

Duration: 3 hours

Marks: 80

- Note: 1) Question 1 is compulsory.
2) Attempt any four from Question 2 to Question 7.
3) Use of calculator is allowed.

Q1 a) Using Zadeh's notation, determine the λ -cut sets for the given fuzzy sets: 5

$$A = \left\{ \frac{1}{1.0} + \frac{0.75}{1.5} + \frac{0.3}{2.0} + \frac{0.15}{2.5} + \frac{0}{3.0} \right\}$$

$$B = \left\{ \frac{1}{1.0} + \frac{0.6}{1.5} + \frac{0.2}{2.0} + \frac{0.1}{2.5} + \frac{0}{3.0} \right\}$$

Express the following for $\lambda = 0.55$

1. $A \cup B$ 2. $A \cap B$ 3. $A \cup \bar{A}$ 4. $\bar{A} \cap \bar{B}$ 5. $\overline{A \cap B}$

b) Differentiate between 15

- Classical sets and Fuzzy sets
- Genetic algorithm versus traditional algorithm
- Hard Computing and Soft Computing.

Q2 a) Discuss the architecture of Perceptron with the training algorithm. 08

b) Consider two fuzzy sets R and S

	Y1	Y2		Z1	Z2	Z3	
R = X1	0.6	0.3	S = Y1	1	0.5	0.3	07
X2	0.2	0.9	Y2	0.8	0.4	0.7	

Find Max-min composition and Max-product composition.

$$T = R \cdot S$$

$$U = R \cdot S$$

Q3 a) What is Fuzzy Inference system (FIS)? Explain it along with its types. 08

b) Draw the flowchart of Genetic Algorithm and explain various types of crossover and mutation techniques. 07

Q4 a) Design a computer software to perform image processing to locate objects within a scene. The two fuzzy sets representing a plane and a train image are: 08

$$\text{Plane} = \left\{ \frac{0.2}{\text{train}} + \frac{0.5}{\text{bike}} + \frac{0.3}{\text{boat}} + \frac{0.8}{\text{plane}} + \frac{0.1}{\text{house}} \right\}$$

$$\text{Train} = \left\{ \frac{1}{\text{train}} + \frac{0.2}{\text{bike}} + \frac{0.4}{\text{boat}} + \frac{0.5}{\text{plane}} + \frac{0.2}{\text{house}} \right\}$$

Find the following:

(1) $\text{Plane} \cup \text{Train}$ (2) $\text{Plane} \cap \text{Train}$ (3) $\overline{\text{Plane}}$ (4) $\overline{\text{Plane} \cup \text{Train}}$

(5) $\overline{\text{Plane} \cap \text{Train}}$ (6) $\text{Train} \cup \overline{\text{Train}}$ (7) $\text{Plane} \cap \overline{\text{Plane}}$ (8) $\overline{\text{Train}}$

(b) Define Defuzzification. What are the different method of defuzzification Process. 07

Q5 a) Using inference method, find the membership values for each of the triangular shapes (I, R, E, IR, T) for each of the following (all in degrees):

- 1) 45, 55, 80
- 2) 40, 60, 80

08

b) What is fuzzification? Explain in brief methods of membership value assignments.

07

Q6 a) Perform the following operations on intervals

08

1. $[3, 2] + [4, 3]$
2. $[2, 1] \times [1, 3]$
3. $[4, 6] + [1, 2]$
4. $[3, 5] - [4, 5]$
5. Image of interval $[5, 3]$
6. Inverse of interval $[5, 3]$
7. If $A=[2, 4]$ and $B=[-4, 5]$ find Max i.e. $A \vee B$
8. If $A=[2, 4]$ and $B=[-4, 5]$ find Min i.e. $A \wedge B$

b) Explain in brief architecture of Fuzzy Logic Controller (FLC).

07

Q7 Write a short note on any three

15

1. Activation functions in ANN
2. Belief and Plausibility Measures
3. Aggregation of fuzzy rules
4. Fuzzy Decision Making