JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- 2025

B.Tech- III Semester (CSE/IT)

COURSE CODE (CREDITS): 24B11CI311 (03)　　　　　　MAX. MARKS: 35

COURSE NAME: COMPUTATIONAL FUNDAMENTALS FOR OPTIMIZATION

COURSE INSTRUCTORS: RBT, VSG　　　　　　MAX. TIME 2 Hours

Note: *(a) All questions are compulsory.*

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

(c) Use of a scientific calculator is allowed.

Q.No	Question	CO	Marks
Q1	a. Differentiate between probability and odds for an event through a suitable example. b. For the customer service data, the proportion of customers who would recommend the service in the sample of customers is p = 0.84. Therefore, the odds of recommending the service department are __. c. What Is Maximum Likelihood Estimation (MLE) in Logistic Regression? d. Consider the following logistic regression model: $$P(Purchase = 1|Age) = \dfrac{1}{1 + exp(-(-6.0 + 0.1 \times Age))}$$ Compute the probability of purchase for an individual aged 20 years. (Use exp(4) ≈ 54.6). e. What is the difference between covariance and correlation?	5	1 + 1 + 1 + 1 + 1
Q2	a. What happens if the learning rate is too high or too low? b. What are main advantages of dimensionality reduction in machine learning? c. Hayden was taking a nap on the hill, only to realize that he has to run back to the campus for his next class in two minutes. He approximates the height h of the hill at position (x , y) as $h = x^2 - 3y^2$, and guesses that his current position is (x , y , h) = (-1 , 0 , 1). Which direction should he take to go down the hill as fast as possible?	4	1 + 2 + 2

Q3		4	2.5 + 2.5
	a. Compare and contrast Gradient Descent and Stochastic Gradient Descent approach. b. Fit the linear curve for the following data points: (1, 1), (2, 2), (3, 2), (4, 2) , (5, 4). Use Gradient descent algorithm with $\beta_0 = \beta_1 = 0$ (initially) , $\eta = 0.1$. Show first iteration only.		
Q4		3	2.5 + 2.5
	a. Use the gradient descent algorithm to find the minimum of the function $3x^2 + 5x + 7$ starting with $x_0 = 10$ and learning rate $\eta = 0.01$ Perform single iteration. b. Find a singular value decomposition of A. $$A = \begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}$$		
Q5		4	2.5 + 2.5
	Write short notes on the following (**ANY TWO**): a. Backpropogation b. Dimensionality reduction c. Univariate versus Multivariate optimization		
Q6		4	5
	Suppose you have two classes of data: class1: (2, 3), (3, 3), (2, 4) and class2: (6, 7), (7,7), (7,6). Use Linear Discriminant Analysis (LDA) to classify the data points.		
Q7		3	5
	Illustrate the concept of Principal Component Analysis (PCA) with an appropriate example. **OR** Find an LU-decomposition of A $$A = \begin{bmatrix} 2 & 4 & 6 \\ 1 & 4 & 7 \\ 1 & 3 & 7 \end{bmatrix}.$$		