Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

SECOND SEMESTER M.TECH. (CONTROL SYSTEMS)

END SEMESTER EXAMINATIONS, APRIL - 2018

SUBJECT: SOFT COMPUTING TECHNIQUES [ICE 5222]

Duration: 3 Hour Max. Marks:50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A Let $\mathcal{X}$ be the universe of satellites of interest, as defined below: 2
Let $\mathcal{X} = \{a12, x15, b16, f4, f900, v111\}$, Let Ạ be the fuzzy set of INSAT-A satellite:
Ạ $= \{\frac{0.2}{a12} + \frac{0.3}{x15} + \frac{1}{b16} + \frac{0.1}{f4} + \frac{0.5}{v111}\}$ Let Ḅ be the fuzzy set of INSAT-B satellite:
Ḅ= $\{\frac{0.1}{a12} + \frac{0.25}{x15} + \frac{0.9}{b16} + \frac{0.7}{f4} + \frac{0.3}{f900} + \frac{0.2}{v111}\}$. Find the following sets of combinations for these two sets:

a) Ạ ∪ Ḅ; b) Ạ ∩ Ḅ; c) $\overline{Ạ}$:d) $\overline{Ḅ}$: e) $\overline{Ạ \cup Ḅ}$; f) $\overline{Ạ \cap Ḅ}$; g) $\overline{Ạ} \cup \overline{Ḅ}$;h) $\overline{Ạ} \cup Ḅ$

1B Explain with suitable example and diagram fuzzy equivalence relation. 2

1C With suitable examples, explain how membership assignment is performed using intuition and inference method. 3

1D Find the defuzzified value using centroid method for the figure shown in Fig.Q1D. 3

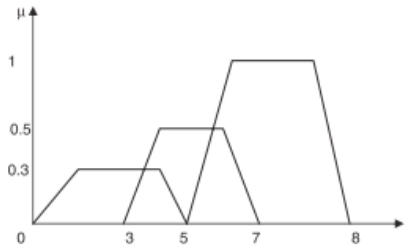

Fig.Q1D

2A Discuss in detail on Decomposition of rules and also the formation of rules in a Mamdani FIS. 5

2B Develop an FIS model for controlling the water level and temperature in the boiler using Mamdani fuzzy inference models. Assume your own linguistic variables. 3

2C Describe in brief the design elements of a general fuzzy logic control system with its block diagram 2

3A Find the weights using perceptron network for the ANDNOT function when all the inputs are prescribed only one time. Use bipolar inputs and targets. 3

3B Implement XOR function using McCulloch –Pitts neuron (consider binary data). 3

3C Construct and test an LVQ net with five vectors assigned to two classes. The given vectors along with the classes are as shown in the Table Q3C. 4

Table Q3C

Vector	Class
[0 0 1 1]	1
[1 0 0 0]	2
[0 0 0 1]	2
[1 1 0 0]	1
[0 1 1 0]	1

4A Consider a Kohonen self- organizing net with two cluster units and five input units. The weight vectors for the cluster units are given by 2

$$w_1 = [1.0\ 0.9\ 0.7\ 0.5\ 0.3]$$
$$w_2 = [0.3\ 0.5\ 0.7\ 0.9\ 1.0]$$

Use the square of the Euclidean distance to find the winning cluster unit for the input pattern $x = [0.0\ 0.5\ 1.0\ 0.5\ 0.0]$. Using a learning rate of 0.25, find the new weights for the winning unit.

4B Consider an ART1 network for clustering four input vectors with low vigilance parameter of 0.4 into three clusters. The four input vectors are [0 0 0 1], [0 1 0 1], [0 0 1 1] and [1 0 0 0]. Assume the necessary parameters needed. 3

4C Generate a neural net using BPN algorithm for XOR function. The architecture and the values of initial weights and biases are shown in Fig.Q4B. 5

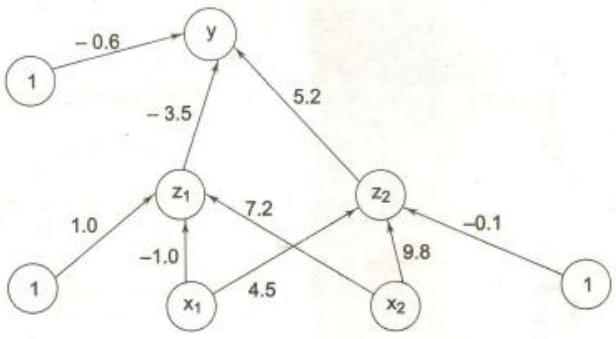

Fig. Q4B

5A Discuss the Applications of neural network in Pattern recognition and Control system applications. 4

5B Describe the three main operators in genetic algorithm 3

5C Construct a Maxnet with four neurons and inhibitory weight $\varepsilon = 0.2$, given the initial activations as follows:$a_1(0) = 0.3;\ a_2(0) = 0.5;\ a_3(0) = 0.7; a_4(0) = 0.9$ 3