

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

**Reference Books:**

- (1) K. Hoffman and R. Kunze, Linear Algebra, 2<sup>nd</sup> edition(2014), Prentice Hall of India, New Delhi
- (2) Steven J. Leon, Linear Algebra with Applications, 4<sup>th</sup> edition(1994), Prentice Hall of India. New Delhi
- (3) Vivek Sahai, Vikas Bist, Linear Algebra, 4<sup>th</sup> Reprint 2017, Narosa Publishing House, New Delhi
- (4) Promode Kumar Saikia, Linear Algebra, 2009, Pearson, Delhi
- (5) S. Lang, Introduction to Linear Algebra, 2<sup>nd</sup> 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.

4.2 Divergence in three Dimensions, Divergence Theorem (without proof).

4.3 Unifying the Integral Theorems.

**Text Book:**

- Thomas' Calculus (14<sup>th</sup> Edition) by Hass, Heil, Weir, Pearson Indian Education Services Pvt. Ltd.  
Unit 1: Chapter 13: Sec- 13.1, 13.2, 13.3, 13.4  
Unit 2: Chapter 16: Sec-16.1, 16.2, 16.3, 16.4  
Unit 3: Chapter 16: Sec- 16.5, 16.6  
Unit 4: Chapter 16: Sec- 16.7, 16.8

**Reference books:**

- (1) Basic Multivariable Calculus by J.E. Marsden, A.J. Tromba, A. Weinstein, Springer Verlag (Indian Edition)
- (2) Advanced Calculus by M.R. Spiegel, Schaum Series.
- (3) Advanced Calculus (2<sup>nd</sup> Edition) by D.V. Widder, Prentice Hall of India, New Delhi (1944).
- (4) Advanced Calculus by John M. H. Olmsted, Eurasia Publishing House, New Delhi (1970)
- (5) Calculus Vol. II (2<sup>nd</sup> Edition) by T.M. Apostol, John Wiley, New York (1967).

**MT-242(B): Dynamical Systems**

**Unit 1: Eigenvalues and Eigenvectors** [08 Lectures]

- 1.1 Eigenvalues and Eigenvectors
- 1.2 Diagonalisation (matrices with real and distinct eigenvalues)

**Unit 2: First-Order Equations and Planar Linear Systems** [12 Lectures]

- 2.1 The Simplest Example
- 2.2 The Logistic Population Model
- 2.3 Second-Order Differential Equations
- 2.4 Planar Systems
- 2.5 Preliminaries from Algebra
- 2.6 Planar Linear Systems
- 2.7 Eigenvalues and Eigenvectors
- 2.8 Solving Linear Systems
- 2.9 The Linearity Principle.

**Unit 3: Phase Portraits for Planar Systems** [08 Lectures]

- 3.1 Real Distinct Eigenvalues
- 3.2 Complex Eigenvalues
- 3.3 Repeated Eigenvalues
- 3.4 Changing Coordinates

**Unit 4: Classification of Planar Systems and Exponential of a matrix** [08 Lectures]