



(3 HOURS)

Total Marks: 80

N.B. (1) Question No 1 is compulsory

(2) Attempt any **three** Questions out of the remaining five questions

- Q1 (a) What are the differences between Hard computing and Soft Computing 5  
 (b) How do you distinguish linearly separable for linearly non-separable patterns? 5  
 (c) Define Extension principle with an example 5  
 (d) What are the various Selection types used in Genetic Algorithms. Explain Roulette Wheel with an appropriate example 5
- Q2 (a) Compare the learning rules used for supervised and unsupervised and specify how the weight adjustments are done in each case 10  
 (b) Use perceptron learning rule for computing weights after **one** iteration for the data given below 10  
 $X_1=[1 \ 2 \ 0 \ -1]^T$ ;  $X_2=[0 \ 1.5 \ -0.5 \ -1]^T$ ;  $X_3=[-1 \ 1 \ 0.5 \ -1]^T$ . Initial weight  $W^1=[1 \ -1 \ 0 \ 0.5]$ . The learning constant is given by  $c=0.1$ .  
 The teacher's desired responses for  $X_1, X_2, X_3$  are  $[-1, -1, 1]$  respectively.
- Q3 (a) Design a fuzzy controller for controlling the amount of detergent required in a washing machine. The inputs are dirt and grease on clothes and the output is amount of detergent required. Use 3 descriptors for inputs and outputs respectively. Prove that clothes which have less dirt and grease requires less detergent and vice versa. Draw figures wherever required. 20
- Q4 (a) An engineer is testing the properties, strength and weight of steel. Suppose he has two fuzzy sets, A defined on universe of discourse  $\{s_1, s_2, s_3\}$  and B defined on a universe of discourse  $\{w_1, w_2, w_3\}$ . The membership of A and B are given by  $\mu_A=\{(s_1, 1), (s_2, 0.5), (s_3, 0.2)\}$  and  $\mu_B=\{(w_1, 1), (w_2, 0.5), (w_3, 0.3)\}$   
 a. Find the Cartesian product of A and B i.e  $R=A \times B$   
 b. Suppose  $C=\{(s_1, 0.1), (s_2, 0.6), (s_3, 1)\}$ . Find  $S=C \times B$   
 c. Find  $C \circ R$  using Max-min composition  
 d. Find  $C \bullet R$  using max-product composition
- (b) How Learning Vector Quantization helps in classifying data samples? Write the algorithm of LVQ? 10
- Q5 (a) With a neat diagram explain the architecture of ANFIS? 8  
 (b) Explain Steepest Descent Algorithm with a suitable example 8  
 (c) State the differences between derivative based and derivative free optimization 4
- Q6 Write short notes on any **two**:-  
 (a) Block Diagram of Error Back Propagation Training Algorithm(EBPTA) 10  
 (b) Different membership functions of fuzzy logic 10  
 (c) Major components of Genetic Algorithm 10