

To: McNichols Faculty Assembly  
From: McNichols Faculty Assembly Undergraduate Standards Committee  
Date: February 11, 2009  
Re: College of Engineering and Science, Department of Mathematics and Computer Science Minor in Applied Mathematics

The Undergraduate Standards Committee has carefully reviewed the proposal for a Minor in Applied Mathematics from the College of Engineering and Science: Department of Mathematics and Computer Science submitted by Dr. Scott Anderson, Dr. Abhijit Dasgupta and Dr. Lazaros Kikas. The Undergraduate Standards Committee have discussed this minor and voted to submit the proposal for the academic minor in Applied Mathematics to the McNichols Faculty Assembly.

This proposal meets all of the requirements for academic minors. The proposal demonstrates academic integrity and intellectual merit by clearly elucidate a set of objectives and outcomes and a thorough plan of assessment. The College of Engineering and Science and the Department of Mathematics and Computer Science is committed to use the results of assessment to modify the curriculum as needed and continuously improve instructional practices.

It is recommended that the current College of Engineering and Science website and all related informational materials be updated to describe the Applied Mathematics Minor. The updated website and all promotional materials should clearly indicate the academic standards required of all minors as well as the requirements specific to the Applied Mathematics Minor.

We conclude that the College of Engineering and Science, Department of Mathematics and Computer Science is well positioned to immediately implement the Applied Mathematics Minor

Respectfully submitted by, Shirley Sherrick-Escamilla, Ph.D. for Dr. Robert Ross.





**University of Detroit Mercy  
College of Engineering and Science  
Department of Mathematics and Computer Science**

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**Minor in Applied Mathematics**

**(Proposal)**

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***Prepared by: Scott Anderson, Abhijit Dasgupta & Lazaros Kikas***

Revised: February 3, 2009

## A. Summary

For many years the University has offered degrees in mathematics and in mathematics related fields. Because of the importance of mathematics in other fields of study, students have approached the Department over the years inquiring as to whether a minor was or could be offered. The Department has studied the issue and recommends two new minors: a minor in mathematics, for students interested in the theory and underpinnings of mathematics *per se*, and a minor in applied mathematics, for students who want a better grounding in the manner by which mathematics is applied (in research and in practice) in other areas of study.

The Mathematics and Computer Science Department stresses the importance of social responsibility, community service, spiritual and ethical commitment, as well as academic excellence in the courses and programs offered. Faculty members model the mission of the University through their approachability, their availability, and the supportive atmosphere they create both inside and outside of class. This care will be a central feature of the mathematics minor as well as the major.

This document describes the Minor in **Applied Mathematics**.

## B. Minor Description

The courses for the minor are divided into four groups: Group A (required of all minors); Group B (courses in Mathematics); Group C (courses in Applied Mathematics); Group D (electives). Below the course list is an explanation of what is required coursework for this minor.

### 1. List of Courses

#### **Group A: Required of All Minors**

**MTH 142 (Calculus II, 4 Credits)**

**MTH 241 (Calculus III, 4 Credits)**

**MTH 402 (Linear Algebra, 3 Credits)**

#### **Group B: Courses in Mathematics**

**MTH 306 (Mathematical Thinking, 3 Credits)**

**MTH 405 (Modern Algebra, 3 Credits)**

**MTH 415 (Theory of Numbers, 3 Credits)**

**MTH 435 (Analysis, 3 Credits)**

#### **Group C: Courses in Applied Mathematics**

**MTH 305 (Mathematics of Finance, 3 Credits)**

**MTH 372 (Differential Equations, 4 Credits)**

**MTH 427 (Applied Probability and Statistics, 3 Credits)**

**MTH 459 (Mathematical Modeling, 3 Credits)**

**MTH 451 (Techniques of Advanced Calculus, 3 Credits)**

#### **Group D: Elective Courses**

**MTH 276 (Discrete Structures, 3 Credits)**  
**Any other course numbered MTH 300 through MTH 469**

**2. The Minor in Applied Mathematics requires:**

All 3 courses from Group A

At least 2 courses from Group C

At least one other course from Group B, C or D

**C. Course Descriptions and Prerequisites**

**MTH 142 Analytic Geometry and Calculus II, 4 credits. Prerequisite:**  
**MTH 141.** Topics in analytic geometry, differentiation and integration of exponential, logarithmic and inverse trigonometric functions; sequences and series.

**MTH 241 Analytic Geometry and Calculus III, 4 credits. Prerequisite:**  
**MTH 142.** Plane curves; polar coordinates; vectors in two and three dimensions; analytic geometry in the three dimensions; vector valued functions; partial derivatives and multiple integrals.

**MTH 305 Mathematics of Finance, 3 credits. Prerequisite: MTH 112 or MTH 142.** Measurement of interest; nominal and effective interest; force of interest; present value factor; annuities; amortization schedules and sinking funds; reinvestment rates; bonds and other securities.

**MTH 306 Mathematical Thinking, 3 credits. Prerequisites: MTH 142, MTH 276.** Students will learn how to form plausible conjectures. Students will be introduced to various techniques of proofs such as direct proof, proof by contrapositive, proof by induction, etc. Applications of these techniques on set theory, analysis, combinatorics group theory, and functions and relations will be discussed.

**MTH 372 Differential Equations with Linear Algebra, 4 credits. Prerequisite: MTH 142.** Linear dependence; linear differential equations and applications; systems of linear differential equations; series solutions.

**MTH 402 Linear Algebra with Applications, 3 credits. Prerequisite: MTH 141 or permission of instructor.** Vector spaces, matrices, systems of linear equations, determinants, inner products, linear transformations, similar matrices, eigenvalues and eigenvectors of a matrix.

**MTH 405 Introduction to Modern Algebra I, 3 credits. Prerequisites: MTH 276, MTH 402.** Sets and mappings, an axiomatic approach to the number system, groups, rings, ideals, fields, isomorphism theorems, induction, permutations.

**MTH 415 Theory of Numbers, 3 credits. Prerequisite: MTH 142.** Divisibility, congruences, quadratic reciprocity, number theoretic functions, Diophantine equations, prime number theorems, recent developments in number theory.

**MTH 427 Applied Probability and Statistics, 3 credits. Prerequisite: MTH 241.** Introductory probability theory; elements of sampling and descriptive statistics; sampling distributions; estimations and hypothesis testing; regression and correlation analysis; computer laboratory using a statistical software package.

**MTH 435 Modern Analysis I, 3 credits. Prerequisite: MTH 276, MTH 306.** Techniques of mathematical proofs chosen from real numbers, sets, functions, point set theory, theory of limits, continuity, differentiation, Riemann integral, and infinite series.

**MTH 451 Techniques of Advanced Calculus, 3 credits. Prerequisites: MTH 241, MTH 372.** Real vector spaces, Laplace transforms, Fourier series, boundary value theorems, series solution about singular points, Bessel functions, Legendre polynomials.

**MTH 459 Principles of Model Building, 3 credits. Prerequisite: MTH 142.** Introduction to the ideas of a mathematical model and model building, linear programming models, game-theoretic models, regression analysis models. Applications in business, ecology, psychology, sociology, and political science.

#### **D. Restrictions**

1. Students must maintain a cumulative 2.0 (C) grade point average in all minor courses in order for the minor to be posted on the official transcript at the time of graduation.

2. Prerequisites must be satisfied if a minor course has them. In particular, a student must have passed or tested out of MTH 141 (Calculus I) in order to begin the minor coursework.
3. At least 12 credits (or 4 courses) of the courses required for the minor must be taken at UDM unless the courses are taken as part of a consortium agreement.
4. The minor is open to students of any major except of course Mathematics.
5. Only 6 credits of mathematics courses that are required by the students' major can count towards the minor. Additional electives may be taken to reach the required minimum of 18 credit hours.

**Minor Advising Worksheet – Applied Mathematics**

**University of Detroit Mercy  
College of Engineering and Science  
Department of Mathematics and Computer Science  
ADVISING WORKSHEET  
Minor in Applied Mathematics**

Name of Student \_\_\_\_\_

Student ID \_\_\_\_\_ Major \_\_\_\_\_

Telephone \_\_\_\_\_ E-Mail \_\_\_\_\_

Courses Completed for the Applied Mathematics Minor

#	Course	Title	Credits	Required	In Major (yes or no)	Grade
1	MTH 142	Calculus II	4	Required		
2	MTH 241	Calculus III	4	Required		
3	MTH 402	Linear Algebra	3	Required		
4	MTH 305	Math. of Finance	3	At least two of these		
5	MTH 372	Differential Equations	4			
6	MTH 427	Applied Prob. and Stats.	3			
7	MTH 451	Techniques of Adv. Calc.	3			
8	MTH 459	Mathematical Modeling	3			
9	Any MTH 300 to MTH 469					
Comprehensive Exam						

MTH Courses Completed: \_\_\_\_\_

GPA for the Minor \_\_\_\_\_

MTH credits *not in major* \_\_\_\_\_

MTH credits counted from major ( $\leq 6$ ) \_\_\_\_\_

(Note: if MTH 142 and/or MTH 241 are required by the student's major, each is counted as three credits for purposes of the Minor, but the GPA calculation for the Minor will be based on the actual course credits)

TOTAL CREDITS \_\_\_\_\_  
(minimum of 18)

\_\_\_\_\_  
(Signature of Minor Advisor)

\_\_\_\_\_  
(Date)

## **E. Mission**

The Mathematics and Computer Science Department stresses the importance of social responsibility, community service, spiritual and ethical commitment, as well as academic excellence in the courses and programs offered. Faculty members model the mission of the University through their approachability, their availability, and the supportive atmosphere they create both inside and outside of class. This care will be a central feature of the mathematics minor as well as the major.

The Minor in Applied Mathematics is a student-centered program that provides support for students to further develop their interest and abilities in the mathematics used by researchers outside the field of mathematics, to expand their understanding of the capabilities of the human intellect, and to develop confidence in their ability to solve problems.

## **F. Objectives, Outcomes, and Assessment**

### **1. Objectives and Learning Outcomes**

#### **Objectives**

The minor in Applied Mathematics should:

- Give students interested in applications a better grounding in the manner by which mathematics is applied to other fields of study.

#### **Learning Outcomes**

A student completing the minor in Applied Mathematics should be able to:

- Apply mathematics to problems in various areas including science, and engineering.
- Use mathematical software to solve problems.
- Understand the theory and applications of calculus, and linear algebra.
- Read, write, listen and speak mathematically and to read and understand mathematically based material.

## **2. Assessment**

A two part test will be given to each student approximately one semester before they graduate. The first part of each test will consist of several questions assessing the breadth of their knowledge across the respective curriculum. The second part will consist of a set of challenging questions from a variety of mathematical fields, which the student will pick one to answer. Each two part test will be graded as pass/fail.

## **3. A Sample Course Selection**

According to the description in Section B above, a minimum of 18 credit hours and six courses are needed to complete the minor in Applied Mathematics. E.g., a student can do this by taking MTH 142, 241, 402, 305, 427, and 451.

## **G. Faculty**

Faculty from the Mathematics Department will serve as advisors for this minor. They will:

- Inform and advise student about the minor
- Monitor the implementation of the minor and recommend future improvements
- Create the Minor Advising Worksheet and ensure its presence in students' files
- Confirm the completion of the minor
- Participate in promoting the minor inside and outside the University

## **H. Resources**

As all the courses needed for the minor are currently included in the course offering of the Department of Mathematics and Computer Science; no new course needs to be developed. In addition no faculty is needed to be hired exclusively for this minor. It is not believed the creation of a minor will place any resource strain on the Department.

No additional facilities or equipment are required in order to provide this minor.

## **I. Changes to the Applied Mathematics Minor**

Any future modifications to the minor are subject to the same review procedure as the major, which is overseen by the Mathematics Curriculum Committee and the administration of the college.