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

N.B. (1) Question No 1 is compulsory
(2) Attempt any 3 Questions out of the remaining six questions

Q1 **(a)** For following dataset, Class 'X' data points are P1(1,2), P2(1,1) and class 'O' data points are Q1(2,3), Q2(-1,1), Q3(3,2). Plot the points and determine that the given dataset is linearly separable or not. **5**

(b) State activation functions used in Neural network? Plot each of them with its equation. **5**

(c) State the differences between derivative based and derivative free optimization **5**

(d) Derive identity for unipolar continuous function : f'(net)= O(1-O) **5**

Q2 **(a)** What is Multi-Layer Perceptron? With the Block Diagram explain the algorithm used to adjust weights at each layer. Show it for two layers. **10**

(b) Use perceptron learning rule for computing weights after one iteration for the data given bellow: (use Binary Bipolar function. **10**
$X_1=[1\ -2\ \ 0\ -1]^T$; $X_2=[0\ 1.5\ \ -0.5\ \ -1]^T$;$X_3=[-1\ 1\ \ 0.5\ \ -1]^T$. Initial weight $W^1=[1\ -1\ \ 0\ \ 0.5]$. The learning constant is given by c=0.1. Desired output for X_1, X_2, X_3 are [-1,-1 1] respectively.

Q3 **(a)** Design a Fuzzy system to predict price of the Resale cars. Assume Total Mileage and year of Manufacturing as input variables (attributes) and Sale price as an output variable. Assume 3 descriptors (values of variables) for each input attributes and 5 descriptors for output attributes.

1. Show clearly the units used for & universe of discourse of each attribute. **02**
2. Create Fuzzy Rulebase for Price prediction Problem. **03**
3. Define fuzzy membership functions for all Input and Output attributes **05**

(b) Explain Kohanan's Self Organizing Map w.r.t its architecture, Layers, How to determine no. of neurons in the layers (may give example), Neighborhood, Stopping conditions and applications. **10**

Q4 **(a)** For the given Fuzzy sets M (Medium) & H (High), Find fuzzy set 1. Very High 2. Medium and High 3. Medium or High 4. $M_{\alpha=0.5}$ (Alpha level) 5. NOT High. **10**
M = {0.2/a + 0.4/b + 1/c + 0.8/d + 0/e}
H = {0.1/a + 0.4/b + 0.3/c + 0.6/d + 0.8/e}

(b) Design Mc- Culloch-Pitt's Neuron model to solve following functions **10**

1.

X1	X2	D
0	0	0
0	1	0
1	0	1
1	1	1

2.

X1	X2	D
0	0	0
0	1	0
1	0	0
1	1	1

Q5	**(a)**	Explain Centre of Sums defuzzification techniques with suitable example.	**04**
	(b)	Determine the weights after two iterations for Hebbian learning of a single neuron network using Bipolar Binary activation function starting with initial weights w = [-1,-1] and input patterns are Xl = [1.3,-1], X2 =[2.1,3.2], X3 = [-1.2,-1.8] and c= 1	**08**
	(c)	Describe Roulette wheel and Tournament selection methods in Genetic Algorithms.	**08**
Q6	**(a)**	Differentiate Winner Take All and Learning Vector Quantization in terms of weight updation, Learning type, topological neighborhood, applications.	**04**
	(b)	Why we need Hybrid systems? Draw and explain architecture of ANFIS.	**10**
	(c)	State the differences between derivative based and derivative free optimization	**06**

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