

Course code	:	DSE – C6
Title of course	:	Numerical Methods
Theory	:	32 Hrs. (40 lecturers of 48 min.)
Marks	:	50 (Credit: 02)

Course Learning Outcomes: This course will enable the students to:

- CO1: find numerical solutions of algebraic, transcendental and system of linear equations.
- CO2: learn about various interpolating methods to find numerical solutions.
- CO3: find numerical solutions of integration and ODE by using various methods.
- CO4: apply various numerical methods in real life problems.

Unit- 1

(16Hrs.)

1.1 Solutions of Algebraic and Transcendental Equations:

- 1.1.1 Introduction
- 1.1.2. Mathematical Preliminaries
- 1.1.3 Bisection Method
- 1.1.4 Method of False position
- 1.1.5 Newton- Raphson method
- 1.1.6 Examples based on art.1.1.3 to 1.1.5

1.2 Interpolation

- 1.2.1 Introduction
- 1.2.2 Finite differences
- 1.2.3 Forward differences
- 1.2.4 Backward differences
- 1.2.5 Symbolic relations and Separation of symbols
- 1.2.6 Newton's formulae for Interpolation
 - 1.2.6.1 Newton's forward difference interpolation formula
 - 1.2.6.2 Newton's backward difference interpolation formula
- 1.2.7 Interpolation with Unevenly Spaced Points
 - 1.2.7.1 Lagrange's Interpolation Formula
- 1.2.8 Examples based on art.1.2.2 to 1.2.7

Unit- 2

(16Hrs.)

2.1 Numerical Integration

- 2.1.1 General formula
- 2.1.2 Trapezoidal rule
- 2.1.3 Simpson's 1/3- rule
- 2.1.4 Simpson's 3/8- rule
- 2.1.5 Examples based on art. 2.1.2 to 2.1.4.

2.2 Solutions of Linear system of equations

- 2.2.1 Solutions of linear system - Direct method
 - 2.2.1.1 Gauss Elimination Method
- 2.2.2 Solutions of linear system - Iterative method
 - 2.2.2.1 Gauss-Seidel Method
- 2.2.3 Examples based on art. 2.2.1 to 2.2.2.

2.3 Numerical Solutions of ODE:

- 2.3.1 Introduction
- 2.3.2 Solution by Taylor's series method
- 2.3.3 Picard's method of successive approximation
- 2.3.4 Euler's method
- 2.3.5 Modified Euler's method
- 2.3.6 Runge-Kutta methods
 - 2.3.6.1 second order Runge-Kutta (without proof)
 - 2.3.6.2 fourth order Runge-Kutta (without proof)
- 2.3.7 Examples based on art. 2.3.2 to 2.3.6.

Recommended Book -

1. S. S. Sastry - Introductory Methods of Numerical Analysis: Fifth Edition, Prentice Hall India Learning Private Limited, New Delhi (2012).

Scope: [Chapter-1: 1.1(a,b,d,c,f), 1.2; Chapter-2: 2.1, 2.2, 2.3, 2.5; Chapter-3: 3.1, 3.3, 3.6, 3.9; Chapter-6: 6.4; Chapter-7: 7.5, 7.6; Chapter-8: 8.1, 8.2, 8.3, 8.4, 8.5]

Reference Books -

1. M.K.Jain, S.R.K.Iyengar & R.K.Jain - Numerical Methods (Problems and Solutions): Revised Second Edition, New Age International Pvt Ltd Publishers, Mumbai.
2. H.C. Saxena - Finite Differences and Numerical Analysis, S. Chand & Company Ltd.(2005).
3. Dr. B. S. Grewal, Numerical Methods in Engineering & Science, Khanna Publishers.