

(3 Hours)

Total Marks: 80

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

Q1 Answer **any four** questions

- a. How do you define core, boundary and support of a fuzzy set **05**  
 b. With neat diagram and necessary equations, List the different types activation functions. **05**  
 c. What do you mean by K-Means algorithm? Where is it used? **05**  
 d. If A and B are two fuzzy sets with membership functions:  $\mu_a(x) = \{0.5, 0.2, 0.1, 0.7\}$   
 $\mu_b(x) = \{0.8, 0.3, 0.4, 0.1\}$ , prove De Morgan's theorem. **05**  
 e. An image of size 32 x 32 is applied to CNN architecture. Using a kernel of size 5 x 5 and with a stride of 2, find out the size of output image after first CNN layer without padding. If this layer is followed with max pooling kernel of size 2 x 2 with stride 2, what is the resultant image size? **05**

- Q2 a. With neat flowchart, explain the training steps and testing steps for Perceptron. **10**  
 b. Briefly discuss the architecture of CNN. **10**

- Q3 a. Construct a Kohonen Self Organizing map to cluster given vectors [0 0 1 1], [1 0 0 0] and [1 1 0 1]. The number of clusters to be formed is 2. Consider the learning rate as 0.25. The weight matrix is given by **10**

$$w_{ij} = \begin{bmatrix} 0.1 & 0.3 \\ 0.6 & 0.9 \\ 0.8 & 0.7 \\ 0.2 & 0.5 \end{bmatrix}$$

- b. Implement OR gate using MP Neuron. **10**

- Q4 a. Construct a discrete Hopfield network to store the patterns [1 1 -1 1], [-1 -1 1 -1] [1 -1 -1 -1], [1 1 1 1]. Calculate the energy of the stored patterns. **10**  
 b. Draw the architecture of Biological Neuron. Compare Artificial Neuron with Biological Neuron. **10**

- Q5 a. What are the different types of membership functions? Discuss with diagram. Give their practical applications in fuzzy systems. **10**  
 b. Discuss the Support Vector algorithm in detail **10**

- Q6 a. What is defuzzification? What are the various methods of defuzzification? **10**  
 b. Design a fuzzy controller to decide the speed of a train approaching a station. **10**