Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY 2025

Date: 29-05-2025 **Time:** 09:30 am – 12:30 pm

School: SOCSE	**Program:** B. Tech - IST	
Course Code :CSE3347	**Course Name:** Optimization Techniques for ML	
Semester: VI	**Max Marks**:100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4
Marks	24	24	26	26

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	**List** the types of clustering.	2 Marks	L1	CO1
2.	**How** to evaluate unsupervised learning models?	2 Marks	L1	CO1
3.	**Write** down the challenges of sparse regression.	2 Marks	L1	CO2
4.	**What** is a loss function?	2 Marks	L1	CO2
5.	**Define** convex composite optimization.	2 Marks	L1	CO3
6.	**Write** an equation for the Proximal Linear Method (PLM).	2 Marks	L1	CO3
7.	**List** the applications of SOCO.	2 Marks	L1	CO3
8.	**How** does gradient descent work?	2 Marks	L1	CO4
9.	**Compare** the features of the IPMS and Simplex methods.	2 Marks	L2	CO4
10.	**When** is the active set method used?	2 Marks	L1	CO4

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	**Experiment** with both linear (e.g., PCA, LDA) and nonlinear (e.g., t-SNE, UMAP, Autoencoders) dimensionality reduction techniques on a high-dimensional dataset to compare their effectiveness in preserving data structure.	**20 Marks**	**L3**	**CO 1**
		Or			
12.	**a.**	**Construct** an example of a hypothesis class and demonstrate how to determine its VC dimension, then explain its implications for PAC learnability and model selection.	**20 Marks**	**L3**	**CO 1**
13.	**a.**	**Build** a sparse principal component analysis (Sparse PCA) model by applying the mathematical formulation and algorithm, and demonstrate its use in genomics data analysis	**20 Marks**	**L3**	**CO 2**
		Or			
14.	**a.**	**Construct** a multiple kernel learning model using an appropriate approach (fixed linear combination or optimization-based), and explain how it can be applied to solve a real-world classification problem	**20 Marks**	**L3**	**CO 2**
15.	**a.**	**Develop** a solution approach for a convex quadratic optimization problem by applying appropriate optimization techniques, and explain how the convexity of the problem ensures a global minimum.	**20 Marks**	**L3**	**CO 3**
		Or			
16.	**a.**	**Apply** second-order cone optimization techniques to solve a real-world problem (portfolio optimization, robust regression, or facility location)	**20 Marks**	**L3**	**CO 3**
17.	**a.**	**Construct** an algorithm using Nesterov's Accelerated Gradient method for optimizing a smooth convex function, and explain how it improves over standard gradient descent in terms of convergence rate.	**20 Marks**	**L3**	**CO 4**
		Or			
18.	**a.**	**Model** the steps of a basic interior point method for solving a linear programming problem, and demonstrate how it differs in approach and efficiency from the simplex method.	**20 Marks**	**L3**	**CO**