

**SES's L.S. RAHEJA COLLEGE OF ARTS AND COMMERCE  
(AUTONOMOUS)**



**BOARD OF STUDIES: Information Technology and Data Science**

Programme: B.Sc. (Artificial Intelligence & Data Science)

Semester: I

Nomenclature of the Course: Linear Algebra for Data Science

NEP Vertical: VSC

Credit: 02

Total Marks: 50

Academic Year: 2026–27

*(As per Choice Based Credit System under NEP 2020)*



## Unit-wise Detailed Syllabus

| Unit      | Detailed Contents                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Andragogy (Theory + Hands-on)                                                                                                                                                                                                                                                                                                               | Hours |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| <b>I</b>  | <b>Matrices and Vector Spaces</b> <ol style="list-style-type: none"> <li>1. Scalars and Vectors</li> <li>2. Vector Operations – Addition, Scalar Multiplication</li> <li>3. Dot Product and Norm of Vector</li> <li>4. Introduction to Matrices</li> <li>5. Matrix Addition, Multiplication, Transpose</li> <li>6. Determinant and Inverse of Matrix</li> <li>7. Rank of Matrix</li> <li>8. System of Linear Equations and Matrix Representation</li> <li>9. Application in Data Science – Data representation in matrix form</li> </ol> | <p>Concept explanation using geometric interpretation,</p> <p>Board problem solving,</p> <p><b>Hands-on using Python (NumPy):</b></p> <ul style="list-style-type: none"> <li>• Creating vectors and matrices</li> <li>• Performing matrix operations</li> <li>• Solving linear equations using NumPy</li> </ul>                             | 15    |
| <b>II</b> | <b>Eigen Concepts and Applications in Data Science</b> <ol style="list-style-type: none"> <li>1. Eigenvalues and Eigenvectors</li> <li>2. Characteristic Equation</li> <li>3. Diagonalization of Matrix (Conceptual Overview)</li> <li>4. Orthogonality and Orthonormal Basis</li> <li>5. Introduction to Vector Spaces</li> <li>6. Basis and Dimension</li> <li>7. Introduction to Singular Value Decomposition (Conceptual)</li> <li>8. Applications in Data Science – PCA concept (Intuitive Explanation)</li> </ol>                  | <p>Mathematical derivations with step-by-step examples,</p> <p>Visualization of vectors in 2D,</p> <p><b>Hands-on using Python (NumPy):</b></p> <ul style="list-style-type: none"> <li>• Compute eigenvalues and eigenvectors</li> <li>• Matrix diagonalization using NumPy</li> <li>• Simple PCA demonstration on small dataset</li> </ul> | 15    |

### Learning Objectives

1. To understand vector and matrix operations used in Data Science.
2. To solve systems of linear equations using matrix methods.
3. To understand eigenvalues and eigenvectors conceptually and computationally.
4. To relate linear algebra concepts with machine learning techniques such as PCA.
5. To perform matrix computations using Python (NumPy).

## Course Outcomes (CO)

| CO No. | Course Outcome                                                  | Bloom's Level            | PSO Mapped |
|--------|-----------------------------------------------------------------|--------------------------|------------|
| CO1    | Perform vector and matrix operations                            | Apply (L3)               | PSO2       |
| CO2    | Solve systems of linear equations using matrices                | Apply (L3)               | PSO2       |
| CO3    | Compute eigenvalues and eigenvectors                            | Apply (L3), Analyze (L4) | PSO3       |
| CO4    | Explain the role of linear algebra in Data Science applications | Understand (L2)          | PSO3       |
| CO5    | Apply basic PCA concept to simple datasets                      | Apply (L3)               | PSO3       |

## Suggested Readings

| Sr. No. | Title                                   | Author / Source       |
|---------|-----------------------------------------|-----------------------|
| 1       | Linear Algebra and Its Applications     | Gilbert Strang        |
| 2       | Introduction to Linear Algebra          | Gilbert Strang        |
| 3       | Mathematics for Machine Learning        | Marc Peter Deisenroth |
| 4       | Applied Linear Algebra for Data Science | Howard Anton          |

## QUESTION PAPER PATTERN

### (A) FOR CONTINUOUS EVALUATION

| Particulars                   | Marks |
|-------------------------------|-------|
| Class Test                    | 10    |
| Assignment / Programming Task | 10    |
| Total                         | 20    |

### B) FOR SEMESTER END EXAMINATION

Maximum Marks: 30

Duration: 1 Hour

| Question No. | Description       | Total Marks |
|--------------|-------------------|-------------|
| Q1           | Attempt Unit I    |             |
|              | A – Remembering   | 15          |
|              | B – Applying      |             |
|              | C – Analysing     |             |
| OR           |                   |             |
|              | P – Remembering   | 15          |
|              | Q – Applying      |             |
|              | R – Analysing     |             |
| Q2           | Attempt Unit II   |             |
|              | A – Understanding | 15          |
|              | B – Applying      |             |
|              | C – Evaluating    |             |
| OR           |                   |             |
|              | P – Remembering   | 15          |
|              | Q – Understanding |             |
|              | R – Evaluating    |             |