CE604A: Numerical Methods for Civil Engineers **1.5-0-0-0 [5]**

Course Contents:

Introduction; Floating Point operations, Round-off and truncation errors, Error Propagation; Solution of Linear System of equations: Gauss Elimination, Matrix Inversion by Gauss Jordon, Thomas Algorithm, Gauss-Siedel iteration, pivoting, equilibration, Ill-Conditioning; Solution of non-linear equation: Newton-Raphson, Bairstow method for polynomials, non-linear system of equations; Eigenvalues: maximum and minimum eigenvalue by Power and Inverse Power Method; All eigenvalues by Fadeev-Leverrier method; Introduction to diagonalization and QR-Factorization; Approximation Theory: Interpolation by Newton's and Lagrange polynomials; Method of Least Squares; Numerical Differentiation: Finite difference formulae; Richadson's extrapolation; Numerical Integration: Newton-Coates formulae; Romberg integration; introduction to quadrature schemes; Ordinary Differential Equations (ODEs): Euler Methods; Trapezoidal methods; Runge-Kutta methods; application to system of ODEs and higher order ODEs; concepts of consistency; stability and convergence; Solution of boundary value problems by shooting method and finite difference method; Partial Differential Equations (PDEs): finite difference methods for Laplace equation; partial and direct discretization schemes; Crank-Nicholson method for parabolic equation; upwind scheme for first order wave equation; direct discretization and time lumping schemes for second order wave equation.