Roll No. .....

National Institute of Technology Delhi

Name of examination: B. Tech 4th Year (End-semester)

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**

(Section-I)

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

i. 'Tansig' transfer function
ii. Delta learning rules
iii. Learning coefficient
iv. Clustering
v. Covariance matrix with suitable example
vi. Difference of fuzzy set with suitable example
vii. Disjunctive sum of fuzzy set
viii. Fuzzy Cartesian product
ix. Fitness Function
x. Reproduction

(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 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- Let X= {a, b, c, d} and Y= {l, m, n, o} are universe of discourse, and

$\tilde{A}$ = {(a, 0),(b, 0.8),(c, 0.6),(d, 1)}

$\tilde{B}$ = {(l, 0.2),(m, 1),(n, 0.8),(o, 0)}

$\tilde{C}$ = {(l, 0),(m, 0.4),(n, 1),(o, 0.8)}

Determine the implication relation **IF x is $\tilde{A}$ THEN y is $\tilde{B}$ else y is $\tilde{C}$** (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) Disjunctive sum of $\hat{G}$ and $\hat{H}$ (ii) $(\hat{G} - \hat{H})$ (iii) $(\hat{G}^c \cap \hat{H}^c)$ (2×3)

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

Q.8- Find the final feature vector using Principal Component Analysis (PCA) for the following 3-dimentional data. (10)

x	0.5	1.0	1.5	2	2.5
y	0.3	0.9	1.2	1.5	1.8
z	0.8	2.0	2.2	2.5	3.0

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)