AQ–2797

Faculty of Engineering & Technology

M.E. (Digital Electronics) (Part Time/Full Time) Semester-II (C.G.S.-New) Examination

ARTIFICIAL INTELLIGENT SYSTEMS

Paper—2 UMEF 4

Time—Three Hours]   [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Assume suitable data wherever necessary.

(3) Illustrate your answers wherever necessary with the help of neat sketches.

(4) Use pen of Blue/Black ink/refill only for writing the answer book.

1. (a) Explain the following fuzzy relations :

    (i) Fuzzy tolerance relation

    (ii) Fuzzy equivalence relation.   6

   (b) What do you mean by Defuzzification ? Why it is required ? Explain different methods for defuzzification.   8

OR

2. We are interested in speed control of a DC shunt motor. Suppose the membership function for both series resistance $\tilde{R}_{se}$ and armature current $\tilde{I}_a$ are given in terms of percentages of their respective related values i.e. :

$$\mu_{\tilde{R}_{se}} = \frac{0.3}{30} + \frac{0.7}{60} + \frac{1}{100} + \frac{0.2}{120}$$

and $\mu_{\tilde{I}_a} = \frac{0.2}{20} + \frac{0.4}{40} + \frac{0.6}{60} + \frac{0.8}{80} + \frac{1.0}{100} + \frac{0.1}{120}$

and the membership value for $\underline{N}$ is given in units of motor speed in r.p.m.

$$\mu_{\tilde{N}} = [(0.33, 500), (0.67, 1000), (1.0, 1500), (0.15, 1800)]$$

Determine :

(i) Relation $\tilde{R}$ in Cartesian space $\tilde{R}_{sc} \times \tilde{I}_a$.

(ii) Relation $\tilde{S}$ in Cartesian space $\tilde{I}_a \times \tilde{N}$.

(iii) Find the max-min composition for a relation $\tilde{T} = \tilde{R} \circ \tilde{S}$. 14

3. (a) Explain the Canonical form of a fuzzy rule based system. What is aggregation of fuzzy rules ? Explain using suitable example. 6

   (b) The set of expensive cars is described by :

   $$\text{Expensive} = \left[\frac{1}{\text{Indica}} + \frac{0.8}{\text{Ford}} + \frac{0.6}{\text{Palio}} + \frac{0.5}{\text{Maruti}} + \frac{0.3}{\text{Fiat}} \right]$$

   and set of cheap car is described by :

   $$\text{Cheap} = \left[\frac{1}{\text{Fiat}} + \frac{0.8}{\text{Maruti}} + \frac{0.6}{\text{Palio}} + \frac{0.5}{\text{Ford}} + \frac{0.3}{\text{Indica}} \right].$$

   Calculate the membership function for the linguistic terms with hedges given below :

   (i) Very Expensive

   (ii) Y = Not very expensive and very very cheap. 7

OR

4. (a) Discuss the following techniques for formation of rules by inference :

   (i) Relational inference

   (ii) Proportional inference. 7

   (b) Prove that for two different identical fuzzy vectors the outer product is minimum and its inner product is maximum. 6

5. (a) Explain what is pattern recognition. Also differentiate between pattern recognition and pattern classification. 6

(b) Give the design steps of a fuzzy logic controller. State the major initial assumptions of a fuzzy control system design. 7

OR

6. (a) Discuss stability analysis of fuzzy control systems. 5

(b) What do you mean by Neuro fuzzy control ? List various properties of such controllers. Discuss inverse learning with suitable block diagram. 8

7. (a) Discuss various tuning parameters in error back propagation training algorithm [EBPTA]. 7

(b) What are the limitations of EBPTA ? 6

OR

8. (a) Design a single layer perceptron network for classifying the patterns of a two class problem, using minimum number of neurons :

Patterns		Class
x_1	x_2	
0	0	C_1
0.5	0	C_1
0	0.5	C_1
1.0	1.0	C_2
0.5	1.0	C_2
1.0	0.5	C_2

7

(b) Enlist the steps involved in single discrete perceptron algorithm. 6

9. (a) A 4-bit weight matrix for an autoassociative memory is :

$$W = \begin{bmatrix} 0 & 0 & -2 & 0 \\ 0 & 0 & 0 & -2 \\ -2 & 0 & 0 & 0 \\ 0 & -2 & 0 & 0 \end{bmatrix}$$

Compute energy associated with the following three vectors :

$S_1 = [\ 1\quad 1\quad -1\quad -1\ ]^t$

$S_2 = [\ 1\quad -1\quad 1\quad 1\ ]^t$

$S_3 = [\ 1\quad -1\quad -1\quad -1\ ]^t$ 　　　　　　　7

  (b) Explain the retrieval algorithm of a discrete Hopfield Network.　　　7

OR

10. (a) Discuss the three essential processes involved in the formation of self organizing Map.

　　　　　　　　　　　　　　　　　　　　　　　　　　　7

  (b) Explain architecture of a Bidirectional associative memory.　　　7

11. (a) Draw the architecture of a Support Vector Machine. How does the implementation of SVM differs from the multilayer perceptron ?　　　7

  (b) Explain how SVM can be used for classification.　　　6

OR

12. Design a multilayer network for hand written digit (0—9) recognition. Each digit is represented by a 16 × 16 pixel image.　　　13