

Total Marks: 80

(3 Hours)

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 4 questions from the given questions: 5x4
- Describe fuzzy inference system with neat block diagram.
 - What is the role of Dendrites, Soma and Axon of biological neuron that led to the concept of artificial neuron? Brief with a diagram.
 - Discuss how momentum factor accelerates training of perceptron neural network.
 - Explain memorization issue in neural networks. How to avoid memorization and get generalization?
 - What is λ -cut set? Brief with an example

- Q2.a. If one of the weights is removed from Multilayer Perceptron Neural Network (MLP NN) the functionality of the network is highly affected whereas Radial Basis Function Neural Network (RBF NN) functionality is not significantly affected. Justify. Also, discuss how pattern separation in RBF NN happens by placing hyper-ellipsoids and hyper-sphere whereas in MLP NN it happens due to hyper-planes. 8

- b. What are the merits of fuzzy controllers over conventional controllers? 4

- c. i) Using max-min composition find relation between R and S 8

$$R = \begin{matrix} & y1 & y2 & y3 \\ \begin{matrix} x1 \\ x2 \\ x3 \end{matrix} & \begin{bmatrix} 1 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix} \end{matrix}$$

$$S = \begin{matrix} & z1 & z2 \\ \begin{matrix} x1 \\ x2 \\ x3 \end{matrix} & \begin{bmatrix} 0 & 1 \\ 1 & 0 \\ 1 & 1 \end{bmatrix} \end{matrix}$$

ii) Consider the following fuzzy sets

$$A = \left\{ \frac{0.8}{10} + \frac{0.3}{15} + \frac{0.6}{20} + \frac{0.2}{25} \right\}$$

$$B = \left\{ \frac{0.4}{10} + \frac{0.2}{15} + \frac{0.9}{20} + \frac{0.1}{25} \right\}$$

Calculate the Demorgan's law

$$\overline{A \cup B} = \bar{A} \cap \bar{B} \text{ and } \overline{A \cap B} = \bar{A} \cup \bar{B}$$

- Q3.a. Describe any two methods for feature extraction of handwritten characters. Also, explain handwritten characters classification using supervised neural network? 10
- b. Describe the application of fuzzy logic for following image processing operations: 10
- Image Contrast Enhancement
 - Image Smoothing
- Q4.a Explain pattern recovery using discrete Hopfield network. 10
- b. Explain Kohonen self-organizing network for pattern clustering. Also, explain its learning algorithm. 10
- Q5.a Explain the purpose of de-fuzzification process? Discuss any three techniques for de-fuzzification. 10
- b. Explain with neat diagram the radial basis function neural network for function approximation. 10
- Q6.a. Describe with architecture Learning Vector Quantization (LVQ) network with suitable diagram and the flow chart for pattern classification. 10
- b. What is the role of a) weights b) bias c) activation function d) training data set and e) validation data sets in the context of neural networks 10
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