

(3 Hours)

[Total Marks : 80

- N.B. :** (1) Question no. 1 is compulsory
 (2) Solve any three from the remaining five questions
 (3) Assume suitable data if necessary.
 (4) **Figures to the right indicate full marks.**

1. Attempt **any four** from the following questions 20
- (a) Draw a simple artificial neuron and discuss the calculation of the output. State any two characteristics of an artificial neural network.
- (b) Indicate the differences between excitatory and inhibitory weighted interconnections.
- (c) Compare and contrast BAM and Hopfield networks.
- (d) Explain fuzzification and defuzzification process.
- (e) Explain the difference between supervised and unsupervised learning.
2. (a) Draw the model of Adaline network. Explain the training algorithm used here. 10
- (b) What are linearly separable and nonseparable pattern classes? Discuss how perceptrons can be used to classify each of them. 10
3. (a) What are the two types of discrete Hopfield nets? Draw the architecture of discrete Hopfield net. State the testing algorithm used in discrete Hopfield Network. 10
- (b) Draw a simple neural network with a single neuron, four input points and one output point. Apply Hebbian rule to this network with binary activation function and obtain the updated weight vector. The initial weight vector is $W^1 = [1 \ -1 \ 0 \ 0.5]^t$ and the training set consists of three inputs, $X_1 = [1 \ -2 \ 1.5 \ 0]^t$; $X_2 = [1 \ -0.5 \ -2 \ -1.5]^t$; $X_3 = [0 \ 1 \ -1 \ 1.5]^t$. Assume learning constant as 1. 10
4. (a) What are LVQs? Explain LVQ1 algorithm in detail. 10
- (b) With a neat architecture, explain the training algorithm of Kohonen self-organizing feature maps. 10
5. (a) Three fuzzy sets are defined as: 10

$$\tilde{A} = \left\{ \frac{0.1}{30} + \frac{0.2}{60} + \frac{0.3}{90} + \frac{0.4}{120} \right\}$$

[TURN OVER]

$$\tilde{B} = \left\{ \frac{1}{1} + \frac{0.2}{2} + \frac{0.5}{3} + \frac{0.7}{4} + \frac{0.3}{5} + \frac{0}{6} \right\}$$

$$\tilde{C} = \left\{ \frac{0.33}{100} + \frac{0.65}{200} + \frac{0.92}{300} + \frac{0.21}{400} \right\}$$

Find the following:

- (a) $\tilde{R} = \tilde{A} \times \tilde{B}$
- (b) $\tilde{S} = \tilde{B} \times \tilde{C}$
- (c) $\tilde{T} = \tilde{R} \circ \tilde{S}$ using max-min composition
- (d) $\tilde{T} = \tilde{R} \circ \tilde{S}$ using max-product composition

(b) Explain any four defuzzification methods with suitable diagrams. 10

6. Write short notes on any four: 20

- (a) Types of activation functions
- (b) Properties of neural networks
- (c) Boltzmann Machine
- (d) Rate of learning
- (e) ANFIS