Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

VI SEMESTER B.TECH. (BME) DEGREE END SEM EXAMINATIONS APRIL/MAY 2017

SUBJECT: ARTIFICIAL NEURAL NETWORKS (BME4001)

(REVISED CREDIT SYSTEM)

Saturday, 29th April 2017, 2 to 5 PM

TIME: 3 HOURS **MAX. MARKS: 100**

Instructions to Candidates:

1. **Answer ALL the questions.**
2. **Draw labeled diagram wherever necessary**

1. (a) How does learning take place in *supervised* networks? Explain the role of "target" in *Supervised learning*, and the "critic information" in *Reinforcement learning*. 06

   (b) Realize the following function: $f = (A + B).(C + D)$ using *McCulloch-Pitt's* neuron model. 06

   (c) Design a perceptron network to classify the following two-dimensional input patterns '*C*' and '*T*'. The symbol '*' indicates data representation to be '+1', '#' indicates data to be '-1'. Consider the learning rate to be equal to 1. 08

$$C = \begin{matrix} * & * & * \\ * & \# & \# \\ * & * & * \end{matrix} \qquad T = \begin{matrix} * & * & * \\ \# & * & \# \\ \# & * & \# \end{matrix}$$

2. (a) Draw the architecture of an *Auto-associative network* and describe its training with no self-connection, for an input vector $[-1 \quad 1 \quad -1]$. Test whether the network is able to recognize one missing entry at the second bit-position 10

   (b) What is Content Addressable Memory (CAM)? Design a discrete Hopfield network with the input vector [1 1 -1 -1]. Test the network with vector x = [-1 1 -1 -1]. 10

3. (a) Consider a *Kohonen self-organising feature map* with two cluster units and four input units. The weight vectors for the cluster units are given by : 10

$$W_{ij} = \begin{bmatrix} 0.2 & 0.8 \\ 0.3 & 0.5 \\ 0.4 & 0.6 \\ 0.7 & 0.2 \end{bmatrix}$$

Draw the network diagram and represent the weights. Find the winning cluster unit for the input pattern $x = [0 \quad 0 \quad 1 \quad 1]$, and calculate the updated weight-matrix. Consider the learning rate to be 0.5 (Use " the square of Euclidean distance" approach).

(b) Describe a supervised training algorithm that helps in the training of a multilayer back propagation network. Draw the network architecture with 'M' number of nodes at the input unit, 'N' number of nodes at the hidden unit and 'P' number nodes at the output unit. Describe the rules used for updating the weights. 10

4. (a) Explain the neural network approach to automatically diagnosing the brain disorder *Dementia* using magnetic resonance images. Identify five key features of those brain patterns that help in the screening of the classes. 08

(b) What are competitive nets? Explain the Maxnet testing algorithm. 08

(c) The data provided in Table-4(c) are the results obtained from a screening test for screening Leukemia, that was performed on a group of 1,00,000 people. From the given true and test results, find the following: a) sensitivity and b) specificity. 04

Table-4(c)

		Test results	
		+ve	**-ve**
Actual status	**+ve**	750 (TP)	25 (FN)
	-ve	4975(FP)	94525 (TN)

5. (a) Explain the classification of heartbeats from digital ECG signals, to assist experts in the diagnosis of typical arrhythmias. 10

(b) Realize the AND gate function with the help of Hebbian network along with the rules used. 10