CE4001 COMPUTER APPLICATIONS IN CIVIL ENGINEERING

Prerequisite: All subjects upto and including 4th semester **Total hours: 42**

A. NUMERICAL METHODS IN CIVIL ENGINEERING

Module 1 (12 hours)

Introduction to Numerical Methods in Civil Engineering: importance of numerical methods in civil engineering; sources of errors in numerical methods; number representations; fixed and floating point numbers; significant digits; round off errors; development of computer algorithms; pseudocode.

Solution of Algebraic and Transcendental Equations in One Variable: bisection method; method of false position; Newton-Raphson method; successive approximation method; development of computer algorithms for each of the above methods.

System of Linear Algebraic Equations: solution of linear algebraic equations using Gauss elimination method and LU decomposition method; solution by iterative method; conditions of convergence-III conditioned system of equations; Applications in Civil Engineering Problems.

Module 2 (10 hours)

Eigenvalue Problems: determination of eigenvalues and eigenvectors by Power method and Jacobi's method.

Interpolation: Newton's formulae; Gauss' formulae; Lagrangian interpolation; Cubic spline interpolation; Applications in Civil Engineering Problems.

Module 3 (10 hours)

Numerical differentiation and integration: numerical differentiation using Newton's formula; maximum and minimum values of tabulated functions; numerical integration; trapezoidal formula; Simpson's formulae and Gauss quadrature; development of computer algorithms for numerical integration.

Numerical solution of ordinary differential equations: Taylor's series method; Euler's method; Runge-Kutta method; finite difference method for the solution of boundary value problems; Applications in Civil Engineering Problems.

B. OPTIMISATION METHODS IN CIVIL ENGINEERING

Module 4 (10 hours)

Linear programming problems: statement of an optimisation problem; linear and nonlinear programming problems; standard form of linear programming problems; applications of linear programming in civil engineering

Introduction to nonlinear programming problems: (outline only; descriptive questions only are expected); difficulties in nonlinear programming problems; unconstrained optimisation problems; unimodal function; search methods; one dimensional minimisation methods; Fibonacci and golden section methods; examples of one dimensional minimisation problems in civil engineering.

References

1. Sastry, S. S., Introductory Methods of Numerical Analysis, Prentice Hall of India, 2003
2. Scarborough, J. B., Numerical Mathematical Analysis, Oxford and IBH, 1971
3. Chapra, S. C., and Canale, R. P., Numerical Methods for Engineers, McGraw Hill, Inc., 2007
4. Rao S. S., Engineering Optimization; Theory and Applications, New Age International, 2007