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GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Seventh Semester – Regular) Examinations, November – 2022

BOEEL7011 / BOEEE7011 – Neural Networks & Fuzzy Logic

(EE / EEE)

Time: 3 hrs

Maximum: 70 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions)

(1 x 10 = 10 Marks)

Q.1. Answer ALL questions

[CO#] [PO#]

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|---|-----|-----|
| <p>a. A perceptron is</p> <p>(i) A single-layer feed-forward neural network with pre-processing</p> <p>(ii) An auto-associative neural network</p> <p>(iii) A double-layer auto-associative neural network</p> <p>(iv) A neural network that contains feedback</p> | CO3 | PO1 |
| <p>b. Which of the following Neural Network architectures are used for Pattern Recognition?</p> <p>(i) Multilayer Perceptron</p> <p>(ii) Kohonen SOM</p> <p>(iii) Radial Basis Function Network</p> <p>(iv) All of the above</p> | CO3 | PO1 |
| <p>c. What is the mathematical expression of α-cut set?</p> <p>(i) $\{x \mu_A(x) \geq \alpha\}$</p> <p>(ii) $\{x \mu_A(x) > \alpha\}$</p> <p>(iii) $\{x \mu_A(x) < \alpha\}$</p> <p>(iv) $\{x \mu_A(x) \leq \alpha\}$</p> | CO2 | PO2 |
| <p>d. In an supervised learning</p> <p>(i) Specific output values are given</p> <p>(ii) Specific output values are not given</p> <p>(iii) No specific inputs are given</p> <p>(iv) Both inputs and outputs are given</p> | CO3 | PO1 |
| <p>e. Fuzzy logic is usually represented as</p> <p>(i) IF-THEN-ELSE rules</p> <p>(ii) IF-THEN rules</p> <p>(iii) Both a and b</p> <p>(iv) None of these</p> | CO2 | |
| <p>f. Which of the following is a fuzzy membership function</p> <p>(i) Binary sigmoid</p> <p>(ii) Increasing</p> <p>(iii) Decreasing</p> <p>(v) Signum</p> | CO2 | PO1 |
| <p>g. ANFIS refers to</p> <p>(i) Adaptive neuro-fuzzy inference system</p> <p>(ii) Artificial neural and fuzzy inference system</p> <p>(iii) Aggregation neural fuzzy inference system</p> <p>(iv) Association of neural fuzzy interconnected system</p> | CO3 | PO1 |
| <p>h. Artificial neural network is used for</p> <p>(i) Pattern Recognition</p> <p>(ii) Clustering</p> <p>(iii) Classification</p> <p>(iii) None</p> | CO3 | PO1 |
| <p>i. Which of the neural network is used for supervised learning?</p> <p>(i) Multilayer Perceptron</p> <p>(ii) Self organizing feature map</p> <p>(iii) Hopfield</p> <p>(iv) None</p> | CO3 | PO1 |
| <p>j. A fuzzy set whose membership function has at least one element x in the universe whose membership value is unity is called</p> <p>(i) Sub-normal fuzzy sets</p> <p>(ii) Normal fuzzy set</p> <p>(iii) Convex fuzzy set</p> <p>(iv) Concave fuzzy set</p> | CO2 | PO1 |

PART – B: (Short Answer Questions)

(2 x 10 = 20 Marks)

Q.2. Answer ALL questions

	[CO#]	[PO#]
a. What type learning is involved in LVQ neural network?	CO3	PO1
b. State the fuzzy rule base in the Mamdani Fuzzy Inference System	CO2	PO2
c. Explain the core, support and boundary of a fuzzy set.	CO2	PO1
d. What is the role of bias in neural networks?	CO3	PO1
e. What is feedback neural network architecture? Draw the single-layer recurrent network and multi-layer recurrent network.	CO3	PO2
f. What is radial basis function neural network?	CO3	PO2
g. What are fuzzy membership functions?	CO2	PO1
h. What are different defuzzification techniques?	CO2	PO2
i. Write the mathematical form of Hebb's rule.	CO3	PO2
j. Compare supervised and unsupervised learning approaches in ANN.	CO3	PO1

PART – C: (Long Answer Questions)

(10 x 4 = 40 Marks)

Answer ALL questions

3. a. Two fuzzy sets are given as

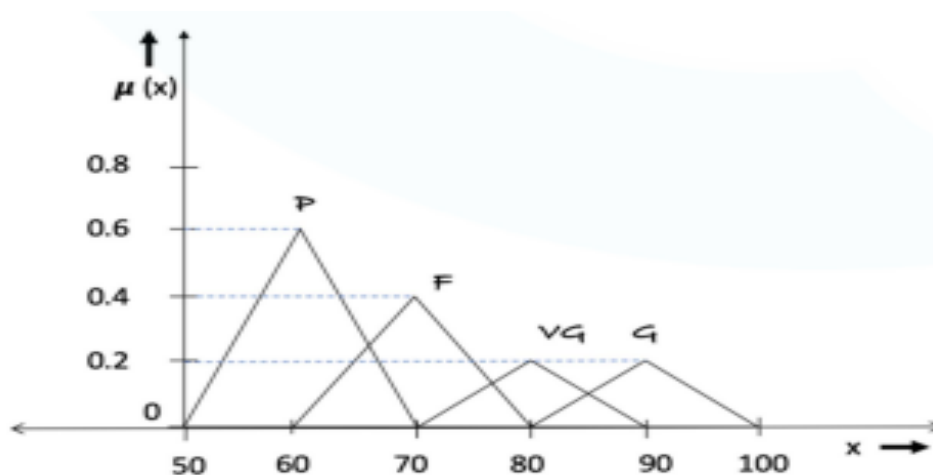
Marks	[CO#]	[PO#]
5	CO3	PO2

	x_1	x_2	x_3	x_4	x_4
A	0.1	0.2	0.3	0.6	0
B	0.3	0.4	0.5	0.7	0.8

(i) Find (i) $(A \cap B)_{0.6}$ (ii) $(B \cup \bar{A})_{0.6}$

b. Let A be a fuzzy set that tells about a student as shown in the figure below. Here, the linguistic variable P represents a Pass student, F stands for a Fair student, G represents a Good student and VG represents a Very Good student. Calculate the defuzzified value for the fuzzy set A with weighted average method and center of sums.

5	CO3	PO2
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(OR)

c. Distinguish between Mamdani FIS and Sugeno FIS.	5	CO3	PO2
d. For a speed control of DC motor, the membership function of series resistance R_{se} , armature current I_a and speed N are given as follows	5	CO3	PO2

$$R_{se} = \left\{ \frac{0.4}{30} + \frac{0.6}{60} + \frac{1.0}{100} + \frac{0.1}{120} \right\}$$

$$I_a = \left\{ \frac{0.2}{20} + \frac{0.3}{40} + \frac{0.6}{60} + \frac{0.8}{80} + \frac{1.0}{100} + \frac{0.2}{120} \right\}$$

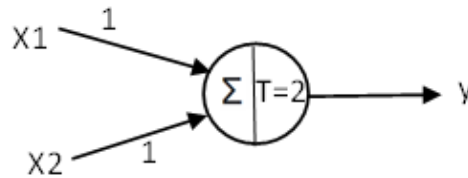
$$N = \left\{ \frac{0.35}{500} + \frac{0.67}{1000} + \frac{0.97}{1500} + \frac{0.25}{1800} \right\}$$

Compute relation T for relating series resistance to motor speed ie Rse to N. Perform max-min composition.

4. a. Consider the initial weight matrix $w = [1 - 1 0 0.5]^T$ the learning rate =1, training set having the input patterns are $X1 = [1 - 2 1.5 0]^T$ $X2 = [1 - 0.5 - 2 - 1.5]^T$

$X3 = [0 1 - 1 1.5]^T$. It has bipolar signum neurons. Perform one iteration of training using Hebbian's Learning Rule.

- b. Identify the logic gate realized by



(OR)

- c. How the training algorithm is performed in back propagation neural networks? Explain with a flow chart.
5. a. Design an X-OR gate by using perceptron learning.
- b. What is the advantage of radial basis function network over multilayer feed-forward neural networks?

(OR)

- c. The set of input training vectors are as follows
 $X1 = [1 - 2 0 - 1]^T$, $X2 = [0 1.5 - 0.5 - 1]^T$ and $X3 = [-1 1 0.5 - 1]^T$
 and initial weight $w = [1 - 1 0 0.5]^T$. The learning rate is 0.1 It has bipolar activation function. Desired responses are $d1 = -1$, $d2 = 1$ and $d3 = 1$ respectively. Find the new weights for six steps according to perceptron learning rule.

6. a. Design a bipolar AND gate function using perceptron network.
- b. The input to a single- input neuron is 2.0, weight is 2.3 and bias is equal to -3. What is the output if it has the following activation functions?

(i) Linear (ii) Log-sigmoid

(OR)

- c. Implement OR-function with bipolar inputs and targets using ADALINE network.

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