



**Module-4**

- 7 a. Differentiate between crisp set and fuzzy set.  
 b. List out the properties of fuzzy sets.  
 c. Given three fuzzy sets membership functions :

(04 Marks)

(04 Marks)

$$\tilde{I} = \left\{ \frac{0.4}{0.8} + \frac{0.7}{0.9} + \frac{1}{1} + \frac{0.8}{1.1} + \frac{0.6}{1.2} \right\}$$

$$\tilde{V} = \left\{ \frac{0.2}{30} + \frac{0.8}{45} + \frac{1}{60} + \frac{0.9}{75} + \frac{0.7}{90} \right\}$$

$$\tilde{C} = \left\{ \frac{0.4}{0.5} + \frac{1}{0.6} + \frac{0.5}{0.7} \right\}$$

Find the Cartesian products

$$\text{i) } \tilde{P} = \tilde{V} \times \tilde{I} \quad \text{ii) } \tilde{T} = \tilde{I} \times \tilde{C}.$$

Find the fuzzy composition relation using max-min composition.

$$\tilde{E} = \tilde{P} \circ \tilde{T}.$$

(08 Marks)

**OR**

- 8 a. Consider the two fuzzy sets  $\tilde{A}$  and  $\tilde{B}$  and find the operations mentioned.

$$\tilde{A} = \left\{ \frac{1}{2} + \frac{0.5}{3} + \frac{0.6}{4} + \frac{0.2}{5} + \frac{0.6}{6} \right\}$$

$$\tilde{B} = \left\{ \frac{0.5}{2} + \frac{0.8}{3} + \frac{0.4}{4} + \frac{0.7}{5} + \frac{0}{6} \right\}$$

$$\text{i) } \tilde{A} \cup \tilde{B} \quad \text{ii) } \tilde{A} \cap \tilde{B} \quad \text{iii) } \tilde{B} | \tilde{A} \quad \text{iv) } \overline{\tilde{A} \cup \tilde{B}}$$

(06 Marks)

- b. Let R and S be defined on the sets  $\{1, 3, 5\} \times \{1, 3, 5\}$  and crisp value specified as  $R : \{(1, 3), (3, 5)\}$  and  $S : \{(1, 3), (1, 5), (3, 5)\}$ . Find the Cartesian relation  $T = R \circ S$  using max-min composition.

(05 Marks)

- c. For the given fuzzy sets :

$$\tilde{A} = \left\{ \frac{1}{1.0} + \frac{0.65}{1.5} + \frac{0.4}{2.0} + \frac{0.35}{2.5} + \frac{0}{3.0} \right\}$$

$$\tilde{B} = \left\{ \frac{0}{1.0} + \frac{0.25}{1.5} + \frac{0.6}{2.0} + \frac{0.25}{2.5} + \frac{1}{3.0} \right\}$$

$$\tilde{C} = \left\{ \frac{0.5}{1.0} + \frac{0.25}{1.5} + \frac{0}{2.0} + \frac{0.25}{2.5} + \frac{0.5}{3.0} \right\}$$

Verify the following relation :

$$\tilde{A} \cap (\tilde{B} \cup \tilde{C}) = (\tilde{A} \cap \tilde{B}) \cup (\tilde{A} \cap \tilde{C}).$$

(05 Marks)

**Module-5**

- 9 a. Differentiate between crisp logic and fuzzy logic.  
 b. State and explain fuzzy inference and rule based system.  
 c. Explain different types of de-fuzzification methods used in fuzzy system.

(05 Marks)

(05 Marks)

(06 Marks)

**OR**

- 10 a. Define Type 2 fuzzy sets and explain the different operations of Type 2 fuzzy sets.

(06 Marks)

- b. Define and explain interval type-2 fuzzy sets.

(05 Marks)

- c. Explain the different operations on interval Type-2 fuzzy sets.

(05 Marks)

\*\*\*\*\*