Numerical Methods

Course Code: PAS6110 **Course Type: IDC for UG III Sem**
Course Credit: 2 **Target Students:** UG (3rd Semester)

Course Objectives:

1. To understand the Importance of error analysis and their propagation.
2. To introduce the basic concepts of solving algebraic, transcendental equations and system of linear and non-linear equations.
3. To understand techniques of interpolation and polynomial fitting.
4. To understand methods too numerical differentiation and integration.
5. To understand numerical solution of ordinary differential equations.
6. To understand basic concepts of probability theory and distributions.

Course Outcomes: After completion of the course students shall be able to :

CO1: calculate errors induced in the values by truncation of a series expansion.
CO2: find roots of linear and non-linear system (algebraic and transcendental) equations.
CO3: fit polynomials to a given set of data points.
CO4: solve differential and integral equations numerically.

UNIT-1:

Reporting a series of measurements, significant figures, expressing inaccuracies, Graphical presentation of experimental data, Classification of errors, error analysis and propagation, Rounding and Truncation errors, Precision and accuracy, Elementary probability theory, random variables, binomial, Poisson and normal distributions, Central limit theorem

UNIT-2:

Solution of algebraic and transcendental equation- Bisection method, Newton's method, multiple roots, Convergence of these methods, Non-linear systems of equations, Solving Linear Systems of Equations: Gauss Method, Pivoting, Gauss - Jordan Method, Jacobi method, Gauss - Seidel Method.

UNIT-3:

Newton's forward and backward interpolation, Lagrange interpolation, Cubic spline, Linear and nonlinear curve fitting

UNIT -4:

Approximation of derivatives using interpolation polynomials, numerical integration using trapezoid and Simpson's rule, Solution of first order differential equation using Runge- Kutta method. Finite difference methods, Random numbers and Monte Carlo method.

Suggested References:

1. Applied Numerical Analysis, C.F. Gerald & P.O.Wheatley, Addison-Wesley 7th Edition (2004).
2. Numerical Recipes The Art of Scientific Computing, W.H. Press, S.A.Teukolsky, & W. T. Vetterling, Cambridge University Press (2007).
3. A student's guide to Data and Error analysis, Herman J. C. Berensden, Cambridge University Press.
4. Numerical Methods, Rao V Dukkipati, New Age International Publishers.