# NUMERICAL METHODS

**Course Code: 13BM1108**

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**Pre requisites:**

1. Fundamental concepts of Calculus.
2. Ordinary differential equations.

**Course Outcomes:**

At the end of the Course, Student will be able to:

**CO 1** Determine numerical solution of algebraic and transcendental equations and discuss different difference operators.

**CO 2** Use interpolation techniques for data analysis.

**CO 3** Develop and apply numerical differentiation and integration techniques.

**CO 4** Estimate the model parameters using principle of least squares.

**CO 5** Solve ordinary differential equations numerically using single and multi-step methods.

## UNIT-I (12 Lectures)

### SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS:

Introduction to Numerical Methods, Solution of algebraic and transcendental equations, Bisection method, method of false position, Newton's method, fixed point iteration method, Introduction to Finite differences, Differences of a polynomial, Difference operators, finding one or more missing terms. (28.1, 28.2, 29.1, 29.2 & 29.4, 29.5)

## UNIT-II (12 Lectures)

### INTERPOLATION:

Newton's interpolation formulae, Central difference interpolation

formulae (Gauss forward, Gauss backward and Stirling's formulae), Interpolation with unequal intervals: Lagrange's formula, Newton's divided difference formula, Inverse interpolation. (29.6 – 29.13)

## UNIT-III (12 Lectures)

### NUMERICAL DIFFERENTIATION AND INTEGRATION

Numerical Differentiation: Derivatives using forward, backward and central difference formula (Stirling's formula), maxima and minima of a tabulated function.

### NUMERICAL INTEGRATION:

Newton-cotes quadrature formula, Trapezoidal rule, Simpson's 1/3$^{rd}$ rule, Simpson's 3/8$^{th}$ rule, Weddle's rule, Boole's rule. (30.1- 30.10)

## UNIT-IV (12 Lectures)

### (EMPIRICAL LAWS AND CURVE FITTING)

Curve fitting: Introduction, Graphical method, Laws reducible to the linear law, Principles of least squares, Method of least squares, fitting of Exponential curves, Gas equation, Method of group averages, fitting of parabola, Method of moments. (24.1 - 24.9)

## UNIT-V (12 Lectures)

### NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS:

Introduction, Picard's method, Taylor's series method, Euler's method, Modified Euler method , Runge's method, Runge-Kutta method, Predictor-corrector methods: Milne's method, Adams-Bashforth method. (32.1 - 32.10)

## TEXT BOOK:

Dr.B.S.Grewal, *"Higher Engineering Mathematics"*, 42$^{nd}$ Edition, Khanna Publishers, 2012.

## REFERENCES:

1. M.K.Jain, S.R.K.Iyengar and R.K.Jain, *"Numerical Methods for scientific and Engineering Computation"*, New age International Publishers, 4$^{th}$ Edition, 2004.

2. S. S. Sastry, *"Introductory Methods of Numerical Analysis"*, Prentice Hall India Pvt., Limited, 5th Edition, 2012.

3. Samuel Daniel Conte, Carl W. De Boor, *"Elementary Numerical Analysis: An Algorithmic Approach"*, Tata McGraw- Hill, 3rd Edition, 2005.