Division of Science

Master’s Degree in Applied Mathematics

The Department of Mathematics at the University of Notre Dame offers an interdisciplinary master of science in applied mathematics (MSAM) degree. The goal of the MSAM is to produce skilled and creative scholars who will be able to use sophisticated mathematical techniques in their professional activities and go beyond the established mathematical paradigms in their particular areas of interest.

Admission to the Program
The mathematics background of a successful applicant to the MSAM degree program is expected to include a four-semester calculus sequence and two additional courses of substantial mathematical content, such as linear algebra and differential equations.

Admission to the MSAM follows standard procedures. Application should be made to the Graduate School of the University of Notre Dame, specifying the area of mathematical application that the student intends to pursue. Students are recommended for admission to the Graduate School by the Graduate Committee of the mathematics department after consultation with the collaborating department, i.e., the department that represents the student's intended study focus.

Tuition waivers and graduate assistantships are available to students with the highest credentials.

Plan of Study
After students are accepted into the program, they present a proposal for a plan of study leading to the MSAM which should aim both to expand the students' mathematical horizons and to develop their expertise in the intended area of application. The Graduate Committee of the mathematics department will evaluate each student's proposal in close consultation with appropriate faculty members from other departments, a process which also serves the purpose of facilitating the selection of the student's official adviser, who may come from either the mathematics department or a collaborating department. The student's proposed plan of study, including the mathematical content of the courses of the interdisciplinary component (see below), requires the approval of the director of graduate studies in the mathematics department, the director of the operating department, the student's adviser, and the Director of Graduate Studies. Once approved, the proposed plan of study becomes the student's official plan of study.

Degree Requirements
The program of study for the MSAM consists of a core mathematics component and an interdisciplinary component for a total course requirement of 24 credit hours.

The Mathematical Core Component
The core component is a solid requirement of mathematics from courses offered by the Department of Mathematics. It consists of either nine or 12 credit hours, depending on both the background and the interests of the student.

1. One requirement is Math 517, Numerical Methods (3 credit hours). This course features a thorough discussion of the mathematical foundations of numerical analysis and considers such concepts as ill-conditioning, numerical stability, and error analysis.

2. To ensure a solid mathematical background, the student is required to learn the elements of at least one of the five basic areas of graduate-level abstract mathematics, which can be chosen in an area that parallels the student's field of interest. For example, a student with an interest in coding theory or computer science could take Math 601, Basic Algebra (three credit hours). If a student's mathematical objectives concern partial differential equations, control and systems theory, or the mathematics of finance, the choice would be either Math 603, Real Analysis (three credit hours), or Math 605, Basic Complex Analysis (three credit hours). A student of physics or molecular biology would want to learn the constructions that are pursued in Math 607, Basic Topology (three credit hours). Finally, students in electrical or computer engineering would likely study Math 613, Basic Modern Logic (three credit hours).

3. The third requirement is a choice of topics in applied mathematics, either Math 663, Topics in Applied Mathematics (three credit hours), or Math 664, Topics in Applied Mathematics (three credit hours). The subject
matter of these two courses depends on the interests of the faculty members teaching them as well as those of the students in the program. Topics may include, but are not limited to, partial differential equations and their applications, control and optimization, and geometric methods in mechanics.

The following themes reflect only a small portion of the expertise of applied mathematicians of the mathematics department, and courses based on them are offered by the department at various times.

- Elements of symplectic geometry and nonlinear soliton equations
- Methods and applications of asymptotic analysis
- Geometric theory of nonlinear dynamical systems
- Connections between systems theory, coding theory, and symbolic dynamics
- Partial differential equations and free boundary problems
- Toda flows with applications to eigenvalue and optimization problems

The Interdisciplinary Component
The interdisciplinary component accounts for the additional 12–15 credit hours.

These can be met by an appropriate selection of courses in any graduate discipline at Notre Dame that makes serious use of mathematics. With the approval of the adviser, the student may pursue an interdisciplinary master’s thesis under the adviser’s direction. If written and defended in accordance with the standard procedures of the Graduate School, the thesis satisfies six of these credit hours. A second way in which the student can complete the requirements of the interdisciplinary component is with a meaningful interdisciplinary project carried out under the adviser’s supervision. The written exposition of the project requires the approval of the director of graduate studies of the mathematics department, the director of the cooperating department, the student’s adviser, and the Director of Graduate Studies. It is designed to connect the mathematical core to the area of application that the student intends to pursue.

Online Application
Applicants may complete and submit the application for graduate admission online. The URL for the Graduate School’s online application is www.nd.edu/~gradsch/applying/appintro.html

Further Information
For further information regarding the master of science in applied mathematics, please contact:

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