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M.Sc. PHYS. (IV SEM.) COMPUTATIONAL METHODS AND PROGRAMMING

Unit 1. Computational methods: Methods for determination of zeros of linear and nonlinear algebraic equations and transcendental equations, Bisection method, Muller's method, Quotient-difference method, Newton-Raphson method
Solution of simultaneous linear equations, consistency of a system of linear equation, Gaussian elimination, LU decomposition method, matrix inversion, Jacobi iterative method, Gauss-Seidel method, convergence of Gauss-Seidel method

Unit 2. Diagonalization of matrices, Eigen values and eigenvectors of matrices, Power and Jacobi method.
Finite differences, Newton's formula for interpolation, Gauss, Stirling, Bessel's, Everett's formulae, Divided differences, Newton's general interpolation formula, Lagrange's interpolation formula.

Unit 3. Numerical differentiation, Numerical integration, Trapezoidal rule, Simpson 1/3 and 3/8 rules, Boole's and waddles rules, Newton-Cote's formula, Euler- Maclaurin formula, Gauss quadrature formula.
Method of Least square curve fitting, straight line and quadratic equation fitting, curve fitting of curves $y = ax^b$, $y = ae^{bx}$, $xy^a = b$ and $y = ab^x$, curve fitting by sum of exponentials, data fitting with cubic splines.

Unit 4. Numerical solution of ordinary differential equations, Euler, Picard and Runge-Kutta methods, Predictor and corrector method, elementary ideas of solutions of partial differential equations, solution of Laplace equation

Unit 5. Programming: elementary information about digital computer principles, compilers, interpreters and operating systems, Fortran programming, flow charts, integer and floating point, arithmetic expressions, built in functions, executable and non executable statements, IF statements, GO TO statements, DO loop and implied DO loop, simple computer programmes.

Text and References Books

Introductory Methods of Numerical analysis by S.S. Shastri
Numerical Analysis by Rajaraman

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Numerical Methods by E. Balagurusamy
Fortran Programming by Rajaraman
Numerical methods for scientific & Eng. Computations by Jain, Iyengar