

Code No. N0221**R07****Set No. 1**

IV B.Tech I Semester Supplementary Examinations, February/March, 2012
NEURAL NETWORKS AND FUZZY LOGIC
(Common to Electrical & Electronics Engineering, Instrumentation & Control Engineering
and Aeronautical Engineering)

Time: 3 hours**Max. Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. a) Describe in detail about biological and artificial neuron models.
b) Compare different neuron models and summarize them. [8+8]
2. a) Elucidate in detail about the different architectural styles of artificial neural networks
b) Explain about Activation and synaptic neural dynamics in detail. [8+8]
3. a) Discuss about discrete and continuous perceptron models.
b) Give a detailed notes on single layer feed forward neural networks. [8+8]
4. a) What is the significance of generalized delta rule? Explain in detail.
b) What is back propagation? Derive its learning algorithm with a schematic two layer feed forward neural network. [8+8]
5. a) Discuss different paradigms of associative memory.
b) Explain how linear associator networks could not suppress cross terms due to noise. [8+8]

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6. a) $X = \{x_1, x_2, x_3\}$ $Y = \{y_1, y_2\}$ $Z = \{z_1, z_2, z_3\}$ Let \tilde{R} be a fuzzy relation

$$\begin{bmatrix} 0.5 & 0.1 \\ 0.2 & 0.9 \\ 0.8 & 0.6 \end{bmatrix}$$

where X represents rows, Y represents columns. Let \tilde{S} be the fuzzy relation

$$\begin{bmatrix} 0.6 & 0.4 & 0.7 \\ 0.5 & 0.8 & 0.9 \end{bmatrix}$$

where Y represents rows, Z represents columns. Find $\mathbf{R} \circ \mathbf{S}$ by max-min composition.

b) Write the mathematical expression of the membership function and sketch of the membership function.

[8+8]

7. a) Given

(i) $C \vee D$

(ii) $\neg H \Rightarrow (A \wedge \neg B)$

(iii) $(C \vee D) \Rightarrow \neg H$

(iv) $(A \wedge \neg B) \Rightarrow (R \vee S)$

(v) Can $(R \vee S)$ be inferred from the above?

b) If an item has partial membership in several sets, would all membership values add up to unity?

[8+8]

8. Explain the application of ANNs for the following

a) Load forecasting

b) Process identification

[8+8]

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1. a) Describe in detail about the organization of human brain.
b) Explain about the following neuron models
i) Mc-Culloch Pitts model ii) Spiking neuron model [8+8]
2. a) Explain about the taxonomy of artificial neural networks.
b) Describe about the operations of artificial neuron in detail. [8+8]
3. a) State perceptron convergence theorem in detail.
b) Give in detail applications of feed forward single layer neural network. [8+8]
4. a) Derive and explain back propagation training algorithm.
b) Explain the modifications suggested to back propagation network. [8+8]
5. a) Explain about linear associator and matrix memories in detail.
b) Explain in detail about architectures of discrete and continuous versions of Hopfield networks. [8+8]
6. a) Explain in detail about membership functions in fuzzy logic with an example.
b) The task is to recognize English alphabetical characters (F,E,X,Y,I,T) in an image processing system. Define two fuzzy sets \tilde{I} and \tilde{F} to represent the identification of characters I and F.
$$\tilde{I} = \{(F,0.4),(E,0.3),(X,0.1),(Y,0.1),(I,0.9),(T,0.8)\}$$
$$\tilde{F} = \{(F,0.99),(E,0.8),(X,0.1),(Y,0.2),(I,0.5),(T,0.5)\}$$
Find the following.
(i) $\tilde{I} \cup \tilde{F}$ (ii) $(\tilde{I} - \tilde{F})$ (iii) $\tilde{F} \cup \tilde{F}^c$ [8+8]
7. a) What is meant by defuzzification? Discuss few widely used methods of defuzzification.
b) Discuss about fuzzy rule base for the air conditioner control in detail. [8+8]
8. a) Briefly discuss about the applications of neural networks.
b) Explain briefly about the process identification with reference to the feed forward and plant inverse identification. [8+8]

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R07**Set No. 3**

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1. a) Discuss in detail about Spiking neuron model.
b) Explain in detail about the organization of human brain. [8+8]
2. a) Explain different learning strategies of artificial neural networks.
b) Give classification of some NN systems with respect to learning methods and architectural styles. [8+8]
3. a) Discuss in detail about Rosenblatt perceptron model. Explain about linearly separable and nonlinearly separable patterns.
b) Discuss in detail about limitations of perceptron model. [8+8]
4. a) Give and explain about the architecture and algorithm of back propagation network.
b) Which criteria is followed to decide the number of neurons in back propagation network [8+8]
5. a) Explain in detail about the energy analysis of discrete Hopfield networks.
b) Describe in detail about bidirectional associative memory architecture with a block diagram. [8+8]
6. a) The task is to recognize English alphabetical characters (F,E,X,Y,I,T) in an image processing system. Define two fuzzy sets \tilde{I} and \tilde{F} to represent the identification of characters I and F.

$$\tilde{I} = \{(F,0.4),(E,0.3),(X,0.1),(Y,0.1),(I,0.9),(T,0.8)\}$$

$$\tilde{F} = \{(F,0.99),(E,0.8),(X,0.1),(Y,0.2),(I,0.5),(T,0.5)\}$$
 Find the Verify De-Morgan's Law, $(\tilde{I} \cup \tilde{F})^c = \tilde{I}^c \cap \tilde{F}^c$
 b) Describe in detail about the cardinalities and relative cardinalities in fuzzy sets. [8+8]
7. a) Describe in detail about fuzzy logic system components.
b) Discuss in detail about the maxima method with an example. [8+8]
8. a) Mention the applications of fuzzy logic in ovens.
b) Design and develop a pressure process control by FLC model. Formulate necessary Membership functions and required fuzzy rules for the application. [8+8]

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1. a) Describe in detail about the characteristics of artificial neural networks.
b) Explain in detail about Hodgkin-Huxley neuron model. [8+8]
2. a) What is the significance of activation function in learning of artificial neural networks and discuss different types of activation functions .
b) Briefly explain about recurrent networks and give its architectural diagram. [8+8]
3. a) Give an algorithm for fixed increment perceptron learning algorithm for a classification problem with n input features (x_1, x_2, \dots, x_n) and two output classes (0/1).
b) Discuss in detail about training algorithms of continuous perceptron networks. [8+8]
4. a) Give suggestions to improve and modify back propagation network.
b) Prove that for $n=2$, the number of hidden layer neurons j needed for hyper plane partition into M regions is $j = 1/2 [(8M-7)^{1/2} - 1]$ [8+8]
5. a) Give the architecture of Hopfield network for discrete and continuous versions.
b) Discuss in detail about hebbian learning and give equations for training the hebbian network. [8+8]

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6. a) Discuss in detail about basic fuzzy set operations. Find the Concentration (CON) and Dilation (DIL) of the following:

$$\tilde{A} = \{(x_1, 0.4), (x_2, 0.2), (x_3, 0.7)\} \text{ and } \alpha = 2$$

- b) Consider a set $P = \{P_1, P_2, P_3, P_4\}$ of four variables of paddy plants, set $D = \{D_1, D_2, D_3, D_4\}$ of various diseases affecting the plants and $S = \{S_1, S_2, S_3, S_4\}$ be the common symptom of diseases. Let \tilde{R} be the relation on $P \times D$ and \tilde{S} be the relation on $D \times S$.

$$\tilde{R} = \begin{bmatrix} 0.6 & 0.6 & 0.9 & 0.8 \\ 0.1 & 0.2 & 0.9 & 0.8 \\ 0.9 & 0.3 & 0.4 & 0.8 \\ 0.9 & 0.8 & 0.1 & 0.2 \end{bmatrix} \quad \text{and} \quad \tilde{S} = \begin{bmatrix} 0.1 & 0.2 & 0.7 & 0.9 \\ 1 & 1 & 0.4 & 0.6 \\ 0 & 0 & 0.5 & 0.9 \\ 0.9 & 1 & 0.8 & 0.2 \end{bmatrix}$$

Obtain the association of plants with the different symptoms of the diseases using max-min composition.

[8+8]

7. a) Choose three fuzzy sets and illustrate the aggregation of the fuzzy sets.

- b) Given (i) Every soldier is strong-willed.

(ii) All who are strong-willed and sincere will succeed in their career.

(iii) Indira is a soldier.

(iv) Indira is sincere.

Prove whether Indira will succeed in her career or not?

[8+8]

8. Describe in detail about process identification and control in neural network applications.

[16]