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

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

1. (a) The formation of algal solutions in surface water is strongly dependent on pH **(05)**
of water, temperature and oxygen content. T is a set of water temperatures
from a lake given by T = {50, 55, 60} and O is a set of oxygen content values
in water given by O = {1, 2, 6}. The fuzzy sets of T and O are
T = {0.7/50 + 0.8/55 + 0.9/60}
O = {0.1/1 + 0.6/2 + 0.8/6}.
Given I = {0.5/50 + 1/55 + 0.7/60} and R = T x O, find
    i.   A = I o R
    ii.   B = I ● R

(b) What is competitive learning? Explain winner take all learning rule. **(05)**

(c) What are hybrid systems? Explain any 2 types of hybrid systems. **(05)**

(d) Explain with example any 5 operations performed in Genetic Algorithm. **(05)**

2. (a) Write Extension Principle and explain with an example. How do you perform **(10)**
fuzzy addition using extension principle?

(b) With a neat diagram explain the architecture of ANFIS. **(10)**

3   Design a fuzzy logic controller to determine the amount of detergent required **(20)**
for a washing machine. Assume the input as dirt and grease on the clothes.
Use 4 descriptors for input as well as output. Derive a set of rules for control
action and appropriate defuzzification. The design should be supported by
figures. Prove that when the clothes are soiled to a larger extent the amount
of detergent required is also more.

4. (a) Compare Mamdani, Tsukamoto and Sugeno models w.r.t number and type of **(10)**
i/p and o/p, fuzzy rules created, defuzzification methods.

(b) Explain with algorithm Kohonen's Self Organizing Feature Maps. **(10)**

5. (a) Explain the method of Steepest Descent of optimization. **(10)**

(b) Explain McCulloch-Pitts model with an example of AND functionality. **(10)**

6. Write short notes on**:**   **(20)**

   (a) LVQ algorithm

   (b) Multi Continuous Perceptron Training Algorithm

   (c) Defuzzification techniques

   (d) Characteristics of Soft Computing