Ganpat University
॥ विद्यया समाजोत्कर्षः ॥
Faculty of Computer Applications

Programme	B.Sc. IT Honours (Data Science)	**Branch**	Computer Applications
Semester	VI	**Version**	1.0.0.0
Effective from Academic Year	2026-27	**Effective for the batch Admitted in**	June 2024
Subject code	U76B4LAP	**Subject Name**	Linear Algebra and Probability Distribution

Teaching scheme						**Examination scheme(Marks)**			
(Per week)	**Lecture (DT)**		**Practical (Lab.)**		**Total**		**CCE**	**SEE**	**Total**
	L	TU	P	TW					
Credit	4	-	-	-	4	Theory	50	50	100
Hours	4	-		-	4				

Objective:

Students will be able to understand matrices and vectors and Apply knowledge of various graphical models in various applications of data science

Pre-requisites:

Basic arithmetic knowledge

Learning Outcome:

Name of CO	Description
CO1	Students will be able to solve systems of linear equations using matrix methods and analyze matrix properties
CO2	Understanding and application of vector spaces, subspaces, rank, basis, and linear transformations
CO3	Develop proficiency in vector and matrix norms, inner product spaces, and orthogonalization methods for advanced linear algebra applications
CO4	Understanding of eigenvalues, eigenvectors, and their applications in SVD and PCA.
CO5	Analyze and infer uncertainty using probability concepts, graphical models, and sampling methods

Mapping of CO and PO:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	0	2	1	1	0	1	1
CO2	3	3	2	2	3	0	2	1	1	0	1	1
CO3	3	2	2	2	2	0	2	1	1	0	1	1
CO4	3	2	3	3	3	0	3	2	2	1	2	2
CO5	3	3	3	3	3	1	3	2	3	2	2	3

Content:

Unit	Content	Hrs.
1	**Linear Equations** Gaussian Elimination and Matrices, Gauss-Jordon Method, Ill-Conditioned Systems, Row-echelon forms, Homogeneous Systems, Linearity, Matrix Multiplication, Matrix Inversion	12
2	**Vector Spaces** Spaces and Subspaces, Null Space, Rank, Basis and Dimension, Classical Least Square, Linear Transformations, Change of Basis, Invariant Subspaces.	12
3	**Norms and Inner Product Spaces** Vector Norms, Matrix Norms, Inner Product Spaces, Orthogonal Vectors, Gram-Schmidt Procedure, Orthogonal Decomposition.	12

4	**Eigenvalues and Eigenvectors** Properties of Eigenvalues and Eigenvectors, Positive definite Matrices, Singular Value Decomposition, Principal Component Analysis.	12
5	**Probability Theory and Graphical Models** Concept of Measure, Sigma algebra, Sample Spaces, Joint distribution, Conditional probability, Marginal Distribution, Independence, Conditional Independence, Continuous Probability Distribution, Gaussian Distribution, Bayesian Networks, Markov Models, Independencies, MAP Inference, Sampling	12

Practical content	
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Reference Books:	
1	Linear Algebra and Its Application by David C. Lay
2	Linear Algebra by Kenneth Hoffman
3	An Introduction to Probability and Statistics by Rohatgi&Saleh
4	Probabilistic Graphical Models by Daphne Koller&Nir Friedman
Web Reference:	
1	https://www.khanacademy.org/math/linear-algebra
2	www.khanacademy.org/math/statistics-probability
3	brilliant.org/wiki/markov-chains/
MOOC/Certificate Course:	
1	https://in.coursera.org/learn/essential-linear-algebra-for-data-science
2	www.coursera.org/learn/machine-learning-probability-and-statistics
3	www.classcentral.com/course/linear-algebra-machine-learning-10453
Question Paper Scheme:	
	End Semester Examination Duration: (2 Hours Theory Examination) **Note for Examiner: -** Q-1 Any Five out of Seven (25 Marks) Q-2 Any Two out of Three (06 Marks) Q-3 Mandatory question (05 Marks) Q-4 Any Two out of Three (08 Marks) Q-5 Any Two out of Three(06 Marks) *The question paper must comprehensively address all Course Outcomes (COs), align with Bloom's Taxonomy levels, and ensure complete syllabus coverage