Prefix, Number and Name of Course:
ACM 612 Computational Foundations of Applied Mathematics From a Problem Solving Perspective

Credit Hours: 1
In Class Instructional Hours: 1 **Labs:** 0 **Field Work:** 0

Catalog Description:
Prerequisite: Instructor Permission
Introduction to algorithm design to implement mathematical models, procedural and functional programming, programming paradigms, higher level languages: statistical and visualization software, typesetting software for science and mathematics.

Reasons for Addition:
To create a one-semester-hour core module for the graduate Professional Applied and Computational Mathematics program where students will be actively engaged in problem solving in Computational Mathematics.

Student Learning Outcomes: Students will:	**Course Content References:**	**Assessment:**
1. demonstrate the ability to program in different computing languages.	II,III,IV	1. Individual homework assignments, group work, examinations and computer projects.
2. design algorithms and implement algorithms using a computing language.	I,II,III,IV	2. Individual homework assignments, group work, examinations and computer projects.
3. analyze, compare and contrast the advantages of disadvantages of different computing languages.	II,III,IV	3. Individual homework assignments, group work, examinations and computer projects.
4. create reports and presentations using typesetting software.	V	4. Individual homework assignments, group work, examinations and computer projects.
Course Content: NOTE: some of the topics will be introduced simultaneously in the context of student		

projects. Some topics will only be covered briefly.

I. Algorithms and applications
- A. Algorithm design
- B. Monte Carlo method examples
- C. Random number generators
- D. Linear vs. parallel programming paradigms
- E. Data base concepts

II. Computer algebra systems
- A. Functional programming
- B. Data visualization and computer graphics
- C. Importing and exporting data from different programming languages

III. Statistical programming languages
- A. @RISK
- B. SAS
- C. EXCEL
- D. SPSS
- E. R
- F. Decision tree software
- G. Importing and exporting data

IV. C++ programming language
- A. Introduction to procedural programming
- B. High performance number crunching
- C. Parallel programming

V. LaTeX
- A. Reports and other document formats
- B. Presentations
- C. Posters

Resources:

Scholarships in the Field:

Ruskeepaa, H., *Mathematica Navigator, Burlington*, Elsevier, 2004.

Ghezzi, C. and Lazayeri, M., *Programming Language Concepts*, New York, Wiley, 1998.

Savitch, W., *Problem Solving with C++*, Menlo Park, Addison-Wesley Publishing Company, 1996.

Cormen, T. et all, *Introduction to algorithms*, Cambridge, Mass, MIT Press, c2001.

Skansholm, J., *C++ From the Beginning*, Dorchester, Addison Wesley, 2002

Periodicals:

SIAM Journal on Computing
The Mathematica Journal

Electronic and/or Audiovisual Resources:

C++ Tutorial
(http://www.cplusplus.com/doc/tutorial/).

Getting started with LaTeX
(http://www.maths.tcd.ie/~dwilkins/LaTeXPrimer/).

Math Gateway online
(http://mathgateway.maa.org).

Mathematica web site
(http://www.Wolfram.com).