20MSM613T					Numerical Solution of 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

- Apply the concept of Splines for solving ordinary differential equations.
- Analyze the stability of the methods.
- Construct the Initial value problems for ordinary differential equations.
- Develop the solutions for parabolic, elliptic and hyperbolic equations.

UNIT 1 SPLINES AND THEIR APPLICATIONS **10 Hrs.**

Introduction, Spline Approximation, Uniqueness of Cubic Splines, Construction of Cubic Splines (First and Second Derivative form), Minimal Property of a Cubic Spline, Applications to Differential Equations.

UNIT 2 INITIAL VALUE PROBLEMS **10 Hrs.**

Initial value problem for ODEs, Zero-stability and convergence for initial value problems, Absolute stability for ODEs, Stiff ODEs, Diffusion equations and parabolic problems, Advection equations and hyperbolic systems.

UNIT 3 PARTIAL DIFFERENTIAL EQUATIONS **10 Hrs.**

Finite Difference approximations for derivatives, Methods for solving parabolic equations – Explicit, Implicit and Crank-Nicolson's methods. Comparison of three schemes. Parabolic equation in two dimensions, ADI method, Non-rectangular space domains.

UNIT 4 ELLIPTIC AND HYPERBOLIC EQUATIONS **10 Hrs.**

Elliptic equations – Solution by Gauss-Seidel and Gauss Elimination, Solution by SOR method, Solution of elliptic equation by ADI method. Hyperbolic equations – Finite difference methods, Explicit method, Implicit method, Stability analysis.

40 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Understand the initial – boundary value problems.
CO2 – Classify the partial differential equations.
CO3 – Apply cubic splines method for solving ordinary differential equations.
CO4 – Analyze the solutions obtained by solving ODEs.
CO5 – Analyze the stability of the methods.
CO6 – Develop the PDEs and solve them.

TEXT / REFERENCE BOOKS

1. M.K. Jain, S.R.K. Iyenger and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th ed., New Age International, 2007.
2. C. F. Gerald and P. O. Wheatley, Applied Numerical analysis, 7th ed., Pearson education, 2003.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th ed., Wiley publication, 2005.
4. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, 3rd ed., Narosa, 2002.