

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VIII (NEW) - EXAMINATION – SUMMER 2018****Subject Code: 2181710****Date: 30/04/2018****Subject Name: Soft Computing in Control(Departmental Elective - III)****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.

MARKS

- Q.1**
- | | | | |
|--|------------|---|-----------|
| | (a) | Explain the features of Membership function. | 03 |
| | (b) | Explain concept of fuzziness and membership function. | 04 |
| | (c) | For the given fuzzy sets | 07 |

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

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

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

- Q.2**
- | | | | |
|--|------------|---|-----------|
| | (a) | Prove the associativity and the distributivity property Explain various operations that can be performed on fuzzy sets. | 03 |
| | (b) | Let X be the universe of commercial aircraft of interest | 04 |

$$X = \{ a10, b52, b117, C5, C130, f4, f14, f15, f16, f111, kc130 \}.$$

Let \tilde{A} be the fuzzy set passenger class aircraft

$$\tilde{A} = \left\{ \frac{0.3}{f16} + \frac{0.5}{f4} + \frac{0.4}{a10} + \frac{0.6}{f14} + \frac{0.7}{f111} + \frac{1.0}{b117} + \frac{1.0}{b52} \right\}$$

Let \tilde{B} be the fuzzy set of cargo

$$\tilde{B} = \left\{ \frac{0.4}{b117} + \frac{0.4}{f111} + \frac{0.6}{f4} + \frac{0.8}{f15} + \frac{0.9}{f14} + \frac{1.0}{f16} \right\}$$

Find the values of all the operations performed on these fuzzy sets.

- | | | | |
|--|------------|--|-----------|
| | (c) | What is conventional control system? Compare Fuzzy logic control with PID control. | 07 |
|--|------------|--|-----------|

OR

- | | | | |
|--|------------|---|-----------|
| | (c) | The three variables of interest in the MOSFET are the amount of current that can be switched, the voltage that can be switched and the cost. The following membership function for the transistor was developed | 07 |
|--|------------|---|-----------|

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

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

$$\text{Cost} = \left\{ \frac{0.4}{0.5} + \frac{1}{0.6} + \frac{0.5}{0.7} \right\}.$$

The power is given by $P = VI$.

- a) Find the fuzzy Cartesian product $\tilde{P} = \tilde{V} \times \tilde{I}$.
- b) Find the fuzzy Cartesian product $\tilde{T} = \tilde{I} \times \tilde{C}$.
- c) Using max–min composition find $\tilde{E} = \tilde{P} \circ \tilde{T}$.
- d) Using max–product composition find $\tilde{E} = \tilde{P} \circ \tilde{T}$.

- Q.3** (a) How is the excluded middle law different for the fuzzy set and the classical set? **03**
 (b) Discuss about the Demorgan's law for the fuzzy sets with one example. **04**
 (c) State and explain various methods of de-fuzzification. **07**

OR

- Q.3** (a) Define reflexivity, symmetry, and transitivity properties of fuzzy relations. **03**
 (b) Discuss in detail on the 'inference method' adopted for assigning membership values. Give details on the concepts of triangle used. **04**
 (c) Explain in detail 'Optimization of Water treatment system using fuzzy logic'. **07**

- Q.4** (a) Using your own intuition, plot the fuzzy membership function for the age of people. **03**
 (b) Discuss fuzzy set properties. **04**
 (c) Draw and explain design and structure of the 'Fuzzy Logic Position Loop for servo motor control'. **07**

OR

- Q.4** (a) Plot following fuzzy set:
 TEMPESENSE (Triangular MFs): **03**

Crisp Input Range	Fuzzy Variable
0 - 20	XSMALL(XS)
10 - 35	SMALL(S)
30 - 75	MEDIUM(M)
60 - 95	LARGE(L)
85 - 125	XLARGE(XL)

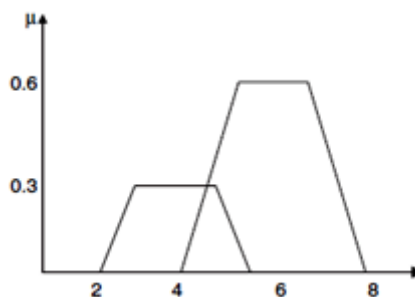
- (b) For the given fuzzy relation **04**

$$R = \begin{bmatrix} 0.2 & 0.5 & 0.47 & 1 & 0.9 \\ 0.3 & 0.5 & 0.6 & 1 & 0.8 \\ 0.4 & 0.6 & 0.4 & 0.5 & 0.3 \\ 0.9 & 1 & 0.3 & 0.3 & 0.2 \end{bmatrix},$$

Find the λ -cut relation for the following values of $\lambda = 0.4, 0.7, 0.8$.

- (c) Write short note on 'Fuzzy Logic Supervisory Control for Coal Power Plant'. **07**

- Q.5** (a) Find the defuzzified value by weighted average method for the figure shown below: **03**



- (b) With examples discuss about the conditional and unconditional statements used for the formation of fuzzy rules. **04**
 (c) Write short note on 'Takagi-Sugeno Fuzzy Method'. **07**

OR

- Q.5** (a) Compare Mamdani and Sugeno method of fuzzy inference system. **03**
 (b) Draw architecture of basic Neural Network. **04**
 (c) Discuss various applications of Fuzzy control in industrial automation. **07**