APPLIED AND INDUSTRIAL MATHEMATICS M.S.

Degree: Master of Science
https://www.towson.edu/fcsm/departments/mathematics/grad/applied/

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The Master of Science program provides students with a broad knowledge in applied mathematics with an emphasis on areas with the highest demand in business and industry. Among the areas stressed in the program are mathematical modeling, numerical computations, operations research, financial mathematics and statistical analysis. Numerical, computational and algorithmic approaches to problem solving are stressed throughout the program. Graduates of the program will be qualified to work in such fields as operations research, stochastic modeling, financial data analysis and statistics, among many others. Graduates of the program will also be prepared for further work at the doctoral level.

The main objectives of the program are:

1. to prepare individuals to apply advanced mathematical skills to problems in areas of science, business and industry;
2. to develop the students' abilities to integrate, in a meaningful way, the use of technology in their everyday professional practice;
3. to give educators an opportunity to satisfy their in-service requirements and simultaneously enhance their knowledge of technology and enrich their mathematical backgrounds;
4. to supply students with the mathematical competency necessary for advancement to a more professional role;
5. to educate students to solve problems, to work in teams and to communicate in an interdisciplinary setting;
6. to familiarize students with the recent advances in applied mathematics;
7. to prepare students for further graduate work at the doctoral level in applied mathematics; and
8. to enrich the academic culture by providing opportunities for interaction of mathematical and industrial research.

Both full-time and part-time students are encouraged to enroll in the program. Core courses are usually offered in the evening, for the convenience of part-time students.

Accelerated Bachelor's-Master's Program

Students may also earn an M.S. in Applied & Industrial Mathematics through the Department of Mathematics' accelerated bachelor's and master's program. This program allows students to complete their undergraduate and graduate degrees in a shorter time frame.

Please see the Undergraduate Catalog for information on the accelerated bachelor's-master's program.

Requirements

Admission Requirements

Application deadlines and a full listing of materials required for admission can be found on the website.

Degree Requirements

There are two concentrations from which to choose: Differential Equations/Optimization or Applied Statistics/Mathematical Finance.

A student may transfer up to two graduate-level mathematics courses taken at another institution, provided that the transfer is consistent with the graduate policy.

The program requires the completion of an applied full-year research project at a graduate level. There are three options listed below in order of priority to complete this requirement. The project can be:

1. An external applied project through a local industry or a government agency. Students choosing this option take MATH 791 and MATH 792, under the supervision of a faculty member from the Department of Mathematics.
2. With a faculty member in the Department of Mathematics on an applied graduate-level project. Students choosing this option take MATH 880 and MATH 881.
3. In the department's Applied Mathematics Laboratory (AML). Typically, corporations and government agencies sponsor these projects. Students choosing this option take MATH 880 and MATH 881. Not all AML projects can be used for the internship purpose.

Students need to submit a project proposal to the graduate committee for approval. In particular, students working on AML projects must describe their roles and responsibilities as part of the team. Students on AML projects must take a primary role in a significant portion of the project. The project proposal must be approved by the graduate committee before students can register for the course. All students must produce a final written project report and make an oral presentation to the graduate committee. For students who participate in AML projects, this is in addition to any project-required reports and presentations. Satisfactory completion of the technical report and the oral presentation, as judged by the Graduate Program Committee, is a requirement for graduation.

If the Graduate Program Committee believes that all attempts, based on the above options, to find an internship project for the student were not successful, the student can take two additional 600-level mathematics courses from the declared concentration and must pass both courses with a letter grade B+ or higher.

All graduate students are required to meet with the APIM graduate program director two and a half terms prior to their graduation (late April or late October, whichever applies) to discuss their choices for completing the internship requirement. Students will commit themselves to their choice by signing a form available from the director.

Students whose careers are in education may, with the approval of the department's Graduate Program Committee, replace the industrial setting of the internship with an educational setting. This will typically entail the development of original course material stressing applied mathematics and using innovative teaching techniques.

The student is required to successfully complete at least 10 courses (a minimum of 30 units) as indicated below: At most, two 500- level classes will count towards the degree

1. at least four 600-level courses from a declared concentration
2. at least two 600-level courses from the other concentration

   [1] NOTE: At most one of the courses in the degree requirement No. 2 above can be replaced with MATH 671, MATH 676 or MATH 685.

3. at least two elective courses at the 500 or 600 level
4. an internship project (MATH 791 & MATH 792) or applied graduate research project (MATH 880 & MATH 881) or alternative coursework approved by the Graduate Committee.

Code	Title	Units
Required Courses for all Concentrations		6
MATH 791 & MATH 792	MASTERS INTERNSHIP I and MASTER'S INTERNSHIP II	
OR		
MATH 880 & MATH 881	APPLIED MATHEMATICS GRADUATE PROJECT I and APPLIED MATHEMATICS GRADUATE PROJECT II	
OR		
6 units of alternative coursework approved by the Graduate Committee		
Concentration Coursework		**12**
Other Concentration Coursework		**6**
Electives		**6**
Total		**30**

Differential Equations/Optimization Concentration

Code	Title	Units
Select at least 4 courses from declared concentration and 2 courses from the other concentration:		
MATH 635	APPLIED NUMERICAL ANALYSIS	3
MATH 636	LINEAR AND NONLINEAR PROGRAMMING	3
MATH 637	ADVANCED TOPICS IN APPLIED OPERATIONS RESEARCH	3
MATH 673	INTEGRAL TRANSFORMS AND APPLICATIONS	3
MATH 674	APPLIED PARTIAL DIFFERENTIAL EQUATIONS	3
MATH 675	ASYMPTOTIC AND PERTURBATION ANALYSIS	3
MATH 686	SPECIAL TOPICS IN DIFFERENTIAL EQUATIONS OR OPTIMIZATION	3

NOTE: All courses above have strictly enforced prerequisites.

Applied Statistics/Mathematical Finance Concentration

Code	Title	Units
Select at least 4 courses from declared concentration and 2 courses from the other concentration:		
MATH 632	COMPUTATIONAL STOCHASTIC MODELING	3
MATH 634	TIME SERIES ANALYSIS AND FORECASTING	3
MATH 638	APPLIED MULTIVARIATE STATISTICAL ANALYSIS	3
MATH 639	LOSS MODELS	4
MATH 640	BAYESIAN STATISTICS	3
MATH 643	COMPUTATIONAL METHODS OF MATHEMATICAL FINANCE	3
MATH 644	MATHEMATICS OF FINANCIAL DERIVATIVES	3
MATH 646	REGRESSION ANALYSIS	3
MATH 687	SPECIAL TOPICS IN APPLIED STATISTICS OR MATHEMATICAL FINANCE	3

NOTE: All courses above have strictly enforced prerequisites.

Electives

Code	Title	Units
Electives for Both Concentrations (at least two courses):		
MATH 531	PROBABILITY	4
MATH 532	MATHEMATICAL STATISTICS	3
MATH 533	APPLIED REGRESSION AND TIME SERIES PREDICTIVE MODELING	4
MATH 535	NUMERICAL ANALYSIS I	3
MATH 537	OPERATIONS RESEARCH	3
MATH 538	FUNDAMENTALS OF LONG-TERM ACTUARIAL MATHEMATICS	4
MATH 563	LINEAR ALGEBRA	3
MATH 574	DIFFERENTIAL EQUATIONS	3
MATH 575	MATHEMATICAL MODELS	3
MATH 576	INTRODUCTORY REAL ANALYSIS	4
MATH 577	COMPLEX ANALYSIS	3
MATH 579	FOURIER ANALYSIS WITH APPLICATIONS	3
MATH 585	MATHEMATICAL FINANCE	3
MATH 586	RISK MANAGEMENT AND FINANCIAL ENGINEERING	3
MATH 671	CHAOTIC DYNAMICS AND FRACTAL GEOMETRY	3
MATH 676	INTRODUCTION TO MATHEMATICAL CONTROL THEORY	3
MATH 685	SPECIAL TOPICS IN APPLIED MATHEMATICS	3

Learning Outcomes

1. Use applied mathematics techniques to model, analyze and solve real world problems.
2. Apply advanced mathematical skills to solve and model problems in areas of science, business and industry.
3. Integrate the use of technology in their professional practices.
4. Apply and demonstrate research skills, writing skills, thinking skills and problem solving skills.