

Semester-VI
Numerical and Stat Methods & Scientific Computing (AS-6001)

Course Code	AS-6001	Credits-4	L-3, T-1, P-0
Name of the Course	Numerical and Stat Methods & Scientific Computing		
Lectures to be Delivered	52 (1 Hr Each) (L=39, T=13 for each semester)		
Semester End Examination	Max Marks: 100	Min Pass Marks: 40	Maximum Time: 3 hrs
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)			Max Marks: 50

Instructions

- For Paper Setters:** The question paper will consist of five sections A, B, C, D and E. Section E will be Compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 20% of the total marks of the semester end examination for the course. Section A, B, C and D will have two questions from the respective sections of the syllabus and each question will carry 20% of the total marks of the semester end examination for the course.
- For Candidates:** Candidates are required to attempt five question in all selecting one question from each of the section A, B, C and D of the question paper and all the subparts of the questions in section E. Use of non-programmable calculators is allowed.

Section A

Computer Arithmetic and Errors: Representation of integers and real numbers in computers. Fixed point arithmetic, Floating point arithmetic, Normalized floating point numbers, Error due to storage imitations and safeguards, Round off and truncation errors, Relative and absolute errors.

Solution of Non-linear equations: Bisection method for solution of a single non-linear equation, rate of convergence of the solution. Newton-Raphson method for solution of a single non-linear equation. Radius of convergence. Generalization to several non-linear equations.

Section B

Interpolation and extrapolation: The Lagrange interpolating polynomial, The Gregory-Newton interpolating polynomial. The difference table and error propagation in calculating the differences. Approximating differentials using finite differences. Uniqueness of the interpolating polynomial.

Numerical differentiation and integration: Numerical differentiation: Method based on finite differences. The trapezoidal rule with error estimate. The Simpson's rule with error estimate. The Gaussian quadrature methods with error estimates.

Section C

Solution of ordinary differential equations: Taylor series method. Euler's method with estimate of error and error propagation. Runge-kutta methods with error estimate and error control using step adjustment. Predictor-corrector methods with error estimate.

Solution of system of linear equation: Gaussian elimination with pivoting. Iterative improvement of solution vector. Gauss Jordan method for finding the inverse of a matrix. Gauss Siedel method together with convergence criterion.

Section D

Matrix Diagonalisatin: Unitary transformations. Jacobi's method for diagonalization of real symmetric matrices.

Statistical methods: Curve fitting using least-square method. Determining the goodness of fit using chi-square test. Generation of pseudo-random numbers. Introduction to Monte-Carlo method for numerical integration. Introduction to genetic algorithm for optimization.

Books:

- M. K. Jain, S. R. K. Jain, "Numerical Methods for scientific and Engineering Computation (1993), New Age Int. (P) Ltd., New Delhi.
- I. R. Miller, J. E. Freund and R. Johnson, "Probability and statistics for Engineers"(1990), Prentice Hall of India, New Delhi.
- S. D. Conte and C. De Boor, "Elementary Numerical Analysis" (1980), McGraw Hill Publications.
- E. Kreyszig, "Advanced Engineering Mathematics", Wiley Eastern Ltd. (7th edition), New Delhi.
- P. L. Meyer, "Introductory Probability Statistical Application", Oxford and IBH Pvt. Ltd. (2nd edition), New Delhi.