MA 203: SCIENTIFIC COMPUTING (3-0-0 : 3)

Introduction:

Approximations: Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy. Computer Arithmetic: Floating Point Numbers, Normalization, Properties of Floating Point Systems, Rounding, Machine Precision, Subnormal and Gradual Underflow, Exceptional Values, Floating-Point Arithmatic, Cancellation.

Systems of Linear Equations:

Linear Systems, Solving Linear Systems, Norms and Condition Numbers, Accuracy of Solutions, Iterative Methods for Linear Systems.

Linear Least Squares

Data Fitting, Linear Least Squares, Normal Equations Method, Orthogonalization Methods, Gram-Schmidt Orthogonalization.

Eigenvalues And Singular Values

Eignvalues and Eigenvectors, Methods for Computing All Eignvalues, Jacobi Method, Methods for Computing Selected Eignvalues, Singular Values Decomposition, Application of SVD.

Optimization

Optimization Problems, One-Dimensional Optimization, Multidimensional Unconstrained Optimization, Nonlinear Least Squares.

Interpolation

Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation.

Calculus

Introduction to Numerical Integration and Differentiation; Numerical Solution to Initial Value Problems in ODEs and PDEs.

Random Numbers

Text Books:

1. Heath Michael T., Scientific Computing: An Introductory Survey, McGraw-Hill.
2. Press William H., Saul A. Teukolsky, Vefterling William T and Brian P. Flannery, Numerical Recipes: The Art of Scientific Computing, Cambridge University Press.

References:

1. Xin-She Yang (Ed.), Introduction to Computation Mathematics, World Scientific Publishing Co.
2. Kiryanov D. and Kiryanova E., Computational Science, Infinity Science Press.