

17HS049 NUMERICAL ANALYSIS

Course Description and Objectives:

To understand appropriate numerical methods to solve algebraic and transcendental equations. To perform an error analysis for various numerical methods and derive appropriate numerical methods to solve definite integrals. To develop appropriate numerical methods to solve a system of linear equations and special kinds of differential equations such as elliptic, parabolic and hyperbolic differential equations.

Course Outcomes:

Upon completion of the course, the student will be able to achieve the following outcomes:

COs	Course Outcomes
1	Solve algebraic and transcendental equations using appropriate numerical methods.
2	Solve approximate a function using appropriate numerical methods.
3	Derive numerical methods for various mathematical operations.
4	Tasks such as interpolation, differentiation, integration and the solution of linear and nonlinear equations.
5	Analyze and evaluate the accuracy of common numerical methods.

Skills:

1. Apply numerical methods to obtain approximate solutions to mathematical problems.
2. Know the basics of numerical methods to solve different equations.
3. Understand appropriate numerical methods.

UNIT- I: (10 hours)

Errors in Numerical computations : Errors and their Accuracy, Mathematical Preliminaries, Errors and their Analysis, Absolute, Relative and Percentage Errors, A general error formula, Error in a series approximation.

UNIT – II: (12 hours)

Solution of Algebraic and Transcendental Equations: The bisection method, The iteration method, The method of false position, Newton Raphson method, Generalized Newton Raphson method. Muller's Method

UNIT – III: (12 hours) Interpolation - I

Interpolation : Errors in polynomial interpolation, Finite Differences, Forward differences, Backward differences, Central Differences, Symbolic relations, Detection of errors by use of Differences Tables, Differences of a polynomial

UNIT – IV: (12 hours) Interpolation - II

Newton's formulae for interpolation. Central Difference Interpolation Formulae, Gauss's central difference formulae, Stirling's central difference formula, Bessel's Formula, Everett's Formula.

UNIT – V : (14 hours) Interpolation - III

Interpolation with unevenly spaced points, Lagrange's formula, Error in Lagrange's formula, Divided differences and their properties, Relation between divided differences and forward differences, Relation between divided differences and backward differences Relation between divided differences and central differences, Newton's general interpolation Formula, Inverse interpolation.

Reference Books:

1. Numerical Analysis by S.S.Sastry, Prentice Hall of India Pvt. Ltd., New Delhi. (Latest Edition)
2. Numerical Analysis by G. Sankar Rao, New Age International Publishers, Hyderabad.
3. Finite Differences and Numerical Analysis by H.C Saxena, S. Chand and Co., New Delhi.
4. Numerical methods for scientific and engineering computation by M.K.Jain, S.R.K.Iyengar, R.K. Jain., S. Chand and Co., New Delhi.

Suggested Activities:

Seminar/ Quiz/ Assignments