

**Indian Institute of Engineering Science and Technology, Shibpur**  
**ME (EE) 2nd Semester Examination 2014**

**Subject: Neural Networks and Systems**

**Paper / Code No:** EE – 1024

**Time:** 3 Hours

**Branch:** Electrical Engineering

**Full Marks:** 70

*Answer any THREE questions from Group-A and any TWO questions from Group-B*

**Group – A**

1. (a) Explain the difference between **artificial intelligence** and **neural network**.

(b) With suitable diagrams explain the model of artificial neuron and the important activation function used in ANN.

(c) Which of the following statements is the best description of “**overfitting**”?

- i) *The network can predict the correct outputs for test examples which lie outside the range of the training examples.*
- ii) *The network becomes “specialized” and learns the training set too well.*
- iii) *The network does not contain enough adjustable parameters to find a good approximation to the unknown function which generated the training data.*
- iv) *None of the above answers.*

[ 4 + 8 + 2 ]

2(a) What is back-propagation?

(b) Derive the weight update algorithm with a schematic two layer feedforward network.

(c) Why convergence is not guaranteed for back propagation learning algorithm?

[ 4 + 6 + 4 ]

3.(a) What is the difference between ‘**learning**’ and ‘**training**’ ?

(b) Explain how you solve **XOR** problem using radial basis function (RBF) network?

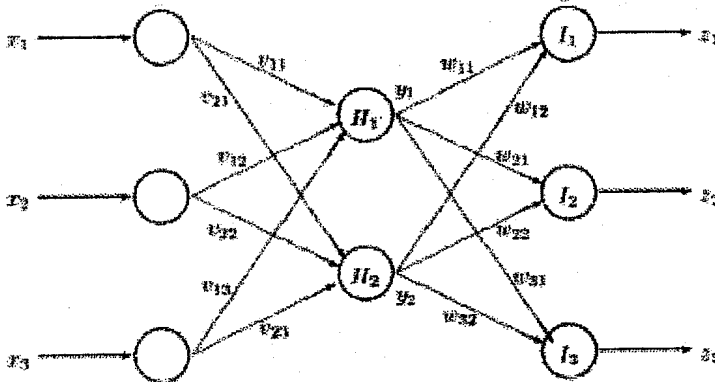
(c) Explain the fault tolerance in ANN.

[4 + 6 + 4]

4. (a) Write in details about advantages and disadvantages of ANN.

(c) Consider the following feed-forward network with one hidden layer of units. Assume that all the units have zero bias and sigmoid transfer function given by

$$f(x) = \frac{1}{1 + \exp(-x)}$$



Given that :

$$v_1 = \begin{bmatrix} 0.4 \\ -0.6 \\ 1.9 \end{bmatrix}, \quad v_2 = \begin{bmatrix} -1.2 \\ 0.5 \\ -0.7 \end{bmatrix}, \quad w_1 = \begin{bmatrix} 1.0 \\ -3.5 \end{bmatrix}, \quad w_2 = \begin{bmatrix} 0.5 \\ -1.2 \end{bmatrix} \quad \text{and} \quad w_3 = \begin{bmatrix} 0.3 \\ 0.6 \end{bmatrix}$$

Compute the output  $Z_1, Z_2$  if the input vector  $x = [1 \ 0 \ 2]^T$ .

[(3 + 3) + (4 + 4)]

5. (a) What is Data mining? Explain its relevance in the field of ANN?

(b) Write short note on any data mining technique.

(c) Explain how GA can be fused with existing ANN model?

[(2+3) + 5 + 4]

### GROUP - B

7. a) What is competitive learning? How the connection weights can be modified in a competitive learning neural network during training? Describe two schemes for updating connection weights in a competitive learning network.

b) What is 'Self-organizing Map (SOM)'? Explain, how lateral competition among output layer neurons results in self organization.

[6+8]

8. a) Describe the role of '*neighbourhood function*' in Kohonen's SOM algorithm. Discuss, how the '*Gaussian type function*' can produce '*ON centre*' and '*OFF surround*' type excitation among the neurons in the Kohonen layer?

b) What do you understand by 'pattern classification'? Develop a flow chart showing the steps to be followed to classify the English alphabets into 26 distinct classes using Kohonen's Self-organizing Map (SOM).

[6+8]

9. a) What is 'objective function' and 'constraint' in an optimization problem? Describe how ANN can be used to solve a non-linear optimization problem like 'Travelling Salesman Problem (TSP)'.

b) What is *Financial Forecasting*? Describe the step by step procedure to be followed to develop an ANN based model for forecasting the future trends in the '*National Stock Index*'.

[6+8]