



CLUSTER UNIVERSITY SRINAGAR
SYLLABUS (FYUP UNDER NEP 2020)
Offered by the Department of Information Technology,
Batch 2022, 2023, 2024

4th Semester - Minor- Numerical Techniques

Course Code: UGICT22N401
Credits: 4 (Theory: 3, Practical: 1)
Contact Hrs: 75 (Theory: 45, Practical: 30)

Max. Marks: 100
Theory External: 60; **Min Marks:** 24
Theory Internal (Continuous Assessment):
15 Marks, Min Marks: 06
Practical Experimental Basis = 15,
Min. Marks: 06
Practical Experimental (Continuous Assessment)
= 10, Min. Marks: 04

Course Objective:

To introduce numerical techniques for solving mathematical problems using computational approaches. The course develops understanding of error analysis, iterative methods, interpolation, differentiation, integration, and solutions of differential equations through algorithmic implementation.

Learning Outcomes:

After completing this course, you will be able to:

- Apply numerical methods to solve linear and nonlinear equations.
- Analyze and minimize computational errors in numerical solutions.
- Implement algorithms for interpolation, differentiation, and integration using programming.
- Use iterative and matrix-based techniques to solve practical computational problems.

Unit I: Introduction to Numerical Methods

Computational Problem-Solving: Requirements for problem-solving on computers, Common pitfalls in numerical computing:

Error Analysis: Types of errors, Approximation, truncation, and round-off errors, Significant figures, accuracy, and precision, Error propagation and its impact on computation.

Unit II: Iterative Methods for Root Finding

Fundamentals of Iterative Techniques: Convergence and divergence of iterative methods, Bisection method, Method of False Position (Regula Falsi), Newton-Raphson method, Secant method.
Applications: Solving polynomial equations, Real-world numerical applications.



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Unit III: Solving Linear Algebraic Equations

Techniques for Systems of Linear Equations: Direct methods: Gauss Elimination and Gauss-Jordan methods. Iterative methods: Gauss-Seidel and Jacobi methods, LU decomposition method, Error analysis in linear systems.

Matrix Methods: Introduction to matrix operations, Eigenvalues and eigenvectors (brief overview).

Unit IV: Interpolation and Numerical Differentiation

Interpolation Techniques: Lagrange interpolation, Newton's divided difference interpolation, Polynomial fitting

Numerical Differentiation and Integration:

Finite difference approximations, Trapezoidal and Simpson's rules, Error estimation in integration

Solving Differential Equations:

Euler's method, Runge-Kutta second-order method (Heun's method), Applications in physics and engineering

Recommended Books:

1. *Numerical Methods* by E. Balagurusamy, Tata McGraw-Hill
2. *Computer-Oriented Numerical Methods* by V. Raja Raman, Prentice Hall of India
3. *Computer-Oriented Numerical Methods* by R. S. Salaria
4. *Numerical Methods for Engineers* by Steven C. Chapra, Raymond P. Canale

Lab Work:

1. Write a program to calculate the absolute and relative errors.
2. Write a program to demonstrate round-off and truncation errors.
3. Write a program to find the root of an equation using the Bisection Method.
4. Write a program to implement the Newton-Raphson Method.
5. Write a program to find the root of an equation using the Secant Method.
6. Write a program for the Method of False Position (Regula Falsi).
7. Write a program to solve a system of linear equations using the Gauss Elimination Method.
8. Write a program to solve a system of linear equations using the Gauss-Seidel Method.
9. Write a program to multiply two matrices.



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10. Write a program to interpolate a value using Lagrange Interpolation.
11. Write a program for Newton's Divided Difference Interpolation.
12. Write a program to approximate the derivative of a function using finite differences.
13. Write a program to integrate a function using the Trapezoidal Rule.
14. Write a program to implement Simpson's 1/3 Rule for numerical integration.
15. Write a program to solve a first-order differential equation using Euler's Method.

Spencer

Rita

Zareka

Sagar

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