ADVANCED COMPUTATIONAL METHODS

Subject Code : 13BM2101

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Pre requisites: 1.Fundamental concepts of Calculus.
2. Ordinary differential equations.
3. Elementary numerical methods

Course Educational Objectives:
To teach advanced numerical methods required for typical scientific and engineering applications. Give students experience in understanding the properties of different numerical methods so as to be able to choose appropriate methods and interpret the results for engineering problems that they might encounter.

Course Outcomes: Upon successful completion of the course, the students should be able to
1. use numerical method in modern scientific computing.
2. use numerical methods to interpolate functions and their derivatives.
3. solve ordinary and partial differential equations using numerical methods.

UNIT-I
Linear System of 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
Eigenvalue 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, 2009.

REFERENCE:

1. Samuel Daniel Conte, Carl W. De Boor**,** "*Elementary Numerical Analysis: An Algorithm Approach*", 3rd edition, McGraw-Hill, 2005.