



Department of Mathematics

Master of Science in Industrial Mathematics *Student Handbook*

Revised on August 11, 2022

Welcome to the Master of Science in Industrial Mathematics (**MSIM**) program in the Department of Mathematics. It is also called the Professional Science Master's (PSM) in Industrial Mathematics Program. This student handbook is intended to familiarize you with the overview and curriculum of the MSIM program. More general information for graduate students can be found in the **Graduate Student Handbook** (online) by the Office of Graduate Studies in the department, and other university documents and online resources. If you have a question not answered about the MSIM program here, please contact the program director, Dr. Peiru Wu at peiruwu@msu.edu or msim@math.msu.edu.

Table of Contents

Program Overview	2
Program Components.....	2
PSM in Industrial Mathematics Program.....	2
Admission Requirements	2
How to Apply.....	3
MSIM Curriculum	4
Core Courses.....	4
Elective and Cognate Courses.....	4
Certificate in Project Management Course	5
Portfolio Defense	6
Examples of Course Planning	6
Appendix	
Annual Progress Review for the PSM Students.....	7

Program Overview

The goal of the Master of Science in Industrial Mathematics (MSIM) program is to produce generalized problem solvers of great versatility, capable of moving within an organization from task to task. The program is designed for students planning for careers in business, government, or industry. It has been successfully training data analysts/data scientists, mathematician, and problem solvers for leadership in industry over two decades because

- The graduates will have studied standard mathematical and statistical tools, and computer science principles to strengthen data analytics and machine learning skills.
- They will have gained project experience on solving real-world problems proposed by local companies, and they will have received training in technical writing for the project reports.

Program Components: The degree requires **30 credits** of coursework, the completion of the Certificate in Project Management, and the successful completion of the student's portfolio below:
(1) Industrial Mathematical Core Courses (**6 credits**, MTH 843 (Fall), MTH 844 (Spring))
(2) Elective and Cognate Courses (**24 credits**, MTH, STT, CSE/CMSE etc.)
(3) Certificate in Project Management (PHM 857 (Summer only) as for a "not-for-credit" option).
(4) Portfolio Defense (an oral examination on student's major work (last semester))

PSM in Industrial Mathematics Program: The MSIM program has blossomed since its inception from late 90s in the first group of Professional Science Master's (PSM affiliation in 1998). With initial support from the Alfred P. Sloan Foundation, the PSM in Industrial Mathematics program has continued to get national recognition as one of the earliest and the best-established PSMs. "Professional Science Master's are designed for students who are seeking a graduate degree in science or mathematics and understand the need for developing workplace skills valued by top employers." (See <https://www.professionalsciencemasters.org>). Major successes of the program include over two decades of industrial partnership and strong connections with local companies, and outstanding graduate placement rate. We have the industrial advisory board served by industrial representatives from world well-known companies since 1999 to present.

Admission Requirements

Students who wish to apply for admission to the MSIM program should

- Have completed 4-year bachelor's degree and the mathematics/applied mathematics courses required for a major in mathematics, statistics, economics, physics, or science or engineering.
- Have completed coursework at the senior level in mathematical analysis, linear algebra, and differential equations.
- Familiarity or exposure to programming languages such as MATLAB, Python, as well as knowledge and exposure to statistical software package or tools.

Application will be reviewed based on academic record that shows background for success in the program, and professional goal that would be furthered by the coursework and training in the program, as well as recommendation letters that indicate the likelihood of success for meeting the program requirements and completing the MSIM degree.

How to Apply

A complete application to the MSIM includes the following:

1. MSU Graduate Application at <https://admissions.msu.edu/apply/graduate-students> .
2. Current CV/resume, and Academic Statement and Personal Statement are required be included or uploaded within this MSU Graduate Application.
3. Three letters of recommendation be included in the application also.
4. Within the application you will select Industrial Mathematics as your intended major and you will be asked for supplemental questions. Within these questions should contain the Math and Statistics Classes you have (or will have) taken at the Junior, Senior, or Graduate level.
5. Official transcripts of all college work (undergraduate and graduate), including diplomas and certificate. These are to be sent to our department directly from the school(s) which you attended.

Our mailing address is as follows:

Graduate Office
Department of Mathematics
619 Red Cedar Rd. Room C213
Michigan State University
East Lansing, MI 48824

There is no need to send more than one set of transcripts. The Office of Graduate Studies will forward the original transcript to the Office of Admissions.

6. GRE Scores - The three standard sections of the GRE, verbal, quantitative, and analytic are required for admission.
7. TOEFL Scores (International Students Only) -Applicants for whom English is not their primary language are required to submit TOEFL (Test of English as a Foreign Language) or IELTS (International English Language Testing System) scores. TOEFL scores must meet the University minimum requirements: no subscore below 19 for reading, listening, and speaking; no writing subscore below 22; with a minimum total score of 80. For more details, See <https://grad.msu.edu/english-language-competency> .
8. The financial proof for international students (Affidavit of Support for Graduate International Students at https://grad.msu.edu/sites/default/files/content/apply/AffidavitofSupport_form.pdf). See more information regarding the Financial Proof (e.g., Estimated funding requirements for international students) at <https://grad.msu.edu/internationalapplicants> .

Applications are accepted for Fall Semester only. We do not accept applications for Spring or Summer Semester.

You will be able to check your application status through the Graduate Portal found at <http://www.admissions.msu.edu/gradportal> .

For any questions you might have about the MSIM program, please email msim@math.msu.edu .

MSIM Curriculum

In addition to meeting the requirements of University and the College of Natural Science, you must complete a total of **30 credits** of graduate coursework (core courses, elective and cognate courses), the course for Certificate in Project Management, and the student's portfolio defense.

Core Courses (6 credits)

MTH 843 Survey of Industrial Mathematics (Fall)

MTH 844 Projects in Industrial Mathematics (Spring)

Elective and Cognate Courses (24 credits)

A minimum of two of the following courses:

MTH 810 Error-Correcting Codes

MTH 841 Boundary Value Problems I

MTH 842 Boundary Value Problems II

MTH 847 Partial Differential Equations I

MTH 849 Partial Differential Equations II

MTH 850 Numerical Analysis I

MTH 852 Numerical Methods for ODE

MTH 880 Combinatorics

MTH 881 Graph Theory

A minimum of two of the following courses:

STT 801 Design of Experiments

STT 802 Statistical Computation

STT 843 Multivariate Analysis

STT 844 Time Series Analysis

STT 847 Analysis of Survival Data

STT 861 Theory of Probability and Statistics I

STT 862 Theory of Probability and Statistics II

STT 863 Applied Statistics Methods I

STT 864 Applied Statistics Methods II

STT 866 Spatial Data Analysis

STT 875 R Programming for Data Sciences

STT 886 Stochastic Processes and Applications

STT 888 Stochastic Models in Finance

A minimum of two of the following courses:

CMSE 801 Introduction to Computational Modeling

CMSE 802 Methods in Computational Modeling

CMSE 820 Mathematical Foundations of Data Science

CMSE 821 Numerical Methods for Differential Equations

CMSE 822 Parallel Computing

CMSE 823 Numerical Linear Algebra

CSE 802 Pattern Recognition and Analysis

CSE 803 Computer Vision

CSE 830 Design and Theory of Algorithms

CSE 835 Algorithmic Graph Theory

CSE 836 Probabilistic Models and Algorithms in Computational Biology

CSE	841	Artificial Intelligence
CSE	847	Machine Learning
CSE	860	Foundations of Computing
CSE	872	Advanced Computer Graphics
CSE	880	Advanced Database Systems
CSE	881	Data Mining
CSE	885	Artificial Neural Networks
EC	811A	Mathematical Applications in Economics
EC	811B	The Structure of Economic Analysis
EC	812A	Microeconomics I
EC	812B	Microeconomics II
EC	813A	Macroeconomics I
EC	813B	Macroeconomics II and its Mathematical Foundations
EC	820A	Econometrics IA
EC	820B	Econometrics IB
EC	821A	Cross Section and Panel Data Econometrics I
EC	821B	Cross Section and Panel Data Econometrics II
EC	822A	Time Series Econometrics I
EC	822B	Time Series Econometrics II
ECE	848	Evolutionary Computation
ECE	849	Digital Image Processing
ECE	863	Analysis of Stochastic Systems
ME	830	Fluid Mechanics I
ME	840	Computational Fluid Dynamics and Heat Transfer
ME	872	Finite Element Method
MKT	805	Marketing Management
MKT	806	Marketing Research for Decision Making
MKT	816	Marketing Analysis
MKT	819	Advanced Marketing Research
MKT	864	Data Mining in Marketing
SCM	800	Supply Chain Management
SCM	815	Emerging Topics in Supply Management
SCM	826	Manufacturing Design and Analysis
SCM	833	Decision Support Models
SCM	843	Sustainable Supply Chain Management
SCM	853	Operations Strategy
SCM	854	Integrated Logistics Systems

You can learn more about the course descriptions on The Office of the Registrar website at <https://reg.msu.edu/Courses/Search.aspx>. You will discuss with the program director about your course planning prior to each semester. See examples of course planning below.

Certificate in Project Management Course (only offer in summer): It requires the successful completion of the course PHM 857 Project Management covering such topics as formal project management culture, principles, knowledge areas, and terminology. It will be normally undertaken during the summer of your first year of enrollment as for a “not-for-credit” option. Certification will also require participation in Industrial Mathematics-specific discussion sessions.

Portfolio Defense: It requires successfully defending your portfolio of the completed projects to fulfill the MSIM requirements in the last semester. This includes all projects reports done during MTH 843 course work and the industrial project report(s) done as your participation in MTH 844 project team(s). The portfolio defense is about 1.5 hours oral examination conducted by three MSU faculty members. You are expected to be thoroughly conversant with your entire portfolio.

Examples of Course Planning: The following is the collection of (2 years) course planning from recent five years of MSIM graduates, where MTH 890* in Spring (Semester 4) means to do the second industrial project under MTH 844. The students take the course PHM 857 for the Certificate in Project Management in the summer (before Semester 3) and complete the portfolio defense in their last semester.

Semester	Core*; MTH	STT	Cognate
Fall (Semester 1)	MTH 843*; MTH 841, MTH 850	STT 801, STT 802, STT 861, STT 863, STT 886	EC 820A, EC 821A, ECE 863, ME 830, SCM 800, SCM 833
Spring (Semester 2)	MTH 844*; MTH 810, MTH 842, MTH 852	STT 843, STT 864, STT 888	CMSE 801, CSE 802, CSE 881, ME 840, MKT 806, MKT 819
Fall (Semester 3)	MTH 841, MTH 847, MTH 850, MTH 880	STT 801, STT 802, STT 861, STT 863, STT 866, STT 886	CMSE 801, CMSE 802, CMSE 820, CSE 841, CSE 881, EC 820A, ME 830, MKT 805, MKT 806, MKT 819, SCM 800
Spring (Semester 4)	MTH 810, MTH 842, MTH 849, MTH 852	STT 847, STT 864, STT 888	MTH 890*, CMSE 823, CSE 802, CSE 830, CSE 881, MKT 819

Appendix

Annual Progress Review for the PSM Students (form)

PERFORMANCE EXPECTATIONS FOR THE STUDENTS IN PSM IN INDUSTRIAL MATHEMATICS AT MICHIGAN STATE UNIVERSITY

Student (Print) _____

Semester _____

Student (Signature*) _____

Date _____

* Signature acknowledges review; it does not imply that student agrees with all comments.

Advisor (Signature) _____

Date _____

1. PROFESSIONAL CRITERIA:

- a) Professional Department – In advance of each semester, the student will provide to his/her advisor a formal memo outlining semester courses and goals. Each student is expected to prepare for and attend job fairs, and to inform the program coordinator via memo of the outcome of each fair. All academic and professional duties are to be completed within schedule.
- b) Team Building – Each student will promote teamwork while performing as an individual contributor during the course work and projects in MTH 843 and MTH 844. Each team member must be open and candid with their peers and faculty manager. Students are expected to study teaming theory and to continually practice and improve their teaming skills.
- c) Communication Skills – Each student will communicate clearly, concisely, and professionally. This requires timely oral and written communications with the program coordinator, peers and faculty manager regarding projects, summer internships (or co-ops), job searches, and professional improvement etc. Students are expected to continually improve their communication skills.

2. PERFORMANCE EXPECTATIONS:

Top:	Middle:	Low:
Performance that substantially exceeds the expectations of the PSM student	Performance that fully meets the expectations of the PSM student	Performance that does not meet the expectations of the PSM student
<ul style="list-style-type: none"> ▪ Student excelled at obligations as a professional graduate and demonstrated initiative 	<ul style="list-style-type: none"> ▪ Followed directions and discharged obligations in this professional training program 	<ul style="list-style-type: none"> ▪ Reluctantly followed directions or resisted training in the program
<ul style="list-style-type: none"> ▪ Recognized a need and took significant action in this professional training 	<ul style="list-style-type: none"> ▪ Understood role and cooperated with training positively 	<ul style="list-style-type: none"> ▪ Minimal understanding of training and minimal action beyond what was asked
<ul style="list-style-type: none"> ▪ Exceeded major goals in a way that benefited personal growth and learning 	<ul style="list-style-type: none"> ▪ Successfully achieved professional and personal goals that meet the program requirements 	<ul style="list-style-type: none"> ▪ Barely meet the program requirement and minimal improvement related to development goals
<ul style="list-style-type: none"> ▪ Consistently demonstrated PSM professionalism and discipline 	<ul style="list-style-type: none"> ▪ Regularly demonstrated PSM professionalism and discipline 	<ul style="list-style-type: none"> ▪ Poorly demonstrated PSM professionalism and discipline

3. PERFORMANCE REVIEW AND IMPROVEMENT AREAS BY THE STUDENT*:

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* Read items 1 and 2 regarding the criteria and expectations for the students in Professional Science Master's (PSM) Program in Industrial Mathematics.

4. PERFORMANCE SHARED VALUES:

Shared Value	Excellent	Adequate	Needs Development
Professional Improvement			
Integrity/Attitude			
Promptness			
Open/Clear Communication			
Teamwork			
Academic Development			

5. PERFORMANCE IMPROVEMENT AREAS AND COMMENTS BY THE ADVISOR:

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