Course Type	Course Code	Name of Course	L	T	P	Credit
DP	**NMCC518**	Advanced Numerical Methods Lab	0	0	3	1.5

Course Objective
● This course aims to deliver hands on practice on how to use advanced methods to get numerical solution of problems like finding roots of non-linear equations, numerical integration, ordinary differential equations and partial differential equations with initial and boundary conditions.
Learning Outcomes
● It is expected that students will learn to apply different numerical methods for the problems of non-linear equations, interpolation and numerical integration. Also this course will enable students to use suitable numerical methods for ODE and PDE with initial and boundary conditions.

Lab No.	Name of Experiment/Lab	Contact Hours	Learning Outcomes
1.	Solution of tridiagonal system	3	Students will learn to apply numerical method for solution of tridiagonal system.
2.	Solution of simultaneous non-linear equations.	3	Students will learn to use suitable numerical method to solve system of Simultaneous non-linear equations.
3.	Numerical evaluation of double integrals with constant and variable limits.	3	Students will learn to use numerical methods for approximation of double integrations with constant and variable limits, using Simpson's rule.
4.	Numerical evaluation of triple integrals with constant and variable limits.	3	Students will learn numerical approximation of triple integrations with constant and variable limits using Simpson's rule.
5.	Numerical Solution of integral equations	3	Students will learn numerical approximation of integral equations.
6.	Solution of initial-value problem by single step methods.	3	Students will learn Euler's method (a single step approach) for Solution of initial-value problem
7.	Solution of initial-value problem by multistep methods.	3	Students will learn multi-step method for Solution of initial-value problems.
8.	Solution of linear and non-linear boundary-value problems.	3	This part will demonstrate finite difference method for Solution of linear and non-linear boundary-value problems.
9.	Solution of Laplace equation in two variables by five point formula.	3	Laplace equation in two variables will be solved numerically using five point formula.

10.	Solution of Poisson equation in two variables by five point formula.	3	Poisson equation in two variables will be solved numerically using five point formula.
11.	Solution of parabolic equation in two and three variables	3	Students will learn to solve parabolic PDE by explicit and implicit methods.
12.	Solution of hyperbolic equation in two and three variables	3	Students will learn to solve hyperbolic PDE by explicit and implicit methods.
13	Practice (Based on lab experiments/ topics)	3	Will enable students to revisit some experiments and will strengthen their practical skill.
14	Lab Exam	3	Practical Examination
Total		**42**	

Text Books:

1. Ward Cheney and David Kincaid. . Numerical Mathematics and Computing. International Thomson Publishing Company (2013).
2. E. Isaacson & H. B. Keller. Analysis of Numerical Methods. John Wiley & Sons. Dover Publications, Inc., New York (1966).

Reference Books:

1. S. Dey and S. Gupta. Numerical Methods. MC Graw Hill Education (India) Private Limited (2013).
2. G. D. Smith. Numerical Solution of Partial Differential Equations: Finite Difference Methods. Oxford University Press (1985).