20MA501T					Advanced Numerical Techniques and Computer Programming					
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 enrich the concept of finite element techniques.
- To extract the roots of a polynomial equation.

UNIT 1 INTERPOLATION AND CURVE FITTING 10 Hrs.

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. Curve fitting, Least square approximations (discrete and continuous data).

UNIT 2 NUMERICAL SOLUTION OF NON-LINEAR EQUATIONS AND POLYNOMIAL 08 Hrs.

Introduction, Solution of nonlinear simultaneous equations, Descarte's Sign rule, Horner's method, Lin-Bairstow's method, Graeffe's root squaring method, Muller's method, Comparison of various methods.

UNIT 3 NUMERICAL SOLUTION OF ODEs AND PDEs 14 Hrs.

Mathematical modeling and engineering problem solving, Taylor's method, Euler's method, 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. 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.

UNIT 4 INTRODUCTION TO FINITE ELEMENT METHOD 08 Hrs.

Introduction, Method of Approximation, The Rayleigh-Ritz Method, The Galerkin Method, Application to One dimensional/ 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.
CO5 – Evaluate a sufficiently accurate solution of various physical models of science as well as engineering interest whose governing equations can be approximated by linear/nonlinear ODEs or PDEs or system of ODEs or PDEs.
CO6 – Design /develop 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.
2. S.S. Sastry, Introductory Methods for Numerical Analysis, 4th ed. Prentice Hall of India, 2009.
3. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th ed., New Age International, 2007.
4. C F Gerald and P O Wheatley, Applied Numerical analysis, 7th ed., Pearson education, 2003.
5. Erwin Kreyszig, Advanced Engineering Mathematics, 9th ed., Wiley publication, 2005.
6. R.K. Jain & S.R.K. Iyengar, Advanced Engineering Mathematics, 3rd ed. Narosa, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs.**
Part A: 6 questions of 4 marks each	24 Marks
Part B: 6 questions of 8 marks each	48 Marks
Part C: 2 questions of 14 marks each	28 Marks