Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY/ JUNE 2025

Date: 05-06-2025 **Time:** 09:30 am – 12:30 pm

School: SOE	**Program:** B. Tech	
Course Code: ECE3051	**Course Name:** Machine Learning and Deep Learning using FPGA	
Semester: VI	**Max Marks**: 100	**Semester**: VI

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**22**	**28**	**24**	**26**	

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Demonstrate the importance of natural intelligence in the evolution of Artificial Intelligence	**2 Marks**	**L1**	**CO1**
2.	Explain the 'naive' assumption in the Naive Bayes classifier	**2 Marks**	**L2**	**CO2**
3.	Develop the HDL code for the 4:1 Multiplexer using Logic gates	**2 Marks**	**L3**	**CO2**
4.	Distinguish between decision tree and random forest machine learning algorithm	**2 Marks**	**L2**	**CO2**
5.	List the types of Naïve Bayes algorithm	**2 Marks**	**L2**	**CO2**
6.	Outline the Step/Threshold Activation Function with a diagram	**2 Marks**	**L2**	**CO3**
7.	Distinguish between the Human Neuron Cell and the Artificial Neuron Cell.	**2 Marks**	**L2**	**CO3**
8.	Develop the VHDL code for the Sigmoid Function using Look-up Table. Assume any 5 values of your choice.	**2 Marks**	**L3**	**CO4**
9.	Explain the criterion to select the number of hidden layers and several neurons in each hidden layer of the neural network	**2 Marks**	**L3**	**CO4**

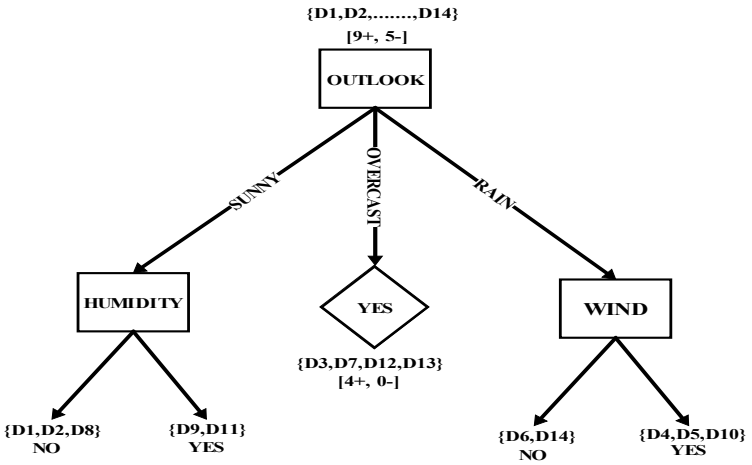
10.	Explain the types of Neural Network models	**2 Marks**	**L2**	**CO4**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Illustrate the merits and demerits of machine learning algorithms	**4 Marks**	**L3**	**CO1**
	b.	Using the Naïve Bayes classifier can be explained with the data sample to play the game of tennis considering the four classes as Outlook, Climate, Humidity, and Wind as given in Table. *Dataset to play game of tennis using Naïve Bayes Classifier* Day | Outlook | Climate | Humidity | Wind | Play Game 1 | Sunny | Hot | High | Weak | No 2 | Sunny | Hot | High | Strong | No 3 | Overcast | Hot | High | Weak | Yes 4 | Rain | Mild | High | Weak | Yes 5 | Rain | Cool | Normal | Weak | Yes 6 | Rain | Cool | Normal | Strong | No 7 | Overcast | Cool | Normal | Strong | Yes 8 | Sunny | Mild | High | Weak | No 9 | Sunny | Cool | Normal | Weak | Yes 10 | Rain | Mild | Normal | Weak | Yes 11 | Sunny | Mild | Normal | Strong | Yes 12 | Overcast | Mild | High | Strong | Yes 13 | Overcast | Hot | Normal | Weak | Yes 14 | Rain | Mild | High | Strong | No Predict the decision of playing the game of tennis for (Outlook = Sunny; Temperature = Cool; Humidity = High; Wind = Strong)	**16 Marks**	**L3**	**CO1**
		Or			
12.	**a.**	Explain in detail the types of Logistic Regression with equations.	**4 Marks**	**L2**	**CO1**
	b.	Make use of the given Table, consisting of 5 samples for students to clear the examination based on the number of hours utilized for studying. Now using the logistic regression, evaluate the following 1. Probability for a pass, if a student has studied for 33 hours. 2. Minimum required hours for a student to pass the examination that has a probability of more than 95%. Sl. No.: | Hours of Study | Pass or Fail 1 | 29 | 0 2 | 15 | 0 3 | 33 | 1 4 | 28 | 1	**16 Marks**	**L3**	**CO1**

			5	39	1				

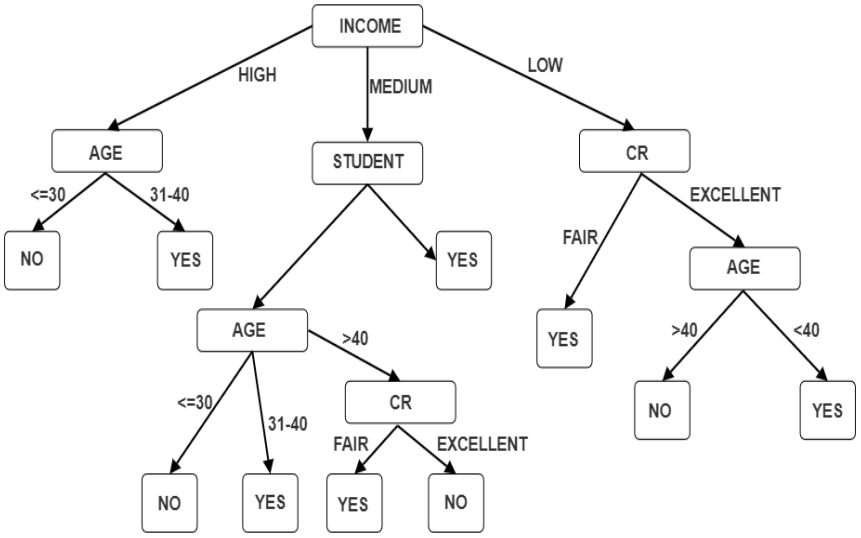
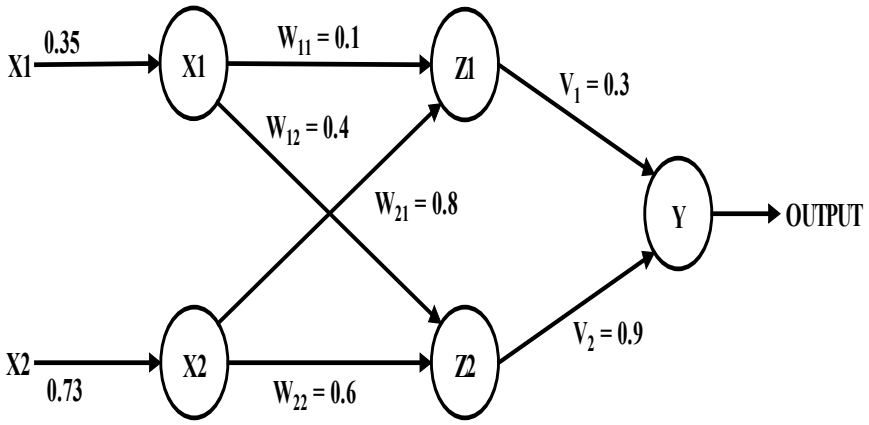
13.	**a.**	Develop the HDL code for the following flowchart 	**4 Marks**	**L3**	**CO2**
	b.	Utilize the KNN algorithm to predict whether JOHN will be diabetic or not with the given attributes assuming the values of K = 3. Name: Tuhina Joseph, Age = 5	**16 Marks**	**L3**	**CO2**

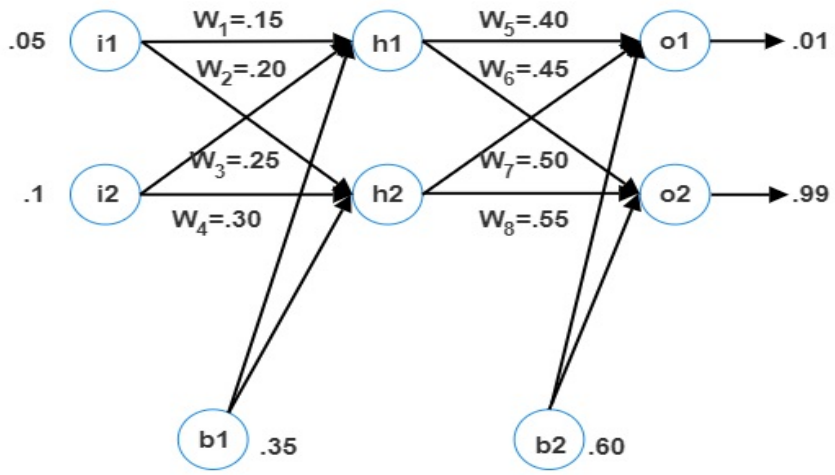
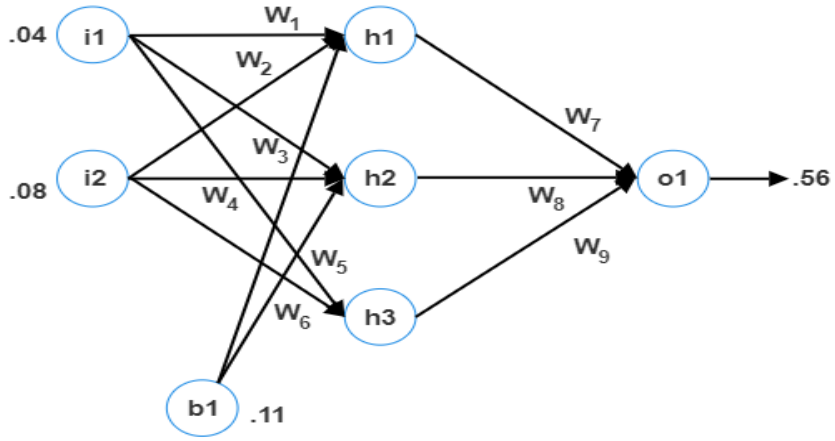
Dataset for the KNN algorithm example with 2 attributes and 1 outcome

Sl. No	Name	Age	Gender	Game
1	Albert	32	Male	Football
2	Mark	40	Male	None
3	Louisa	16	Female	Cricket
4	Natasha	34	Female	Cricket
5	Stephen	55	Male	None
6	Robin	40	Male	Cricket
7	Angelina	20	Female	None
8	Smith	15	Male	Cricket
9	Marie	55	Female	Football
10	Michael	15	Male	Football

Or

14.	**a.**	Develop the HDL Code for the 8 bit synchronous DOWN counter using the if else construct	**4 Marks**	**L3**	**CO2**
	b.	Develop the HDL code for the following decision tree classification using the behavioral model with Test bench	**16 Marks**	**L3**	**CO2**

					
15.	**a.**	Analyze the neurons that have a sigmoid activation function to perform a forward pass and Backward pass on the network given. Assume that the actual output is 0.5 and the learning rate is 1. Prove that the error is reduced after the iteration. 	**20 Marks**	**L4**	**CO3**
		Or			
16.	**a.**	Analyze the neural network for one complete cycle and calculate the total error. Perform the forward and backward propagation for the following neural network to prove that the error is minimized	**20 Marks**	**L4**	**CO3**

					
17.	**a.**	Examine the neural network for one complete cycle and calculate the error for the following with W1 = 0.11; W2 = 0.22; W3 = 0.33; W4= 0.44; W5 = 0.55; W6 = 0.66; W7=0.77; W8=0.88 & W9 = 0.99, Perform the forward and backward propagation for the following neural network to prove that the error is minimized. 	**20 Marks**	**L4**	**CO4**
Or					
18.	**a.**	Illustrate in detail the neural network architecture and its types with a neat diagram	**5 Marks**	**L2**	**CO4**
	b.	Develop the HDL code for the following floating values using the fixed point representation of 16 bits in LUT format. a) x1 = 0.56789 b) x2 = 0.12345 c) x3 = 0.34562 d) x4 = 0.14872 e) x5 = 0.99822 f) x1 = 0.45628 g) x2 = 0.22119 h) x3 = 0.38624	**15 Marks**	**L3**	**CO4**

		i) x4 = 0.51234 j) x5 = 0.77123			