20MA303T					Numerical Methods (SPT)					
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 and acquaint the concept of various numerical methods.
- To develop numerical skills in solving problem of engineering interest.
- To lay foundation of computational techniques for post graduate/specialized studies and research.
- To make familiar the numerical solution techniques for linear/nonlinear ODEs/PDEs.

UNIT 1 SOLUTION OF SIMULTANEOUS LINEAR EQUATIONS AND INTERPOLATION 10 Hrs.

Iterative methods: Gauss-Jacobi's method, Gauss-Seidel method, Numerical evaluation of largest as well as smallest (numerically) Eigen values and corresponding Eigen vectors.
Introduction to interpolation, Newton Gregory Forward Interpolation Formula, Newton Gregory Backward Interpolation Formula, Central difference interpolation formula, Lagrange's Interpolation Formula for unevenly spaced Formula, Error in interpolation, Newton's Divided Difference Formula, cubic spline interpolation.

UNIT 2 NUMERICAL DIFFERENTIATION AND INTEGRATION 10 Hrs.

Numerical Differentiation: Introduction, Formulae for Derivatives. Numerical Integration: Introduction, Newton-Cotes's Quadrature Formula, Trapezoidal rule, Simpson'sone-third rule, Simpson's Three-Eighth rule, Weddle's rule, Romberg's method, Double Integration.

UNIT 3 NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS AND TRANSCENDENTAL EQUATIONS 10 Hrs.

Runge-Kutta methods of various order, Modified Euler's method, Predictor corrector method: Adam's method, Milne's method, Solution of Boundary value problems using finite differences, Fixed Point Iteration Method, Newton's Method.
Introduction, Descarte's Sign rule, Bisection Method, Method of false position, Secant method, Iteration method, Extended method of iteration, Newton-Raphson method, It's applications, Solution of nonlinear simultaneous equations, Newton-Raphson method for multiple roots.

UNIT 4 NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATION AND FINITE LELEMNTS METHODS 10 Hrs.

Finite difference approximation of partial derivatives, Classification of 2nd order PDEs, different type of boundary conditions, solutions of Elliptic, parabolic and hyperbolic equations of one and two dimensions, Crank- Nicholson method, ADI method. Introduction to Finite Elements Methods: Introduction to Finite Element Methods, Functionals, Base Functions. Methods of Approximation: The Rayleigh-Ritz Method, The Galerkin Method. The FEM for one dimensional Problems and applications to two dimensional problems.

40 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 – Apply a suitable numerical technique to extract approximate solution to the problem whose solution cannot be obtained by routine methods.
CO2 – Analyze the accuracy of numerical methods by estimating error.
CO3 – Analyze / interpret the achieved numerical solution of problems by reproducing it in graphical or tabular form.
CO4 – Evaluate a polynomial on which operations like division, differentiation and integration can be done smoothly from the data generated by performing an experiment or by an empirical formula with.
CO5 – Evaluate a sufficiently accurate solution of various physical models of science as well as engineering interest whose governing equations can be approximated by nonlinear ODEs or PDEs or system of ODEs or PDEs.
CO6 – Design / create an appropriate numerical algorithm for various problems of science and engineering.

TEXT/REFERENCE BOOKS

1. B.S. Grewal, Numerical Methods in Engineering and Science with Programs in C & C++, Khanna Publishers, 2010.