Computational and Applied Mathematics

Program of Study
The Departments of Computer Science, Mathematics, and Statistics offer a BS in Computational and Applied Mathematics. The program is designed for students who intend to specialize in computational and/or applied mathematics, as well as students who want to acquire a strong quantitative background to be applied in such varied areas as physics, biological sciences, engineering, operations research, economics, and finance.

Summary of Requirements

General Education

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>CHEM 12100 &amp; CHEM 12200</td>
<td>200</td>
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<tr>
<td>Honors General Chemistry I</td>
<td></td>
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<tr>
<td>and Honors General Chemistry II (or higher)</td>
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<td>OR</td>
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<tr>
<td>PHYS 13100-13200</td>
<td>200</td>
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<tr>
<td>Mechanics; Electricity and Magnetism (or higher)</td>
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One of the following sequences:

- MATH 13100-13200: Elementary Functions and Calculus I-II §
- MATH 15100-15200: Calculus I-II §
- MATH 16100-16200: Honors Calculus I-II +

Total Units: 400

Major

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
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<tbody>
<tr>
<td>MATH 16300</td>
<td>100</td>
</tr>
<tr>
<td>Honors Calculus III</td>
<td></td>
</tr>
<tr>
<td>MATH 15910</td>
<td>100</td>
</tr>
<tr>
<td>Introduction to Proofs in Analysis</td>
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One of the following sequences:

- MATH 20300-20400-20500: Analysis in Rn I-II-III
- MATH 20700-20800-20900: Honors Analysis in Rn I-II-III

One of the following:

- STAT 24300 or MATH 20250: Numerical Linear Algebra
- Abstract Linear Algebra

One of the following sequences:

- CMSC 12100-12200: Computer Science with Applications I-II
- CMSC 14100 & CMSC 14200: Introduction to Computer Science I and Introduction to Computer Science II
- CMSC 15100-15200: Introduction to Computer Science I-II
- CMSC 16100-16200: Honors Introduction to Computer Science I-II
- CMSC 27100: Discrete Mathematics **
- CMSC 27200: Theory of Algorithms
- MATH 27300: Basic Theory of Ordinary Differential Equations

One of the following:

- MATH 21100: Basic Numerical Analysis
- MATH 21200: Advanced Numerical Analysis
- STAT 24400-24500: Statistical Theory and Methods I-II

One of the following: ***

- STAT 25100: Introduction to Mathematical Probability
- STAT 25150: Introduction to Mathematical Probability-A
- MATH 23500: Markov Chains, Martingales, and Brownian Motion
- STAT 28000: Optimization

Notes:
- §: Students who have completed the AP Calculus AB exam with a score of 4 or 5 should take MATH 15100 or MATH 16100.
- §+: Students who have completed the AP Calculus BC exam with a score of 4 or 5 should take MATH 15100 or MATH 16100.
- +: Students who have completed the AP Calculus BC exam with a score of 5 should take MATH 16100 or MATH 16200.
- **: Students who have completed the AP Computer Science exam with a score of 4 or 5 should take CMSC 12100.
- ***: Students who have completed the AP Statistics exam with a score of 4 or 5 should take STAT 24300.
Three approved electives (see Elective Courses below) 300
Total Units 1800

* Students with AP credit for PHYS 12100-12200 may substitute quantitative courses in other scientific
departments with permission of the director of undergraduate studies; whether these other courses count
as electives within the major or as general electives will be determined by the director of undergraduate
studies.

+ Credit may be granted by examination.
§ Students who take MATH 13100-13200 or MATH 15100-15200 must also take the third quarter of the
sequence as a prerequisite for MATH 15910; however, neither MATH 13300 nor MATH 15300 will be
counted toward the major.

** Students may substitute a higher-level Computer Science course in discrete mathematics or algorithms
with approval of the director of undergraduate studies.

*** Students who take STAT 25100 or STAT 25150 may take MATH 23500 as one of their electives with
approval of the director of undergraduate studies. STAT 31200 may be substituted for MATH 23500.

**ELECTIVE COURSES**

Students will propose a coherent set of three courses to complete the major program. These will be chosen to
complete a specialization. Possibilities include: preparation for PhD programs in applied mathematics, scientific
computing, machine learning, operations research, economics and finance, physical sciences, or biological
sciences. These are intended to be mathematical and computational courses that complement the program and at
least at the mathematical level of the advanced classes in the required courses. The program must be approved
by the undergraduate adviser, who will also serve as a resource for suggested mentors and programs in different
areas.

**GRADING**

Students must receive quality grades in all courses required in the degree program. To qualify for the BS
degree, students must complete the 18 courses above with (1) a GPA of 2.0 or higher and (2) no grade lower than
C-.

**HONORS**

A BS with honors in Computational and Applied Mathematics requires an overall GPA of at least 3.0, a GPA
in the required courses for the major of at least 3.25, and the completion of an honors paper written under the
supervision of a faculty member and approved by the undergraduate adviser for the major. Students planning
to complete an honors paper should submit a short proposal to the undergraduate adviser for approval by the
Computational and Applied Mathematics board by the end of the student’s third year. The proposal must be
approved by the board no later than the end of fifth week of the Autumn Quarter of the student’s fourth year.