ADVANCED COMPUTATIONAL METHODS

Course Code: 15BM2201

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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 (10-Lectures)

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 (10-Lectures)

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 (10-Lectures)

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.

UNIT-IV (10-Lectures)
Numerical Solutions of ordinary differential equations (boundary value problem): introduction, shooting method: linear and non linear second order differential equations.

UNIT-V (10-Lectures)
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**.**

REFERENCE:

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