Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech (EE)/SEM-1/CAM-104A/2011-12

2011
SOFT COMPUTING TECHNIQUES

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* questions of the following

1. a) Briefly discuss the advantages and disadvantages of Artificial Neural Networks.

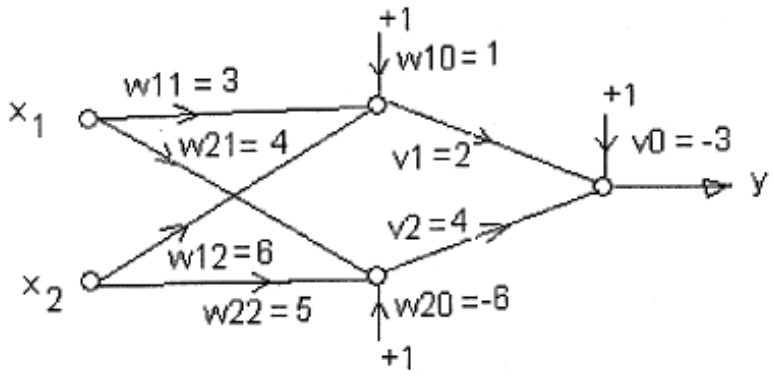
   b) Explain the Steepest Descent method for unconstrained optimization of a nonlinear objective function. What are its major drawbacks ?

   c) What is the main limitation of a Perceptron network ? How can it be overcome ? 5 + 7 + 2

2. a) Show the computations for one epoch of training when an ADALINE is trained to learn the Boolean OR function. Assume the initial weights and bias to be $w1 = 0{\cdot}1$, $w2 = 0{\cdot}2$, $b = 0{\cdot}3$ and the learning rate α to be $0{\cdot}4$.

   b) Show that the Boolean XOR function is linearly inseparable. 10 + 4

3. a) The following two-layer back propagation network is trained with the input-output data set, $x_1 = 0 \cdot 6$, $x_2 = 0 \cdot 8$, $d = 0 \cdot 9$. Update all the weights once assuming sigmoidal activation functions for all the neurons and learning rate to be 0·01. The initial weights are shown in Fig. 1



b) Discuss how a standard back propagation algorithm can be improved by momentum method. 11 + 3

4. Write short notes on any *two* of the following :

a) Winner-take-all competitive learning network

b) Hopfield network

c) Nonlinear system identification using back propagation network. 7 + 7

5. a) Why do we use fuzzy logic ? When do we not use fuzzy logic ?

   b) Sketch different membership functions which are used in fuzzy logic.

   c) What do you mean by α-cut of a fuzzy set ? 6 + 6 + 2

6. a) What are the properties of crisp sets and fuzzy sets ?

   b) What are the application areas of fuzzy logic ? 10 + 4

7. a) Two fuzzy sets A and B are given as

   $A = \{(F,0{\cdot}4), (E,0{\cdot}3), (X,0{\cdot}1), (Y,0{\cdot}1), (I,0.9), (T,0{\cdot}8)\}$

   $B = \{(F, 0{\cdot}99), (E,0{\cdot}8), (X, 0{\cdot}1), (Y, 0{\cdot}2), (I,0{\cdot}5), (T, 0{\cdot}5)\}$

   i) Find $A \cup B$, $A - B$.

   ii) Verify DeMorgan's law, $\overline{A \cup B} = \overline{A} \cap \overline{B}$

   b) In the context of Genetic Algorithm, describe the following terms : 8 + 6

   i) selection

   ii) cross-over

   iii) mutation.