

**B. Tech Instrumentation 3<sup>rd</sup> Year 2<sup>nd</sup> Semester Examination 2018**

**Neural Networks: Theory and Applications**

Time: 3 hours

Full Marks: 100

*Attempt all questions from the following*

1.
  - (a) What do you understand by supervised and unsupervised learning algorithm?  
Explain with suitable examples.
  - (b) Draw and explain the functionalities of a typical artificial neuron.
  - (c) Compute the outputs  $out_1$ ,  $out_2$  and  $out_3$  for the neural net in Fig. 1.

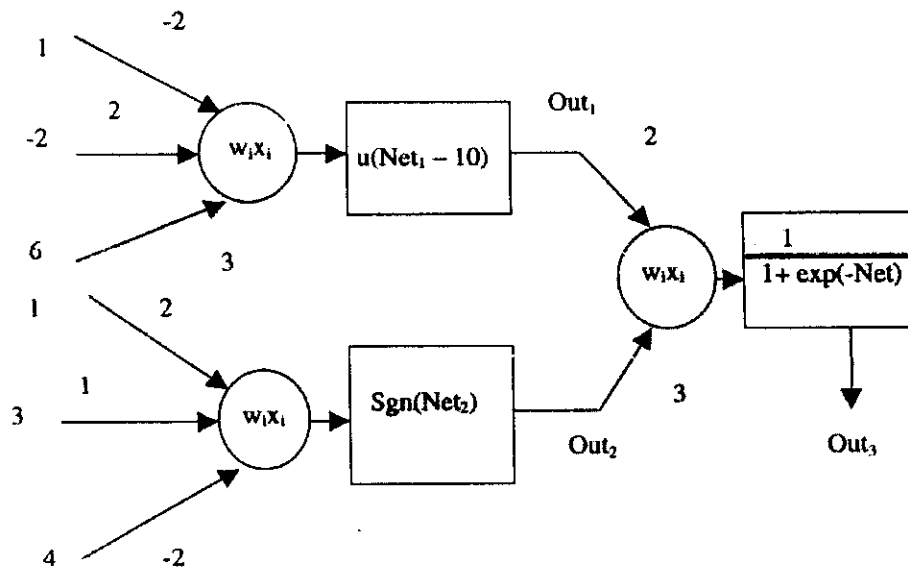


Fig. 1

6+4+10

2.
  - (a) Design a multi-layered perceptron classifier for an XNOR function.
  - (b) Draw and explain the functional architecture of ADALINE neuron.
  - (c) How the neurons in Widrow-Hoff's neural net are generally trained?

8+8+4

- 3.
- (a) Explain how the weight connections between the neurons in the output layer and penultimate layer are updated in accordance with back-propagation learning algorithm. Assume that the neurons in the output layer contain no non-linearity.
  - (b) What are the limitations of back-propagation learning algorithm?
  - (c) Write down the steps of training algorithm of a RBF neural net.

10+4+6

- 4.
- (a) Draw and explain the operation of an electrical realization of a continuous Hopfield network. Comment on the stability of its dynamics.
  - (b) Use a bidirectional associative memory to store three pairs of vectors as follows:

$$A_1 = [1 \quad -1 \quad 1] \text{ and } B_1 = [-1 \quad 1 \quad 1 \quad -1]$$

$$A_2 = [-1 \quad 1 \quad 1] \text{ and } B_2 = [1 \quad -1 \quad 1 \quad 1]$$

$$A_3 = [1 \quad 1 \quad 1] \text{ and } B_3 = [-1 \quad 1 \quad 1 \quad -1]$$

Determine the weight matrix. Examine whether the BAM can accurately retrieve the associated vector  $B_i$  given each of the original vectors  $A_i$  for  $i = 1$  to 3.

10+10

- 5.
- (a) Explain in detail how translation, rotation and size invariant pattern recognition could have been accomplished using planes of ADALINEs.
  - (b) Mention few of the application areas of Hopfield neural net in brief.

15+5

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