QPC: R251M008 AR 24 Reg. No

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET UNIVERSITY)

Ph.D. (First Semester-Summer) Examinations, December – 2025

23SPPECS1011 – Machine Learning

(CSE)

Time: 3 hrs Maximum: 70 Marks

The figures in the right hand margin indicate marks.

Answer *ANY FIVE* Questions. **(14 x 5 = 70 Marks)** **Marks**

1.a. Discuss the working criteria of K-Nearest Neighbor with an example. 8

b. Describe how Linear discriminant analysis is carried out to reduce dimensionality of data sets. 6

2. Design a SVM model and draw a hyperplane on a data set with 2 features x1 and x2 14

Data Point	(x1,x2)	Class Y
A	**(2,2)**	**1**
B	**(4,4)**	**1**
C	**(2,0)**	**1**
D	**(0,4)**	**-1**

3.a. How does the Naïve Bayes algorithm classify data? 7

b. Design a polynomial regression model of degree 2 for the following data 7

x: 3 2 5 6 5

y: 3 2 6 3 4

4. Explain how **Random Forest** works as a bagging-based ensemble of decision trees. 14

5.a. Discuss necessary measure required to select the attributes for building a decision tree using ID3 algorithm. 7

b. Explain how ensemble learning helps in **bias–variance tradeoff** using a conceptual diagram. 7

6.a. Explain the concept of **recurrent neural networks (RNNs)**. How are they different from feedforward networks? 7

b. Two classifiers A and B yield accuracy on 6-fold CV: 7

Fold	A	B
1	82	80
2	85	84
3	78	75

4	80	79
5	88	90
6	84	82

Perform paired t-test to **c**onclude if difference is statistically significant

7. Construct a KNN model with Test point = (3,3) and k=3 on the following samples 14

X1	**X2**	**Class**
1	1	A
2	2	A
3	4	B
4	6	B
5	7	B

Compute the following:

i. min-max normalization
ii. Compute Euclidean distances
iii. Select k nearest neighbors and Perform majority vote
iv. Comment on decision boundary

8.a. What is the role of radial basis function in separating nonlinear patterns? 7

b. Describe the multilayer neural network. Explain why back propagation algorithm is required. 7

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