MA607 Numerical Analysis

Credit: 2-0-2-3 Approval: Approved in 2nd Senate

Prerequisites: Basic Knowledge in FORTRAN/C/C++/Matlab/Scilab

Students intended for:M.A./Ph.D., B.Tech. 3rd and 4th year students.

Elective or Compulsory:Elective Semester: Odd

Weekly Lecture Hours: 2; Weekly Lab Hours:2; Relative Weightage: Quiz-1 (15%); Quiz-2(15%); Final Exam (40%); HW and Computer Experiments (30%)

Course Objective: The course emphasizes the development of numerical algorithms to provide solutions to common problems formulated in science and engineering. An important component of numerical analysis is computational implementation of algorithms which are developed in the course in order to observe first-hand issues of accuracy, computational work effort and stability. Exercises include computational experiments in a programming language of the student's choice. Finally the primary objective of the course is to develop the basic understanding of the construction of algorithms, and perhaps more importantly, the applicability and limits of their appropriate use.

Course Outline:

- Approximate Numbers and Significant Digits, Propagation of errors, Different types of errors, Backward error analysis, Sensitivity and conditioning, Stability and accuracy.
- Nonlinear equations, Bisection method, Newton's method and its variants, Fixed point iterations, Convergence analysis.
- Finite differences, Polynomial interpolation, Hermite interpolation, Spline interpolation. Numerical integration, Trapezoidal and Simpson's rules, Newton-Cotes formula, Gaussian quadrature.
- Initial Value Problem (IVP): Taylor series method, Euler and modified Euler methods, Runge-Kutta methods, Multistep methods, Predictor-Corrector method.
- Boundary Value Problem (BVP): Solution of Boundary Value Problem by Finite Difference Method.

Texts Books:

K. E. Atkinson, An Introduction to Numerical Analysis, 2nd Edition, John Wiley, 2008.

S. D. Conte and Carl de Boor, Elementary Numerical Analysis, McGraw Hill, 1988.

References:

M. T. Heath, Scientific Computing: An Introductory Survey, McGraw Hill, 2002.

A. Ralston and P. Rabinowitz, A First Course in Numerical Analysis, Dover Publications, 2001.