

Title: Numerical Analysis

Code Number: NS2204

Credit Hours: 3 (3+0)

Prerequisites: NS1105 Calculus & Analytical Geometry

Semester: 4th

Course Objectives

The course will enable students to:

1. Apply different numerical methods to perform polynomial interpolation, curve fitting, differentiation, integration, and estimation of algebraic nonlinear equations
2. Solve ordinary differential equations and compute optimum points in optimization problems using numerical techniques.
3. Apply a simulation tool to implement various numerical methods.

Contents

Unit 1: Introduction to Numerical Analysis

1. Measuring Errors
2. Sources of Errors
3. Propagation of Errors
4. Roundoff & Truncation Errors

Unit 2: Solution of Nonlinear Equations

1. Bisection Method
2. Newton Raphson Method
3. Secant Method
4. False Position Method.

Unit 3: Regression and Interpolation

1. Linear Regression
2. Nonlinear Regression & Adequacy of Regression
3. Direct Method Interpolation
4. Newton's Method of Interpolation
5. Lagrange Interpolation
6. Spline Interpolation

Unit 4: Numerical Differentiation and Integration

1. Numerical Differentiation: Continuous and Discrete Functions
2. Numerical Integration: Trapezoidal Rule, Simpson's Rule, Gauss Quad. Rule
3. Improper Integrals

Unit 5: Numerical Solutions of Differential Equations

1. Elementary Theory of Initial Value Problems
2. Euler's Method
3. Finite Differential Method
4. Runge Kutta Methods
5. Higher Order Differential Equations

Unit 6: Numerical Optimization

1. Golden Section Search Method
2. Newton's Method
3. Direct Search Method

4. Gradient Search Method
5. Simplex Method.

Teaching-Learning Strategies:

The pedagogical approach to this course relies on face-to-face teaching in a university classroom environment. The lectures are delivered using multimedia support and on white board. Students are engaged and encouraged to solve real world problems using computer-aided tools.

Assignments/Types and Number with calendar:

A minimum of four assignments to be submitted before the written exams for each term.

Assessment and Examinations:

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	It takes place at the mid-point of the semester.
2.	Sessional Assessment	25%	It is continuous assessment. It includes classroom participation, attendance, assignments and presentations, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

Recommended Books:

1. Numerical Analysis: By Richard L. Burden, J. Douglas Faires, Latest Edition
2. Numerical methods for scientist and engineers by R.W. Hamming (Latest Edition)
3. Numerical methods for Engineers by Steven C. Chapra and R. P. Canale (Latest Edition)
4. Numerical Methods with Applications by Autar K. Kaw, Latest Edition.