20BSM301T					NUMERICAL ANALYSIS					
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 introduce the elements of error analysis for numerical methods.
- To derive and use appropriate numerical methods to solve algebraic and transcendental equations.
- To introduce appropriate numerical methods to solve interpolation based problems.
- To introduce various techniques to solve initial and boundary value problems in differential equations.

UNIT 1 NUMERICAL METHODS FOR SOLVING ALGEBRAIC AND TRANSCENDENTAL EQUATIONS 10 Hrs.

Definition and sources of errors, Propagation of errors, Sensitivity and conditioning, Stability and accuracy, Floating-point arithmetic and rounding errors; Bisection method, False position method, Fixed point iteration method, Newton's method and secant method for solving equations, Convergence analysis with order of convergence.

UNIT 2 INTERPOLATION 10 Hrs.

Lagrange and Newton interpolations, Piecewise linear interpolation, Cubic spline interpolation, Finite difference operators, Gregory, Newton forward and backward difference interpolations.

UNIT 3 NUMERICAL DIFFERENTIATION AND INTEGRATION 10 Hrs.

First order and higher order approximation for first derivative, Approximation for second derivative; Numerical integration: Trapezoidal rule, Simpson's rules and error analysis, Bulirsch, Stoer extrapolation methods, Richardson extrapolation.

UNIT 4 INITIAL AND BOUNDARY VALUE PROBLEMS OF DIFFERENTIAL EQUATIONS 10 Hrs.

Euler's method, Runge–Kutta methods, Higher order one step method, Multi-step methods; Finite difference method, Shooting method.

40 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Understand the errors, source of error and its effect on any numerical computations.
CO2 – Solve algebraic and transcendental equations by various numerical methods.
CO3 – Use various interpolating and extrapolating methods.
CO4 – Solve initial and boundary value problems numerically.
CO5 – Analyze the order of convergence of various numerical methods.
CO6 – Evaluate the integrals numerically.

TEXT/REFERENCE BOOKS

1. Jain, M.K., Iyengar, S.R.K., and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, New Age International Publisher (2012).
2. Burden R. L. and Faires J. D., Numerical Analysis, Brooks Cole, 2004.
3. Gerald, C.F., and Wheatley P.O., Applied Numerical Analysis, Addison Wesley (2003).
4. Atkinson, K. E. and W. Han, Elementary Numerical Analysis, John Wiley & sons (2004).