BACHELOR OF SCIENCE IN APPLIED MATHEMATICS

Applied mathematics is the mathematics that is created in response to problems in science, engineering, and society. Applied mathematicians work on a wide variety of topics such as how to construct methods for multi-criteria decision making (requiring discrete mathematics and statistics), predicting how the financial markets will behave (requiring probability/statistics, analysis, optimization), analyzing how liquid flows around solids, and how ions move in biological environments (requiring expertise in computational methods and analysis). Students with an applied mathematics background are prepared for careers in the insurance industry, electronics and computer manufacturers, logistics companies, pharmaceutical firms, and more. An applied mathematics background also prepares students for continuing on the academic path, in graduate programs in pure and applied mathematics, statistics, data science, and financial mathematics.

Our graduates work in financial and insurance companies as analysts, computer and IT companies as programmers and hardware developers, and in many different fields as researchers, as well as in academia. They have gone to excellent graduate schools in mathematics (pure, applied, and financial), physics, design, accounting, and M.B.A. programs. Students have the flexibility to assemble a portfolio of courses that will satisfy both intellectual needs and career preparation. There is a wide variety of courses offered, with strengths in contemporary topics in applied mathematics: stochastic analysis (including mathematical finance), applied analysis, computational mathematics, discrete mathematics, and statistics.

A minor is required, which gives students an area of focus where mathematics may be applied. It consists of five or more related courses in an area outside of applied mathematics. With a minor in computer science, business, or one of the engineering areas, for example, the student will be well prepared to enter the job market in business or government.

If desired, a student can choose a specialization, which selects electives appropriate for different career paths. Another popular option is to double major in both applied mathematics and another subject, such as computer science or physics. There is also the option of a co-terminal degree, where a student graduates with a B.S. and a master's degree at the same time, in as little as five years.

Required Courses

Code	Title		Credit Hours
Applied Mathematics Requirements			**(42)**
MATH 100	Introduction to the Profession		3
MATH 151	Calculus I		5
MATH 152	Calculus II		5
MATH 230	Introduction to Discrete Math		3
MATH 251	Multivariate and Vector Calculus		4
MATH 252	Introduction to Differential Equations		4
MATH 332	Elementary Linear Algebra		3
MATH 350	Introduction to Computational Mathematics		3
MATH 380	Introduction to Mathematical Modeling		3
MATH 400	Real Analysis		3
Select one of the following:			3
MATH 410	Number Theory	3	
MATH 430	Applied Algebra	3	
MATH 431	Computational Algebraic Geometry	3	
MATH 454	Graph Theory and Applications	3	
MATH 475	Probability		3
Applied Mathematics Electives			**(18)**
Select 18 credit hours [1]			18
Minor Requirement			**(15)**
Select five related courses from an area outside of applied mathematics			15
Computer Science Requirements			**(4-6)**
Select one of the following sequences:			4-6
CS 115 & CS 116	Object-Oriented Programming I and Object-Oriented Programming II	4	
CS 104 & CS 201	Introduction to Computer Programming for Engineers and Accelerated Introduction to Computer Science	6	

CS 105 & CS 201	Introduction to Computer Programming and Accelerated Introduction to Computer Science	6
Science Requirement		**(4)**
PHYS 123	General Physics I: Mechanics	4
Science Electives		**(9)**
Select nine credit hours		9
Humanities and Social Science Requirements		**(21)**
See Illinois Tech Core Curriculum, sections B and C		21
Interprofessional Projects (IPRO)		**(6)**
See Illinois Tech Core Curriculum, section E		6
Free Electives		**(9)**
Select nine credit hours		9

Minimum degree credits required: 128

[1] Applied mathematics electives are to be chosen after consultation with an academic adviser. Student goals, interests, and course availability should be determining factors in this selection process. The optional specializations on the Specializations tab may also serve as a guide to applied mathematics elective selection.

Bachelor of Science in Applied Mathematics Curriculum

			Year 1
Semester 1	**Credit Hours**	**Semester 2**	**Credit Hours**
MATH 100	3	MATH 152	5
MATH 151	5	MATH 230	3
Computer Science Course[1]	2	Computer Science Course[1]	2
Science Elective	3	PHYS 123	4
Humanities 200-level Course	3	Social Sciences Elective	3
	16		**17**

			Year 2
Semester 1	**Credit Hours**	**Semester 2**	**Credit Hours**
MATH 251	4	MATH 252	4
MATH 332	3	MATH 380	3
Minor Elective	3	Minor Elective	3
Science Elective	3	Science Elective	3
Humanities or Social Sciences Elective	3	Social Sciences Elective (300+)	3
	16		**16**

			Year 3
Semester 1	**Credit Hours**	**Semester 2**	**Credit Hours**
MATH 430 or 431[2]	3	MATH 350	3
MATH 475	3	MATH 410 or 454[2]	3
Applied Mathematics Elective[3]	3	Applied Mathematics Elective[3]	3
Minor Elective	3	IPRO Elective I	3
Humanities Elective (300+)	3	Minor Elective	3
Free Elective	3		
	18		**15**

			Year 4
Semester 1	**Credit Hours**	**Semester 2**	**Credit Hours**
MATH 400	3	IPRO Elective II	3
Minor Elective	3	Applied Mathematics Elective[3]	3
Applied Mathematics Elective[3]	3	Applied Mathematics Elective[3]	3
Social Sciences Elective (300+)	3	Humanities Elective (300+)	3
Free Elective	3	Free Elective	3
	15		**15**

Total Credit Hours: 128

1. Students must complete one of the following computer science sequences: CS 115 and CS 116, CS 104 and CS 201, or CS 105 and CS 201.
2. Applied mathematics majors are required to take one of the following: MATH 410, MATH 430, MATH 431, or MATH 454. MATH 430 and MATH 431 are offered only during fall semesters; MATH 410 and MATH 454 are offered only during spring semesters. If a student chooses to take only one of these courses, then the other slot is to be interpreted as an applied mathematics elective.
3. Applied mathematics electives are to be chosen after consultation with an academic adviser. Student goals, interests, and course availability should be determining factors in this selection process. The optional specializations on the Specializations tab may also serve as a guide to applied mathematics elective selection.

Applied Mathematics Specializations

In addition to the general B.S. in Applied Mathematics degree, the department offers five 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
- industrial research
- graduate school

Choosing any of the following specializations is optional.

Specialization in Applied Analysis

Program adviser: 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.

Required Courses

Code	Title	Credit Hours
MATH 380	Introduction to Mathematical Modeling	3
MATH 400	Real Analysis	3
MATH 461	Fourier Series and Boundary-Value Problems	3
MATH 488	Ordinary Differential Equations and Dynamical Systems	3
MATH 489	Partial Differential Equations	3
Closely related courses which are recommended as additional electives include:		
MATH 402	Complex Analysis	3
MATH 478	Numerical Methods for Differential Equations	3
MATH 486	Mathematical Modeling I	3

MATH 380 and MATH 400 are required for all applied mathematics majors. The other three courses count toward MATH electives.

Recommended minors include: Physics or an engineering minor.

Specialization in Computational Mathematics

Program adviser: 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.

Required Courses

Code	Title	Credit Hours
MATH 350	Introduction to Computational Mathematics	3
MATH 435	Linear Optimization	3
or MATH 461	Fourier Series and Boundary-Value Problems	
MATH 476	Statistics	3
MATH 477	Numerical Linear Algebra	3
MATH 478	Numerical Methods for Differential Equations	3
Closely related courses which are recommended as additional electives include:		
MATH 431	Computational Algebraic Geometry	3
MATH 435	Linear Optimization [1]	3
MATH 461	Fourier Series and Boundary-Value Problems [1]	3
MATH 484	Regression	3
MATH 486	Mathematical Modeling I	3

MATH 488	Ordinary Differential Equations and Dynamical Systems	3
MATH 489	Partial Differential Equations	3

[1] Only if not already counted as a required course.

MATH 350 is required for all applied mathematics majors. The other four courses count toward MATH electives.

Recommended minors include: Artificial Intelligence, Computational Structures, or Software Engineering.

Specialization in Discrete Applied Mathematics

Program adviser: 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.

Required Courses

Code	Title	Credit Hours
MATH 332	Elementary Linear Algebra	3
MATH 430	Applied Algebra	3
MATH 435	Linear Optimization	3
MATH 453	Combinatorics	3
MATH 454	Graph Theory and Applications	3
Closely related courses which are recommended as additional electives include:		
MATH 410	Number Theory	3
MATH 431	Computational Algebraic Geometry	3

MATH 332 is required for all applied mathematics majors, and MATH 430 or MATH 454 satisfies the discrete mathematics core requirement. The other three courses count toward MATH electives.

Recommended minors include: Artificial Intelligence, Computational Structures, or Computer Networking.

Specialization in Mathematical Finance

Program adviser: T. Bielecki

Students who choose this specialization may qualify for admission to the Master of Mathematical Finance program—a collaborative program between the Stuart School of Business and the Department of Applied Mathematics. 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.

A business or entrepreneurship minor is required. See the Minors section for more details.

Required Courses

Code	Title	Credit Hours
MATH 475	Probability	3
MATH 476	Statistics	3
MATH 478	Numerical Methods for Differential Equations	3
MATH 481	Introduction to Stochastic Processes	3
MATH 485	Introduction to Mathematical Finance	3
Closely related courses which are recommended as additional electives include:		
MATH 461	Fourier Series and Boundary-Value Problems	3
MATH 477	Numerical Linear Algebra	3
MATH 483	Design and Analysis of Experiments	3
MATH 484	Regression	3
MATH 486	Mathematical Modeling I	3
MATH 489	Partial Differential Equations	3

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

Specialization in Stochastics

Program Adviser: I. Cialenco

Stochastics 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.

Required Courses

Code	Title	Credit Hours
MATH 475	Probability	3
MATH 476	Statistics	3
MATH 481	Introduction to Stochastic Processes	3
MATH 485	Introduction to Mathematical Finance	3
MATH 488	Ordinary Differential Equations and Dynamical Systems	3
Closely related courses which are recommended as additional electives include:		
MATH 453	Combinatorics	3
MATH 483	Design and Analysis of Experiments	3
MATH 484	Regression	3
MATH 486	Mathematical Modeling I	3

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