

- N.B. : 1. Question no. 1 is **compulsory**.
2. Solve any **Three** questions out of remaining **Five** questions.

- Qu-1 Attempt any **FOUR** of the following.
- How do genetic Algorithms differ from conventional optimization algorithms? **5**
 - Demonstrate/Outline** the excluded middle axioms, extended for fuzzy sets. **5**
 - Demonstrate/outline the working of Roulette-wheel selection. **5**
 - Consider a fuzzy set and use Zadeh's notation to represent the same defined on universe $X = \{a, b, c, d, e, f\}$. Then compute/Infer λ cut for: a) $\lambda = 0.9$ b) $\lambda = 0.3$ **5**
 - A single-layer neural network has the weights $w = [0.2 \ 0.5 \ 0.66 \ 0.45]$ with bias $b=0.3$. It is given an input of $I = [0.5 \ 0.8 \ 0.1 \ 0.36]$. **5**
Find/estimate the output if the sigmoidal activation function is used (slope = 0.3)
- Qu-2 a) Determine the weights after one iteration for Hebbian learning of a single neuron network starting with initial weights $w = [1 \ -1]$. The inputs are $X_1 = [1 \ -2]$, $X_2 = [2 \ 3]$, $X_3 = [1, -1]$ and learning rate $c=1$. **10**
a) Use Bipolar Binary activation function.
b) Use Bipolar continuous activation function.
- b) What are Neuro-Fuzzy Systems? Explain the steps in Neuro-Fuzzy Hybrid System. **10**
- Qu-3 a) Using Mamdani fuzzy model design a fuzzy logic controller to determine the wash time of a domestic washing machine. Assume that the inputs are dirt and grease on cloths. Use three descriptors for each input variables and five descriptors for the output variable. Derive a set of rules for control action and defuzzification. The design should be supported by figures wherever possible. Show/Defend that if the clothes are soiled to a larger degree the wash time will be more and vice-versa. **10**
- b) Explain McCulloch Pitts neuron model with example. **10**
- Qu-4 a) Describe Genetic Algorithms considering: Encoding, Selection, Crossover, Mutation, and Stopping Condition for Genetic Algorithms. **10**
- b) Consider a suitable set of the binary input/output row matrix to train a hetero-associative network. Demonstrate the working of hetero-associative network and compute the final weight matrix. **10**
- Qu-5 a) Explain the Backpropagation Algorithm with flowchart. **10**
- b) List the variety of Genetic algorithms and explain the Hybrid GA. **10**
- Qu-6 a) What is Linear Separability? Explain with example why single layer perceptron is not capable of solving Linearly Inseparable problems. **10**
- b) Let R and S be two fuzzy relations defined as: **10**

$$R = \begin{matrix} & y1 & y2 & y3 \\ x1 & \begin{pmatrix} 0.0 & 0.2 & 0.8 \end{pmatrix} \\ x2 & \begin{pmatrix} 0.3 & 0.6 & 1.0 \end{pmatrix} \end{matrix} \quad S = \begin{matrix} & z1 & z2 & z3 \\ y1 & \begin{pmatrix} 0.3 & 0.7 & 1.0 \end{pmatrix} \\ y2 & \begin{pmatrix} 0.5 & 1.0 & 0.6 \end{pmatrix} \\ y3 & \begin{pmatrix} 1.0 & 0.2 & 0.0 \end{pmatrix} \end{matrix}$$

- Compute/Infer the result of $R \circ S$ using max-min composition.
- Compute/Infer the result of $R \cdot S$ using max-product composition.