(Time: $2\frac{1}{2}$ hours)

[Total Marks: 60]

N. B.: (1) **All** questions are **compulsory**.
(2) Make **suitable assumptions** wherever necessary and **state the assumptions** made.
(3) Answers to the **same question** must be **written together**.
(4) Numbers to the **right** indicate **marks**.
(5) Draw **neat labeled diagrams** wherever **necessary**.
(6) Use of **Non-programmable** calculator is **allowed**.

1. Attempt *any two* of the following: **12**

a. Discuss in detail on artificial neural network and binary sigmoidal activation function.
b. Describe genetic algorithm.
c. Write in detail on hard computing and soft computing.
d. Explain about content addressable memory.

2. Attempt *any two* of the following: **12**

a. Give the details on perceptron network.
b. Write in detail about the tree neural networks.
c. Explain in detail on bidirectional associative memory.
d. Implement ANDNOT function using McCulloch - Pitts neuron. Consider binary data and the excitatory weight as 1 and inhibitory weight as -1.

3. Attempt *any two* of the following: **12**

a. Describe adaptive resonance theory 1 (ART1).
b. Explain about Kohonen self-organizing feature maps.
c. Discuss about simulated annealing network.
d. Write in detail on the architecture of spiking neural networks.

4. Attempt *any two* of the following: **12**

a. Explain about fuzzy equivalence and fuzzy tolerance relation in detail.
b. Define the following: (i) core (ii) support (iii) boundary (iv) normal fuzzy set (v) subnormal fuzzy set (vi) convex fuzzy set
c. What is defuzzification? List and explain any 2 methods of defuzzification.
d. Consider the two fuzzy sets

$$\tilde{A} = \left\{\frac{1}{2} + \frac{0.3}{4} + \frac{0.5}{6} + \frac{0.2}{8}\right\} \tilde{B} = \left\{\frac{0.5}{2} + \frac{0.4}{4} + \frac{0.1}{6} + \frac{1}{8}\right\}$$

Perform union, intersection, difference and complement over fuzzy sets A and B.

5. Attempt *any two* of the following: **12**

a. Using a suitable example explain the single-point and two-point crossover technique.
b. Write in detail on categorical reasoning.
c. What are the classifications of neuro-fuzzy hybrid systems? Explain in detail any one of the neuro-fuzzy hybrid systems.
d. Explain the basic architecture of a fuzzy logic controller system in detail.
