ECONOMICS BA/ MATHEMATICS, BS - DUAL DEGREE

Introduction
Please click here (http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/economics/) to see Economics department information or here (http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/mathematical-statistical-sciences/) for Mathematical and Statistical Sciences department information.

A solid training in the mathematical and statistical sciences is fundamental to optimally prepare economics students for graduate school. A dual degree in economics and mathematics will substantially increase program quality and career prospects for our students, as well as enhance the reputation of the economics program at CU Denver. Similarly, a solid training in quantitative and qualitative economic principles offers significant benefits to mathematics majors who seek industrial and/or consulting positions.

These degree requirements are subject to periodic revision by the academic department, and the College 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 major advisor and CLAS advisor to confirm the best plans of study before finalizing them.

Program Requirements
1. Students must complete a minimum of 72 hours with a minimum of 30 ECON credit hours and a minimum of 39 MATH credit hours.
2. Students must complete a minimum of 27 upper division (3000-level and above) ECON credit hours and a minimum of 27 upper division (3000-level and above) MATH credit hours.
3. Students must earn a minimum grade of C- (1.7) in all major courses taken at CU Denver and must achieve a minimum cumulative GPA of 2.0 in ECON courses and a cumulative GPA of 2.25 in MATH courses. All graded attempts in required and elective courses are calculated in the major GPA. Students cannot complete major or ancillary course requirements as pass/fail.
4. Students must complete a minimum of 18 ECON credit hours including ECON 4811 Introduction to Econometrics, with CU Denver faculty. Once a student has enrolled at CU Denver, no more courses in the major can be taken outside the CU Denver Economics Department. This includes courses offered at Metropolitan State University. The department reserves the right to require a demonstration of competence for any core courses not taken from CU Denver faculty. Additionally, the Department of Mathematical and Statistical Sciences requires that at least 15 upper-division Mathematics credits must be taken at CU Denver.

Program Restrictions, Allowances and Recommendations
1. In addition to the CLAS residence requirements, the Economics Department requires that all courses other than ECON 2012 Principles of Economics: Macroeconomics and ECON 2022 Principles of Economics: Microeconomics require written department approval to be transferred in as satisfying major requirements.
2. A student who attempts the dual degree but who does not fulfill all requirements for the Mathematics BS will need to complete the requirements for the Economics BA as a stand-alone degree. A Mathematics elective will substitute for one of the six economics electives only if all requirements of the Mathematics major are met.

Required Courses

Economics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take all of the following Economics courses:</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>ECON 2012</td>
<td>Principles of Economics: Macroeconomics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 2022</td>
<td>Principles of Economics: Microeconomics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 4071</td>
<td>Intermediate Microeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECON 4081</td>
<td>Intermediate Macroeconomic Theory</td>
<td>3</td>
</tr>
<tr>
<td>ECON 4811</td>
<td>Introduction to Econometrics</td>
<td>3</td>
</tr>
</tbody>
</table>

Mathematics

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Take all of the following Mathematics courses:</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>MATH 1401</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2411</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2421</td>
<td>Calculus III</td>
<td>4</td>
</tr>
<tr>
<td>MATH 3000</td>
<td>Introduction to Abstract Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3191</td>
<td>Applied Linear Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3200</td>
<td>Elementary Differential Equations</td>
<td>3</td>
</tr>
</tbody>
</table>

Declarating This Major

• Click here (http://catalog.ucdenver.edu/cu-denver/undergraduate/records-registration/registration/declare-change-major-minor/) to go to information about declaring a major.

General Requirements

To earn a degree, students must satisfy all requirements in each of the three areas below, in addition to their individual major requirements.

• CU Denver General Graduation Requirements (http://catalog.ucdenver.edu/cu-denver/undergraduate/graduation/general-graduation-requirements/)
• CU Denver Core Curriculum (http://catalog.ucdenver.edu/cu-denver/undergraduate/graduation-undergraduate-core-requirements/)
• College of Liberal Arts & Sciences Graduation Requirements (http://catalog.ucdenver.edu/cu-denver/undergraduate/schools-colleges-departments/college-liberal-arts-sciences/#graduationrequirements)
• Click here (http://catalog.ucdenver.edu/cu-denver/undergraduate/academic-policies-procedures/) for information about Academic Policies
Economics Electives

Programming Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1376</td>
<td>Programming for Data Science</td>
<td>3</td>
</tr>
<tr>
<td>CSCI 1410 &amp; CSCI 1411</td>
<td>Fundamentals of Computing and Fundamentals of Computing Laboratory</td>
<td>4</td>
</tr>
</tbody>
</table>

Take one of the following programming requirements:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 4770</td>
<td>Development Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 4812</td>
<td>Advanced Econometric Methods</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3301</td>
<td>Introduction to Optimization</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3302</td>
<td>Simulation in Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4390</td>
<td>Game Theory</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4387</td>
<td>Applied Regression Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4650</td>
<td>Numerical Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4733</td>
<td>Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4810</td>
<td>Introduction to Probability</td>
<td>3</td>
</tr>
<tr>
<td>MATH 5350</td>
<td>Mathematical Theory of Interest</td>
<td>3</td>
</tr>
</tbody>
</table>

Take four upper division level Mathematics elective courses or three Mathematics elective course plus one Economics elective course from the list of approved Economics electives below.


One of the following approved Economics electives can be double counted as the fourth Mathematics elective.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON 4030</td>
<td>Data Analysis with SAS</td>
<td>3</td>
</tr>
<tr>
<td>ECON 4110</td>
<td>Money and Banking</td>
<td>3</td>
</tr>
<tr>
<td>ECON 4150</td>
<td>Economic Forecasting</td>
<td>3</td>
</tr>
<tr>
<td>ECON 4320</td>
<td>Financial Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 4430</td>
<td>Economic Growth</td>
<td>3</td>
</tr>
<tr>
<td>ECON 4550</td>
<td>Game Theory and Economic Applications</td>
<td>3</td>
</tr>
<tr>
<td>ECON 4610</td>
<td>Labor Economics</td>
<td>3</td>
</tr>
<tr>
<td>ECON 4740</td>
<td>Industrial Organization</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3041</td>
<td>Fundamental Mathematics: Algebra, Probability and Data Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3210</td>
<td>Higher Geometry I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3301</td>
<td>Introduction to Optimization</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3302</td>
<td>Simulation in Operations Research</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3376</td>
<td>Data Wrangling &amp; Visualization</td>
<td>3</td>
</tr>
<tr>
<td>MATH 3440</td>
<td>Introduction to Symbolic Logic</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4010</td>
<td>History of Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4015</td>
<td>Capstone Course for Secondary Teachers</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4027</td>
<td>Topics in Mathematics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4110</td>
<td>Theory of Numbers</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4140</td>
<td>Introduction to Modern Algebra</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4320</td>
<td>Introduction to Real Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4337</td>
<td>Intro to Statistical and Machine Learning</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4387</td>
<td>Applied Regression Analysis</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4388</td>
<td>Machine Learning Methods</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4390</td>
<td>Game Theory</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4394</td>
<td>Experimental Designs</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4408</td>
<td>Applied Graph Theory</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4409</td>
<td>Applied Combinatorics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4450</td>
<td>Complex Variables</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4650</td>
<td>Numerical Analysis I</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4660</td>
<td>Numerical Analysis II</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4733</td>
<td>Partial Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>Course</td>
<td>Title</td>
<td>Credits</td>
</tr>
<tr>
<td>----------</td>
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<tr>
<td>MATH 4791</td>
<td>Continuous Modeling</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4792</td>
<td>Probabilistic Modeling</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4793</td>
<td>Discrete Math Modeling</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4794</td>
<td>Optimization Modeling</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4810</td>
<td>Introduction to Probability</td>
<td>3</td>
</tr>
<tr>
<td>MATH 4820</td>
<td>Introduction to Mathematical Statistics</td>
<td>3</td>
</tr>
<tr>
<td>MATH 5350</td>
<td>Mathematical Theory of Interest</td>
<td>3</td>
</tr>
</tbody>
</table>

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

To review the Degree Map for this program, please visit our [website](https://www.ucdenver.edu/student/advising/undergraduate/degree-maps/clas/).