Subject: Soft Computing Techniques in Electrical Engineering

Paper / Code No: EE – 706/1   **Branch:** Electrical Engineering

Time: 2 HRS.   **Full Marks:** 35

i) Use separate Answerscript for each half.
ii) The questions are of equal value.
ii) Answer FOUR questions, taking TWO from each half.
iii) ½ mark is reserved for neatness in each half.

FIRST HALF

1.a) What do you mean by the term 'Fuzzy Entropy (E(A)) '?   [2]

b) Prove that :

$$E(A) = \frac{M(A \cap A^c)}{M(A \cup A^c)}$$

[4 ½]

c) Two sets are given below :

A = (0, 0.8, 0.7, 1 , 0.5),   B = (0, 0.9, 0.7, 0.6, 0.2)

In which set "fuzziness" is more and why?   [2]

2. Consider the design of a fuzzy controller for an air conditioning system using Mamdani type fuzzy model. There are two input spaces,   Humidity(H) [0% - 100%] and Temperature (T) [0°C – 45°C], and one output space, compressor speed (N) [0 - 100]. Assuming four uniform triangular membership functions --- Very Low (VL), Low (L), High(H) and Very High (VH) on H, T and N, determine the compressor speed N, when H = 90% and T = 32°C . Assume center of largest area method of defuzzification strategies. Fuzzy rules are as follows:

T → ↓ H	VL	L	H	VH
VL	VL	VL	L	H
L	VL	VL	H	VH
H	VL	L	VH	VH
VH	L	H	VH	VH

[8 ½]

3. Write short notes on any **two** of the following: [4 ¼ × 2]

a) Applications of ANN in Electrical Engineering
b) Mamdani and Sugeno type Fuzzy system
c) Back propagation training algorithm

SECOND HALF

1. a) What is competitive learning? How is the architecture of a *Competitive Learning Neural Network* different from that of a *Conventional Neural Network*?

   b) How can the connection weights be modified in a competitive learning neural network during training? Describe a scheme for updating connection weights in a competitive learning network. $[3+5^1/2]$

2. a) What is 'Self-Organizing Map (SOM)'? Explain, how lateral competition among output layer neurons results in self organization?

   b) Explain the role of 'neighbourhood function' in Kohonen's SOM. Discuss the suitability of using 'Mexican Hat' type function as neighbourhood function in Kohonen's SOM.

   $[3+5^1/2]$

3. a) Define with examples, the *'Objective function'* and *'Constraints'* in an optimization problem.

   b) What is 'pattern classification'? Develop a flow chart to show how can the English alphabets be classified into 26 distinct classes using Kohonen's SOM?

   $[3+5^1/2]$