Name: **Enrolment No:**	

UPES

End Semester Examination, December 2024

Course: Applied Machine Learning **Semester: V**

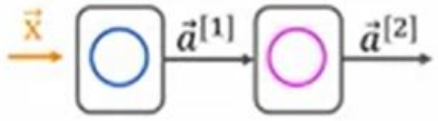
Program: B. Tech Mechanical & Mechatronics **Time : 03 hrs.**

Course Code: MECH3059 **Max. Marks: 100**

Instructions: ***All questions are compulsory. The question paper consists of 11 questions divided into 3 sections A, B and C. Section A comprises 5 questions of 4 marks each, Section B comprises 4 questions of 10 marks each and Section C comprises 2 questions of 20 marks each.***

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Compare ReLU and sigmoid activation functions.	**4**	**CO1**
Q 2	A layer 'L' in a neural network has 5 neurons and the previous layer has 4 neurons. How many model parameters are associated with layer L?	**4**	**CO2**
Q 3	Describe the matrix notation for getting activation from layer l (that is L) in a neural network.	**4**	**CO1**
Q 4	Explain vectorization in implementing machine learning algorithms and its advantage? Give an example	**4**	**CO1**
Q 5	Linear regression is not a good algorithm for classification. Discuss with an example	**4**	**CO1**
	SECTION B **(4Qx10M= 40 Marks)**		
Q 6	Given two features, x1 (Range 1-5) and x2 (Range 10000-14000), what step will you take before applying gradient descent to ensure fast convergence.	**10**	**CO2**
Q 7	For given confusion matrix calculate (A)Precision (b)Recall (C)f1-score [[45,1], [11,33]],	**10**	**CO2**
Q 8	Describe the algorithmic steps of the K-Means Cluster method	**10**	**CO1**
Q 9	What is Information Gain and how is it used for deciding the feature for splitting in Decision tree?	**10**	**CO2**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Consider the data for a linear regression problem given below. The raw data has x_1, x_2 and y. Manually do only 1 iteration of Gradient Descent for Linear regression on this data. In calculations, take initial guess as	**20**	**CO3**

	$w_1 = 2, w_2 = 1, b = 1$. Use learning rate $\alpha = 0.1$. After doing 1 iteration of Gradient Descent, also determine the equation for regression and the prediction for the following input $x_1 = 1, x_2 = 3$ All calculations must be shown clearly. x_1 | x_2 | y 2 | 3 | 15 3 | 2 | 12 1 | 0 | 2 0 | 2 | 8 **OR** Implement K-Means algorithms for a given set of data using K = 2. **Individual** | **Variable 1** | **Variable 2** 1 | 1 | 1 2 | 1.5 | 2 3 | 3 | 4 4 | 5 | 7 5 | 3.5 | 5 6 | 4.5 | 5 7 | 3.5 | 4.5		
Q 11	Consider a hypothetical Neural Network with just two neurons with ReLU activation in layer 1 and Linear activation in layer 2.  The cost function is defined by the mean square error as $J = \frac{1}{2}(a^{[2]} - y)^2$ Assuming $w^{[1]} = 3, b^{[1]} = 2, w^{[2]} = 2, b^{[2]} = 4$ and a single data point of x= 3 & y=4, show the forward propagation as well as back propagation steps through a computational graph and determine the value of updated model parameters $w^{[1]}, b^{[1]}, w^{[2]}, b^{[2]}$ after first iteration assuming learning rate α = 0.1	**20**	**CO3**