MATH 3423 - Numerical Methods 2
Acadia University

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1 Summary

Numerical differentiation and integration, numerical solution of differential equations, optimization. The solution of problems on computer forms an integral part of the course.

2 Prerequisite

- Math 2413.
- Strongly suggested: Math 2023 or a comparable background in Differential Equations. We will be solving differential equations in this course so you need to know what they are!!!

3 Textbooks

Required:

- Michael T. Heath, *Scientific Computing: An Introductory Survey*, 2nd Edition (McGraw-Hill, 2001). ISBN #007112229X.

4 Course outline

1. Numerical Differentiation and Integration (2 weeks)
    - Numerical Quadrature
    - Integral Equations
    - Finite Difference
2. Optimization (4 weeks)
    - Steepest Descent

- Newton's Method
- Linear and Nonlinear Least Square Methods
- Linear Programming

3. Numerical Solution of Differential Equations (Part 1) (4 weeks)

   - Euler's Method
   - Taylor Series Methods
   - Runge-Kutta Methods

4. Advanced Numerical Solution of Differential Equations (Part 2 - as time permits!) (5 weeks)

   - Finite Difference Method
   - Galerkin
   - Finite Elements Method

The first half of the course will be on Numerical integration and differential up to optimization problems. The Mid-Term Exam (after study week) and the first two assignments will cover that material. We will then spend the rest of the course solving differential equations. The last two assignments will be on differential equations.

5 Grading Scheme

Exams will consist of pen and paper questions and while they will be similar in content to the assignments, students are expected to be able to prove theorems (for example).

	percentage
4 Assignments	20%
Mid-Term Exam	20%
Final Exam	60%

6 Assignments

Assignments will consist mostly of challenging problems to be solved using Matlab or any other convenient programming environment (C++ for example). In general, students will have two weeks to submit a report on the problem with plots and tables. Students may work in teams of up to 2 or work alone. In all cases, each student must write his own report. Students will be encouraged to use a word processor or similar tools (TEX, LATEX...) to produce their reports.