Reg. No.									

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)

MAKEUP EXAMINATIONS, JULY 2016

SUBJECT: SOFT COMPUTING [ELE 328]

REVISED CREDIT SYSTEM

Time: 3 Hours **04, July 2016** MAX. MARKS: 50

Instructions to Candidates:

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

1A. Write the expressions for the following:
(i) Yager compliment (ii) Dubois-Prade S-norm **(02)**

1B. Sketch the membership functions described and mark the constants used by the following expressions:

(i) $\mu(A) = e^{-\frac{1}{2}*\left(\frac{x-c}{\sigma}\right)^2}$

(ii) $$\mu(B) = \begin{cases} 0 & x \le a \\ \dfrac{x-a}{b-a} & a \le x \le b \\ 1 & b \le x \le c \\ \dfrac{d-x}{d-c} & c \le x \le d \\ 0 & x \ge d \end{cases}$$ **(04)**

1C. An FIS has a rule "IF Flux is large THEN speed is low". Consider fuzzy sets "large" and "NOT large" defined in Flux:{x1, x2, x3} and "low" defined in speed:{y1, y2} as shown below:

$$\text{large} = \left\{\frac{0.5}{x_1} + \frac{1}{x_2} + \frac{0.6}{x_3}\right\}; \quad \text{low} = \left\{\frac{1}{y_1} + \frac{0.4}{y_2}\right\}; \quad \text{NOT large} = \left\{\frac{0.6}{x_1} + \frac{0.9}{x_2} + \frac{0.7}{x_3}\right\};$$

Determine the fuzzy set "NOT low" using
(i) Zadeh implication and
(ii) Dienes-Rescher implication. **(04)**

2A. 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 $= [1 \quad -0.5]^T$ and $O = [0.28 \quad -0.73]^T$. Biasing input = -1. The activation function is bipolar continuous with λ = 1.25. Determine the input matrix X and sketch the neural network. **(04)**

2B. Consider the fuzzy sets

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

(02)

2C. The membership function of a fuzzy set Y is defined as follows in a universe of discourse U:[0:4]

$$\mu(y)=\begin{cases} 0.25*y^2 & 0\le y \le 2 \\ 1 & 2\le y \le 3 \\ 4-y & 3\le y \le 4 \end{cases}$$

Sketch the membership function and determine the crisp value Y* using centroid defuzzification method. **(04)**

3. A 20 MVA alternator delivers 1.0 pu power to an infinite bus over a double circuit transmission line. The inertia constant M = 2.8 x 10^{-4} sec^2 /electrical degree. When a symmetrical fault occurs on one of the transmission line the power output is given by 0.88*Sin δ. A braking resistor is used to improve transient stability. A fuzzy inference system is to be designed to determine the power dissipated P_R in the braking resistor with inputs as rotor speed (dδ/dt) and accelerating power (P_a) Given the initial conditions of power angle $\delta_0 = 21.64^0$ and (dδ/dt) = 75^0/sec at t = t_0, determine the braking resistance required in first swing. The required membership functions are shown in Fig. Q3. Use last of maximum defuzzification. **(10)**

4A. Design a bipolar discrete neural model such that the input pattern lies in the shaded region shown in Fig. Q4A. **(03)**

4B. 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 $f(x,y)= x^2 + x*y$ **(03)**

4C. The initial weight matrix of a neural network is $W^{(1)} = [1 \quad -1 \quad 0 \quad 0.5]^t$. The set of input training vectors and desired responses are given below:

$$X_1 = [1 \quad -2 \quad 0 \quad -1]^t; \quad X_2 = [0 \quad 1.5 \quad -0.5 \quad -1]^t; \ d_1 = -1; \quad d_2 = -1;$$

Assuming learning constant c = 0.4 and λ = 1 for bipolar sigmoidal activation function, determine the modified weights at the end of one cycle using delta learning rule. **(04)**

5A. A neural network has two neurons in its hidden layer with biasing synaptic weight of -0.5 for each neuron connected to a single input X. The output layer has five neurons with biasing synaptic weight of -1 for each neuron. The biasing signal for all neurons is -1. The activation function for hidden layer is unipolar sigmoidal while the output neurons have their activation function defined by f(net)=net. Hidden layer weights are Y = $[0.5 \quad 0.8]^t$. Output layer weights are

$$W=\begin{bmatrix} 1 & 0.7 & 0.5 & 0.6 & 0.91 \\ 0.5 & 1 & 1 & 0.9 & 1 \end{bmatrix}$$

Sketch the network described as above.

If the desired output O = $[6 \quad 7 \quad 8 \quad 9 \quad 10]^t$ for an input X = 4, determine the output error matrix. **(06)**

5B. Using genetic algorithm, find the maximum value of the given function $y = e^{-(x-3)^2}$ where $1 < x < 5$ using 5 bit binary string.
The initial population given are [1 0 0 0 1], [0 0 1 1 0], [1 0 1 0 0], [0 1 0 1 1]. **(04)**

6A. Design a neural network to perform the following classification:

Class A : x_1 =(0.5, 1), x_2 = (2, 1) and d_1 = -1

Class B : x_3 =(-1, 1), x_4 = (-2, 1) and d_2 = 1

The learning constant is 0.5 and initial weight vector is $[2, 1.5]^t$. Draw the locus of weight vector in W_1/W_2 plane. **(05)**

6B. It is required to store two patterns $S_1 = [1\ -1\ 1\ -1]^t$ and $S_2 = [-1\ 1\ -1\ 1]^t$ in an associative memory using Hopfield network. Obtain the suitable weight matrix. For asynchronous mode of bit transfer, draw the state transition diagram when the input for the network is $[1\ 1\ 1\ 1\ ]^t$. Calculate the energy level for the initial and final state in the transition diagram. **(05)**

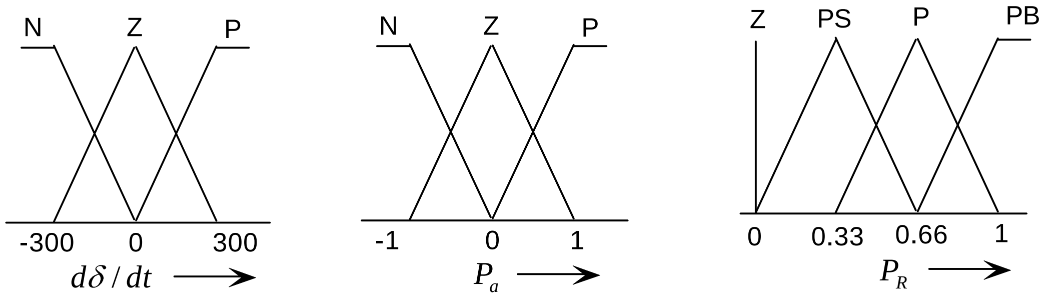

Fig. Q 3

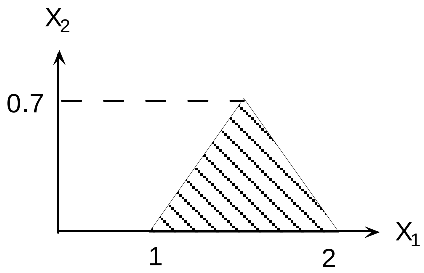

Fig. Q 4A