UNIVERSITY OF CALGARY

FACULTY OF SCIENCE
Department of Mathematics and Statistics

Applied Mathematics 493 Numerical Analysis II

(see Course Descriptions for the applicable academic year: http://www.ucalgary.ca/pubs/calendar/)

Syllabus

Topics	**Number of Hours**
Numerical differentiation	3
Numerical Solution of Ordinary Differential Equations:	
• Euler's Method	2
• Multistep Methods	3
• Runge-Kutta Methods	3
• Stiff Equations and Stability	3
• Adaptive Methods	3
Numerical Solution of Partial Differential Equations:	
• Finite Difference Methods: Elliptic equations; Hyperbolic equations; Parabolic equations	10
• Variational Techniques, Galerkin's Method, The Rayleigh-Ritz Method, The Finite Element Method	9
TOTAL HOURS	**36**

AMAT 493 (Numerical Analysis II)
Course Outcomes:

Overview

This course is the continuation of AMAT 491. It is an introduction to the methods and tools that are used to compute numerical differentiation, solve ordinary and partial differential equations. It assumes knowledge of the standard calculus sequence, linear algebra, differential equations and some working experiences with procedural programming languages.

By the end of this course, students should be able to

1. Derive finite difference formula for numerical differentiation of a function with specified order of accuracy.

2. Derive and implement the following numerical methods: Euler's method, Multistep method, Runge-Kutta method; conduct stability and convergence analysis of these methods.

3. Understand the definition of stiff ordinary differential equations and the numerical methods that are suitable for stiff ordinary differential equations.

4. Develop and implement adaptive methods for ordinary differential equations.

5. Derive and implement finite difference method for solving the three types of partial differential equations: Elliptic equations; hyperbolic equations and parabolic equations.

6. Analyze and prove the stability, convergence of finite difference methods for solving partial differential equations; Implement finite difference methods and verify the order of convergence.

7. Understand and apply vibrational techniques; derive the Galerkin's method, the Rayleigh-Ritz method for solving partial differential equations.

8. Implement finite element method for solving partial differential equations in one-dimensional and two-dimensional spaces.

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16:11:02
Prerequisite change 2009:07:01
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