Mathematics Paper II
Linear Algebra
[CORE COURSE]

Semester: II	Credits: 2	Subject Code: BS22004	Lectures: 40

Course Outcomes:

At the end of this course, the learner will be able to:
- Apply computational techniques and algebraic skills essential for the study of systems of linear equations.
- Set up equations based on real life situations and solve system of linear equations.
- Describe R^2 and R^3 spaces, as well as conceptually extend these results to higher dimensions.
- Explain the concept/theory in linear algebra.
- Apply computational techniques and algebraic skills essential for
- Study of eigenvalues and eigenvectors, orthogonality and diagonalization. (Computational and Algebraic Skills).
- Recognize the basic applications of the chosen topics and their importance in the modern science and search engines.
- Explain applicability of Linear algebra.

Unit 1: Introduction	2
• Matrix Operations • The Inverse of a Matrix • Characterizations of Invertible Matrices	

Unit 2: Linear Equations-I	8
• Systems of Linear Equations • Row Reduction and Echelon Forms • Vector Equations • The matrix equation AX=B • Solution Sets of Linear Systems.	

Unit 3: Linear Equations-II	8
• Matrix Factorizations [Lu decomposition] • Linear Independence and Dependence • Introduction to Linear Transformation • The matrix of Linear Transformation • Dimension and Rank	

Board Of Studies	Name	Signature
Chairperson (HoD)	Ms. Gitanjali Phadnis	G.M.Phadnis

Unit 4: Vector Spaces	12

- Vector spaces
- Subspaces, Subspaces of R^n.
- Null Spaces, Column Spaces and Linear Transformations.
- Linearly Independent Sets ; Bases
- Coordinate Systems
- The dimension of a Vector Space
- Rank

Unit 5: Eigenvalues and Eigenvectors	10

- Eigenvalues and Eigenvectors
- The characteristic equation
- Diagonalization
- Eigenvectors and Linear Transformations
- Cayley Hamilton theorem(without proof)
- Applications

Recommended Text Books:

- David C. Lay, Steven R. Lay JudiJ.McDonald *Linear Algebra and its Application,* Pearson Publication, Fifth Edition, 2016.
  Unit 1: Chapter 2: Sec. 2.1, 2.2, 2.3
  Unit 2: Chapter 1: Sec. 1.1, 1.2, 1.3, 1.4, 1.5
  Unit 3: Chapter 2: 2.5,2.8, 2.9, Chapter 1: 1.7, 1.8, 1.9
  Unit 4:Chapter 4: Sec.4.1, 4.2, 4.3,4.4, 4.5, 4.6
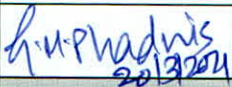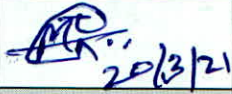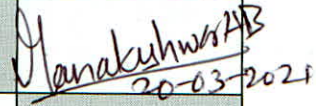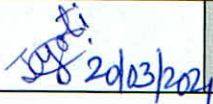 Unit 5: Chapter 5: Sec. 5.1, 5.2, 5.3, 5.4

Reference Books:

- Gilbert Strang, *Introduction to Linear Algebra*, Wellesley- Cambridge Press, Fifth Edition
- Howard Anton, *Elementary Linear Algebra with supplemental Applications*, Wiley Student Edition, Fourth edition.

E-Resources:

- https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/
- https://swayam.gov.in/
- https://nptel.ac.in/

Board Of Studies	Name	Signature
Chairperson (HoD)	Ms. Gitanjali Phadnis	G.M.Phadnis

Board of Studies	Name	Signature(In white cell)	
Chairperson (HoD)	Gitanjali Phadnis	G.M.Phadnis 20/3/2024	
Faculty	Vrushali Paranjpe		20/3/2021
Subject Expert (Outside SPPU)	Dr. Machchhindra Gophane	20/3/21	
Subject Expert (Outside SPPU)	Dr. Prashant Malavadkar		Prav. 20-03-2021
VC Nominee	Dr. Vinayak Joshi	Yasu	
Industry Expert	Mr. Anup Manakeshwar		Manakuhwar 20-03-2021
Alumni	Ms.Jyoti Sharma	Jyoti 20/03/2021	

Board Of Studies	Name	Signature
Chairman (HoD)	Gitanjali Phadnis	G.M.Phadnis