

**IMA-302: COMPUTER ORIENTED NUMERICAL AND**

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**STATISTICAL TECHNIQUES**

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**(CS, ET, IT, III Semester)**

**UNIT I: Nonlinear Equations and Simultaneous Linear Equations:**

Roots of nonlinear equation, Methods of solution, Order of convergence of iterative methods, Simple roots: Bisection, False position, Secant, Newton-Raphson, Chebyshev, Iteration and multi point iteration methods, Multiple roots: Newton-Raphson and Chebyshev, Complex roots: Newton-Raphson and Muller's method, a system of nonlinear equations: Newton-Raphson and Iteration methods, Polynomial equations: Bairstow's method, convergence analysis of above methods.

Linear systems: Introduction, Direct methods, Operation count, Pivoting, Ill conditioned linear systems & condition number, Iteration methods: Jacobi, Gauss-Seidel, SOR methods, convergence conditions. Special system of equations: Thomas algorithm. Eigen value problems: Given's and Power methods.

**UNIT II: Interpolation, Differentiation and Integration:**

Curve fitting: Polynomial interpolation, error, Existence and Uniqueness, Truncation error bounds, difference operators, Newton forward and backward difference interpolations, Lagrange, Newton divided difference and Iterated interpolations, Stirling and Bessel's interpolations, Spline interpolation, Least squares and Chebyshev approximations.

Numerical Differentiation: Methods based on interpolation, Error analysis.

Numerical Integration: Methods based on interpolations (Trapezoidal, Simpson's  $1/3$  , Simpson's  $3/8$  rule), Gauss quadrature methods, Romberg integration, Error bounds and estimates.

**UNIT III: Numerical Solution of Ordinary Differential Equations:**

Initial-value problems, Single step methods: Taylor's, Picard's, Euler's, Modified Euler's method and Runge -Kutta method (Fourth Order), Error estimates, Multi-step methods: Adam's-Bashforth and Milne's methods, convergence and stability analysis, Simultaneous and Higher order equations: RK Fourth order method.

#### **Unit – IV: Curve – Fitting, Correlation, Regression and Probability:**

Curve-fitting, method of least- squares , fitting of straight lines, polynomials, non-linear and exponential curves etc., correlation analysis, linear, non-linear and multi-regression analysis, probability, random variables and probability distributions, expectation, moments and transform methods, Binomial, Poisson and Normal distributions, overview of t-distribution, F-distribution and  $\chi^2$ -distribution.

#### **Unit – V: Statistical Methods:**

Sampling theory, parameter estimation, confidence intervals, tests of hypotheses and significance; z-, t-, F-, and  $\chi^2$  tests, goodness of fit test -  $\chi^2$  test, analysis of variance, non-parametric tests (Simple application), time series analysis, index numbers, quality control charts and acceptance sampling, Introduction to design of experiments, Forecasting models.

#### **Books Recommended:**

1. M.K.Jain, S.R.K. Iyengar & R.K.Jain, Numerical methods for Scientific and Engineering Computation, New age International Publication.
2. S.S. Sastry, Introductory Methods of Numerical Analysis, Eastern Economy Edition.
3. S. Rajasekaran, Numerical Method in Science and Engineering, Wheeler Publishing House.
4. B.S. Grewal, Numerical Method in Engineering & Science, Khanna Publishers.
5. D. L. Harnett, Statistical methods.

