20MSM502T					Theory of Ordinary Differential Equations					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs. / Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

COURSE OBJECTIVES

- To understand the subject at greater depth than the standard undergraduate-level ODE course.
- Introduce the theory, solution, and application of ordinary differential equations.
- Analyze some critical non-linear problems in ODE.
- To encounter confidently the courses like PDE, mathematical modeling using this course of ODE.

UNIT 1 LINEAR EQUATIONS WITH CONSTANT COEFFICIENTS **11 Hrs.**

The second order homogeneous equation, initial value problems for second order equations, Linear dependence and independence, A formula for Wronskian, A non-homogeneous equation of order two, The homogeneous equation of order n, Bernoulli's equations, Initial value problems for nth order equations, equations with real constants, A non-homogeneous equation of order n.

UNIT 2 LINEAR EQUATIONS WITH VARIABLE COEFFICIENT AND REGULAR SINGULAR POINT **10 Hrs.**

Linear equations with variable coefficient: Initial value problems for the homogeneous equation, Solution of the homogeneous equation, The Wronskian and linear independence, Reduction of the order of the order of homogeneous equation, The non-homogeneous equation, Homogeneous equations with analytical co-efficient, The Legendre's equation.
Linear equations with Regular singular point: The Euler equation, Second order equations with regular singular points, its convergence (with proof), The Bessel equation, regular singular points at infinity.

UNIT 3 EXISTENCE AND UNIQUENESS OF SOLUTION TO FIRST ORDER EQUATIONS **09 Hrs.**

Equations with variables separated, Exact equations, The method of successive approximations, The Lipschitz condition, Convergence of successive approximations, non-local existence of solutions, Approximations to, and uniqueness of, solutions, Equations with complex valued functions.

UNIT 4 BOUNDARY VALUE PROBLEMS **10 Hrs.**

Green's function, Sturm-Liouville problem, eigenvalue problems. Stability of linear and nonlinear systems: Lyapunov stability, Sturm's Comparison theorem, mathematical modeling.

40 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to
CO1 – Identify the ordinary differential equations and their importance in applied sciences.
CO2 – Understand the types of ODE's and their theoretical aspects.
CO3 – Demonstrate various linear differential equations along with their theory and applications.
CO4 – Analyze the methods to solve ordinary differential equations and also the nature of their solution.
CO5 – Appraise the existence and uniqueness of solution of first order differential equations.
CO6 – Develop the solutions of boundary value problem for linear and nonlinear cases.

TEXT/REFERENCE BOOKS

1. S.G. Deo, V. Raghavendra, Rasmita Kar, V. Lakshmikantham, Textbook of Ordinary Differential Equations, 3rd ed., McGraw Hill Education Pvt. Ltd., India, 2015.
2. G.F. Simmons, Differential equations with applications and historical notes, 2nd ed., McGraw-Hill, 2017.
3. S. L. Ross, Differential Equations-3rd ed., John Wiley & Sons, 1980 .
4. L. Perko, Differential Equations and Dynamical Systems, Texts in Applied Mathematics, 2nd ed., Springer Verlag, 1998.
5. Carl M. Bender, Steven A. Orszag, Advanced mathematical methods for Scientists and Engineers, Springer, New York,1999.