BS 403 MT With effect from the Academic Year 2016-2017
University College of Engineering (A)

NUMERICAL METHODS

(Civil)

Instruction	4 Periods per week (3 Theory + 1 Tutorial)
Duration of SEE	3 Hours
SEE	70 Marks
CIE	30 Marks
Credits	3

Course objectives:

- To introduce a few numerical methods to solve non linear equations and system of linear equations
- To provide the necessary basic concepts of numerical differentiation, numerical integration and differential equations
- To introduce finite differences and their applications

Outcomes: At the end of the course students will be able to

- solve non linear equations, system of linear equations,differential equations and eigenvalue problems numerically .
- perform numerical differentiation and numerical integration
- apply finite differences to solve initial and boundary value problems

Unit I

Solution of linear and non linear equations: Solution of Algebraic and Transcendental equations-Bisection method, Newton-Raphson method, Solution of linear system of equations-Gauss elimination method, LU decomposition method, Gauss-Jacobi and Gauss-Seidel iteration methods**.**

UNIT-II

Eigenvalue problems and Interpolation: Eigenvalues and Eigenvectors-Jacobi method for symmetric matrices- Given's method for symmetric matrices, Interpolation, Lagrange's interpolation, Newton's divided difference interpolation, Newton's Forward and Backward difference interpolations.

UNIT-III

Numerical differentiation and Integration : Numerical differentiation, Interpolation approach, Numerical integration-Trapezoidal rule,Simpson's 1/3 rule, Romberg method, Two point and three point Gaussian quadrature formulae, Double integration- Trapezoidal rule, Simpson's 1/3 rule.

UNIT-IV

Numerical solutions of ordinary differential equations : Single step methods, Taylor's series method, Euler's method, Picard's method of successive approximations, Runge-Kutta method of 4^{th} order, Multi step methods, Milne's and Adams-Bash forth Predictor-Corrector methods.

UNIT-V

Finite Differences and their applications: construction of finite difference approximations-Taylor series, forward, backward and central difference approximation, finite difference approximation of boundary value and initial value problems, 1D and 2D problems- Explicit and implicit and Crank Nicolson schemes, convergence and stability.

Suggested Reading:

1. M.K.Jain,S.R.K.Iyengar and R.K.Jain, *Numerical methods for scientific and engineering computation* ,6^{th} edition , New Age International Limited., 2012.
2. Richard L Burden, J. Douglas Faires , *Numerical Analysis* , 9^{th} edition, Cengage Learning, 2013.
3. S.S.Sastry, *Introductory Methods of Numerical Analysis*, 5^{th} edition , PHI Private Limited, 2012.
4. Dr.B.S.Grewal, *Numerical methods in Engineering and Science*, Khanna Publishers, 2014.
5. Stevan C.Chopra, Raymond P.Canal, *Numerical Methods for Engineers* ,6^{th} edition, McGraw-Hill company,2010.

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