Course Name   : Linear Algebra

Course Number   : MA-512

Credit   : 3-1-0-4

Prerequisites   : Basic knowledge on matrix and determinants

Students intended for   : M.Sc./M.S./Ph.D.

Elective or core   : Core for M.Sc. in applied Mathematics and Elective for

                                                              other discipline.

Semester   : Odd/Even

Course Objective:

Problems in linear algebra arise in a wide variety of scientific and engineering applications including the design of structures, the analysis of electrical networks, and the modeling of chemical processes. This course will cover the analysis and implementation of algorithms used to solve linear algebra problems in practice. This course will enable students to acquire further skills in the techniques of linear algebra, as well as understanding of the principles underlying the subject. This course will prepare students for further courses in mathematics and/or related disciplines (e.g. engineering, economics, actuarial science, etc.). At the end of this course, and having completed the Essential reading and activities, students should have used the concepts, terminology, methods and conventions covered in this course to solve the mathematical problems in this subject. Student will also develop the ability to demonstrate an understanding of the underlying principles of the subject and the ability to solve unseen mathematical problems involving an understanding of the concepts and applications of these methods.

Course Outline:

Unit 1: Matrices, vectors, and systems of linear equations—Introduction to Matrix and Determinant.   [Lecture hours: 3]

Unit 2: Vector spaces, basis, dimension – Vector spaces, Subspaces, Subspaces connected with matrices, Linear span, Linear independence, Bases and dimension, Basis and dimension of range and null space.   [Lecture hours: 10]

Unit 3: Linear transformations, change of basis - Linear transformations and matrices, Coordinate change, Change of basis and similarity.   [Lecture hours: 6]

Unit 4: Diagonalisation - Eigenvalues and eigenvectors, Diagonalisation of a square matrix, Inner products, orthogonality, orthogonal diagonalisation, Applications of diagonalisation, .   [Lecture hours: 7]

Unit 5: Direct sums and projections - The direct sum of two subspaces, Orthogonal complements, Projections, Characterising projections and orthogonal projections, Minimising the distance to a subspace.   [Lecture hours: 7]

Unit 6: Complex matrices, vector spaces - Complex vector spaces, Complex inner product spaces, The adjoint. Hermitian and unitary matrices, Unitary diagonalisation. Normal matrices, Spectral decomposition.   [Lecture hours: 9]

Text Books:

1. G.Strang, "Linear Algebra and its Applications",4th Edition, Thomson, (2006).

2. K. Hoffman and R. Kunze, "Linear Algebra", Prentice Hall, (2008).

3. H.Anton, "Elementary Linear Algebra with Applications",9th Edition, John Wiley (2004).

Reference Books:

1. Loehr, Nicholas, Advanced Linear Algebra, Taylor & Francis Inc, ISBN13 : 9781466559011.

2. Iuliana Iatan, Advanced Lectures on Linear Algebra with Applications, LAP Lambert Academic Publishing, ISBN13 : 9783844324105.

3. Sohail A. Dianat, Eli Saber, Advanced Linear Algebra for Engineers with MATLAB, Taylor Francis Inc, ISBN13 : 9781420095234.