**APPLIED MATHEMATICS - MASTER OF SCIENCE (MS)**

The MS degree can serve as a stepping-stone for any student considering a PhD program at CU Boulder or elsewhere. However, the MS degree is unique and an important program in its own right. One of the principal advantages is in preparation for teaching or industry, which is the genesis of the required numerical analysis and out-of-department sequences. It is also a flexible program that supports special interest directions.

Students should carefully read the Requirements for Advanced Degrees in the Graduate School section. What follows is an abbreviated summary of specific requirements for the department. A precise description of the degree requirements is available in the department's Applied Mathematics Graduate Student Supplement (http://www.colorado.edu/amath/prospective-students/graduate/supplement-course-catalog-degree-requirements).

**Optional Computational Science and Engineering Track**

The purpose of this track is to meet the needs of students who want to learn the basic concepts and skills of computational science and engineering, and then to continue toward a PhD in a discipline outside applied mathematics. The program is designed to provide interested students with a foundation in computational mathematics and, at the same time, to allow sufficient latitude for the student to become proficient in an outside discipline. Approximately half of the credit hours for the master's degree will be taken from a department other than applied mathematics.

A student in the computational science and engineering track will be enrolled simultaneously in two graduate programs, one in applied mathematics and one in the department from which the student wishes to receive a PhD. An interested student may apply for admission to this track either when applying for graduate study at CU, or at any time in the student's first two years of graduate study. First-year and second-year graduate students in any of the participating departments may apply for admission to this program. A student who completes this program successfully will obtain a master's degree in applied mathematics in the computational science and engineering track.

**Concurrent Degree Program**

**BS/MS in Applied Mathematics**

The concurrent BS/MS program in applied mathematics enables well-qualified and motivated students to experience graduate-level course work earlier in their education and to obtain an MS degree in a reduced time period. Applied math majors may apply for this program during their junior year. Minimum requirements for admission include completion of at least two APPM courses numbered 3000 or higher, an overall GPA of 3.40 or higher, an APPM and MATH GPA of 3.40 or higher, and two letters of recommendation from APPM faculty. Students interested in this program are encouraged to consult with an applied mathematics faculty advisor early in their undergraduate career.

**MS/MA in Applied Mathematics and MCDB**

This three-year interdisciplinary program offers two master's degrees: an MS in applied mathematics and an MA in molecular, cellular and developmental biology (MCDB). The goal of the program is to produce well-trained applied mathematics students who are capable of making serious contributions leading to advancements in molecular biology. Such students will be well educated in computational sciences, statistics, probability and molecular biology.

Students are expected to meet all requirements for admission to the graduate program in the Department of Applied Mathematics and to possess a basic science background suitable for pursuit of this dual degree. Students also are expected to meet minimum requirements for admission to the graduate program in MCDB. Adequate undergraduate preparation consists of successful completion of basic courses on cell and molecular biology. Any student deemed deficient in either area will be required to take Molecular Cell Biology I and II (MCDB 3135 and MCDB 3145) after enrollment.

Students will be required to apply to both programs, with APPM the primary one. Subject to joint recommendation and approval by APPM and MCDB, incoming students will be admitted to this dual degree program as a regular part of the applied mathematics recruitment process.

**Requirements**

**Prerequisites**

Prerequisites for graduate study in applied mathematics include three semesters of calculus and a course in differential equations and linear algebra. The overall grade point average for mathematics and applied mathematics must be B or better.

Other strongly recommended courses are:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td><strong>Strongly Recommended Prerequisites</strong></td>
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<tr>
<td>APPM 4650 &amp; APPM 4660</td>
<td>Intermediate Numerical Analysis 1 and Intermediate Numerical Analysis 2 (or MATH 4650 &amp; MATH 4660)</td>
<td>6</td>
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<tr>
<td>APPM 4440</td>
<td>Undergraduate Applied Analysis 1</td>
<td>3</td>
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<td>One of the following:</td>
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<tr>
<td>APPM 3310</td>
<td>Matrix Methods and Applications</td>
<td>3</td>
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<tr>
<td>MATH 2130</td>
<td>Introduction to Linear Algebra for Non-Mathematics Majors</td>
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**Course Requirements**

The department requires a master's degree candidate to complete an approved program of study consisting of at least 30 credits, at least 18 of which must be applied mathematics courses at the 5000 level or above. A grade of C (2.0) or higher must be attained in each course.

Generally, the following courses do not count toward the 30-credit requirement: APPM 5350, APPM 5360, APPM 5570 and APPM 5720.

**NOTE:** The APPM 5720 course number is used for a variety of courses that are either run for the first time or on an ad hoc basis. When appropriate, the Graduate Committee may decide that a particular version of this course should count towards graduate credits. If a student would like to count credits from APPM 5720 toward an APPM graduate degree,
advice should be sought from the chair of the graduate committee on whether this would be permissible.

All master's degree students must complete two year-long, 5000-level course sequences in applied mathematics:

- APPM 5600 & APPM 5610 (required; may be waived for students who obtain a pass on the numerical analysis preliminary exam) AND
- a sequence listed in the "Graduate Courses" section of the Applied Mathematics Graduate Student Supplement (http://www.colorado.edu/amath/prospective-students/graduate/supplement-course-catalog-degree-requirements) (other sequences require approval from the chair of the graduate committee).

MS candidates must take a yearlong 5000-level graduate sequence outside of applied mathematics in an area where mathematics has significant application. This sequence must be approved by the chair of the graduate committee.

Upon approval by petition to the graduate committee, up to 6 credit hours may be taken in 4000-level courses in other departments, provided members of the graduate faculty teach those courses.

**Degree Plans**

There are two courses of action for graduate students who are looking to graduate with a master's degree.

**Plan I: Thesis Option**

A student electing to do a thesis must enroll in 4–6 hours of thesis credit, which count toward the required 30 hours, and must take an oral comprehensive exam (also referred to as a defense) on that thesis work. A student can only enroll in a total of 6 thesis hours for the course of the degree program. This exam will be administered by a committee consisting of the faculty advisor, who serves as committee chair, and two other faculty members. Each committee member must hold a current graduate faculty appointment. The chair must have a regular graduate faculty appointment, and the remaining committee members must hold either regular or special membership. At least one committee member must hold a regular (tenure or tenure-track) faculty appointment in Applied Mathematics.

**Plan II: Non-Thesis Option**

A student choosing the non-thesis option must pass ("pass" or "PhD research pass") any one of four PhD preliminary exams. Details are provided in the Applied Mathematics Graduate Student Supplement (http://www.colorado.edu/amath/prospective-students/graduate/supplement-course-catalog-degree-requirements).

Each MS student electing the non-thesis option must submit a completed MS degree audit form to the graduate chair upon submitting the Candidacy Application for an Advanced Degree.

A student who fails a written preliminary exam may, in a later semester, make one and only one more attempt to satisfy this requirement. In doing so, the student may switch between the thesis and the non-thesis option of the program, or between one preliminary exam area and another. Students who fail two preliminary exams are subject to dismissal from the program.