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

Q.No.  Question                          M.M.
1(a) Give the diagram of a biological neuron and its mathematical model along with the various activation functions that are commonly used. [05]
1(b) Why is it not possible to implement the XOR function using a single layer neural network? [05]
1(c) How can you implement an artificial neuron in electronic form? Realise a neuron to implement the NAND function. [05]
2(a) Design a binary classifier if the three 3-bit binary input vectors [000], [001], and [101] lie in Class A and the remaining five are in Class B. [06]
2(b) Why is it possible to generate the look ahead carry for a 4-bit Binary using a single neuron? Implement the output carry of a two-bit Binary adder, which adds two 2-bit numbers along with input carry, using a single neuron. [09]
2(b') Compare the computational complexity of Neural Threshold logic and Boolean logic, with reference to the Majority and Parity functions. [09]
3(a) What is training of neural networks? Give the Perceptron training algorithm. [06]
3(b) Using minimum number of neurons, implement
   i.  \( F(x,y,z) = \sum(0,1,4,7) \)
   ii. Parity function of 3 variables
   iii. Majority function of 21 variables [09]
4(a) What is the concept of the Energy function of a feedback neural network? Where do the stable states of Hopfield network, without self feedback, lie and why?

4(b) Modify the Hopfield neural network by interchanging the input terminals of the neuronal opamps, and derive the Energy function for a network of 3 neurons with complete cross feedback, self feedback and external input.

OR

4'(a) Derive the Energy function of a Hopfield network of N neurons, without external input and self feedback.

4'(b) Design a Feedback neural network to solve the following set of linear equations.

\[ 2V_1 + V_2 + 1 = 0, \quad 3V_1 + 2V_2 = 2 \]