

Code No: N0221

**R07**

**Set No. 1**

**IV B.Tech I Semester Supplementary Examinations, March 2013**  
**NEURAL NETWORKS AND FUZZY LOGIC**  
**(Common to Electrical & Electronics Engineering and Aeronautical Engineering)**

**Time : 3 hours**

**Max. Marks :80**

**Answer any Five Questions**  
**All Questions carry equal marks**

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1. a) Briefly describe how the Hodgkin-Huxley Neuron model is deduced?  
b) What are the artificial neural networks? Where they are implemented? [8+8]
2. a) Briefly describe about neural dynamics and explain Synaptic dynamics of neural network?  
b) Explain the three classifications of ANNs based on their functions. Explain them in brief? [8+8]
3. a) Draw the single layer network with continuous perceptron and explain its training algorithm?  
b) State and explain the limitations of single layer perceptron? [8+8]
4. a) Explain how the initial weights and learning rate parameter is selected in Back propagation algorithm.  
b) Explain how momentum method improves the training time of the Back propagation algorithm. [8+8]
5. a) Explain how weights are computed in Bidirectional Associative memory. Also show how associations are stored and retrieved  
b) Explain how Bidirectional memory can be used as hetero associative memory? [10+6]

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6. a) Consider fuzzy sets
- $\tilde{A}$
- and
- $\tilde{B}$

$$\tilde{A} = \left\{ \frac{0}{5} + \frac{0.1}{30} + \frac{0.3}{50} + \frac{0.8}{100} + \frac{1.0}{300} \right\}$$

$$\tilde{B} = \left\{ \frac{0.7}{2} + \frac{0.8}{4} + \frac{0.2}{8} + \frac{0.1}{10} + \frac{0.7}{1.2} \right\}$$

Find fuzzy relation using Cartesian product between  $\tilde{A}$  and  $\tilde{B}$ ,

- b) Another Fuzzy set
- $\tilde{C}$
- is defined as

$$\tilde{C} = \left\{ \frac{1.0}{5} + \frac{0.8}{30} + \frac{0.1}{50} + \frac{0.2}{100} + \frac{0}{300} \right\}$$

Find the relation between  $\tilde{C}$  and the relation determined in the part (a) using max-min composition and max-product composition [4+12]

7. a) Using your own intuition and your own definitions of the universe of discourse, plot fuzzy membership functions with necessary assignment for the following variables: Weight of people

- i) Very light.
- ii) Light.
- iii) Average.
- iv) Heavy.
- v) Very heavy.

- b) Write the components of a fuzzy logic system and explain them in brief? [8+8]

8. a) Explain the role of neural networks in the load forecasting problem?

- b) Explain the fuzzy logic controller design for dc motor speed control? [8+8]

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1. a) Briefly describe biological and artificial abstractions of neuron model?  
b) Explain about the humans & computer? List out the potential applications of ANN? [6+10]
2. a) Explain in detail how weights are adjusted in Supervised and Unsupervised Learning?  
b) List and explain various activation functions. Also explain their suitability with respect to application? [8+8]
3. a) What is perceptron? Write the differences between Single layer perceptron and Multilayer Perceptron.  
b) Explain Why XOR problem cannot be solved by a single layer perceptron? [8+8]
4. a) Derive the weight update equations of hidden layer and output layer of the B.P. algorithm?  
b) Explain the relevance of the learning rate parameter in B.P. algorithm. How it will affect the learning process? [8+8]
5. a) What is meant by associative memory and hence explain Auto associative and Hetero Associative memories.  
b) Briefly explain storage and recall algorithms of Bidirectional Associative memory? [8+8]

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6. a) Define membership function? Briefly Describe about Symmetric triangle, Trapezoidal and Gaussian membership functions

b) Find the relation between two fuzzy sets  $\widetilde{R}_1$  and  $\widetilde{R}_2$  using Max-min composition

$$\widetilde{R}_1 = \begin{matrix} x_1 \\ x_2 \end{matrix} \begin{bmatrix} y_1 & y_2 & y_3 & y_4 \\ 0.3 & 0.1 & 0.6 & 0.3 \\ 0.1 & 1 & 0.2 & 0.1 \end{bmatrix} \quad \widetilde{R}_2 = \begin{matrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{matrix} \begin{bmatrix} y_1 & y_2 & y_3 \\ 0.9 & 0.1 & 1 \\ 0.1 & 0.5 & 0.4 \\ 0.6 & 0.8 & 0.5 \\ 0.1 & 0 & 0 \end{bmatrix} \quad [8+8]$$

7. Write short notes on aggregation of fuzzy rules and explain about determination of aggregation strategy? [16]

8. a) Discuss how the neural networks are used in process identification application?

b) Describe how fuzzy logic can be used in load frequency control? [8+8]

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1. a) Explain the terms cell body, axon, synapse, dendrite and neuron with reference to Biological neural Network?  
b) Draw the model of McCulloch Pitts neuron and state its characteristics. [10+6]
2. Explain:
  - a) Windrow-Hoff learning rule
  - b) Delta learning rule
  - c) Winner-take-all algorithm
  - d) Memory based learning rule [16]
3. a) Draw the architecture of a single layer perceptron and explain its operation.  
b) What is linear separability? Why can't the single layer perceptron implement an X-OR gate? Explain. [8+8]
4. Draw the architecture of Back Propagation Network (BPN) and explain in detail with its algorithm? [16]
5. a) Why the layers in the Bidirectional Associative Memory are called x and y layers? Explain  
b) Explain the stability condition in a Hopfield network? [8+8]

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6. a) Write the properties of fuzzy set theory and explain?  
b) Let  $A = \{(x_1, 0.3), (x_2, 0.6), (x_3, 0.4)\}$  and  $B = \{(y_1, 0.2), (y_2, 0.4)\}$  be two fuzzy sets defined on the universe of discourse  $X = \{x_1, x_2, x_3\}$  and  $Y = \{y_1, y_2\}$  respectively. Find Cartesian product of the A and B and find the fuzzy relation R. [8+8]
7. a) Explain in detail decision making system in the Fuzzy logic control?  
b) Briefly describe about different de-fuzzification methods? [8+8]
8. Design and develop a pressure process control by Fuzzy Logic Control model. Formulate necessary membership functions and required fuzzy rules for the application. [16]

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1. a) What are the biological aspects that lead to the development of Artificial Neural Networks?  
b) Write the advantages and disadvantages of Artificial Neural Networks? [6+10]
2. a) Explain Delta and Hebbian learning rules?  
b) Explain the three classifications of ANNs based on their functions. Explain them in brief? [8+8]
3. a) Explain discrete Perceptron Learning Law with its algorithm?  
b) Write the step by step procedure for discrete perceptron training algorithm? [8+8]
4. a) Derive the weight update equations of hidden layer and output layer of the B.P. algorithm?  
b) Explain what are the learning difficulties in Back propagation algorithm? How they can be overcome? [8+8]
5. What is the Hopfield neural network? Explain differences between discrete and Continuous Hopfield models and hence explain its stability? [16]
6. a) What are the different linguistic hedges and how linguistic hedges have the effect of modifying the membership function on basic atomic term  $\alpha$  ?  
b) Fuzzy sets  $\tilde{A}$ ,  $\tilde{B}$  and  $\tilde{C}$  are defined in the interval  $x = [0, 10]$  of real numbers by membership functions  
 $\mu_A(x) = x/(x + 2)$ ,  $\mu_B(x) = 2^{-x}$  and  $\mu_C(x) = 1 / (1 + 10(x - 2)^2)$   
Determine  $\tilde{A}$  Union  $\tilde{B}$ ,  $\tilde{B}$  Union  $\tilde{C}$  and  $\tilde{B}$  intersection  $\tilde{C}$  [8+8]

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7. With a neat block diagram, explain the FLC system and discuss the steps involved in designing the FLC? [16]
8. a) Explain how neural networks are used in the power system fault diagnosis application?  
b) Explain the fuzzy logic controller design for dc motor speed control? [8+8]

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