

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: BE
BRANCH: ECE**

**SEMESTER : VII
SESSION : MO/19**

SUBJECT: EC8203 NEURAL NETWORK & FUZZY SYSTEMS

TIME:3:00 HOURS

FULL MARKS: 60

INSTRUCTIONS:

1. The question paper contains 7 questions each of 12 marks and total 84 marks.
 2. Candidates may attempt any 5 questions maximum of 60 marks.
 3. The missing data, if any, may be assumed suitably.
 4. Before attempting the question paper, be sure that you have got the correct question paper.
 5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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- Q.1(a) State Hebbian Postulate? [2]
Q.1(b) Explain Competitive learning rule? [4]
Q.1(c) Find the weights required to perform the following classification using Perceptron network. The vectors (1,1,1,1) and (-1,1,-1,-1) are belonging to the class (so have target value 1), vectors (1,1,1,-1) and (1,-1,-1,1) are not belonging to the class (so have target value -1). Assume learning rate as 1 and initial weights as 0. Use the below activation function. Perform 3 epochs and show the calculated results of every step in a tabular form? [6]

$$Y = \begin{cases} 1 & \text{if } y_{in} > 0.2 \\ 0 & \text{if } -0.2 \leq y_{in} \leq 0.2 \\ -1 & \text{if } y_{in} < -0.2 \end{cases}$$

- Q.2(a) Write two limitations of back propagation? [2]
Q.2(b) Show that a two layer network can generate any Boolean function provided that the number M of hidden units is sufficiently large? [4]
Q.2(c) Derive back-propagation algorithm for a general network having arbitrary feed forward topology and arbitrary differentiable non-linear activation function for the case of an arbitrary differentiable error function? [6]

- Q.3(a) Define interpolation problem? How we achieve interpolation radial basis function network? [2]
Q.3(b) Describe FLANN and cascaded FLANN? [4]
Q.3(c) Solve the XOR problem using Radial Basis Function network? [6]

- Q.4(a) Define Extension Principle? [2]
Q.4(b) Determine whether DeMorgan's Law hold or not, if the fuzzy union and intersection are defined differently? [4]

- Q.4(c) $\mu_{A \cup B}(x) = \mu_A(x) + \mu_B(x) - \mu_A(x)\mu_B(x)$, $\mu_{A \cap B}(x) = \mu_A(x)\mu_B(x)$
IF x is A THEN y is B, where $A = \frac{0.2}{1} + \frac{0.5}{2} + \frac{0.7}{3}$, $B = \frac{0.6}{5} + \frac{0.8}{7} + \frac{0.7}{9}$. [6]
Infer B' using Mamdani Implication and Max-Min Composition for another rule,
IF x is A' THEN y is B' where $A' = \frac{0.5}{1} + \frac{0.9}{2} + \frac{0.3}{3}$,

- Q.5(a) Draw the block diagram of the Fuzzy Inference System? [2]
Q.5(b) Explain the Centroid Method of defuzzification? [4]
Q.5(c) Explain with a suitable graph, the fuzzy reasoning procedure for a first order Sugeno Fuzzy Model? [6]

- Q.6(a) Define with an example two-point Cross Over? [2]
Q.6(b) Explain Particle Swarm Optimization algorithm in flow chart form? [4]
Q.6(c) Minimize the function $f(x_1, x_2) = (x_1^2 + x_2 - 1)^2 + (x_1 + x_2^2 - 7)^2$ in the interval $0 \leq x_1, x_2 \leq 6$. Show reproduction, crossover and mutation and perform atleast 2 generations? [6]

- Q.7(a) Design an Air Conditioner Controller using Fuzzy Rule Base. [6]
Q.7(b) Design an ANN to differentiate a normal EEG signal from a diseased one? EEG signals record the electrical activity of the brain from the human scalp [6]