(Time: 2 hours)   [Total Marks: 50]

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: 10

a.   Differentiate between hard computing and soft computing.

b.   Develop the Hebb Rule for pattern recognition.

c.   Compare and contrast fuzzy sets and classical sets.

d.   Write a note on traditional optimization and search techniques.

2.   Attempt *any two* of the following: 10

a.   Compare and contrast classification with clustering.

b.   Describe the learning process for adaptability of neural networks to various stimuli with its types.

c.   With a neat architectural diagram, write and explain the Adaline linear Neuron training algorithm.

d.   Summarize the working of Tree Neural Network.

3.   Attempt *any two* of the following: 10

a.   Explain the ART-1 and ART-2 model of Neural network.

b.   Construct a Maxnet with four neurons and inhibitory weight $\square=0.2$, given the initial activations as follows: $a1(0)=0.3, a2(0)=0.5, a3(0)=0.7, a4(0)=0.9$

c.   Summarize the layers of Convolutional Neural Network.

d.   Describe Cauchy Machine in detail

4. Attempt *any two* of the following: 10

a. Consider the discrete fuzzy set defined on the universe
$X = \{a,b,c,d,e\}$ as

$$A = \left\{ \frac{1}{a} + \frac{0.9}{b} + \frac{0.6}{c} + \frac{0.3}{d} + \frac{0}{e} \right\}$$

Using Zadeh's notation, find the λ-cut sets for $\lambda = 1$,
$0.9, 0.6, 0.3, 0^+$ and 0.

b. Describe the fuzzy propositions.

c. Derive technique for fuzzy ordering and explain it with an example.

d. Define Fuzzy Measure. Explain the axioms- i)Boundary Condition ii) Monotonicity, iii) Continuity iv) Belief & Plausibility Measure.

5. Attempt *any two* of the following: 10

a. Delineate the steps of Takagi-Sugeno FIS for computing output. Support with a suitable example.

b. Describe the Basic Architecture and Operation of Fuzzy Logic Control System

c. What is mutation? Explain the various mutation techniques for Genetic Algorithms.

d. What are Parallel Genetic algorithms? Explain Master-Slave Parallelization and Multiple-deme parallel Genetic Algorithm.