Rani Rashmoni Green University

M.Sc. 3rd Semester Examination
Subject: Computer Science
Course code: MSCCS304
FM= 40 marks

1. Answer any four out of six questions from the followings: **2×4 =8**

a) State two differences between instance-based learning and model-based learning.
b) Compute Euclidean distance between (2,3) and (5,7).
c) What is inductive bias?
d) Mark two differences between perceptron and multilayer perceptron?
e) Mention the roles of CNN in deep learning.
f) Why is K-means clustering not a Supervised Machine Learning algorithm?

2. Answer any four out of six questions from the following: **4x4=16**

a) Calculate the F1-score, recall, precision, and accuracy from the confusion matrix given below.

		PREDICTED	
		POSITIVE	NEGATIVE
ACTUAL	POSITIVE	83	12
	NEGATIVE	17	55

b) Define Cross-validation. What is k-fold cross-validation?
c) Write the steps in the backpropagation algorithm.
d) Explain logistic regression with the help of the sigmoid function. Write any two advantages of using a decision tree for route optimization.
e) What is loss function? Illustrate various types of loss functions used in neural networks.
f) The following data shows the relationship between the number of hours a student studies (X) and the marks obtained (Y):

Hours Studied (X)	1	2	3	4	5
Marks (Y)	2	4	5	4	5

Using simple linear regression, find the regression equation of Y on X in the form $Y = a + bX$ and estimate the marks obtained when a student studies for 6 hours.

3. Answer any two out of four questions from the following: 2x8=16

a) A delivery company wants to determine the best route for reaching a destination using a Decision Tree. The dataset is shown given below.

Traffic	Weather	Road	Time (min)	Class
Low	Clear	Good	12	Fast
Low	Rainy	Good	18	Fast
High	Clear	Good	25	Slow
High	Clear	Bad	35	Slow
Low	Clear	Bad	22	Slow
High	Rainy	Bad	40	Slow

Using ID3 Decision Tree Learning, solve the following:

i. Calculate the Information Gain (IG) for: Traffic, Weather, Road
ii. Identify which attribute should be selected as the root node.

b) Explain how error minimization occurs during the training of a neural network. Give an example where a single-layer perceptron fails to classify. Mention two advantages of neural networks.

c) Write a detailed note on Principle Component Analysis. State the difference between supervised and unsupervised machine learning.

d) A regression model is used to predict land surface temperature (LST). The actual and predicted values for 6 observations are given below:

Observation	**Actual (Y)**	**Predicted ($\hat{Y}$)**
1	20	18
2	22	21
3	25	24
4	24	20
5	30	28
6	28	27

Using the above dataset, compute the following:

i. Mean Squared Error (MSE)
ii. Mean Absolute Error (MAE)
iii. Root Mean Squared Error (RMSE)
iv. Coefficient of Determination (R^2)
v. Comment on model accuracy based on the calculated metrics.