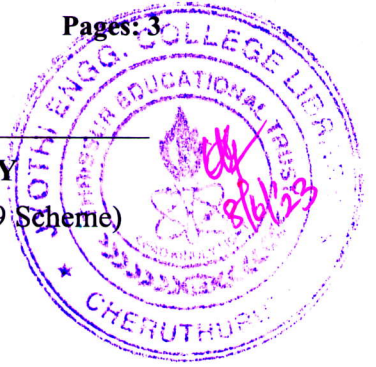Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Eighth Semester B.Tech Degree Regular Examination June 2023 (2019 Scheme)

Course Code: CST444
Course Name: SOFT COMPUTING

Max. Marks: 100   Duration: 3 Hours

PART A
Answer all questions, each carries 3 marks.   Marks

1	Draw a simple Artificial Neuron and discuss the calculation of net input.	(3)
2	Compare and contrast biological neuron and artificial neuron.	(3)
3	State the testing algorithm used in Perceptron Network.	(3)
4	List the stages involved in Backpropagation Network.	3)
5	Using your own intuition, plot the Fuzzy membership function for the "Age of people".	(3)
6	Let A={(x1,0.5), (x2,0.1), (x3,0.9)} and B={(x1,0.4), (x2,0.4), (x3,0.5)} Find intersection, union and complement of both the fuzzy sets.	(3)
7	Draw the flow chart and explain the steps of Genetic Algorithm.	(3)
8	Explain any 3 mutation techniques with example.	(3)
9	Differentiate between linear and nonlinear Multi Objective Optimization Problem.	(3)
10	Explain the processes of tuning in genetic-fuzzy rule-based systems.	(3)

PART B
Answer any one full question from each module, each carries 14 marks.

Module I

11	a)	Implement ANDNOT function using Mc-Culloch Pitts Neuron.	8
	b)	Define linear separability. Justify -XOR function is non-linearly separable by a single decision boundary line.	6

OR

12	a)	Calculate the output of the neuron y for the following network using	6
		1. binary sigmoidal activation function	
		2. bipolar sigmoidal activation function	
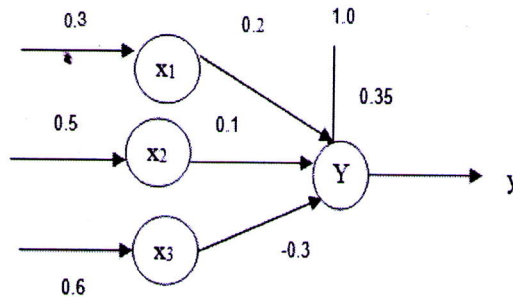
b) Using the Hebb rule, find the weights required to perform the following classifications of the given input patterns shown in figure. The "+" symbols represent the value "1" and empty space indicate "-1". Consider "1" belongs to the members of class (so has target value 1) and "0" does not belong to the members of class (so has target value -1).   **8**

```
+   +   +       +   +   +

    +           +       +

+   +   +       +   +   +

    "I"                 "O"
```

Module II

13 a) Implement AND function with binary inputs and bipolar targets using perceptron training algorithm.   **8**

b) Draw the architecture of Back propagation Network and explain the training algorithm.   **6**

OR

14 a) What is Adaline? Draw the model of an Adaline Network.   **4**

b) Use Adaline to train OR function with bipolar inputs and targets. Perform 2 epochs of training.   **10**

Module III

15 a) Using intuition and your own definition of the universe of discourse, plot fuzzy membership functions to the following variables: **5**

- Liquid level in the tank

(a)Very small (b) Small (c) Empty (d) Full (e) Very full

b) Define defuzzification. With the help of examples, explain various defuzzification methods.   **9**

OR

16 a) Consider the discrete fuzzy set defined on the universe X= {a, b, c, d, e} as   5
    $A = \{ \frac{1}{a} + \frac{0.9}{b} + \frac{0.6}{c} + \frac{0.3}{d} + \frac{0}{e} \}$, Using Zadeh's notation, find the λ- cut sets for λ = 1,
    0.9, 0.6, 0+ and 0.

   b) Given two universes X= {x1, x2, x3, x4, x5} and Y= {y1, y2, y3, y4, y5}, the   9
    fuzzy sets A defined on X and fuzzy set B defined on Y are given below.

$$A = \{\frac{0.4}{x1} + \frac{0.7}{x2} + \frac{1}{x3} + \frac{0.8}{x4} + \frac{0.6}{x5}\}$$

$$B = \{\frac{0.2}{y1} + \frac{0.6}{y2} + \frac{1}{y3} + \frac{0.9}{y4} + \frac{0.7}{y5}\}$$

i) Find the relation R = A × B

Consider another fuzzy set C defined on the universe V = {v1, v2, v3}

$$C = \{\frac{0.4}{v1} + \frac{1}{v2} + \frac{0.8}{v3}\}$$

ii) Find P = B × C.

iii) Using max-min composition find RoP.

Module IV

17 a) What is the Fuzzy Inference System (FIS)? Illustrate Mamdani FIS with an   7
    example.

   b) Explain the different methods of encoding that are possible in genetic algorithms.   7

OR

18 a) What is the concept of crossover in Genetic Algorithm? Explain the different   7
    methods of cross over that are possible in genetic algorithms.

   b) Explain any 4 Genetic Algorithm selection operators.   7

Module V

19 a) Explain convex and non-convex MOOP.   7

   b) Illustrate the different steps in genetic-neuro hybrid systems with the help of a   7
    neat block diagram.

OR

20 a) What are the properties of dominance relation?   7

   b) What are the classifications of neuro-fuzzy hybrid systems? Discuss in detail.   7

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