

Note: (a) All questions are compulsory.

(b) Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems.

Q1. a) Derive the dual form of the SVM optimization problem starting from the primal [3] [CO1]
optimization problem.

b) Explain the concept of the margin in Support Vector Machines. How does the choice of the [2]
C parameter affect the SVM model? What does a larger or smaller C value imply??

c) Describe the difference between linear SVMs and kernel SVMs. What role do kernel [2]
functions play in SVMs, and how do they enable SVMs to handle non-linearly separable
data?

Q2. a) Suppose we have a training dataset with the following data points and their corresponding [3] [CO3]
class labels:

Data Point	Class Label
A (1, 1)	Class 1
B (2, 2)	Class 1
C (5, 5)	Class 2
D (6, 6)	Class 2

If we use a k-nearest neighbor (k-NN) classifier with the Euclidean distance metric, what
is the predicted class label for the test point E(4, 4)?

b) Explain the concept of Principal Component Analysis (PCA) and its significance in data [2]
analysis. Discuss the steps involved in performing PCA on a dataset.

c) Explain the basic concept of Linear Discriminant Analysis (LDA) and how it differs from [2]
Principal Component Analysis (PCA) in the context of dimensionality reduction.

Q3. a) Define what a Bayesian classifier is and explain its fundamental principle in classification [2] [CO3]
tasks.

b) Using the Bayesian classifier, calculate the probability that a new sample with attributes [4]
(A1=1, A2=1) belongs to the class "No."

Sample	Attribute 1 (A1)	Attribute 2 (A2)	Class (C)
1	1	1	Yes
2	0	1	No
3	1	0	No
4	0	0	Yes
5	1	1	Yes

- c) Using the given dataset with attributes Temperature, Humidity, Wind, and Play (Yes/No), [5]
build a decision tree and predict whether to play or not for a day with temperature: Mild,
humidity: High, and wind: Weak.

Temperature	Humidity	Wind	Play
Hot	High	Weak	No
Hot	High	Strong	No
Mild	High	Weak	Yes
Cool	Normal	Weak	Yes
Cool	Normal	Strong	No

JUIT TEST-2 EXAMINATION-APRIL-2024