Semester - IV

MT-241: Linear Algebra

Unit-1: Matrices and System of Linear Equations [06 lectures]

1.1 Row echelon form of a matrix, reduced row echelon form of a matrix.
1.2 Definition of rank of a matrix using row echelon or row reduced echelon form.
1.3 System of linear equations- Introduction, matrix form of linear system, definition of row equivalent matrices.
1.4 Consistency of homogeneous and non-homogeneous system of linear equations using rank, condition for consistency.
1.5 Solution of System of Equations: Gauss elimination and Gauss-Jordan elimination method, examples.

Unit-2: Vector Spaces-I [10 lectures]

2.1 Definition and Examples.

2.2 Subspaces.

2.3 Linear Dependence and Independence.
2.4 Basis of Vector Space

Unit-3: Vector Spaces-II [08 lectures]

3.1 Dimension of a Vector Space.
3.2 Row, Column and Null Space of a matrix.
3.3 Rank and nullity.

Unit-4: Linear Transformations [12 lectures]

4.1 Definition and Examples, Properties, Equality.
4.2 Kernel and range of a linear Transformation
4.3 Rank-Nullity theorem.
4.4 Composite and Inverse Transformation.
4.5 Matrices and Linear Transformation.
4.6 Basic Matrix Transformations in R^2 and R^3
4.7 Linear Isomorphism.

Text Book::

Howard Anton, Chris Rorres, Elementary Linear Algebra, Application Version, Ninth Edition, Wiley, 11th edition.

Unit-1: Chapter-1: Sec. 1.1, 1.2.

Unit-2: Chapter- Sec. 4: 4.1 to 4.4.

Unit-3: Chapter- Sec. 4: 4.5, 4.7, 4.8

Unit- 4: Chapter- Sec.8: 8.1 to 8.4, 1.8, 4.9.

Reference Books:

(1) K. Hoffman and R. Kunze, Linear Algebra, 2nd edition(2014), Prentice Hall of India, New Delhi

(2) Steven J. Leon, Linear Algebra with Applications, 4th edition(1994), Prentice Hall of India. New Delhi

(3) Vivek Sahai, Vikas Bist, Linear Algebra, 4th Reprint 2017, Narosa Publishing House, New Delhi

(4) Promode Kumar Saikia, Linear Algebra, 2009, Pearson, Delhi

(5) S. Lang, Introduction to Linear Algebra, 2nd edition,1986, Springer-Verlag, New York, Inc.

MT 242(A): Vector Calculus

Unit 1: **Vector-Valued Functions** **[08 lectures]**

1.1 Curves in Space, Limits and Continuity, Derivatives and Motion, Differentiation Rules for Vector Function, Vector Functions of Constant Length.

1.2 Integrals of Vector Functions.

1.3 Arc Length along a Space Curve, Speed on a Smooth Curve, Unit Tangent Vector.

1.4 Curvature of a Plane Curve, Circle of Curvature for Plane Curves, Curvature and Normal Vectors for a Space Curve.

Unit 2: **Integrals** **[12 Lectures]**

2.1 Line Integral of Scalar Functions, Additivity, Line integral in the Plane.

2.2 Vector Fields, Gradient Fields, Line Integral of Vector Fields, Line Integrals with respect to dx, dy, dz .

2.3 Work done by a Force over a Curve in Space, Flow Integrals and Circulation for Velocity Fields, Flow across the Simple Closed Plane Curve.

2.4 Path Independence, Conservative and Potential Functions.

2.5 Divergence, Two forms for Green's Theorem, Green's Theorem in the Plane (Proof for special regions),

Unit 3: **Surface Integrals** **[08 Lectures]**

3.1 Parameterizations of Surfaces, Implicit surfaces.

3.2 Surface integrals, Orientation of Surfaces.

3.3 Surface Integrals of Vector Fields.

Unit 4: Applications of Integrals **[08 Lectures]**

4.1 The Curl Vector Field, Stokes' Theorem(without proof), Conservative Fields and Stokes' Theorem.