MA862 Numerical Linear Algebra 4-0-04

PO1. **Mathematics knowledge:** Knowledge of advanced level in applied mathematics.
CO1: To understand the basic concept of linear algebra.

PO2. **Problem analysis:** Develop analytical skills to identify, formulate, and analyze complex mathematical problems.
CO1: To understand the basic concept of linear algebra.

PO3. **Modelling and solutions:** Design solutions for complex problems and evolve procedures for solutions.
CO3: To study numerical algorithms for non-linear systems

PO4. **Modern analytical tool usage:** Select, and apply appropriate techniques, resources, and modern analytical tools.
CO2: To understand the Matlab concept

OBJECTIVES

It contains basics of matrix algebra, computer arithmetic, conditioning and condition number, stability of numerical algorithms, vector and matrix norms, convergent matrices, stability of non-linear systems, sensitivity analysis, singular value decomposition (SVD), algebraic and geometric properties of SVD, least square solutions, Householder matrices and applications, QR method, Power method and applications, Jacobi method for finding the eigenvalues of a given matrix. This course has tremendous applications in diverse fields of Engineering and Sciences such as control theory, image processing, numerical analysis and dynamical systems etc.

CO1: To understand the basic concept of linear algebra.

CO2: To understand the Matlab concept

CO3: To study numerical algorithms for non-linear systems

Unit-I Matrix operations and type of matrices, Determinant of a Matrix, Rank of a matrix, Vector Space, Linear dependence and independence, Bases and Dimensions,

Unit-II Linear Transformation, Orthogonal subspaces, Row space, column space and null Space, Eigenvalues and Eigenvectors, Diagonalizable Matrices, Orthogonal Sets, Gram Schmidt, orthogonalization and orthonormal bases.

Unit-III Introduction to Matlab, Sign integer representation Computer representation of numbers, Floating point representation, Round-off error, Error propagation in computer arithmetic, Addition and multiplication of floating point numbers, Conditioning and condition numbers.

Unit-IV Stability of numerical algorithms, Vector norms Matrix Norms Convergent Matrices Stability of non-linear system Condition number of a matrix: Elementary properties, Sensitivity analysis Residual theorem, Nearness to singularity Estimation of the condition number,

Unit-V Singular value decomposition of a matrix Orthogonal Projections, Algebraic and geometric properties of matrices using SVD SVD and their applications, Perturbation theorem for singular values, Outer product expansion of a matrix, Least square solutions Psudeo - inverse and least square solution, Householder matrices and their applications

References:

- Numerical Linear Algebra Holger Wendland, Cambridge texts in Applied Mathematics
- Linear Algebra A.R Vasistha and JN Sharma, Krishna Publications