ST. JOSEPH’S COLLEGE FOR WOMEN (AUTONOMOUS), VISAKHAPATNAM

III SEMESTER  **MATHEMATICS** TIME:3HRS/WEEK

M-Ma2-3301(3) **NUMERICAL METHODS** MAX. MARKS:100

w.e.f AK 2023-2024 (Admitted batch) **SYLLABUS**

**Course Objectives:** To enable the students to –

**CO1:** Apply the concept of finite differences to express any function value in terms of leading terms and differences, Utilize the E and D operators to manipulate finite differences, Investigate the properties of factorial notation and its role in expressing missing terms, Analyse their between , and E operators. **(K3 & K4)**

**CO2:** Derive Newton–Gregory forward and backward interpolation formulasproblems with equal and unequal intervals, Explore the concept of divided differences and their significance, Understand the properties of Lagrange’s interpolation. **(K3 & K4)**

**CO3:** Compute central difference operators such as ( \delta), ( \mu), and ( \sigma), Apply forward formula for equal intervals, Investigate the practical implications of Stirling’s and Bessel’s formulas, Understand the relationship between central difference operators.**(K3 & K4)**

**CO4:** Determine an initial approximate value for solving algebraic and transcendental equations, Implement bisection method, Regula Falsi method, and Newton–Raphson method, Evaluate the efficiency and accuracy of different root-finding techniques, Understand the convergen behavior of iterative methods. **(K3 & K4)**

**CO5:** Apply least-squares curve fitting procedures, Fit data using a straight line and explore nonlin curve fitting, Construct curve fits by combining sums of exponentials, Devel in curve fitting. **(K3 & K6)**

**Course Outcomes:** Students will be able to

**CO1:** Express function values using finite differences, Understand the fundamental theo difference calculus. **(K3 & K4)**

**CO2:** Implement Newton–Gregory interpolation techniques, Utilize divide Lagrange’s method for interpolation. **(K3 & K4)**

**CO3:** Calculate central difference operators and apply them in interpolation, Utilize Gauss forward and backward formulas. **(K3 & K4)**

**CO4:** Solve given equations using bisection, Regula Falsi, and Newton–Raphson methods.**(K3 & K4)**

**CO5:** Perform least-squares fitting for various types of data. **(K3 )**

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**Course Content:**

**UNIT – I:**  **The Calculus of Finite Differences:**

The operators - Fundamental theorem of difference calculus- properties of , E and problems on them to express any value of the function in terms of the leading terms and the leading differences - relations between E and D - relation between D and - problems on one .or more missing terms- Factorial notation- problems on separation of symbols- problems on Factorial notation.

**UNIT – II: Interpolation with Equal and Unequal Intervals:**

Derivations of Newton – Gregory Forward and backward interpolation and problems on them - Divided differences, Newton divided difference formula, Lagrange’s and problems on them.

**UNIT – III**: **Central Difference Interpolation formulae:**

Central Difference operators and relation between them - Gauss forward formula for equal intervals - Gauss Backward formula - Stirling’s formula - Bessel’s formula and problems on the above formulae.

**UNIT – IV: Solution of Algebraic and Transcendental Equation**:

Method for finding initial approximate value of the root - Bisection method - to find the

solution of given equations by using (i) Regula Falsi method (ii) Iteration method (iii)

Newton – Raphson’s method and problems on them.

**UNIT – V:** **Curve Fitting:**

Least-squares curve fitting procedures - fitting a straight line-nonlinear curve fitting-curve fitting by a sum of exponentials

**ACTIVITIES:** Seminar/ Quiz/ Assignments/ Applications of Numerical methods to Real life Problem /Problem Solving Sessions.

**TEXT BOOK:** Numerical Analysis by G. Shanker Rao, New Age International Publications

**REFERENCE BOOKS:**

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson,(2003)

7th Edition

2. Introductory Methods of Numerical Analysis by S.S. Sastry, (6th Edition) PHI New Delhi

2012

3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S .R. K.

Iyengar and R. K. Jain, New Age International Publishers (2012), 6th edition.

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