

COURSE CODE (CREDITS): 21M1WEC233 (3)

MAX. MARKS: 15

COURSE NAME: Applied Machine Learning for IoT

COURSE INSTRUCTORS: Dr. Vikas Baghel

MAX. TIME: 1 Hour

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) What is machine learning? Explain the difference between supervised and unsupervised learning. [1] [CO1]
 b) Describe the bias-variance tradeoff in the context of machine learning models. What is overfitting and how can it be prevented in machine learning models? [2]
 c) Derive the parameter equation for the simple linear regression model. Clearly show each step of the derivation and explain the assumptions made during the derivation process. [3]
- Q2.** a) Suppose a classifier predicts 150 instances as positive, out of which 120 are actually positive. Additionally, it predicts 50 instances as negative, out of which 40 are actually negative. What are the precision and recall of the classifier? [2] [CO1]
 b) In a multi-class classification problem with 5 classes, a classifier achieves the following confusion matrix: [1]

	Predicted				
	Class 1	Class 2	Class 3	Class 4	Class 5
Class 1	50	5	2	0	3
Class 2	8	45	10	5	2
Class 3	3	7	40	8	2
Class 4	0	4	6	35	4
Class 5	2		3	4	45

Calculate the overall accuracy of the classifier.

- c) Given the true positive rate (TPR) and false positive rate (FPR) values at different thresholds for a binary classifier, calculate the AUC of its ROC curve: [1]

Threshold	TPR	FPR
0.1	0.2	0.1
0.3	0.4	0.2
0.5	0.6	0.3
0.7	0.8	0.4
0.9	1	0.5

- Q3.** a) In a multiple linear regression model with two predictors, if the coefficients are $\beta_1 = 2$ and $\beta_2 = 3$, and the intercept is $\beta_0 = 5$, what is the predicted value of y when $x_1 = 3$ and $x_2 = 4$? [2] [CO3]
 b) For the given dataset: $\bar{X} = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$, $\bar{y} = \begin{bmatrix} 1 \\ 2 \end{bmatrix}$. Use the normal equation to compute the linear regression parameters. [3]