Roll No. .....

National Institute of Technology Delhi

Name of examination: B. Tech 4th Year (Make-up)

Branch : EEE Semester: 7

Title of Course : AI Techniques in Electrical Engineering Subject Code: EE-416

Time: 3 Hours Marks: 50

Note:

1. **All sections are compulsory**
2. **Assume any data suitably if found missing**

Q. 1- Explain the following terms: (1*10)

i. Logsig transfer function
ii. Delta learning rule
iii. 'Tansig' transfer function
iv. Perceptron learning rule
v. Back-propagation network
vi. Momentum coefficient
vii. Covariance
viii. Gaussian radial basis function
ix. Optimal hyper-plane
x. De Morgan's Law in fuzzy set

(Section-II)

Note: Attempt ant FOUR

Q.2- Find the final updated weight for the delta learning rule with the following input vectors and initial weights:

$x1 = [1\ -2\ 0\ -1]$; $x2 = [0\ 1.5\ -0.5\ -1]$; $x3 = [-1\ 1\ 0.5\ -1]$;

$w1 = [1\ -1\ 0\ 0.5]^t$; desired response for x1, x2, x3 are d1= 1, d2= 1, d3= -1 respectively and c = 0.1, activation function is "logsig" (5)

Q.3- What is RBFNN? Explain different methods of selection of Gaussian centres. (5)

Q.4- In 2-D space, if 'w' is a vector perpendicular to the hyper-planes H0 and H1, then prove that the hyper-planes are optimum under certain condition if ||w|| is minimum. (5)

Q.5- Find the *tautology* or *contradiction* on the crisp propositions P and Q for the following expressions:

(i) $(P \rightarrow Q) \wedge (Q \rightarrow P) = (P = Q)$

(ii) $(P \rightarrow Q) = (\sim P \vee Q)$ (2×2.5=5)

Q.6- Explain 'Difference' and 'Disjunctive sum' of fuzzy set with suitable example. (5)

(Section-III)
Note: Attempt ant TWO

Q.7- The task is to recognize English alphabetical characters (F, E, X, Y, I, T) in an image processing system. Two fuzzy sets $\hat{G}$ and $\hat{H}$ to represent the identification of characters are:

$\hat{G}$ = {(F, 0.4), (E, 0.3), (X, 0.1), (Y, 0.1), (I, 0.9), (T, 0.8)}

$\hat{H}$ = {(F, 0.99), (E, 0.8) (X, 0.1), (Y, 0.2), (I, 0.5), (T, 0.5)}

Find the Following:

(a) (i) $(\hat{G} \cup \hat{H})$ (ii) $(\hat{G} - \hat{H})$ (iii) $(\hat{G} \cup \hat{H}^c)$ (iv) $(\hat{G}^c \cap \hat{H}^c)$ (1.5× 4)

(b) Verify De Morgan's Law. (4)

Q.8- What is Principal Component Analysis (PCA)? Explain all the steps of PCA with suitable example. (10)

Q.9- With the enlightenment of all the steps clearly, find the update weight $[V]^1$ and $[W]^1$ up-to four decimal points, after the first iteration of the following back-propagation network. Assume $\alpha = 0$, $\eta = 0.5$ (10)