20MA504T				Numerical Methods and Geostatistics					
Teaching Scheme				Examination Scheme					
L	T	P	C	Hrs. / Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	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 geostatistics
- To extract the applications of geostatistics in petroleum exploration techniques

UNIT 1 INTERPOLATION, SIMULTENOUSE LINEAR EUQATIONS **10 Hrs.**

Interpolation by polynomials, divided differences, error of the interpolating polynomial, piecewise linear and cubic spline interpolation. Numerical integration, composite rules, error formulae. Solution of a system of linear equations, implementation of Gaussian elimination and Gauss-seidel methods, partial pivoting, row echelon form, LU factorization Cholesky's method, ill-conditioning, norms.

UNIT 2 NUMERICAL SOLUTION OF ODE AND PDE **14 Hrs.**

Solution of a nonlinear equation, bisection and secant methods. Newton's method, rate of convergence, solution of a system of nonlinear equations, numerical solution of ordinary differential equations, Euler and Runge-Kutta methods, multi-step methods, predictor corrector methods, order of convergence, finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations. Eigenvalue problem, power method, QR method, Gershgorin's theorem. Exposure to software packages like IMSL subroutines, MATLAB.

UNIT 3 INTRODUCTION OF GEOSTATISTICS AND PROBABILITY THEORY **08 Hrs.**

Introduction to Geostatistics, Probability Theory review, Spatial Analysis, Variogram Modelling, Estimation (Global and Local).

UNIT 4 APPLICATIONS OF GEOSTATISTICS **08 Hrs.**

Cross validation, Estimators (Simple kriging, Indicator kirging, Block kriging); Geostatistical simulation (Cholesky decomposition, conditional simulation, sequential Gaussian simulation- SGS)

40Hrs

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 basic theory of geostatistics and probability theory
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 geostatistical model and simulation

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.
7. S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach
(3rd Edition), McGraw-Hill, 1980.
14. C. E. Froberg, Introduction to Numerical Analysis (2nd Edition), Addison-Wesley, 1981
15. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999)

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