Approval: 8th Senate Meeting

Course Name: Numerical Analysis

Course Number: MA551

Credit: 3-0-0-3

Prerequisites: IC 110 Engineering Mathematics, IC 111 Linear Algebra

Intended for: 3rd and 4th year UG/PG

Distribution: Elective

Semester: Odd /Even

Course Outline: The course emphasizes the effective use of numerical analysis in applications require both a theoretical knowledge of the subject and computational experience with it. The theoretical knowledge should include an understanding of both the original problem being solved and of the numerical methods for its solution, including their derivation, error analysis and an idea of when they will perform well or poorly. Finally the primary objective of the course is to develop the basic understanding of the numerical methods, and perhaps more importantly, the applicability and limits of their appropriate use.

Course Modules:

Unit 1: Introduction [6 Lectures]

Approximate Numbers and Significant Digits, Propagation of errors, Different types of errors, Backward error analysis, Sensitivity and conditioning, Stability and accuracy.

Unit 2: Nonlinear Equations [8 Lectures]

Bisection method, Newton's method and its variants, Secant method, Fixed point iterations and their Error analysis.

Unit 3: [8 Lectures]

Finite differences, Polynomial interpolation, Newton Divided Differences, Spline interpolation. Numerical integration, Trapezoidal and Simpson's rules, Newton- Cotes formula, Gaussian quadrature, and Numerical differentiations.

Unit4: System of linear equations: [8 Lectures]

Gaussian Elimination, Partial Pivoting, Pivoting and Scaling in Gaussian Elimination method, Iteration methods, Error analysis.

Unit 5: Initial Value Problem (IVP) [6 Lectures]

Taylor series method, Euler and modified Euler methods, Runge-Kutta methods, Multistep methods, Predictor-Corrector method.

Unit 6: Boundary Value Problem (BVP) [6 Lectures]

Solution of Boundary Value Problem by Finite Difference Method.

Texts Books:

1. K. E. Atkinson, An Introduction to Numerical Analysis, 2nd Edition, John Wiley, 2008.
2. S. D. Conte and Carl de Boor, Elementary Numerical Analysis, McGraw Hill, 1988.

References:

1. M. T. Heath, Scientific Computing: An Introductory Survey, McGraw Hill, 2002.
2. Ralston and P. Rabinowitz, A First Course in Numerical Analysis, Dover Publications, 2001.