Major and Minor in
Applied Mathematics and Statistics
Department of Applied Mathematics and Statistics, College of Engineering and Applied Sciences

Major and Minor in
Applied Mathematics and Statistics (AMS)

Faculty
Hongshik Ahn, Associate Professor, Ph.D., University of Wisconsin: Biostatistics; survival analysis.
Esther Arkin, Professor, Ph.D., Stanford University: Computational geometry; combinatorial optimization.
Edward J. Beltrami, Professor Emeritus, Ph.D., Adelphi University: Optimization; stochastic models.
Yung Ming Chen, Professor Emeritus, Ph.D., New York University: Partial differential equations; inverse problems.
Yuefan Deng, Professor, Ph.D., Columbia University: Computational fluid dynamics; parallel computing.
Daniel Dicker, Professor Emeritus, Dr. Eng. Sci., Columbia University: Civil engineering.
Eugene Feinberg, Professor, Ph.D., Vilnius University: Operations research.
Stephen Finch, Professor, Ph.D., Princeton University: Applied statistics.
Robert Frey, Research Professor, Ph.D., Stony Brook University: Operations research.
James Glimm, Distinguished Professor, Ph.D., Columbia University: Mathematical physics; nonlinear physics.
John Grove, Adjunct Professor, Ph.D., Ohio State University: Conservation laws; computational fluid dynamics.
Xiabin Li, Professor, Ph.D., Columbia University: Computational applied mathematics.
Brent Lindquist, Professor, Ph.D., Cornell University: Computational fluid dynamics; reservoir modeling.
Nancy Mendell, Professor, Ph.D., University of North Carolina, Chapel Hill: Biostatistics; statistical genetics.
Joseph Mitchell, Professor, Ph.D., Stanford University: Computational geometry. Recipient of the State University Chancellor's Award for Excellence in Teaching, 1996.
Bradley Plohr, Adjunct Professor, Ph.D., Princeton University: Conservation laws; computational fluid dynamics.
John Reinitz, Associate Professor, Ph.D., Yale University: Mathematical biology.

Robert Rizzo, Assistant Professor, Ph.D., Yale University: Bioinformatics; drug design.
David Sharp, Adjunct Professor, Ph.D., California Institute of Technology: Mathematical physics.
Ram P. Srivastav, Professor, D.Sc., University of Glasgow; Ph.D., University of Lucknow: Integral equations; numerical solutions.
Michael Takacs, Professor Emeritus, Ph.D., Cornell University: Stochastic processes.
Reginald P. Tewarson, Professor Emeritus, Ph.D., Boston University: Numerical analysis; biomathematics.
Alan C. Tucker, Distinguished Teaching Professor, Ph.D., Stanford University: Combinatorics; applied models. Recipient of the State University Chancellor's Award for Excellence in Teaching, 1974.
Ilya Vakser, Associate Professor, Ph.D., Moscow State University: Computational structural biology.
E. Alper Yildirim, Assistant Professor, Ph.D., Cornell University: Optimization; operations research.
Yongmin Zhang, Assistant Professor, Ph.D., University of Chicago: Computational fluid dynamics; numerical analysis.
Wei Zhu, Assistant Professor, University of California, Los Angeles: Biostatistics.

Affiliated Faculty
Hussein Badr, Computer Science
Michael Bender, Computer Science
Pradeep Dubey, Economics
David Ferguson, Technology and Society
Abraham Neyman, Economics
Steven Skiena, Computer Science
Jadranka Skorin-Kapov, College of Business
Judith Tanur, Sociology

Adjunct Faculty
Estimated number: 2

Teaching Assistants
Estimated number: 20

The undergraduate program in Applied Mathematics and Statistics aims to give mathematically oriented students a liberal education in quantitative problem solving. The courses in this program survey a wide variety of mathematical theories and techniques that are currently used by analysts and researchers in government, industry, and science. Many of the applied mathematics courses give students the opportunity to develop problem-solving techniques using campus computing facilities.

About half of the Applied Mathematics majors enter graduate or professional programs, primarily in statistics, operations research, computer science, and business management. Others go directly into professional careers as actuaries, programmer analysts, management trainees, and secondary school teachers.

While some career-oriented course sequences are listed below, students are strongly encouraged to seek faculty advice in coordinating their career plans with their academic programs. In the spring of their junior year, all students contemplating graduate studies, upon graduation or at a later date, should consult with the Department’s graduate placement advisor, who assists them in choice of schools and provides information about Graduate Record Examinations, etc. Students considering secondary school mathematics teaching can major in Applied Mathematics and Statistics or in Mathematics.
Courses Offered in Applied Mathematics and Statistics

See the Course Descriptions listing in this Bulletin for complete information.

AMS 101-C  Applied Precalculus
AMS 102-C  Elements of Statistics
AMS 110  Probability and Statistics in the Life Sciences
AMS 151-C, 161-C  Applied Calculus I, II
AMS 201  Matrix Methods and Models
AMS 210  Applied Linear Algebra
AMS 261  Applied Calculus III
AMS 300  Writing in Applied Mathematics
AMS 301  Finite Mathematical Structures
AMS 303  Graph Theory
AMS 310  Survey of Probability and Statistics
AMS 311  Probability Theory
AMS 312  Mathematical Statistics
AMS 315  Data Analysis
AMS 318  Theory of Interest
AMS 321  Computer Projects in Applied Mathematics
AMS 322  Groundwater Modeling
AMS 326  Numerical Analysis
AMS 331  Mathematical Modeling
AMS 335  Game Theory
AMS 341  Operations Research I: Deterministic Models
AMS 342  Operations Research II: Stochastic Models
AMS 345  Computational Geometry
AMS 351  Applied Algebra
AMS 361  Applied Calculus IV: Differential Equations
AMS 373  Analysis of Algorithms
AMS 394  Statistical Laboratory
AMS 410  Actuarial Mathematics
AMS 421  Statistical Quality Control and Design of Experiments
AMS 441  Business Enterprise
AMS 475  Undergraduate Teaching Practicum
AMS 487  Research in Applied Mathematics
AMS 492  Topics in Applied Mathematics

Sample Course Sequence for the Major in Applied Mathematics and Statistics

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<tr>
<th>Freshman Fall</th>
<th>Credits</th>
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<tr>
<td>First Year Seminar 101</td>
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<tr>
<td>D.E.C. A</td>
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<td>AMS 151*</td>
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<tr>
<td>D.E.C.</td>
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<td>D.E.C.</td>
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<tr>
<td>D.E.C.</td>
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<tr>
<td>Upper-Division elective</td>
<td>3</td>
</tr>
<tr>
<td>AMS Upper-Division elective</td>
<td>3</td>
</tr>
<tr>
<td>AMS Upper-Division elective or ECO 321</td>
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</tr>
<tr>
<td>AMS Upper-Division elective</td>
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<td>AMS 300</td>
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<td>Upper-Division elective</td>
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</tr>
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<tr>
<td>Related Area course**</td>
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<tr>
<td>Elective</td>
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<td>AMS 161*</td>
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<tr>
<td>D.E.C.</td>
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<tr>
<td>D.E.C.</td>
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<td>AMS 301</td>
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<td>AMS 310</td>
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<tr>
<td>Related Area course**</td>
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<tr>
<td>Elective</td>
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<tr>
<td>Elective</td>
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<tr>
<td>Elective</td>
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<tr>
<td>Total</td>
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</table>

* See A. 1. for alternate course selections.

** Consult the department for appropriate courses.

Acceptance into the Applied Mathematics and Statistics Major

Qualified freshman and transfer students who have indicated their interest in the major on their applications are accepted directly into the major upon admission to the University. Students who did not apply for the major and those who were not accepted into the major when they entered the University may apply directly to the Department only after completion of AMS 161 or MAT 132 or 142 or 127; AMS 210 or MAT 211; and CSE 110 or 114 or 130 or ESG 111 or MEC 111 or 112.

Requirements for the Major in Applied Mathematics and Statistics (AMS)

The major in Applied Mathematics and Statistics leads to the Bachelor of Science degree.

Completion of the major requires approximately 60 credits.

A. Study Within the Area of the Major

1. AMS 151, 161 Applied Calculus I, II
AMS 210 or MAT 211 Applied Linear Algebra
AMS 261 or MAT 203 or MAT 205 Applied Calculus III

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Note: The following alternate calculus course sequences may be substituted for AMS 151, 161 in major requirements or prerequisites:

- MAT 125, 126, 127
- or MAT 131, 132
- or MAT 141, 142

2. CSE 110 Introduction to Computer Science
   - or CSE 114 Computer Science I
   - or CSE 130 Introduction to Programming in C
- or ESG 111 C Programming for Engineering
- or MEC 111 Computer Science for Engineers
- or MEC 112 Practical C/C++ for Scientists and Engineers

3. 24 credits of AMS courses numbered 301 and above including AMS 301 Finite Mathematical Structures and either AMS 310 Survey of Probability and Statistics or AMS 311 Probability Theory. (A minimum of 18 of these 24 credits must be designated AMS courses. The remaining six credits may be replaced by an equal number of credits taken from approved upper-division mathematically oriented courses. Typical approved substitutions are ECO 321, ECO 348, and all courses designated CSE numbered 301 and above and MAT 310 and above.)

4. Upper-Division Writing Requirement: AMS 300 Writing in Applied Mathematics
   All degree candidates must demonstrate skill in written English at a level acceptable for Applied Mathematics and Statistics majors. AMS students must register for the writing course AMS 300, or submit a technical paper(s) written for other courses. The requirement may also be met by earning a grade of C or higher in a writing course approved by the Department or, if the student has a double major, by satisfying the requirement for the other major.

B. Study in Related Areas
   To gain a background in fields that generate mathematical applications, a minimum of 14 additional credits are chosen from among the course offerings in appropriate social sciences, the natural sciences, and engineering. Courses taken to satisfy item 3 above may not be used to satisfy this requirement. No more than eight of these credits may come from any one department.

Grading
   All courses taken to satisfy requirements A. 1, 2, and 3 above must be taken for a letter grade and passed with a grade of D or higher.

Double Majors
   The Department urges students in other majors who are considering a double major with AMS first to select individual AMS courses on the basis of their academic interests or career plans. Only after a student has taken several AMS courses should he or she decide on this as a second major.

   On the other hand, AMS students are strongly encouraged to double major (or to minor) in another discipline. The most frequent choices of AMS double majors are computer science and economics.

Actuarial Science
   The AMS major covers the mathematical sciences topics tested in the first actuarial examination and part of the second actuarial examination. For more information about actuarial science as well as study materials to help prepare for actuarial examinations, students should see the Department’s actuarial advisor. Also see the Web site http://www.soa.org for details.

Recommendations for Students Majoring in Applied Mathematics and Statistics
   The Department encourages students to have a broad exposure to many types of mathematical reasoning and to its diverse roles in the social and natural sciences. During their first two years, students considering an AMS major are encouraged to take, in addition to the required calculus sequence, two semesters of physics numbered PHY 121 or higher; CSE 110 or 113, 114 or 130 or ESG 111 or MEC 111 or 112; one other computer course (competence in computer programming is essential for many professional careers); and some economics. At the end of the sophomore year or the beginning of the junior year, students begin taking upper-division AMS courses, usually starting with AMS 301 and 310. At the same time, they are strongly encouraged to continue taking MAT and CSE courses and mathematically oriented courses in other departments, such as ECO 303. The following list of course sequences for certain professions is given as a preliminary guide to students with interests in these professions. Students should speak with faculty members specializing in these areas as early as possible for more information.

Statistics: AMS 301, 310, 311, 312, 315, another CSE course beyond 110 or 114 or 130 or MEC 111; students considering graduate statistics programs should take MAT 310 and 320.

Operations Research or Management Science: AMS 301, 310, 311, 341, and 342; students considering graduate operations research programs should take MAT 310 and 320.

Programmer-Analyst: AMS 301, 310, 311, 321, 326, 341, and CSE 214, 220, and 301.

Secondary Teaching: Students preparing for a career as a teacher of mathematics in the secondary schools enroll in the Mathematics Secondary Teacher Education Program. See the Education and Teacher Certification entry in the alphabetical listings of Approved Majors, Minors, and Programs.
Course Sequence in the Applied Mathematics and Statistics Major

Many students enter the University intending another major and change to the Applied Mathematics and Statistics major, or add it as a second major, toward the end of the sophomore year or in the junior year. Required courses for the major in the first two years are the calculus sequence and linear algebra—virtually the same mathematical requirements as found in the intended majors of students who subsequently switch to Applied Mathematics and Statistics.

The particular set of 300-level AMS courses taken in the junior and senior years by Applied Mathematics and Statistics majors, and the order in which they are taken, is very flexible. Normally, majors take AMS 301 and 310 (the two required 300-level AMS courses) first. For assistance in 300-level AMS course sequences, majors are encouraged to speak with the undergraduate program director.

B.S./M.S. Program in Applied Mathematics and Statistics

An Applied Mathematics and Statistics major may apply at the end of the junior year for admission to a special program that leads to the Bachelor of Science degree at the end of the fourth year and the Master of Science degree at the end of the fifth year. In the fourth and fifth years, in addition to completing 120 credits for the B.S. degree, the student takes 30 graduate credits to fulfill the M.S. requirements in either applied mathematics, operations research, or statistics.

The advantage of the combined program is that the M.S. degree can be earned in less time than that required by the traditional course of study. The M.S. degree in Applied Mathematics and Statistics normally requires three to four semesters of study after completion of a bachelor’s degree. The in-depth training of a master’s degree is required by many employers for professional positions in applied mathematics and statistics (beyond beginning programmer analyst jobs).

For more details about the B.S./M.S. program, see the undergraduate program director or graduate studies director in the Department of Applied Mathematics and Statistics.

Requirements for the Minor in Applied Mathematics and Statistics (AMS)

The minor in Applied Mathematics and Statistics is designed for students who take a limited amount of mathematics in their major. The AMS minor must include at least 18 credits in courses that are not used to satisfy the requirements of the student’s primary major; therefore, students in majors requiring a substantial amount of mathematics may find that a double major with AMS requires fewer credits.

A. Calculus: AMS 151, 161 (See Note)
B. Linear algebra: AMS 210 or MAT 211 (Students who took AMS 201 prior to declaring the AMS minor may substitute AMS 201)
C. Core AMS courses: AMS 301 and 310
D. AMS electives: two additional 300-level AMS courses

Note: The following alternate calculus course sequences may be substituted for AMS 151, 161 in requirements for the minor or prerequisites:

- MAT 125, 126, 127
- or MAT 131, 132
- or MAT 141, 142