

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group - A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**
- (i) The values of the membership function is represented by
(a) Discrete Set (b) Degree of truth
(c) Probabilities (d) Both b & c.
- (ii) Fuzzy logic has rapidly become one of the most successful of today's technologies for developing sophisticated control systems. Which of the following are reasons for this?
(i) Fuzzy logic resembles the human way of thinking.
(ii) Fuzzy logic enables the ability to generate precise solutions from certain or approximate information.
(iii) Fuzzy logic is easy to implement.
(a) i, ii & iii (b) i & ii (c) i & iii (d) ii & iii.
- (iii) Considering a graphical representation of the 'tallness' of people using its appropriate member function, which of the following combinations are true?
(i) TALL is usually the fuzzy subset.
(ii) HEIGHT is usually the fuzzy set.
(iii) PEOPLE is usually the universe of discourse.
(a) i & ii (b) ii & iii (c) i, ii & iii (d) i & iii.
- (iv) The network that involves backward links from output to the input and hidden layers is called
(a) self organizing maps (b) perceptrons
(c) recurrent neural network (d) multi layered perceptron.

- (v) The room temperature is hot. Here the hot can be represented by _____.
(a) π MF (b) increasing MF
(c) decreasing MF (d) triangular MF.
- (vi) Which of the following is not the promise of artificial neural network?
(a) It can explain result
(b) It can survive the failure of some nodes
(c) It has inherent parallelism
(d) It can handle noise.
- (vii) Which of the following are the advantages of neural networks over conventional computers?
(i) They have the ability to learn by example
(ii) They are more fault tolerant
(iii) They are more suited for real time operation due to their high 'computational' rates
(a) (i) and (ii) (b) (i) and (iii)
(c) (ii) and (iii) (d) all of them.
- (viii) Which is true for neural networks?
(a) It has set of nodes and connection
(b) Each node computes it's weighted input
(c) Node could be in excited state or non-excited state
(d) All of the mentioned.
- (ix) A perceptron is
(a) a single layer feed-forward neural network with preprocessing
(b) an autoassociative neural network
(c) a double layer autoassociative neural network
(d) none of these.
- (x) $A = \{3,4,5,6\}$; $B = \{5,6,7,8,9\}$; Then $A \cup B =$
(a) $\{3,4,5,6,7,8,9\}$ (b) $\{3,4,5,6\}$
(c) $\{5,6\}$ (d) $\{7,8,9\}$.

Group - B

2. (a) What is soft-computing? Write the goals of soft-computing.
(b) "Possibility theorem is related to fuzzy logic". Explain with a real life example. **6 + 6 = 12**
3. (a) Explain π membership function with suitable example.

- (b) Establish relation between T-norm and S-norm with example.
- (c) A fuzzy set described in the domain of natural numbers [0, 8]. Find out the fuzzy closeness membership functions for the number "5".
3 + 3 + 6 = 12

Group - C

4. How will you represent the following every day notions using appropriate fuzzy membership function:
(i) the notion of being *short*;
(ii) the notion of feeling *hot*;
(iii) cost of an apartment is highest in Salt Lake area and is about Rs.2,00,00,000;
(iv) a person feels comfortable at the temperature between 15°C to 25°C.
(3 + 3 + 3 + 3) = 12
5. (a) Define and explain the use of projection and cylindrical extension in fuzzy set operation?
(b) Calculate Mamdani implication and Zadeh implication for two fuzzy sets, $\tilde{A} = 0.8/x_1 + 0.4/x_2 + 0.6/x_3 + 1/x_4$ and $\tilde{I} = 0.9/y_1 + 0.5/y_2 + 0.3/y_3$.
5 + 7 = 12

Group - D

6. (a) Draw the structure of a biological neuron and compare biological neural network with artificial neural network.
(b) Write the importance of ANN. What is the significance of weights used in artificial neural networks?
(c) Define bias and threshold in context of ANN.
4 + 4 + 4 = 12
7. (a) Describe the functions of dendrite, axon and soma in human nervous system.
(b) Generate the truth table of NAND logic by McCulloch-Pitts neural network.
(c) The net input of an output neuron is 0.35 and steepness factor is 0.1, calculate its output when the activation function is (i) binary sigmoidal (ii) bipolar sigmoidal.
4 + 3 + 5 = 12

Group - E

8. (a) Derive the equation of fuzzy PI controller.
(b) Write the importance of Normalization and Denormalization.
(c) Describe any defuzzification module.
2 + 4 + 6 = 12
9. (a) What is stochastic search?
(b) Write short descriptions about different stochastic algorithms.
3 + 9 = 12