Soft Computing **Q.P. Code: 22936**

(3 Hours) **Total Marks: 80**

N.B : (1) Question **No. 1** is **compulsory**
(2) Attempt **any three** questions out of remaining **five.**

1. (a) Distinguish between hard computing and soft computing. **5**

(b) Explain fuzzy extension principle with suitable example. **5**

(c) Prove that f `(net) = (1 - O^2) / 2 for bipolar continuous activation function **5**

(d) What are hybrid systems? Explain any 2 types of hybrid systems. **5**

2. (a) Explain EBPTA with the help of block diagram. **10**

(b) What do you understand by learning? Compare the different learning rules w.r.t weight adjustments, initial weights, type of learning, neuron characteristics and number of neurons. **10**

3. Design a fuzzy logic controller for an air-conditioner. Consider room temperature and humidity as input and AC temperature as output. Use four descriptors each for inputs and output. Derive proper set of rules and using appropriate de-fuzzification technique get exact AC temperature. The design should be supported by appropriate figures. Also prove that if the room temperature is hot and humidity is high then the AC temperature is set to cool. **20**

4. (a) Explain working of LVQ with the help of an algorithm. Also construct and test an LVQ net with five vectors assigned to two classes. The given vectors along with the classes are as shown in Table 1. **10**

Vector	Class
[0 0 1 1]	1
[1 0 0 0]	2
[0 0 0 1]	2
[1 1 0 0]	1
[0 1 1 0]	1

Consider α = 0.1. Show the weight change for only one epoch.

(b) Draw and explain the architecture of ANFIS. Briefly explain the application of ANFIS. **10**

5. (a) Explain Genetic Algorithm with a suitable flowchart. Explain Roulette wheel selection and rank selection methods used in GA. **10**

(b) Explain the alpha cut and strong alpha cut features of fuzzy membership function. **10**

Also consider the following fuzzy sets.

A = {(0, 1), (0.1, 2), (0.2, 3), (0.3, 4), (0.4, 5), (0.5, 6), (0.6, 7)}

B = {(1, 1), (0.9, 2), (0.8, 3), (0.7, 4), (0.6, 5), (0.5, 6), (0.4, 7)}

Find the following

A/B

$(A \cap \overline{B})_{0.4}$

$\overline{A}_{0..2}$

$\dfrac{\overset{.}{B}_{0.6}}{\overline{A}_{0.8}}$

6. (a) What is linear separability? Using the linear separability concept, obtain the response for AND function with bipolar inputs and targets. **10**

(b) Explain the Newton's methods of derivative based optimization techniques. **10**