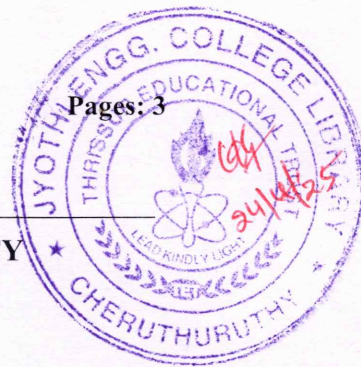


Reg No.: _____

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 $A = \{(x_1, 0.7), (x_2, 0.3), (x_3, 0.9)\}$ 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 $\eta=0.1$ (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) $T = RoS$, using Max-Min composition
(iv) $T = RoS$, 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. (8)
Illustrate the classification of MOOP.
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)
