Reg. No.										

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

VI SEMESTER B.TECH. (MECHATRONICS ENGINEERING)

MAKE-UP EXAMINATIONS, MAY 2018

SUBJECT: ARTIFICIAL INTELLIGENCE [MTE 4027]

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Data not provided may be suitably assumed with justification

1A Describe the feed forward architecture in artificial neural network. **03**

1B Given two fuzzy sets $A = \frac{0.4}{x_1} + \frac{0.3}{x_2} + \frac{1}{x_3} + \frac{0.9}{x_4}$ $B = \frac{0.2}{x_1} + \frac{0.6}{x_2} + \frac{1}{x_3} + \frac{0.75}{x_4}$ **03**

Find: i) AUB ii) A∩B iii) center and height of fuzzy sets A and B

1C Perform 4 training steps of delta learning rule assuming unipolar continuous activation function for the following data pairs. **04**

$$\{X^1 = [0 \quad -1 \quad 2]^t, \quad d_1 = -1\}$$
$$\{X^2 = [-1 \quad -2 \quad 1]^t, \quad d_2 = +1\}$$

The initial weights are $W^t = [1\ 0\ 1]^t$. Learning constant is 0.5.

2A Compare Hebbian learning rule and Perceptron learning rule. **03**

2B "XOR problem cannot be implemented using single layer perceptron network". **03**
Is the above statement TRUE or FALSE? Justify your answer.

2C Given two fuzzy sets High and Low as below: **04**

$$High: \frac{0.3}{1} + \frac{0.6}{2} + \frac{0.9}{3} \qquad Low: \frac{0.8}{-1} + \frac{0.5}{0} + \frac{0.2}{1}$$

Perform DR implication to interpret "IF x is High THEN y is Low".

3A Discuss the steps involved in modelling of a neuro controller. **05**

3B Perform single step error-back propagation of a multilayer perceptron network for the given data. Use η=1, λ=1 and both the layers are unipolar continuous. **05**

$$Z = \begin{bmatrix} 1 \\ 2 \\ -1 \end{bmatrix} \qquad V^t = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix} \qquad W^t = [1 \quad 1 \quad 1] \qquad d = -1$$

4A Explain the significance of Genetic Algorithm over ANN and Fuzzy system. **02**

4B Explain the characteristics of the three categories resulting from integration of neural networks and fuzzy systems. **03**

4C Perform five training steps using Perceptron learning rule for the data given below: **05**

$$\left\{X_1 = \begin{bmatrix} 1 \\ -2 \\ 0 \\ -1 \end{bmatrix}, d_1 = -1\right\}, \left\{X_2 = \begin{bmatrix} 0 \\ 1.5 \\ -0.5 \\ -1 \end{bmatrix}, d_2 = -1\right\}, \left\{X_3 = \begin{bmatrix} -1 \\ 1 \\ 0.5 \\ -1 \end{bmatrix}, d_3 = 1\right\}$$

The initial weights are $W^1 = [1\ -1\ 0\ 0.5]^t$. Use bipolar binary neurons and c=1.

5A Compare biological neuron and artificial neuron. **02**

5B Differentiate fuzzification and defuzzification. List the different types of fuzzifiers. **04**

5C Let U= $\{a, b, c\}$, $V = \{p, q\}$ and assume a fuzzy if then rule: "If x is A then y is B" is given where, $A = \frac{0.3}{a} + \frac{1}{b} + \frac{0.85}{c}$ and $B = \frac{0.5}{p} + \frac{0.6}{q}$. Also given is a fact "x = more or less A". Use Generalized Modus Ponens to derive a conclusion in the form " y is B′ ", where A→B is interpreted using Mamdani Product Implication. **04**