

**B.A. (Prog.) Semester-VII with Mathematics as Major**  
**Category-II**

**DISCIPLINE SPECIFIC CORE COURSE (DSC-7): NUMERICAL METHODS**

**CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE**

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Numerical Methods	4	3	0	1	Class XII pass with Mathematics	Calculus, Real Analysis

**Learning Objectives:** The primary objective of this course is to introduce:

- Solutions of nonlinear equations in one variable by various methods.
- Interpolation and approximation, numerical differentiation, and integration.
- Direct methods for solving linear systems, numerical solution of ODE's.

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

- Find the consequences of finite precision and the inherent limits of numerical methods.
- Appropriate numerical methods to solve algebraic and transcendental equations.
- Solve first order initial value problems of ODE's numerically using Euler methods.

**SYLLABUS OF DSC-7**

**UNIT-I: Errors and Roots of Transcendental and Polynomial Equations (12 hours)**

Errors: Roundoff error, Local truncation error, Global truncation error; Order of a method, Convergence, and terminal conditions; Bisection method, Secant method, Regula-Falsi method, Newton-Raphson method.

**UNIT-II: Algebraic Linear Systems and Interpolation (18 hours)**

Gaussian elimination method (with row pivoting); Iterative methods: Jacobi method, Gauss-Seidel method; Interpolation: Lagrange form, Newton form, Finite difference operators.

**UNIT-III: Numerical Differentiation, Integration and ODE (15 hours)**

Numerical differentiation: First and second order derivatives; Numerical integration: Trapezoidal rule, Simpson's rule; Ordinary differential equation: Euler's method.

**Essential Readings**

1. Chapra, Steven C. (2018). Applied Numerical Methods with MATLAB for Engineers and Scientists (4th ed.). McGraw-Hill Education.
2. Fausett, Laurene V. (2009). Applied Numerical Analysis Using MATLAB. Pearson. India.
3. Jain, M. K., Iyengar, S. R. K., & Jain R. K. (2012). Numerical Methods for Scientific and Engineering Computation (6th ed.). New Age International Publishers. Delhi.

### **Suggestive Reading**

- Bradie, Brian (2006). A Friendly Introduction to Numerical Analysis. Pearson Education India. Dorling Kindersley (India) Pvt. Ltd. Third Impression, 2011.

**Note:** Non programmable scientific calculator may be allowed in the University examination.

Practical / Lab work to be performed in Computer Lab: Use of computer algebra software (CAS), for example Mathematica/MATLAB/Maple/ Maxima/Scilab etc., for developing the following numerical programs:

1. Bisection method
2. Secant method and Regula–Falsi method
3. Newton-Raphson method
4. Gauss–Jacobi method and Gauss–Seidel method
5. Lagrange interpolation and Newton interpolation
6. Trapezoidal rule and Simpson’s rule
7. Euler’s method for solving first order initial value problems of ODE’s.