ADVANCED COMPUTATIONAL METHODS
(Professional Elective II)

Course Code: 19BM2250

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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 nonlinear 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.

TEXTBOOKS:

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.