Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S8 (R,S) Exam April 2025 (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	How does the presence of bias affect the output of a neural network layer, and what would be the output difference if the bias were omitted? Provide an example calculation.	(3)
2	What are the different types of activation functions used in neural networks?	(3)
3	Illustrate the different steps involved in the Perceptron Training Algorithm for Single Output Class.	(3)
4	Explain the Widrow - Hoff learning rule for supervised learning in neural networks.	(3)
5	Using your own intuition and definition of the universe of discourse, plot membership functions for the speed of a vehicle. Define the fuzzy sets as very slow, slow, moderate, fast, and very fast.	(3)
6	Let $A=\{(x_1,0.7),(x_2,0.3),(x3,0.9)\}$and $B=\{(x_1,0.6),(x_2,0.4),(x_3,0.8)\}$. Find intersection, union, and complement of both the fuzzy sets	(3)
7	Explain Value Encoding and Permutation Encoding with an example	(3)
8	Explain the Roulette wheel technique for traditional GA selection.	(3)
9	Explain the characteristics of a genetic neuro hybrid system .	(3)
10	Discuss the reflexive and antisymmetric properties of dominance relation in Multi-Objective Optimization Problem.	(3)

PART B

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

Module I

11	a)	Illustrate the concepts of Supervised, Unsupervised, and Reinforcement Learning through real-world applications.	(9)
	b)	Explain training algorithm used in McCulloch-Pitts neuron	(5)

OR

12 a) How does the output of a two-input single-output biased artificial neural network, utilizing binary sigmoidal and bipolar sigmoidal activation functions, differ when given input values $X_1 = 0.6$ and $X_2 = 0.9$ with corresponding weight values of 0.4 and 0.5 respectively, along with a bias input weight of 0.7? What are the resultant outputs (Y) for each activation function? (6)

b) Explain the terms cell, axon, synapse, dendrite and soma with reference to biological Neural Network (8)

Module II

13 a) Implement one epoch of the Adaline algorithm for the OR logic function with binary inputs and bipolar outputs. The initial weights are w_1=0.3, w_2=−0.2, and the learning rate parameter is η=0.1 (9)

b) Explain training algorithm used in adaptive linear neuron (5)

OR

14 a) Illustrate the architecture of an Adaline network. Compare and contrast it with the Perceptron Network. (7)

b) Consider a simple feedforward neural network with one hidden layer. The input vector is x = [1, 2], the weights for the input to hidden layer are w_1=[0.1,0.2;0.3,0.4], and the weights for the hidden to output layer are w_2=[0.5,0.6]. The biases for the hidden and output layers are b_1=[0.1,0.2] and b_2=0.3. Assume the activation function is sigmoid. Perform the forward pass and calculate the output. (7)

Module III

15 a) Consider the following two fuzzy sets: A={0.4/1,0.6/2,0.8/3,0.3/4} B={0.2/1,0.5/2,0.7/3,0.9/4}. Find the algebraic sum, algebraic product, bounded sum, and bounded difference for the given sets. (8)

b) State the conditions for fuzzy tolerance and fuzzy equivalence relations? (6)

OR

16 a) Three fuzzy sets are defined as follows: (10)

A = {(0.2/10), (0.3/30), (0.5/50), (0.7/70)} B = {(0.9/1), (0.6/2), (0.8/3), (0.5/4), (0.3/5), (0.2/6)} C = {(0.3/100), (0.6/200), (0.8/300), (0.4/400)}

Find: (i)$R = A \times B$ (ii) $S = B \times C$ (iii) $T = R$oS, using Max-Min composition (iv) $T = R$oS, using Max-Product composition.

b) Consider the fuzzy relation (4)

$$\begin{bmatrix} .90 & .60 & .20 & .30 & .50 \\ .60 & .80 & .40 & .10 & .70 \\ .20 & .40 & .70 & .30 & .20 \\ .30 & .10 & .30. & .90 & .60 \end{bmatrix}$$

Perform λ-cut operations for the values of $\lambda = 0.9, 0$

Module IV

17 a) Explain different types of Encoding Techniques. (10)

b) Explain four mutation methods? (4)

OR

18 a) Illustrate the Outline of the Basic Genetic Algorithm, using Pseudocode and flowchart (10)

b) Explain different selection methods in genetic algorithm (4)

Module V

19 a) Explain the Mathematical form of Multi-Objective Optimization Problems. Illustrate the classification of MOOP. (8)

b) Explain the classifications of a neuro-fuzzy hybrid system with neat diagrams (6)

OR

20 a) How do genetic algorithms and neural networks complement each other in genetic-neuro hybrid systems? Provide an example of how a genetic-neuro hybrid system can be applied to a real-world multi-objective optimization problem. (10)

b) How do you find a non-dominated set in multi-objective optimization? (4)

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