Note: All questions are compulsory. Marks are indicated against each question in square brackets.

Q1) Construct a Kohenen self organizing map to cluster 4 given vectors [0,0,1,1]; [1,0,0,0]; [0,1,1,0] and [0,0,0,1]. Number of clusters to be formed are 2. Assume initial learning rate of 0.5.

[7] [CO-4]

Q2) Consider an Adaptive resonance theory type 1 (ART-1) net with 5 input units and 3 cluster units. After some training the net attains the bottom-up and top-down weight matrices as shown below. Show the behavior of the net if it is presented with the training pattern s = [0,1,1,1,1]. Assume learning rate L=2 and vigilance parameter ρ=0.8.   **[7] [CO-4]**
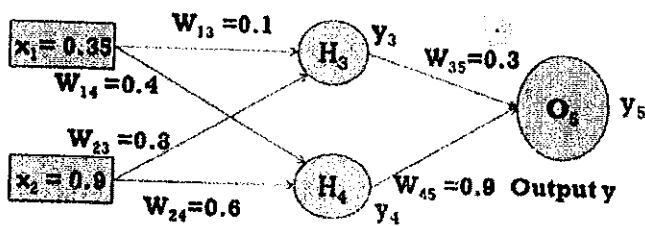
$$B_{5 \times 3} = \begin{bmatrix} .2 & 0 & .2 \\ .5 & .8 & .2 \\ .5 & .5 & .2 \\ .5 & .8 & .2 \\ .1 & 0 & .2 \end{bmatrix}, \text{ and } T_{3 \times 5} = \begin{bmatrix} 1 & 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

Q3) Implement XOR gate using multilayer perceptron network.   **[5] [CO-3]**

Q4) Assume that the neurons have a sigmoid activation function, perform a forward pass and a backward pass on the network. Assume that the actual output of y is 0.5 and learning rate is 1.

[6] [CO-3]

Q5) Write short notes on

a) Recurrent Neural Networks.
b) Linear seperability and activation functions.
c) Memory based learning rule.
d) Genetic Algorithm.
e) Feed forward neural network.

[10] [CO-3]