximation Theory	3
MATH 7821	Topics in Projective Geometry	3
MATH 7822	Topics in Linear Algebra	3
MATH 7823	Topics in Discrete Math	3
MATH 7824	Topics in Computational Mathematics	3
MATH 7825	Topics in Optimization	3
MATH 7826	Topics in Probability and Statistics	3
MATH 7827	Topics in Applied Mathematics	3
MATH 8660	Mathematical Foundations of Finite Element Methods	3
MATH 8664	Iterative Methods in Numerical Linear Algebra	3

<sup>1</sup> Except MATH 5000-5010, MATH 5017 Topics in Mathematics for Teachers and MATH 5198 Mathematics for Bioscientists. Contact a graduate advisor in the Math Department for information about Math course requirements.

To learn more about the Student Learning Outcomes for this program, please visit our website (<https://clas.ucdenver.edu/economics/programs/master-arts-economics/>).

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