

ES400/500: NUMERICAL AND ENGINEERING COMPUTING
Spring 2008

Pre-requisites: At least second semester sophomore standing, ES100, or consent of instructor
Course Type: Elective
Textbook: None required.
Instructor: Ross Taylor (CAMP 222, 268-6652, taylor@clarkson.edu)
Office hours: Open door policy or by appointment

Learning Objectives:

1. To introduce the principles behind engineering models and the need for numerical methods of solving engineering model equations.
2. To introduce methods for solving systems of nonlinear algebraic equations.
3. To introduce methods of numerically solving ordinary differential equations.
4. To introduce methods of numerically solving partial differential equations

Learning Outcomes¹:

1. Students will be able to select appropriate methods for numerically solving the equations that model engineering systems.
2. Students will gain experience with a programming language of their choice.
3. Students will be able to program some simple numerical methods and use these methods to solve representative engineering models.

Evaluation Methods:

Students will be “assigned” ten problems that cover the full spectrum from systems of nonlinear equations to ODEs, to PDEs. To earn a grade of “A” correct solutions to all are required. Grade will be lowered by half a letter grade for each incorrect or incomplete problem.

Homework will be assigned to give you experience but homework grades will not be counted. This is not an invitation to avoid these assignments; they are an essential part of this course.

Course Outline:

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| 1. Introduction to Modeling | 7. Differential Equations II |
| 2. Introduction to Numerical Computing | <i>Stiff ODEs</i> |
| 3. Nonlinear Equations I | <i>Extrapolation methods</i> |
| <i>Single equations</i> | <i>Systems of ODEs</i> |
| 4. Matrix Computations | <i>Introduction to BVPs</i> |
| 5. Nonlinear Equations II | 8. Differential and Algebraic Systems (DAEs) |
| <i>Systems of equations</i> | 9. Nonlinear Equations III |
| 6. Differential Equations I | <i>Homotopy Methods</i> |
| <i>Euler</i> | <i>Interval Methods for nonlinear systems</i> |
| <i>Runge-Kutta</i> | 10. Differential Equations III - PDEs |
| <i>Stability</i> | <i>Finite difference methods</i> |
| | <i>Method of Lines</i> |

Class Time: Monday evenings at 6:30. CAMP 175

Prepared by: Ross Taylor, October 24, 2007