Applied Mathematics Specializations

In addition to the general B.S. degree in Applied Mathematics, the department offers 6 special five-course sequences that may be used as a guide for the selection of **mathematics electives** and will prepare the student for a career in
- business/finance,
- education,
- industrial research, or
- graduate school.

Choosing any of the following specializations is **optional**. If students wish to receive an accurate audit of their academic programs (see Miscellaneous, Section VIII) then they need to notify the Office of Undergraduate Academic Affairs (ugaa@iit.edu) of their specialization (see Forms, Section IX). In addition to speaking with their academic advisor, students should also consult with the program advisors of their chosen specialization as they can act as additional mentors.

Specialization in Mathematical Finance
Program advisor: T. Bielecki

Students who choose this specialization may qualify for admission to the Master of Mathematical Finance program (see http://www.iit.edu/mathematical_finance/) – a collaborative program between the Stuart School of Business and the Applied Mathematics Department. The objective of the MMF program is to provide individuals interested in pursuing careers in the finance industry with advanced education in theoretical, computational and business aspects of relevant quantitative methodologies.

Students are required to earn a **business minor** or an **entrepreneurship minor** (see the IIT Undergraduate Bulletin for details).

Students need to complete
        MATH 475 (Probability),
        MATH 476 (Statistics),
        MATH 478 (Numerical Methods for Differential Equations),
        MATH 481 (Introduction to Stochastic Processes),
        MATH 485 (Introduction to Mathematical Finance).

MATH 475 is required for all applied mathematics majors, the other four courses count toward MATH electives.

Closely related courses which are recommended as additional electives include
        MATH 461 (Fourier Series and Boundary Value Problems),
        MATH 477 (Numerical Linear Algebra),
        MATH 483 (Design and Analysis of Experiments),
        MATH 484 (Regression and Forecasting),
        MATH 486 (Mathematical Modeling),
        MATH 489 (Partial Differential Equations).

Specialization in Math Education
Program advisor: G. Fasshauer

Completion of the following 24 credit hour **education minor** will prepare students for the Illinois State Certification in Secondary Mathematics (grades 6-12) and Secondary Science: Biology, Chemistry, Physics (grades 6-12).

MSED 200 (Analysis of Classrooms) ,
MSED 250 Curriculum/Foundations,
MSED 300 Instructional Methods /Strategies I,
MSED 320 Inquiry and Problem Solving,
MSED 350 Informal Education Practicum and Seminar,
MSED 400 Instructional Methods /Strategies II,
MSED 450 Professional Internship.

Please note that MSED 450 is a 6-credit course focused on student teaching. A student enrolled in this course will spend the entire semester teaching at a local area school under the supervision of a classroom teacher and university supervisor. Therefore, enrollment in MSED 450 generally makes the student unavailable for enrollment in any concurrent weekday classes at IIT.

Students need to complete 5 of the following courses:

MATH 300 (Perspectives in Analysis),
MATH 410 (Number Theory),
MATH 420 (Geometry),
MATH 430 (Applied Algebra),
MATH 453 (Combinatorics),
MATH 454 (Graph Theory),
MATH 475 (Probability),
MATH 476 (Statistics),
MATH 486 (Mathematical Modeling).

MATH 430 or 454, and 475 are required for all applied mathematics majors. The other courses count toward MATH electives. Courses not chosen for the specialization are recommended as additional electives.

Specialization in Applied Analysis
Program advisor: J. Duan

Applied analysis is one of the foundations for interdisciplinary applied mathematics. The principles of analysis are applied to such areas as partial differential equations, dynamical systems and numerical analysis. The basic framework, concepts and techniques of modern mathematical analysis are essential for modeling, analysis and simulation of complicated phenomena in engineering and science.

Students need to complete

MATH 400 (Real Analysis),
MATH 402 (Complex Analysis),
MATH 461 (Fourier Series and Boundary Value Problems),
MATH 488 (Ordinary Differential Equations and Dynamical Systems),
MATH 489 (Partial Differential Equations).

MATH 400 and 402 are required for all applied mathematics majors. The other three courses count toward MATH electives.

Closely related courses which are recommended as additional electives include
        MATH 478 (Numerical Methods for Differential Equations),
        MATH 486 (Mathematical Modeling).

Recommended minors include: physics, or one of the engineering minors.

<u>Specialization in Computational Mathematics</u>
Program advisor: X. Li

The use of computation/simulation as a third alternative to theory and experimentation is now common practice in many branches of science and engineering. Many scientific problems that were previously inaccessible have seen tremendous progress from the use of computation (e.g., many-body simulations in physics and chemistry, simulation of semi-conductors, etc.). Researchers and scientists in these areas must have a sound training in the fundamentals of computational mathematics and become proficient in the use and development of new algorithms and analytical techniques as they apply to modern computational environments.

Students need to complete
        MATH 350 (Introduction to Computational Mathematics),
        MATH 435 (Linear Optimization) or MATH 461 (Fourier Series and Boundary
            Value Problems),
        MATH 476 (Statistics),
        MATH 477 (Numerical Linear Algebra),
        MATH 478 (Numerical Methods for Differential Equations).
MATH 350 is required for all applied mathematics majors. The other four courses count toward MATH electives.

Closely related courses which are recommended as additional electives include
        MATH 435* (Linear Optimization),
        MATH 461* (Fourier Series and Boundary Value Problems),
        MATH 486 (Mathematical Modeling),
        MATH 488 (Ordinary Differential Equations and Dynamical Systems),
        MATH 489 (Partial Differential Equations).
* Only if not already counted as a required course.

Recommended minors include: artificial intelligence, computational structures, or software engineering.

<u>Specialization in Discrete Applied Mathematics</u>
Program advisor: M. Pelsmajer

Discrete applied mathematics is a fairly young branch of mathematics and is concerned with using combinatorics, graph theory, optimization, and portions of theoretical computer science to attack problems in engineering as well as the hard and soft sciences.

Students need to complete
        MATH 332 (Elementary Linear Algebra),
        MATH 430 (Applied Algebra),

MATH 435 (Linear Optimization),
MATH 453 (Combinatorics),
MATH 454 (Graph Theory).
MATH 332 and MATH 430 or 454 are required for all applied mathematics majors. The other three courses count toward MATH electives.

Closely related courses which are recommended as additional electives include
MATH 410 (Number Theory),
MATH 431 (Applied Algebra II).

Recommended minors include: artificial intelligence, computational structures, or computer networking.

Specialization in Stochastics
Program advisor: I. Cialenco

Stochastics at IIT includes traditional statistics (the methods of data analysis and inference) and probability (the modeling of uncertainty and randomness). However, also included are other areas where stochastic methods have been becoming more important in recent years such as stochastic processes, stochastic integration, stochastic dynamics, stochastic partial differential equations, probabilistic methods for analysis, mathematical finance, discrete mathematics, and computational methods for stochastic systems.

Students need to complete
MATH 475 (Probability),
MATH 476 (Statistics),
MATH 481 (Introduction to Stochastic Process),
MATH 485 (Introduction to Mathematical Finance),
MATH 488 (Ordinary Differential Equations and Dynamical Systems).
MATH 475 is required for all applied mathematics majors, the other four courses count toward MATH electives.

Closely related courses which are recommended as additional electives include
MATH 453 (Combinatorics),
MATH 483 (Design and Analysis of Experiments),
MATH 484 (Regression and Forecasting),
MATH 486 (Mathematical Modeling).