Elementary Numerical Analysis - Video course

COURSE OUTLINE

The important topics covered in this course are polynomial and piecewise polynomial (spline) interpolation, numerical integration and numerical differentiation, approximate solutions of differential equations, direct and iterative solution of a system of linear equations and eigenvalue problems.

The theory behind various methods is rigorously discussed. Emphasis is on comparison of various methods and their implementation using a computer.

COURSE DETAIL

Module No.	Topic/s	Lectures
1	**Polynomial and piecewisepolynomial Interpolation:** • Divided Difference, Lagrange and Newton Form • Osculatory Interpolation	 4 2
2	**Numerical Integration:** • Some Basic Rules, Gaussian Integration, Composite Rules • Adaptive Quadrature, Romberg integration	 4 3
3	**Numerical Differentiation**	2
4	**Vector and Matrix Norms**	2
5	**Solution of System of Linear Equations:** • Gauss Elimination Method, Partial Pivoting • Jacobi and GaussSeidel Methods • QR factorization using reflectors	 3 3 2
6	**Eigenvalue Problem:** • Basic properties: • Eigenvalue location: • Power Method and its variants:	 3 3 2
7	**Initial Value Problems:** • Single step methods such as Euler's Method, RungeKutta	 3

NPTEL

http://nptel.iitm.ac.in

Mathematics

Pre-requisites:

Basic Course in Calculus / Real Analysis

Additional Reading:

D. S. Watkins, Fundamentals of Matrix Computations, John Wiley & Sons, 1991

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	Methods, Taylor series method • Multistep methods such as AdamsBashforth method, Milne's method • PredictorCorrector Formula: AdamMoulton method	3 2
8	**Boundary value problem:** • Finite Difference method	2
9	**Solution of nonlinear system of equations:**	3

References:

1. S. D. Conte and Carl de Boor, Elementary Numerical Analysis, An Algorithmic Approach, MacgrawHill International Editions, 1981.
2. K. E. Atkinson, An Introduction to Numerical Analysis, John Wiley & Sons, paperback, 1989.