ME-611 (I Semester)

Unit-I

***Number Representation*:** Representation of decimal numbers in Binary system-integers and floats, machine epsilon, Round-off error, error propagation in arithmetic operations, Truncation error.

MATLAB- Introduction, Basic operations involving scalars, vectors and matrices, built-in functions for vector and matrix analysis, Solution of algebraic linear system of equations, Symbolic math, Programming constructs – {loops, decision statements, input/output statements, File I/O}, Plotting commands – XY plots, Contour plots, 3D plots

Unit-II

Interpolation – Definition, Polynomial interpolation, Horner's rule, Taylor's Polynomials, Lagrange interpolation, Truncation error of interpolating polynomials, Newton representation, Piecewise polynomial methods – Splines, Cubic splines, Two-dimensional polynomial interpolation, Lagrange interpolation in 2D.

Root finding – Bisection, False Position method, Contraction Mapping method, Secant method, Muller's method, Newton's method, Nonlinear Systems of equations

Numerical Differentiation – First and Second derivatives, Richardson extrapolation

Unit-III

Numerical Integration – Newton-Cotes Integration-{Midpoint, Trapezoid and Simpson's rules}, Romberg integration, Gauss Quadrature, Improper integrals

Linear Algebraic Systems- Gauss-Jordan Elimination, Gaussian Elimination, LU-decomposition, Ill-conditioned systems, Iterative methods –{Jacobi's method, Gauss-Siedel methods, Relaxation methods}

Function approximation and curve fitting-Linear and Non-linear least squares approximation, Orthogonal functions and Fourier basis

Unit-IV

Optimization- Local and Global minima, Line searches, Steepest Descent method, Conjugate-Gradient method, Quasi-Newton methods

Ordinary Differential Equations- Euler's method, Runge-Kutta methods, Runge-Kutta-Fehlberg method, Multistep methods (Adams-Bashforth, Adams-Moulton), Modified mid-point method, Richardson extrapolation, Boundary-Value problems.

Evaluation: Sessional - 25 marks
End-Semester Exam – 75 marks
Total – 100 marks