

[Time: Three Hours]

[ Marks:80]

Please check whether you have got the right question paper.

- N.B:
1. Question.No.1 is compulsory.
  2. Attempt any **three** questions out of the remaining **five** questions.
  3. Figures to the **right** indicate **full marks**.
  4. Assume suitable data wherever required but justify the same.

1. Answer any four questions from the given questions: 20
  - (a) What is Linear separability? Explain OR, AND and XOR functions with diagram.
  - (b) Mention the five properties of fuzzy sets.
  - (c) Explain operations on Fuzzy relations.
  - (d) What is  $\lambda$  – cut sets? Explain its types.
  - (e) Write a note on Genetic Algorithm.
2. (a) Explain Perceptron model and Delta learning rule. 10
  - (b) What is Fuzzy membership function? Explain basic features of membership function and types of fuzzy sets. 10
3. (a) Explain McCulloch Pitt model with examples. 5
  - (b) What are the advantages of Fuzzy logic over the crisp logic? Explain with example. 5
  - (c) Two relations are defined as 10

$$R = \begin{matrix} & B_1 & B_2 & B_3 & B_4 \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \\ A_4 \end{matrix} & \begin{bmatrix} 1 & 0.2 & 0.3 & 0 \\ 0.2 & 0.4 & 0.5 & 0.6 \\ 0.3 & 0.4 & 0.6 & 0.9 \\ 0 & 0.2 & 0.9 & 1 \end{bmatrix} \end{matrix} \quad S = \begin{matrix} & V_1 & V_2 \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \\ A_4 \end{matrix} & \begin{bmatrix} 1 & 0.5 \\ 1 & 0.5 \\ 0.5 & 1 \\ 0.5 & 1 \end{bmatrix} \end{matrix}$$

Find relation 1)  $R^T \circ S$  2)  $R^T \bullet S$

4. (a) Explain Cartesian product with example. 5
  - (b) What is fuzzy inference system? Explain different methods of Fuzzy inference system. 10
  - (c) Explain different types of hybrid system. 5
5. (a) Consider the two fuzzy sets 5

$$\tilde{A} = \left\{ \frac{0}{0.2} + \frac{0.8}{0.4} + \frac{1}{0.6} \right\}$$

$$\tilde{B} = \left\{ \frac{0.9}{0.2} + \frac{0.7}{0.4} + \frac{0.3}{0.6} \right\}$$

Using Zadeh's notations express the fuzzy sets into  $\lambda$ - cut sets for  $\lambda=0.4$  and  $\lambda=0.7$  for the following operations.

  - a)  $\tilde{A} \bar{b}$  b)  $\bar{B}$  c)  $\tilde{A} \cup \tilde{B}$  d)  $\tilde{A} \cap \bar{B}$  e)  $\tilde{A} \cup \bar{B}$
- (b) Explain Fuzzy back propagation network. 5

- (c) Design fuzzy controller to determine wash time of a fuzzy washing machine. Assume that the two inputs are dirt and grease on the cloths. The design should be supported by figures wherever possible. Clearly indicate that if the cloths are soiled to large degree the time required for washing is also more. 10
6. (a) Write a note on Adaptive Neuro Fuzzy Inference system. 5  
(b) Explain the application of fuzzy logic in pattern recognition and Image processing. 5  
(c) Design a fuzzy controller for Air Conditioner. 10

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