Course Type	Course Code	Name of Course	L	T	P	Credit
ESC	**NMCE102**	**Numerical Methods**	3	0	0	3

Course Objective

The objective of the course is to provide knowledge of essential numerical techniques to solve mathematical problems arising in Engineering and Science.

Learning Outcomes

Upon successful completion of this course, students will:

- Learn to find roots of algebraic and transcendental equations and solve system of linear equations
- learn the concept of interpolation, numerical differentiation and integration
- be able to solve differential equations (ODE and PDE) for IVPs and BVPs

Unit No.	Topics to be Covered	Lecture Hours	Learning Outcome
1	**Root finding techniques** : Solution of algebraic and transcendental equations by bisection, iteration, false position, secant and Newton Raphson methods	6	Students will learn different root finding methods for algebraic and transcendental equations
2	**Solution of system of linear simultaneous equations:** Gauss elimination, Gauss-Jordan, Factorization Methods, Jacobi and Gauss-Seidel methods, Numerical Solution of Tridiagonal system.	6	This unit will help to understand numerical solution of system of linear simultaneous equations
3	**Methods of Interpolation**: Newton-Gregory forward and backward, Gauss forward and backward, Stirling, Bessel, Everett, Lagrange and Newton's divided difference formulae, Inverse interpolation by Lagrange and iterative methods.	8	Students will learn different Interpolation techniques
4	**Numerical differentiation:** Newton forward and Backward Formula and their applications.	5	Students will learn numerical differentiation
5	**Numerical Integration**: Trapezoidal rule, Simpson's1/3rule, Simpson's3/8rule and Weddle's rule. Gaussian quadrature methods.	5	This unit will enable students to perform numerical integration
5	**Numerical Solution of Ordinary Differential Equations:** **For IVP**: Taylor series method, Euler's method, Modified Euler's method, Runge-Kutta Method, **For BVP**: Finite Difference Method	6	Students will be able to solve IVPs and BVPs of ODEs
6	**Numerical solution of Partial Differential Equations(PDEs)**: Finite difference method for elliptic, parabolic and hyperbolic PDEs.	6	Students will learn numerical solution of PDEs

Text Book:

1. Numerical Mathematics and Computing, by Ward Cheney and David Kincaid, International Thomson Publishing Company, (2013).
2. Jain and Iyengar. Numerical Methods for Scientific and Engineering Computation. New Age International Publications, 2012.

Reference Book:

1. Applied Numerical Analysis, by Curtis Gerald and Patrick Wheatley, Addison-Wesley. Pearson Education India; 7 edition (2007).
2. S. Dey, S. Gupta, Numerical Methods, MCGraw Hill Education(India) Private Limited, 2013