

**GUJARAT TECHNOLOGICAL UNIVERSITY****BE - SEMESTER-VIII(NEW) EXAMINATION – SUMMER 2019****Subject Code: 2181710****Date:09/05/2019****Subject Name: Soft Computing in Control****Time: 10:30 AM TO 01:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

**Q.1 (a) Define fuzzy set, vagueness and uncertainty 03****(b) Consider 2 fuzzy sets  $\tilde{A}$  and  $\tilde{B}$ , find complement, union, intersection, and difference 04**

$$\tilde{A} = \left\{ \frac{1}{2} + \frac{0.5}{3} + \frac{0.6}{4} + \frac{0.2}{5} + \frac{0.6}{6} \right\} \quad \tilde{B} = \left\{ \frac{0.5}{2} + \frac{0.8}{3} + \frac{0.4}{4} + \frac{0.7}{5} + \frac{0.3}{6} \right\}$$

**(c) Explain with block diagram working of fuzzy logic control system 07****Q.2 (a) List and explain 3 general forms in which the canonical rules can be formed. 03****(b) List and explain 4 methods of decomposition of rules. 04****(c) Explain in detail 7 methods used for defuzzifying the fuzzy output functions 07****OR****(c) 2 fuzzy sets are defined on x as follows: 07**

$\mu(x_i)$	$x_1$	$x_2$	$x_3$	$x_4$	$x_5$
$\tilde{P}$	0.1	0.2	0.7	0.5	0.4
$\tilde{Q}$	0.9	0.6	0.3	0.2	0.8

Find the following  $\lambda$  cut sets:

$$a) (\tilde{P})_{0.2} \quad b) (\tilde{Q})_{0.3} \quad c) (\tilde{P} \cup \tilde{Q})_{0.5} \quad d) (\tilde{P} \cap \tilde{Q})_{0.4} \quad e) (\tilde{Q} \cup \tilde{P})_{0.8} \quad f) (\tilde{P} \cup \tilde{P})_{0.2}$$

**Q.3 (a) For the given fuzzy set prove the distributive law 03**

$$\tilde{A} = \left\{ \frac{1}{1.0} + \frac{0.65}{1.5} + \frac{0.4}{2.0} + \frac{0.35}{2.5} + \frac{0}{3.0} \right\} \quad \tilde{B} = \left\{ \frac{0}{1.0} + \frac{0.25}{1.5} + \frac{0.6}{2.0} + \frac{0.25}{2.5} + \frac{1}{3.0} \right\}$$

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

**(b) State the 4 properties of lamda cut sets. 04****(c) Draw block diagram of fuzzy inference system and explain function of each block of fuzzy inference system. 07****OR****Q.3 (a) For the given fuzzy set prove the associative law 03**

$$\tilde{A} = \left\{ \frac{1}{1.0} + \frac{0.65}{1.5} + \frac{0.4}{2.0} + \frac{0.35}{2.5} + \frac{0}{3.0} \right\} \quad \tilde{B} = \left\{ \frac{0}{1.0} + \frac{0.25}{1.5} + \frac{0.6}{2.0} + \frac{0.25}{2.5} + \frac{1}{3.0} \right\}$$

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

**(b) List and explain 4 properties for set of rules. 04****(c) Explain in detail Takagi – Sugeno Fuzzy Inference Method. 07****Q.4 (a) Define aggregation of fuzzy rule. List and explain 2 methods for determining aggregation of rules. 03****(b) Define learning. List any 2 types of learning and explain Hebbian learning. 04****(c) Explain in detail how fuzzy logic can be used in coal power plant. 07**

**OR**

- Q.4** (a) Compare PID control and fuzzy logic control **03**  
(b) List the 4 operation of Adaptive Resonance Theory (ART) Networks **04**  
(c) Explain in detail how fuzzy logic can be used to enhance control of an AC induction motor. **07**

- Q.5** (a) List 3 advantages of Mamdani Method **03**  
(b) Explain in detail neuron in biological system with a neat figure. **04**  
(c) Explain in detail how fuzzy logic can be used in Antilock brake system in Automobile industry **07**

**OR**

- Q.5** (a) List 3 advantages of Sugeno Method **03**  
(b) Explain the perceptron (simple model of biological neuron) with figure **04**  
(c) Explain in detail how fuzzy logic can be used in Drying Process Control **07**

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