DEPARTMENT OF MATHEMATICS AND STATISTICS
Spring Semester 2014-2015 (141)

MATH 571: NUMERICAL ANALYSIS OF ORDINARY DIFFERENTIAL EOUATIONS
Catalog Data: Theory and implementation of numerical methods for initial and boundary value problems in ordinary differential equations. One-step, linear multi-step, Runge-Kutta and extrapolation methods; convergence, stability, error estimates and practical implementation. Study and analysis of shooting, finite difference and projection methods for boundary value problems for ordinary differential equations.

Prerequisite: MATH 471 or Consent of the Instructor

Textbook/References:

- J. C. Butcher, Numerical Methods for Ordinary differential equations, 2nd ed. Wiley, 2007.
- J. D. Lambert, Numerical Methods for Ordinary Differential Systems: The Initial Value Problem, Wiley, 1991.
- D. Griffiths, D. J. Higham, Numerical Methods for Ordinary Differential Equations: Initial Value Problems (Springer Undergraduate Mathematics Series), Springer, 2010.

Instructor: Dr. Muhammad Yousuf, Associate Professor, Department of Mathematics and Statistics, 5-403, Tel 7196

Goals: The course provides the essential tools for the analysis and implementation of the numerical methods currently used extensively in the solution of ordinary differential equations encountered in applications.

Prerequisites by topic:

1) Solution of systems of linear and non-linear algebraic equations.
2) Numerical differentiation and integration.
3) Vector and matrix norms
4) Some theoretical background at the advanced calculus level.

Topics

1) Euler method, general one-step methods.
2) Linear multistep methods.
3) Runge-Kutta mehtods. Shooting methods, finite difference methods and projection methods for boundary value problems.
4) Tests and presentations
5) Computer usage: Each student must write and run computer programs to implement methods and solve application problems as assigned.

Projects:

A project that includes application of the above topics will be assigned to each student. Reports are required.

Grading:

The distribution of grade is as follows:

Class Test 30%

Class work (homework and project) 30%

Final Exam 40%

Total 100