Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: SOFT COMPUTING [ELE 328]

(PROGRAM ELECTIVE – I)

REVISED CREDIT SYSTEM

11, May 2016

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer any **FIVE** full questions.
- Missing data may be suitable assumed.

1A. Define the following:
(i) Support of a fuzzy set (ii) convex fuzzy set (iii) Law of exclusion **(03)**

1B. Given $\text{small} = \left[\frac{1}{1} + \frac{0.8}{2} + \frac{0.6}{3} + \frac{0.4}{4} + \frac{0.2}{5}\right]$ and $\text{Large} = \left[\frac{0.2}{1} + \frac{0.4}{2} + \frac{0.6}{3} + \frac{0.8}{4} + \frac{1}{5}\right]$
Obtain membership functions for NOT intensely small AND NOT Large **(03)**

1C. Consider fuzzy sets CURRENT and SPEED given by

$$\text{Flux } \Phi = \left\{ \frac{0.4}{0.5} + \frac{0.75}{0.8} + \frac{1}{1} + \frac{0.4}{1.2} \right\} \text{ and } \text{Speed } N = \left\{ \frac{0.2}{300} + \frac{0.6}{800} + \frac{0.95}{1000} \right\}$$

Fuzzy rule: IF Flux THEN Speed
Obtain the inference using the following implications:
(i) Luckasiewicz and (ii) Mamdani-product. **(04)**

2A. Two output fuzzy sets are defined as given below in a universe of discourse X [0:9]:
A = triangular (0, 3, 5) and B = trapezoidal (3, 5, 6, 9)
(i) Obtain the equations to represent the above fuzzy sets.
(ii)The truncation levels of A and B are 0.5 and 1.0 respectively during fuzzy rule implication. Determine the crisp output by centroid method. **(04)**

2B. Given the inputs of distance to the target and speed of a vehicle, it is required to design a fuzzy inference system to determine the force to be applied on the brakes.
(i) List linguistic variables and their linguistic values.
(ii) Give equations for triangular membership functions for all linguistic values as listed above.
(iii) Develop IF-THEN rule base.
Assume universe of discourse of [0:100%] for all linguistic variables. **(06)**

3A. A_1 and A_2 are fuzzy sets defined as $A_1 = \left[\frac{0.5}{-1} + \frac{0.1}{0} + \frac{0.9}{1}\right]$ and $A_2 = \left[\frac{0.4}{-2} + \frac{1}{2}\right]$. Using extension principle derive $f(A_1, A_2)$ given $f(y) = x^2 + y$ **(03)**

3B. Consider the fuzzy sets

$A=\left\{\frac{0.4}{1}+\frac{0.7}{2}+\frac{1}{3}+\frac{0.8}{4}\right\}$ and $B=\left\{\frac{0.2}{1}+\frac{0.6}{2}+\frac{0.9}{3}+\frac{0.7}{4}\right\}$, prove that $\overline{A \cap B} = \overline{A} \cup \overline{B}$ **(03)**

3C. A neural network has one layer of two neurons. The available information of the network are $W = \begin{bmatrix} 2 & -1 \\ 0.5 & 0.75 \end{bmatrix}$, Bias $= \begin{bmatrix} -0.5 \end{bmatrix}^T$ and $O = \begin{bmatrix} 0.28 & -0.73 \end{bmatrix}^T$. Biasing input = -1. The activation function is bipolar continuous with λ = 1.25. Determine the input matrix X and sketch the neural network. **(04)**

4A. Design a bipolar discrete neural model such that the input pattern lies in the shaded region shown in Fig. Q4A. **(04)**

4B. A neuron output is given by $O = f(net) = \frac{1}{1+e^{-net}}$.

Show that $\frac{dO}{d(net)} = O^1 = f^1(net) = O(1-O)$ **(03)**

4C. Three sets of input pattern and initial weight matrix are as shown below:

$X_1 = \begin{bmatrix} 2 & -1.5 & 3 & -1 \end{bmatrix}^T$; $X_2 = \begin{bmatrix} -1 & 2 & 1.5 & -1 \end{bmatrix}^T$; $X_3 = \begin{bmatrix} 2.5 & 1 & -3.5 & -1 \end{bmatrix}^T$;

$W^{(1)} = \begin{bmatrix} 0.5 & 1 & -2 & -1 \end{bmatrix}^T$

The desired outputs of respective patterns are $d_1 = -1$; $d_2 = 0.5$; $d_3 = -1.5$. Assume learning constant c = 0.5. Determine the modified weights at the end of one cycle using Windrow-Hoff learning rule. **(03)**

5A. A bipolar continuous activation function neural network is shown in Fig. Q5A. The desired outputs A and B are 0.5 and -0.5 respectively for a given input X = 1.25. Assuming activation function constant and learning constant as 1.0 modify the weights of hidden layer and output layer with the aid of back propagation algorithm after one cycle of iteration. **(07)**

5B. A fuzzy set has its membership function $\mu_A(x) = \exp\left[-0.1*(x-5)^2\right]$. Convert it to a neuron model with x as input and O as the membership value. Draw the neural network to represent the above fuzzy set. **(03)**

6A. Consider patterns A (-2, -1) and B (3, 1.5) to belong to Class P (+1) and patterns C (- 4, - 2) and D (4, 2) belong to class Q (-1). Design a suitable neural network. **(04)**

6B. It is required to store two patterns $S_1 = \begin{bmatrix} -1 & -1 & 1 & 1 \end{bmatrix}$ and $S_2 = \begin{bmatrix} 1 & -1 & -1 & 1 \end{bmatrix}$ in an associative memory using Hopfield network. Obtain the suitable weight matrix. Draw the Hopfield network indicating the weights. **(03)**

6C. Explain (i) fitness (ii) cross over and (iii) mutation as applied in Genetic algorithm. **(03)**

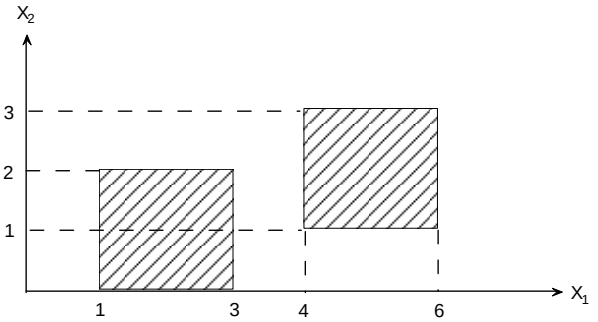

Fig. Q 4A

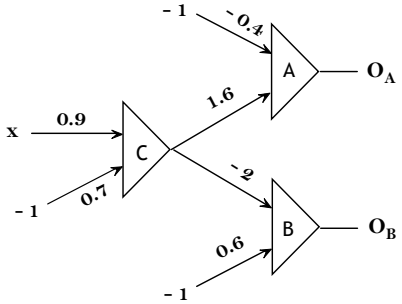

Fig. Q 5A