MATHEMATICS, MS: INDUSTRIAL MATHEMATICS

Objective of Mathematics MS: Industrial Mathematics (Option B)

The objective of the master's program in industrial mathematics is to enable students to acquire the fundamentals of applied mathematics in areas of classical and numerical analysis, differential equations and dynamical systems, and probability and statistics. At the same time, the connection of these fields to modeling of physical, biological, and engineering phenomena will be stressed by requiring credits outside of the Department of Mathematical Sciences. Students are to obtain practical experience in mathematical modeling and analysis during an internship or industrial project that will culminate in a thesis.

Overview of Mathematical Sciences Department MS programs

The Department of Mathematical Sciences offers graduate programs of study in mathematics with specializations in the fields of algebra, analysis, topology, applied mathematics, probability and statistics, and actuarial science.

The programs of study at the master's level are designed to suit both the student intending to continue toward a PhD as well as the student who wishes to begin a professional career upon completion of the master's program.

The student may prepare for a career in teaching at the secondary or college level and for a career in research in the academic, industrial, government, or business communities.

Three options for the master's degree are offered: the standard mathematics option (A), the statistics option (B), and the actuarial science option (C). Students who plan to continue for a PhD degree with a focus on mathematics/statistics should elect an option from options A, B, C, or the dual master's degree option.

Dual Master's Degree Option

In addition to multiple options available for MS in mathematics, the Department of Mathematical Sciences at UWM and the Department of Technomathematics of Fachhochschule Aachen (FHA), Germany have recently created a Dual Master's Degree Program in Mathematics. The students enrolled in this program will be able to earn Master's degrees from both institutions upon completion of the common course requirements.

The program is designed in such a way that students typically will be able to complete all the course requirements within a two-year time period (one year at each institution). Within this program students can choose courses that will allow them to concentrate in the areas of Statistics, Numerical Analysis or General Mathematics. Complete information on the admission policy and graduation requirements, including sample schedules, is available at the Department of Mathematical Sciences web page http://uwm.edu/math/graduate/.

Admission Requirements

Application Deadlines

Application deadlines vary by program, please review the application deadline chart (http://uwm.edu/graduateschool/program-deadlines/) for specific programs. Other important dates and deadlines can be found by using the One Stop calendars (https://uwm.edu/onestop/dates-and-deadlines/).

Admission

An applicant must meet the Graduate School requirements as well as the following departmental requirements to be considered for admission to the program:

1. A bachelor's degree in an area of mathematical science (applied or pure mathematics, actuarial science, statistics, etc.), computer science, economics or finance, physics, engineering, or a related field.
2. Completion of at least three semesters of undergraduate calculus plus at least 6 credits of acceptable mathematics courses requiring calculus.
3. Knowledge of a high-level programming language.

Students satisfying only the minimum mathematics requirements will be expected to take courses that do not count toward the degree.

General Requirements

A student must have completed, either prior to entering the program or by the time of graduation, courses in advanced calculus, numerical analysis, and ordinary differential equations. In addition, students must complete courses involving Fourier series, linear algebra, linear programming, mathematical modeling, partial differential equations, probability, and calculus-based statistics.

Credits and Courses

At least 36 graduate credits in G or U/G courses at UWM are required.

Code	Title	Credits
Industial Mathematics Courses		24
MATH 701	Industrial Mathematics I	
MATH 715	Numerical Analysis	
6 additional credits at or above the 600 level		
Coherent set of approved courses (300-level or above) in application area outside the department *		6
Max 6 credits in any combination of independent study or seminar or thesis (MATH 790, MATH 791, MATH 792, MATH 799, or MATH 990)		6
Total Credits		36

* Application areas: Physics, Engineering, Business. Students already proficient in an application area are expected to substitute mathematics courses.

Courses are subject to the following regulations:

- Maximum 12 credits below the 500 level from within the Department of Mathematical Sciences;
- Advisor's prior written approval for every course.

Student also must have demonstrated knowledge of an advanced scientific programming language approved by the Industrial Mathematics Committee.

Special Recommendation

It is recommended that, by the time of graduation, students master the material presented in the following courses, either prior to enrolling or through coursework:

Code	Title	Credits
MATH 313	Linear Programming and Optimization	3
MATH 315	Mathematical Programming and Optimization	3
MTHSTAT 564	Time Series Analysis	3
MATH 571	Introduction to Probability Models	3
MATH 601	Advanced Engineering Mathematics I	3
MATH 602	Advanced Engineering Mathematics II	3
MATH 701	Industrial Mathematics I	3
MATH 702	Industrial Mathematics II	3
MATH 715	Numerical Analysis	3

Students must work closely with their advisors to ensure satisfaction of the General, Coursework, and Thesis requirements for timely graduation.

Approved Industrial Mathematics Courses

Applied Mathematics

Code	Title	Credits
MATH 320	Introduction to Differential Equations	3
MATH 321	Vector Analysis	3
MATH 322	Introduction to Partial Differential Equations	3
MATH 371	Introduction to Stochastic Models in Finance	3
MATH 405	Mathematical Models and Applications	3
MATH 423	Complex Analysis	3
MATH 521 & MATH 522	Advanced Calculus I and Advanced Calculus II	6
MATH 535	Linear Algebra	3
MATH 581	Introduction to the Theory of Chaotic Dynamical Systems	3
MATH 601 & MATH 602	Advanced Engineering Mathematics I and Advanced Engineering Mathematics II	6
MATH 621 & MATH 622	Introduction to Analysis I and Introduction to Analysis II	6
MATH 701 & MATH 702	Industrial Mathematics I and Industrial Mathematics II	6
MATH 703	Advanced Engineering Mathematics I	3
MATH 709	Differential Geometry	3
MATH 716	Ordinary Differential Equations	3
MATH 719	Partial Differential Equations	3
MATH 726	Introduction to Functional Analysis	3
MATH 801	Topics in Applied Mathematics: (Subtitle)	3
MATH 816 & MATH 817	Ordinary Differential Equations and Advanced Ordinary Differential Equations II	6

Numerical Analysis

Code	Title	Credits
MATH 313	Linear Programming and Optimization	3
MATH 315	Mathematical Programming and Optimization	3
MATH 413	Introduction to Numerical Analysis	3
MATH 415	Introduction to Scientific Computing	3
MATH 417	Computational Linear Algebra	3
MATH 715	Numerical Analysis	3
MATH 793	Scientific Computational Laboratory: (Subtitle)	1-2
MATH 813	Numerical Solution of Ordinary Differential Equations	3
MATH 814	Numerical Solution of Partial Differential Equations	3
MATH 815	Topics in Numerical Analysis: (Subtitle)	3

Probability and Statistics

Code	Title	Credits
MTHSTAT 361 & MTHSTAT 362	Introduction to Mathematical Statistics I and Introduction to Mathematical Statistics II	6
MTHSTAT 461 & MTHSTAT 462	Data Analysis and Graphing Using SAS-I and Data Analysis and Graphing Using SAS-II	4
MTHSTAT 562	Design of Experiments	3
MTHSTAT 563	Regression Analysis	3
MTHSTAT 564	Time Series Analysis	3
MTHSTAT 565	Nonparametric Statistics	3
MTHSTAT 568	Multivariate Statistical Analysis	3
MATH 571	Introduction to Probability Models	3
MTHSTAT 761 & MTHSTAT 762	Mathematical Statistics I and Mathematical Statistics II	6
MATH 768	Applied Stochastic Processes	3
MTHSTAT 863	Hypothesis Testing	3
MTHSTAT 869	Advanced Topics in Mathematical Statistics:	3

Classes in Biostatistics at the Medical College of Wisconsin

Additional Requirements

Major Professor as Advisor

The student must have a major professor to advise and supervise the student's studies. The entering graduate student is assigned an advisor by the chair of the Industrial Mathematics Committee. Depending on the thesis topic, the student may later change advisors.

Thesis

A thesis in which the student solves a mathematical problem with an industrial source is required. The student must work with the advisor/major professor from the start of the thesis through its completion, receiving his/her approval. The student must pass an oral defense before three faculty members.

Time Limit

Full-time students, without deficiencies, could be expected to complete the program in two years. All degree requirements must be completed within seven years of initial enrollment.