Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NCEC503	Numerical Methods in Civil Engineering	3	1	0	4

Course Objective
The course aims at the solution procedures to linear and nonlinear systems, partial differential equations and integral equations.
Learning Outcomes
Upon successful completion of this course, the students should be able to: ● Comprehend the fundamental principles of estimating errors and solving linear and nonlinear systems, partial differential equations and integral equations. ● Learn the computer-based techniques to utilize numerical methods in civil engineering applications.

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
1	Sources of Errors, Truncation Error, Round-off Error, Order of Accuracy, Taylor series expansion.	**7 L + 1T**	Types of errors in numerical processes.
2	Solution of Linear System of Equations: Gauss Elimination, Gauss Jordan Elimination, Pivoting, Factorization, Cholesky Decomposition, Jacobi Iteration, Gauss Seidel Iteration, Newton Raphson Iterations, Newton Iterations, Quasi Newton Iterations, Convergence Criteria.	**10 L + 4 T**	Thorough idea about various types of equations.
3	First and Second Order Equations, Strong and Weak form of differential equations, Introduction to Finite Element Method, Galerkin method, Interpolation Functions, Lagrange Polynomials, Numerical Quadrature, Numerical Stability.	**10 L + 4 T**	Differential equations and related numerical methods.
4	Difference Operators, Stability and Accuracy of Solutions, Finite Difference Operators to solve Initial and Boundary Value Problems, Case studies on application of numerical algorithm in Civil Engineering Problems	**9 L + 3T**	Numerical methods for differentiation and solution of differential equations arising in dynamics and stability related problems. Idea about numerical stability.
5	Programming of Numerical Methods in Civil Engineering Case Studies.	**6 L + 2 T**	Application through programming.
Total Contact Hours		**42 L + 14 T**	

Text Books:

1. G. Dahlquist and A. Bork (2003), Numerical Methods, Dover Publications, Reprint Edition.

Reference Books:

1. S.C. Chapra (2019), Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw Hill Education, Fourth edition.
2. J.H. Mathews and K.D. Fink (2004), Numerical Methods using MATLAB, Pearson Publishing, Fourth Edition.