

(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 bellow 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