M.E. First Semester (Electronics & Tele.) (Full Time) (C.G.S.- New)

13337 : Elective-I : Artificial Intelligent System : 1 ENTC 5

AW - 3632

P. Pages : 2

Time : Three Hours

0751

Max. Marks : 80

Notes : 1. Assume suitable data wherever necessary.
2. Illustrate your answer necessary with the help of neat sketches.
3. Use of pen Blue/Black ink/refill only for writing the answer book.

1. a) List the various properties of fuzzy sets. Do the law of excluded middle & law of contradiction hold for fuzzy sets? Prove. **7**

   b) What is defuzzification? Explain different defuzzification methods. **7**

   OR

2. A fuzzy relation matrix $\underset{\sim}{R}$ is given **14**

   $$\underset{\sim}{R} = \begin{bmatrix} 1 & 0.8 & 0 & 0.1 & 0.2 \\ 0.8 & 1 & 0.4 & 0 & 0.9 \\ 0 & 0.4 & 1 & 0 & 0 \\ 0.1 & 0 & 0 & 1 & 0.5 \\ 0.2 & 0.9 & 0 & 0.5 & 1 \end{bmatrix}$$

   Justify that $\underset{\sim}{R}$ represents a tolerance relationship.

   Reform this tolerance relation into equivalence relation.

3. a) Explain canonical forms of a fuzzy rule based system. What do you understand by aggregation of fuzzy rules? Explain with example. **7**

   b) Explain different fuzzy ranking methods with suitable examples. **6**

   OR

4. a) In a temperature controller for room, the Linguistic comfort range is "slightly cold" and "not too hot" using these membership functions defined on the universe of temperature in °Celsius. **7**

   $$Hot = \left\{ \frac{0}{25} + \frac{0.1}{26} + \frac{0.3}{27} + \frac{0.5}{28} + \frac{0.7}{29} + \frac{0.9}{30} \right\}$$

   $$Cold = \left\{ \frac{0.2}{30} + \frac{0.3}{29} + \frac{0.4}{28} + \frac{0.7}{27} + \frac{0.8}{26} + \frac{1}{25} \right\}$$

   Find the membership functions for
   i) Not very hot   ii) Slightly cold or slightly hot

   b) Discuss graphical inference technique with appropriate example. **6**

5. a) Summarize in point form the design steps of a fuzzy logic controller (FLC). How is turning achieved in FLC. **6**

   b) A fuzzy relation matrix is given by : **7**

   $$M = \begin{bmatrix} 0.1 & 0.8 \\ 0.4 & 0.2 \end{bmatrix} \text{ on } x = \{1,2\} \, \& \\ y = \{1,2\}$$

   determine whether the system is stable, oscillating or unstable.

   OR

AW - 3632

1

P.T.O

6. Design a fuzzy PI controller for a series DC motor. Assume suitable data for the variables used. **13**

7. a) Consider the classification problem defined below : **6**

$$P_1 = \begin{bmatrix} -1 \\ 1 \end{bmatrix}; P_2 = \begin{bmatrix} 0 \\ 0 \end{bmatrix}; P_3 = \begin{bmatrix} 1 \\ -1 \end{bmatrix}; P_4 = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \& P_5 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

Given: $P_1, P_2 \& P_3$ in class I

$P_4 \& P_5$ in class II

Is this problem linearly separable?
If yes draw the single neuron perceptron to solve this problem.
If no, justify your answer.

b) Derive an expression for a generalized delta rule for a feed forward neural network with single hidden layer. **8**

OR

8. a) Discuss various activation functions used in neural networks. **8**

b) Differentiate between cumulative weight adjustment and incremental weight adjustment. **6**

9. Design a Hopfield network for storing following 4 bit bipolar patterns. **13**

$$S_1 = [1, -1, -1, -1]$$
$$S_2 = [-1, 1, 1, -1] \ \&$$
$$S_3 = [-1, -1, -1, 1]$$

Find energy associated with each sample. Use retrieval algorithm to determine association of the sample $[-1, 1, -1, -1]$.

OR

10. a) Discuss the Kohonen's self organization of feature map learning algorithm. **7**

b) Describe the architecture of BAM and discuss its training algorithm in detail. **6**

11. a) Explain the following steps in Genetic Algorithm. **6**
i) Cross over   ii) Mutation
iii) Reproduction

b) Explain how the robot manipulator with two – degree of freedom can be controlled using Artificial Neural Network. **7**

OR

12. a) Following two dimensional patterns for a 2 – class problem used to be classified using SVM. Determine hyperplane using suitable support vector. **6**

x_1	0	0	0.5	0.75	0.75	1.0
x_2	0	0.5	0	0.75	1	0.75
Class	+1	+1	+1	-1	-1	-1

b) Discuss various steps involved in designing a neural network for printed character recognition with suitable example. **7**

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AW - 3632   2