



ARSD College, University of Delhi

Model Course Handout/Lesson Plan

Course Name:		B.Sc. (H) Mathematics				
Semester	Course Code	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credit (C)
II	DSC-4	Linear Algebra	3	1	0	4
Teacher/Instructor(s)		DR. MOHAMMAD SALMAN				
Session		2022-23				

Course Objectives:

The objective of the course is to introduce the concept of vectors in \mathbb{R}^n . The concepts of linear independence and dependence, rank and linear transformations has been explained through matrices. Various applications of vectors in computer graphics and movements in a plane has also been introduced.

Course Learning Outcomes: This course will enable the students to:

1. Visualize the space \mathbb{R}^n in terms of vectors and the interrelation of vectors with matrices.
2. Familiarize with basic concepts in vector spaces, linear independence and span of vectors over a field.
3. Learn about the concept of basis and dimension of a vector space.
4. Basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation with application to computer graphics.

Lesson Plan:

Unit No.	Learning Objective	Lecture No.	Topics to be Covered
Unit 1	Matrices and System of Linear Equations	1-2	Fundamental operation with vectors in Euclidean space \mathbb{R}^n
		3	Linear combinations of vectors
		4-5	Dot product and their properties
		6	Cauchy-Schwarz inequality, Triangle inequality
		7-8	Solving system of linear equations using Gaussian elimination
		9	Gauss-Jordan row reduction
		10	Reduced row echelon form
		11-12	Equivalent systems, Rank and row space of a matrix
		13	Eigenvalues, Eigenvectors
		14	Eigenspace
		15-16	Diagonalization
		17	Characteristic polynomial of a matrix
18	Cayley-Hamilton theorem		
Unit 2	Introduction to Vector Spaces	19-21	Vector spaces
		22-23	Subspaces

		24	Algebra of subspaces
		25	Linear combination of vectors
		26	Linear span
		27	Linear independence
		28-29	Bases and dimension
		30	Dimension of subspaces
Unit 3	Linear Transformations	31	Linear transformations
		32	Null space, Range
		33-34	Rank and nullity of a linear transformation
		35	Matrix representation of a linear transformation
		36	Algebra of linear transformations
		37-38	Invertibility and isomorphisms
		39	Application: Computer graphics – Fundamental movements in a plane
		40	Homogenous coordinates
		41	Composition of movements
		42	Revision and Test

Evaluation Scheme:

S. No.	Component	Duration	Marks
1	Internal Assessment <ul style="list-style-type: none"> • Quiz • Class Test • Assignment 		24
2	End Semester Examination	3 hrs	90
3	Continuous Assessment <ul style="list-style-type: none"> • Literature Review • Book Review • Movie Review • Project Activity (Group) • Research Cum Presentation • Creative Writing/Paper Writing • Group Discussion • Problem Solving Exercises • Any creative Production (May be Done in a Group) • Innovative Project • Any Other Scholastic Work Related to Application of Conceptual Understanding of the Subject 		35
4	Tutorial Attendance		5
5	Class Attendance		6

Details of the Course:

Unit	Content	Contact Hours
1	Matrices and System of Linear Equations Fundamental operations with vectors in Euclidean space \mathbb{R}^n , Linear combinations of vectors, Dot product and their properties, Cauchy-Schwarz inequality, Triangle	18

	inequality, Solving linear systems using Gaussian elimination, Gauss-Jordan row reduction, Reduced row echelon form, Equivalent systems, Rank and row space, Eigenvalues, Eigenvectors, Eigenspace, Diagonalization, Characteristic polynomial of a matrix, Cayley-Hamilton theorem	
2	Introduction to Vector Spaces Vector spaces, Subspaces, Algebra of subspaces, Linear combination of vectors, Linear span, Linear independence, Bases and dimension, Dimension of subspaces.	12
3	Linear Transformations Linear transformations, Null space, Range, Rank and nullity of a linear transformation, Matrix representation of a linear transformation, Algebra of linear transformations, Invertibility and isomorphisms; Application: Computer Graphics-Fundamental movements in a plane, homogenous coordinates, composition of movements.	12
Total		42

Suggested Books:

S. No.	Name of Authors/Books/Publishers	Year of Publication/Reprint
1	Andrilli, S., & Hecker, D. (2016). Elementary Linear Algebra (5th ed.). Elsevier India	2016
2	Friedberg, Stephen H., Insel, Arnold J., & Spence, Lawrence E. (2003). Linear Algebra (4th ed.). Prentice-Hall of India Pvt. Ltd. New Delhi	2003
3	Lay, David C., Lay, Steven R., & McDonald, Judi J. (2016). Linear Algebra and its Applications (5th ed.). Pearson Education	2016
4	Kolman, Bernard, & Hill, David R. (2001). Introductory Linear Algebra with Applications (7th ed.). Pearson Education, Delhi. First Indian Reprint 2003.	2001

Mode of Evaluation:

Internal Assessment/End Semester Exam