ADVANCED COMPUTATIONAL METHODS

Course Code: 13BM2101

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Course Outcomes:

At the end of the Course, Student will be able to:

CO1 : Discuss several important methods with widespread application for solving large system of equations

CO2 : Appraise the importance of eigen value problems in engineering sciences.

CO3 : Analyze experimental data by fitting a polynomial or estimating the derivative or finding the integrals or performing Fourier analysis.

CO4 : Prepare mathematical model for physical situations and numerically analyze the corresponding ordinary linear/nonlinear, initial/boundary value differential equations.

CO5 : Prepare mathematical model for physical situations and numerically analyze the corresponding partial linear/nonlinear, initial value/ initial boundary value differential equations.

UNIT-I

System of linear equations: Gauss elimination method, triangularization method, Cholesky method, Partition method, Error Analysis for Direct Methods.

Iteration Methods: Jacobi Iteration Method, Gauss Seidel Iteration Method, SOR Method.

UNIT-II

Eigen value and Eigen Vectors, Bounds on Eigen values, Jacobi Method for symmetric matrices, givens method for symmetric matrices, householders method, power method.

UNIT-III

Numerical differentiation: Introduction, methods based on undetermined coefficients, optimum choice of step length, extrapolation methods, partial differentiation.

Numerical Integration: Introduction, open type integration rules, methods based on undetermined coefficients: Gauss-Legendre, Gauss-Chebyshev, Romberg Integration.

Double integration: Trapezoidal method, Simpson's method.

UNIT-IV

Numerical Solutions of ordinary differential equations (boundary value problem): introduction, shooting method: linear and non linear second order differential equations.

UNIT-V

Numerical solutions of partial differential equations: introduction, finite difference approximation to derivatives. Laplace equation- Jacobi method, Gauss Seidel Iteration Method, SOR Method, Parabolic Equations, iterative methods for parabolic equations, hyperbolic equations.

TEXT BOOKS:

1. M.K. Jain, S.R.K. Iyengar and R.K.Jain, "*Numerical Methods for Scientific and Engineering Computation*", New Age International (P) Limited, Publishers, 4th Edition, 2003.

2. S.S.Sastry, "*Introductory Methods of Numerical Analysis*", Prentice Hall India Pvt., Limited, 4th Edition.

REFERENCES:

1. Samuel Daniel Conte, Carl W. De Boor**, "***Elementary Numerical Analysis: An Algorithmic Approach***",** 3rd Edition**,** McGraw-Hill.