

Numerical Analysis (MTH4311)

- Textbook:** 1. “Numerical Analysis,” 9th ed., Richard Burden and Douglas Faires.
2. “Finite Difference Methods for Ordinary and Partial Differential Equations”, Randall Leveque, SIAM.

Contents to be Covered

- (1) Root Finding Algorithm for Single/System of Equations: Bisection Method, Fixed Point Iterations, Newton’s Method and Variations, Convergence Analysis
- (2) Polynomial Approximations: Lagrange Polynomial and Newton’s Divided Difference, Error Analysis and Chebyshev Points, Piecewise Interpolations and Cubic Splines
- (3) Numerical Differentiation and Integration: Basic Finite Difference Formulas, Truncation Error Analysis, Newton-Cotes Formula for Numerical Integration, Composite and Adaptive Numerical Quadrature
- (4) Numerical Solution of ODE/System of ODEs: General Single-Step First/Second Order ODE Solvers, Runge Kutta Methods, Multi-Step Methods and the Root Condition, Numerical Solution of a Stiff System
- (5) Direct and Iterative Methods for Linear Systems: Gaussian Elimination and LU Factorization, General Residual Correction Schemes such as Jacobi, Gauss-Seidel and SOR, Convergence Analysis