(3 Hours) **Total Marks: 80**

N.B.: 1) Questions No. 1 is compulsory.
2) Solve any three questions out of remaining
3) Draw neat labelled diagram whenever necessary.
4) Assume suitable date if necessary.

Q.1 Solve **any four.**

(a) Describe activation function used in RBF neural network and it's properties. (5)

(b) What is λ cut set? Explain with an example. (5)

(c) Draw and explain working of AND and OR function using single neuron. (5)

(d) Prove De Morgan's Theorems for following fuzzy sets. (5)

$$A=\{\frac{0}{0}+\frac{0.5}{20}+\frac{0.65}{40}+\frac{0.85}{60}\}$$

$$B=\{\frac{0}{0}+\frac{0.45}{20}+\frac{0.6}{40}+\frac{0.8}{60}\}$$

(e) With mathematical list four different activation functions used in neurons. (5)

Q.2(a) Explain Error Back Propagation learning algorithm for the training of perceptron network. (10)

(b) Three fuzzy sets are defined as follows: (10)

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

$$B=\{\frac{1}{1}+\frac{0.2}{2}+\frac{0.5}{3}+\frac{0.7}{4}\}$$

$$c=\{\frac{0.33}{100}+\frac{0.67}{200}+\frac{0.92}{300}+\frac{0.21}{400}\}$$

Find the following:
(i) R=AXB (ii) S=B X C (iii) T =R o S (by max-min composition)
(iv) T=R o S (by max product composition)

Q.3(a) Explain ADALINE training algorithm with flow chart. (10)

(b) Explain with diagram any four fuzzy membership functions with diagrams and examples. (10)

Q.4(a) Explain in details discrete Hopfield network with training and testing algorithm. (10)

(b) Find the weights required to perform the following classifications using perceptron network. The vectors (1 1 -1 -1); (1 -1 1 -1) are members of one class (target =1). Vectors (-1 -1 -1 1) and (-1 -1 1 1) are not members of the class (target = -1). Assuming learning rate = 1 and initial weights=0. (Max Epochs=2). Assume threshold =0. (10)

Q.5(a) Describe with neat diagram the radial basis function neural network for function approximation. (10)

(b) Explain the application of fuzzy logic in image filtering. (10)

Q.6(a) Design a fuzzy controller for deciding the washing cycle duration. Inputs are washing load and dirt. Justify the design for the washing time duration for high dirt and high load. (10)

(b) Describe the application of neural network for dot matrix character recognition. (10)
