2016-17
M.TECH. (AUTUMN SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
ARTIFICIAL NEURAL NETWORKS and ITS APPLICATIONS
EL-745

Maximum Marks: 60
Credits: 04
Duration: Two Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question M.M.
1(a) What is the concept of Energy Dynamics in a Hopfield Neural Network? [06]
1(a') OR How do you realise a neuron as an electronic circuit? Justify your answer. [06]
1(b) Write a short note on the application of neural networks for pattern recognition in ECG signals for detecting heart diseases. [06]
1(b') OR Give some applications of self-organising feature maps. [06]

2. Derive the Energy Function of Hopfield Neural Network of N neurons, with complete cross-feedback, self-feedback and external input. [08]

OR

2'. Derive the theoretical limit N for the maximum number of uncorrelated patterns which can be stored in a hopfield neural network with n neurons. [08]

For the network shown in Figure 1 the initial weights and biases are chosen to be \( w_1(0) = -1 \), \( b_1(0) = 1 \), \( w_2(0) = -2 \), \( b_2(0) = 1 \). An input/target pair is given to be \((p=-1,t=1)\). Perform one iteration of backpropagation with \( \alpha = 1 \). [08]

3(a) How does the functionality of Recurrent Neural Network differ from Multi-Layer Perceptron Network? Explain the weight learning algorithm, “Backpropagation Through Time”, in context of Recurrent Neural Networks. [08]

3(b) Figure 2 illustrates a classification problem, where Class I vectors are represented by dark circles, and Class II vectors are represented by light circles. Design a multi layer perceptron network to correctly classify these categories, using minimum number of neurons. [07]

4(a) Contd. - 2.
4(b) Illustrate the capabilities of a Multi-Layer Perceptron Network for function approximation, with the help of an example.

OR

4(b') Design a Radial basis Function Network for strict interpolation of the given input-output pairs \(\{x_i, d_i\} : \{(0,2), (1,-1), (3,0)\}\).

5. What is a Kohonen Self Organising Map? Describe briefly the Competition, Cooperation and Weight Updation process for training a self-organising map.