Title: **Algorithmic Mathematics**

Course Code: CSc 545

Credit Hours = 3

Nature of the course: Theory + Tutorial

Full Marks: 45+30

Pass Marks: 22.5+15

Course Objectives: To solve the technical and scientific problems by using the theory of numerical, statistical, and optimal computational procedures along with practical applications.

Course Contents:

Unit 1: Solution of Algebraic and Transcendental Equations (3 Hrs)

Newton Raphson Method, Secant Method, Solution of systems of Nonlinear Equations (Newton Raphson Method)

Unit 2: Interpolation (5 Hrs)

Errors in polynomial interpolation, Finite Differences, Differences of a polynomial, Newton's formulae for Interpolation, Bessel's Formula, Everett's Formula, Relation between Bessel's and Everett's Formulae, Lagrange's Interpolation Formula

Unit3: Curve Fitting, B-Splines and Approximation (4 Hrs)

Least- squares Curve Fitting Procedures (Linear, Quadratic and Exponential), B-splines, Approximation of Functions

Unit 4: Numerical Differentiation and integration (4 Hrs)

Numerical Differentiation, Trapezoidal Rule, Simpson's 1/3 –Rule, Simpson's 3/8 –Rule, Volume calculation, Newton-Cotes Integration Formulae, General Quadrature Formula, Gaussian Integration.

Unit 5: Matrices and Linear Systems of Equations (3 Hrs)

Solution of Linear Systems- Direct Methods (Gauss Jordan), Solution of Linear Systems- Iterative Method (Gauss-Seidel), Eigen value Problem (Eigen Value, Eigen Vector)

Unit 6: Numerical Solution of Ordinary Differential Equations (4 Hrs)

Solution of Taylor's Series, Euler's Method (Modified Method), Predictor-Corrector Methods, Simultaneous and Higher Order Equations (4th order Runge Kutta Method), Boundary Value Problems (Finite Difference Method)

Unit 7: Numerical Solution of the Partial Differential Equations (3 Hrs)

Finite- Difference Approximations to derivatives, Laplace's Equation, Parabolic Equations, Hyperbolic Equations, Iterative Methods for solution of Equations

Unit 8: Introduction and Descriptive Statistics (3 Hrs)

An overview of probability and statistics, Pictorial and tabular methods in descriptive statistics, Measures of central tendency, dispersion, and direction, Joint and conditional probabilities, Central limit theorem

Unit 9: Discrete Random Variables and Probability Distributions (3 Hrs)

Random variables, Probability distributions for random variables, Expected values of discrete random variables, The binomial probability distribution, Hypothesis testing using the binomial distribution, The Poisson probability distribution

Unit 10: Hypothesis Testing Procedures (4 Hrs)

Tests about the mean of a normal population, The t-test, Test procedures for a population variance, Z-tests for differences between two populations means, The two-sample t-test, A confidence interval for the mean of a normal population

Unit 11: Optimization Techniques (4 Hrs)

The simplex method, objective function and constraint conditions, changing inequalities to equalities, the conical form, of solution, optimal values of variables, Integer programming, Dynamic programming

Unit 12: Transformation (5 Hrs)

Laplace transform, Fourier transform, Discrete Fourier transform, Fast Fourier transform, Z transform and their inverse transform

References:

1. Jay L. Devore, "Probability and Statistics for Engineering and the Sciences", Brooks/Cole Publishing Company, Monterey, California, 1982.
2. Introductory methods of Numerical analysis, S.S. Sastry
3. An Introduction to numerical computations, S. Yakowitz and F. Szidarovszky
4. Numerical Methods, Dr. V.N. Vedamurthy, Dr. N. Ch. S.N . Iyengar 6. Numerical Methods , E. Balagurusamy

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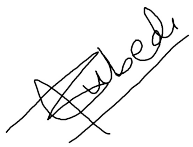

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