QUAID-E-AWAM UNIVERSITY OF ENGINEERING, SCIENCE AND TECHNOLOGY, NAWABSHAH

DEPARTMENT OF MATHEMATICS AND STATISTICS

Title of Subject : Numerical Analysis-I
Course Code : MS 204
Discipline : MS Second Term Second Year
Effective : 2011 Batch and onwards
Assessment : 25% Sessional Work, 75% Written Examination
Credit Hours : 04 + 00
Minimum Contact Hours : 52
Total Marks : 100 + 00

Course Description: This course will emphasize the development of numerical algorithms to provide solutions to common problems formulated in science and engineering. The primary objective of the course is to develop the basic understanding of the construction of numerical algorithms, and perhaps more importantly, the applicability and limits of their appropriate use. The emphasis of the course will be the thorough study of numerical algorithms to understand (i) the guaranteed accuracy that various methods provide, (ii) the efficiency and scalability for large scale systems. and (iii) issues of stability and comparison with analytical methods.

Prerequisites: Linear Algebra, Calculus and Differential Equations. Each student must has his/her own calculator in the class room.

Course Objectives: Upon completion of this course students should be able to:

1. Predict, detect, understand, and control errors when approximating solutions to problems using numerical algorithms.
2. Understand numerical algorithms for interpolation and approximation of functions, their derivatives and integrals from discrete data using polynomials, spline functions.
3. Have knowledge of issues in calculating roots of nonlinear and linear systems of equations, including pivoting strategies for the solution of a linear system of equations.
4. Understand convergence, accuracy and stability of numerical algorithms.
5. Have an understanding of some additional topics selected from eigenvalues and eigenvectors.

Course Contents:

1. Introduction and Basic Concepts:
Introduction and importance of Numerical Analysis (NA), Errors and their computations, Precision, Accuracy, Concept of iterate and iteration.

2. Numerical Methods for Linear Algebra:
Cholesky Method, Jacobi's Method, Gauss-Seidel Method, Computation of eigenvalues and eigenvectors by Power Method, Practical applications.

3. Numerical Solution of Algebraic and Transcendental Equations:
Graphical Method, Bisection Method, False-Position Method, Simple one point Iteration, Newton-Raphson Method (For Real and Complex Roots), Secant Method, Multiple Roots, Practical applications.

P.T.O

4. Finite Differences and Interpolation:

Finite differences and operators, construction and evaluation of a difference table, Concept of interpolation and extrapolation, Interpolation with equally spaced and unequally spaced data, Spline interpolation, Cubic spline, Practical applications.

5. Numerical Differentiation:

Numerical differentiation of first and second order derivatives, Numerical differentiate-ion using finite difference formulas, Practical applications.

6. Numerical Integration:

Derivation of Newton-Cotes formulas, Numerical integration for given function, Numerical integration for given data points, Practical applications.

Text Books:

[1] Steven C. Chapra, *Numerical Analysis with Engineering Applications*, McGraw Hill.

[2] M. Iqbal, *Numerical Analysis*, National Book Foundation.

Reference Books:

[1] E. Kreyszig, *Advanced Engineering Mathematics*, Wiley.

[2] B.S Grewal, *Higher Engineering Mathematics*, Khana Publisher.

[3] Saeed Akhtar Bhatti, *Numerical Analysis with C++*,