

# NPTEL Video Lecture Topic List - Created by LinuXpert Systems, Chennai

NPTEL Video Course - Mathematics - NOC:Numerical Analysis (2023)

Subject Co-ordinator - Prof. S. Baskar

Co-ordinating Institute - IIT - Bombay

Sub-Titles - Available / Unavailable | MP3 Audio Lectures - Available / Unavailable

- Lecture 1 - Introduction
- Lecture 2 - Mathematical Preliminaries: Taylor Approximation
- Lecture 3 - Mathematical Preliminaries: Order of Convergence
- Lecture 4 - Arithmetic Error: Floating-point Approximation
- Lecture 5 - Arithmetic Error: Significant Digits
- Lecture 6 - Arithmetic Error: Condition Number and Stable Computation
- Lecture 7 - Tutorial Session-1: Problem Solving
- Lecture 8 - Python Coding: Introduction
- Lecture 9 - Linear Systems: Gaussian Elimination Method
- Lecture 10 - Linear Systems: LU-Factorization (Doolittle and Crout)
- Lecture 11 - Linear Systems: LU-Factorization (Cholesky)
- Lecture 12 - Linear Systems: Operation Count for Direct Methods
- Lecture 13 - Tutorial Session-2: Python Coding for Naive Gaussian Elimination Method
- Lecture 14 - Tutorial Session-3: Python Coding for Thomas Algorithm
- Lecture 15 - Matrix Norms: Subordinate Matrix Norms
- Lecture 16 - Matrix Norms: Condition Number of a Matrix
- Lecture 17 - Iterative Methods: Jacobi Method
- Lecture 18 - Iterative Methods: Convergence of Jacobi Method
- Lecture 19 - Iterative Methods: Gauss-Seidel Method
- Lecture 20 - Iterative Methods: Convergence Analysis of Iterative Methods
- Lecture 21 - Iterative Methods: Successive Over Relaxation Method
- Lecture 22 - Tutorial Session-4: Python implementation of Jacobi Method
- Lecture 23 - Eigenvalues and Eigenvectors: Power Method (Construction)
- Lecture 24 - Eigenvalues and Eigenvectors: Power Method (Convergence Theorem)
- Lecture 25 - Eigenvalues and Eigenvectors: Gerschgorin's Theorem and Applications
- Lecture 26 - Eigenvalues and Eigenvectors: Power Method (Inverse and Shifted Methods)
- Lecture 27 - Nonlinear Equations: Overview
- Lecture 28 - Nonlinear Equations: Bisection Method
- Lecture 29 - Tutorial Session-5: Implementation of Bisection Method

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- Lecture 30 - Nonlinear Equations: Regula-falsi and Secant Methods
- Lecture 31 - Nonlinear Equations: Convergence Theorem of Secant Method
- Lecture 32 - Nonlinear Equations: Newton-Raphson's method
- Lecture 33 - Nonlinear Equations: Newton-Raphson's method (Convergence Theorem)
- Lecture 34 - Nonlinear Equations: Fixed-point Iteration Methods
- Lecture 35 - Nonlinear Equations: Fixed-point Iteration Methods (Convergence) and Modified Newton's Method
- Lecture 36 - Nonlinear Equations: System of Nonlinear Equations
- Lecture 37 - Nonlinear Equations: Implementation of Newton-Raphson's Method as Python Code
- Lecture 38 - Polynomial Interpolation: Existence and Uniqueness
- Lecture 39 - Polynomial Interpolation: Lagrange and Newton Forms
- Lecture 40 - Polynomial Interpolation: Newton's Divided Difference Formula
- Lecture 41 - Polynomial Interpolation: Mathematical Error in Interpolating Polynomial
- Lecture 42 - Polynomial Interpolation: Arithmetic Error in Interpolating Polynomials
- Lecture 43 - Polynomial Interpolation: Implementation of Lagrange Form as Python Code
- Lecture 44 - Polynomial Interpolation: Runge Phenomenon and Piecewise Polynomial Interpolation
- Lecture 45 - Polynomial Interpolation: Hermite Interpolation
- Lecture 46 - Polynomial Interpolation: Cubic Spline Interpolation
- Lecture 47 - Polynomial Interpolation: Tutorial Session
- Lecture 48 - Numerical Integration: Rectangle Rule
- Lecture 49 - Numerical Integration: Trapezoidal Rule
- Lecture 50 - Numerical Integration: Simpson's Rule
- Lecture 51 - Numerical Integration: Gaussian Quadrature Rule
- Lecture 52 - Numerical Integration: Tutorial Session
- Lecture 53 - Numerical Differentiation: Primitive Finite Difference Formulae
- Lecture 54 - Numerical Differentiation: Method of Undetermined Coefficients and Arithmetic Error
- Lecture 55 - Numerical ODEs: Euler Methods
- Lecture 56 - Numerical ODEs: Euler Methods (Error Analysis)
- Lecture 57 - Numerical ODEs: Runge-Kutta Methods
- Lecture 58 - Numerical ODEs: Modified Euler's Methods
- Lecture 59 - Numerical ODEs: Multistep Methods
- Lecture 60 - Numerical ODEs: Stability Analysis
- Lecture 61 - Numerical ODEs: Two-point Boundary Value Problems