JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST–1 EXAMINATION – 2026

B.Tech–IV Semester (ECE)

COURSE CODE (CREDITS): 25B1WEC431 (3) **MAX. MARKS:** 15

COURSENAME: Foundation of Machine Learning and Python

COURSE INSTRUCTORS: Dr. Vikas Baghel **MAX. TIME:** 1 Hour

Note: (a) All questions are compulsory.

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

(c) Use of calculators is allowed.

Q.No	Question	CO	Marks
Q1	a. For the matrix $A = \begin{bmatrix} 1 & 0 \\ 5 & 4 \\ 2 & 4 \end{bmatrix}$, (i) Find the column space of A. (ii) Find the null space of A. (iii) State the rank and nullity of A.	CO1	[3]
	b. What is the span of a set of vectors? Explain with an example.		[1]
Q2	a. A dataset has 1,000 samples with 950 negative and 50 positive examples. A classifier predicts all samples as negative. Compute Accuracy, Recall, Precision, and explain why Accuracy is misleading here.	CO1	[2]
	b. In real-world ML systems, why is generalization error more important than training error? Explain using examples from healthcare or finance.		[1]
	c. A classifier outputs scores $[0.9, 0.7, 0.4, 0.3, 0.1]$ with true labels $[1, 1, 0, 1, 0]$. Manually compute TPR and FPR at threshold 0.5.		[2]

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Q.No	Question	CO	Marks
Q3	a. A hypothesis is given as $h(x) = \beta_0 + \beta_1 x$. For $x = 2$, the prediction is $h(2) = 10$, and for $x = 0$, the prediction is $h(0) = 4$. (i) Find β_0 and β_1. (ii) Predict the output for $x = 1$. (iii) Compute the squared error if the true value is $y = 6$.	CO2	[2]
	b. Starting from $$J(\beta) = \frac{1}{2m}\sum_{i=1}^{m}\left(h_\beta(x^{(i)}) - y^{(i)}\right)^2,$$ derive the gradient descent update rule for β_0 and β_1.		[3]
	c. For a learning algorithm, cost values over iterations are [15, 9, 6, 5.5, 5.49]. Comment on convergence and suitability of the learning rate.		[1]