FACULTY OF COMPUTER APPLICATIONS
B.Sc (Data Science)

- **Sem.** : 1
- **Subject Code** : 05DS0102
- **Subject** : Linear Algebra and Matrices
- **Course Objectives** :

1. To understand concepts of linear algebra and matrices concepts which can be applicable in various computer science problems.
2. To enable students to understand concepts of matrices, determinants to solve simple application problems related to Computer Science.
3. To apply concepts of system of linear applications to solve problems.
4. To analyse linear mappings and operations with it.
5. To analyse Eigen values and Eigen vectors.

- **Prerequisites** : Vectors in R^n and C^n , Spatial Vectors

Unit No	Topics Covered	No of lectures required
1	**Algebra of Matrices and Determinants** **Algebra of Matrices:** Definition of Matrix, Matrix addition and Scalar Multiplication, Matrix Multiplication, Transpose of a Matrix, Square Matrices, Powers of Matrices, Polynomials in Matrices, Special Types of Square Matrices, Invertible Matrices, Special Types of Square Matrices, Complex Matrices and Block Matrices. **Determinants:**Determinants of Order 1, 2 and 3, Permutations, Determinants of Arbitrary Order,	**15**

	Properties of Determinants, Minors and Cofactors, Classical Adjoint, Cramer's Rule, Submatrices, Minors and Principal Minors, Block Matrices and Determinants.	
2	**System of Linear Equations:** Basic Definitions, Solutions, Equivalent Systems, Elementary Operations, Small Square System of Linear Equations , Systems in Triangular and Echelon Form, Echelon Matrices, Row Canonical Form, Row Equivalences, Gaussian Elimination, Matrix Equation of a system of Linear Equations and Linear Combination of Vectors, Homogeneous Systems of Linear Equations.	**10**
3	**Vector Spaces:** Definition and examples of Vector Spaces, Linear Combinations and Spanning Sets, Subspaces, Linear Spans and Row Space of a Matrix , Linear Dependence and Independence, Basis and Dimensions , Rank of a Matrix , Sums and Direct Sums , Coordinates	**10**
4	**Linear Mappings:** Introduction, Mappings, Functions, Linear Mappings (Linear Transformations), Kernel and Image of A Linear Mapping, Singular and Non Singular Linear Mappings, Isomorphisms, Operations with Linear Mappings, Algebra A(V) of Linear Operators, Matrix Representation of a Linear Operator, Change of Basis, Similarity, Matrices and General Linear Mapping.	**10**
5	**Diagonalization: Eigenvalues and Eigenvectors** Polynomials of Matrices, Characteristic Polynomial, Cayley – Hamilton Theorem, Diagonalization, Eigen values and Eigen vectors, Diagonalizing Matrices, Diagonalizing Real Symmetric Matrices, Minimal Polynomial, Characteristic and Minimal Polynomials of Block Matrices.	**15**

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Course Outcomes: At the end of the syllabus students will able to :

1. Perform various operations on Matrix
2. Solve systems of linear equations with various methods
3. Demonstrate the concept of vector space and subspace
4. Apply principles of matrix algebra to linear transformations
5. Determine Eigen values and Eigen vectors and solve related problems

Course Outcomes – Program Outcomes Mapping Table:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	H		M	L			L		
CO2	H		M				L		
CO3	H		M				L		
CO4	H		M	L			L		
CO5	H		M	L			L		

Text Book:

1. **" Schaum's Outlines Linear Algebra ", Seymour Lipschutz, Marc Lipson, Tata McGraw – Hill, 3rd Edition**

Reference Books:

1. **"Linear Algebra and its Applications", Gilbert Strang, Cengage Learning, 4th edition**
2. **"Linear Algebra : A geometric Approach", S. Kumaresan, PHI Learning Private Limited**
3. **"Elementary Linear Algebra: Applications Version", Howard Anton, Chris Rorres, Wieley Publication , 9thEdition**

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Web References:

1. **Essential Linear Algebra for Data Science – Courseera**
2. **Linear Algebra – Full College Course Youtube**

App References:

1. **Math Helper – Algebra Calculus**

   https://play.google.com/store/apps/details?id=com.bagatrix.mathway.android&hl=en_IN&gl=US

2. **Linear Algebra – Doctor Math**

   https://play.google.com/store/apps/details?id=doctormath.linearalgebra

Syllabus Coverage from text /reference book & web/app reference:

Unit #	Chapter Numbers
1	Chapter2 & Chapter 8 [Chapter 2: 2.1 to 2.12] [Chapter 8: 8.1 to 8.12]
2	Chapter 3 [3.1 to 3.11]
3	Chapter 4 [4.1 to 4.11]
4	Chapter 5 & 6 [Chapter 5: 5.1 to 5.7] [Chapter 6: 6.1 to 6.5]
5	Chapter 9 [9.1 to 9.8]