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

III SEMESTER  **MATHEMATICS** TIME:2HRS/WEEK

M-Ma2-3351(2) **NUMERICAL METHODS**  MARKS: 50

w.e.f AK 2023-2024 (Admitted batch) **PRACTICAL 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 the relations between , and E operators. **(K3 & K4)**

**CO2:** Derive Newton–Gregory forward and backward interpolation formulas, Solve interpolation

problems 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 Gauss 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 convergence behavior of iterative methods. **(K3 & K4)**

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

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

**CO1:** Apply theoretical / analytical / statistical knowledge gained in various courses of

B.Sc to solve numerical problems based on real life situations during practicals and

draw meaningful solutions to day-to-day problems

**CO2:** Express function values using finite differences, Understand the fundamental theorem of

difference calculus. **(K3 & K4)**

**CO3:** Implement Newton–Gregory interpolation techniques, Utilize divided differences and

Lagrange’s method for interpolation. **(K3 & K4)**

**CO4:** Calculate central difference operators and apply them in interpolation, Utilize Gauss forward

and backward formulas. **(K3 & K4)**

**CO5:** Solve given equations using bisection, Regula Falsi, and Newton–Raphson methods. **(K3 & K4)**

**CO6:** 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 – 3**: **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 – 4: 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 – 5**: **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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