

NIRMA UNIVERSITY
Institute of Technology

Bachelor of Technology (EC Eng. and CSE)
Semester V/VI

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Course Code	2MAOE30
Course Title	Numerical Methods

Course Outcomes (CO):

At the end of the course, students will be able to-

- 1 apply numerical methods to solve nonlinear equations and system of linear and nonlinear equations
- 2 predict the desired data using interpolation, numerical differentiation and numerical integration from discrete data
- 3 solve initial and boundary value problem using numerical methods
- 4 analyze the error occur due to the approximation in numerical methods

Syllabus:

Teaching Hours: 45

Unit I	1
Error Analysis: Types of errors and evaluation of errors	
Unit II	7
Numerical Methods to Solve Non-linear Equations: Bisection method, Regula Falsi method, Simple and modified iteration methods, Newton Raphson method, Rate of convergence, Solution of a System of Nonlinear Equations, Applications in engineering field and simulations	
Unit III	7
Solution of System of Linear Equations: Gauss elimination method using partial pivoting, Gauss Jacobi iterative method, Gauss Seidel method, LU decomposition, Power Method, Applications in engineering field and simulations	
Unit IV	7
Finite Differences and Interpolation: Finite difference operators, Interpolation, Newton's forward and backward interpolations, Stirling's central difference interpolation, Newton divided difference interpolation, Lagrange's interpolation, Cubic Spline Interpolation, Applications in engineering field and simulations	
Unit V	8
Numerical Differentiation and Integration: Numerical differentiation using different interpolation formulae, Newton-Cote's formula for quadrature, Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule, Weddell's Rule, Gauss Quadrature 2 points & 3 points formula, Applications in engineering field and simulations	

Unit VI

7

Numerical solution of Ordinary Differential Equations: Taylor's series method, Picard's method, Euler's method, Modified Euler's method, 4-th ordered Runge-Kutta method, Shooting Method and Finite Difference Method, Applications in engineering field and simulations

Unit VII

8

Numerical solution of Partial Differential Equations: Finite Difference Method, Derivation, Accuracy and order, explicit and implicit methods, Crank-Nicolson method, solution of Heat Equation, Wave Equation & Laplace's Equation

Self-Study: Self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from the self-study contents.

Suggested Readings[^]:

1. Dr B.S Grewal, Higher Engineering Mathematics, Khanna Publishers
2. M K Jain, S R K Iyengar and R K Jain, Numerical Methods for Scientific and Engineering Computation, New Age Pvt. Publication
3. S D Conte and C De Boor, Elementary Numerical Analysis, McGraw-Hill Publisher
4. E V Krishnamurthy and S K Sen, Applied Numerical Analysis, East-West Publication
5. Steven C. Chapra and Raymond P. Canale, Numerical methods for engineers, McGraw-Hill.

L = Lecture, T = Tutorial, P = Practical, C = Credit

[^] this is not an exhaustive list