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

N.B.:   **(1) Question No. 1 is compulsory.**
            (2) Solve any three questions from remaining five questions.
            (3) Draw neat diagrams and assume suitable data wherever necessary. Justify your
                assumptions.

1. **(a).**   Explain k means algorithm.   **5**
   (b)   Explain the different types of activation functions.   **5**
   (c)   Impement Mc-culloch Pitts model for OR function.   **5**
   (d)   Model the following as fuzzy set using suitable membership function. "Number close to 5"   **5**

2. **(a)**   Design the fuzzy controller to control the feed amount of the coagulant for the water purification   **12**
plant. Raw water is purified by injecting chemicals at rate related to water quantity. Aluminium
sulphate or PAC (polymerized aluminium chloride) is used as coagulant. Aluminium sulphate is
less expensive than PAC but is not effective in low temperature water. Assume inputs water
temperature (cold, normal, hot) and grade of water (low, medium, high), output variable amount
of coagulant(small, medium and large) . Derive the rule for control action and defuzzification.
The design should be supported by figure whenever necessary. Clearly indicate that if water
temperature is low and grade of water quality is low then PAC is used in large amount.
   (b)   Explain the concept of linear separability with suitable example.   **8**

3. **(a)**   Explain Hebbian learning rule with the help of an example. .   **10**
   (b)   Use perceptron training rule for implementing AND function for bipolar inputs and   **10**
target(Repeat for two EPOCHS)

4. **(a)**   Explain Error Back Propagation algorithm with a neat flow chart.   **10**
   (b)   Write a short note on Kohonen self organizing maps.   **10**

5. **(a)**   Explain any five defuzzification methods   **10**
   (b)   Explain the method of solving EX-OR problem using RBF and MLP   **10**

6. **(a)**   If the two fuzzy sets are given as-   **10**

$$A=\left\{\frac{1}{2}+\frac{0.5}{3}+\frac{0.6}{4}+\frac{0.2}{5}+\frac{0.6}{6}\right\}$$

$$B=\left\{\frac{0.5}{2}+\frac{0.8}{3}+\frac{0.4}{4}+\frac{0.7}{5}+\frac{0.3}{6}\right\}$$

    Find the complement, union, intersection, difference and De-Morgan's law

   (b)   Draw and explain the architecture of Auto associative neural network.   **10**

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