RollNo. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOV / DEC 2024

DEPT. OF ELECTRONICS AND COMMUNICATION ENGINEERING

VII Semester

EC5079 &SOFT COMPUTING AND APPLICATIONS

(Regulation2019)

Time:3hrs Max.Marks: 100

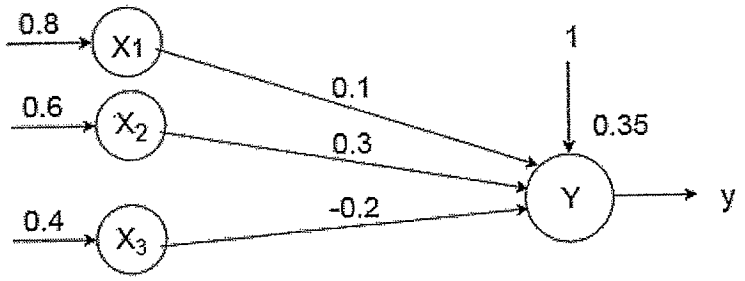
CO1	Students should be able to apply various soft computing frame works
CO2	Students should be able to design of various neural networks
CO3	Students should be able to use fuzzy logic
CO4	Students should be able to discuss hybrid soft computing

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)

(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Compute CON (A) and DIL (A) for the fuzzy set A = {(a, 0.3), (b, 0.6), (c, 0.1)} .	2	1	L3
2	Determine the image B of a fuzzy set A given by A = {(-1, 0.1), (0, 0.3), (1, 0.5), (2, 0.7)} using extension principle with the mapping $f(x) = x^2 - 2$.	2	1	L3
3	Determine the offspring by performing two-point crossover between 5th and 7th bits of the parent, Chromosome1 = 101011111000 and Chromosome 2 = 111001011011.	2	2	L3
4	State the disadvantages of Newton's descent method.	2	2	L2
5	Find the output neuron Y for the network shown in Figure 1 using binary sigmoid function with steepness parameter equal to 1.  Figure 1	2	3	L3
6	Draw the architecture of Kohonen Self organizing map and write the weight update equation.	2	3	L1
7	State the optimization methods adapted for antecedent and consequent parts of an adaptive FIS.	2	4	L2
8	Draw the Neuro-fuzzy spectrum and what trade-off does it indicate?	2	4	L1
9	How data scarcity problem is addressed by various multivariate regression models?	2	5	L2
10	State the role of neuro-fuzzy models in color recipe prediction.	2	5	L2

PART- B(5x 13=65Marks)

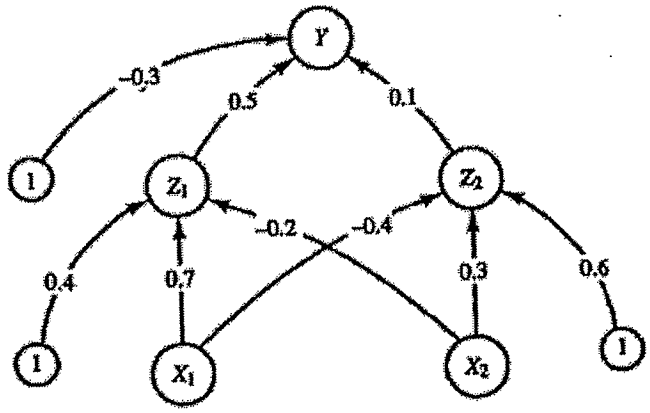
(Restrict to a maximum of 2 subdivisions)

Q.No.	Questions	Marks	CO	BL
11 (a)	Design a Fuzzy inference system based on Mamdani model with the following Rule base: RULE 1: IF INPUT x is LOW AND INPUT y is F THEN OUTPUT z is V_1. RULE 2: IF INPUT x is HIGH AND INPUT y is F THEN OUTPUT z is V_2. The input and output membership function distributions are defined as: x (LOW) = {(-2, 0.25), (-1, 0.5), (0, 0.75), (1, 1), (2, 0.75), (3, 0.5), (4, 0.25)}, x (HIGH) = {(2, 0.25), (3, 0.5), (4, 0.75), (5, 1), (6, 0.75), (7, 0.5), (8, 0.25)}, F (y) = {(10, 0.33), (11, 0.67), (12, 1), (13, 0.67), (14, 0.33)} , V_1 (z) = {(20, 0.25), (30, 0.5), (40, 0.75), (50, 1), (60, 0.75), (70, 0.5) , (80, 0.25)} and V_2 (z) = {(60, 0.25), (70, 0.5), (80, 0.75), (90, 1), (100, 0.75), (110, 0.5) , (120, 0.25)} Determine the output z using centroid of area defuzzification strategy for the crisp inputs x equal to 4 and y equal to 10. Justify the computation with required pictorial representation of rules and rule table.	13	1	L3
	OR			
11 (b) i)	Let a, b, c, d and e be five students who scored 55, 35, 60, 85 and 75 out of 100 respectively in Mathematics. The students constitute the Universe of Discourse U= {a, b, c, d, e} and a fuzzy set M of the students who are good in Maths is defined on U with the following membership function: $\mu_M(x) = \begin{cases} 0 & ; \text{ if } x < 40 \\ \frac{x-40}{40} & ; \text{ if } 40 < x < 80 \\ 1 & ; \text{ if } x > 80 \end{cases}$ Compute the membership function value for each student.	7	1	L3
ii)	Describe approximate reasoning with single rule and multiple antecedents with appropriate equations and diagrams.	6	1	L2
12 (a) i)	Describe the steepest descent algorithm and find the optimal solution to minimize the objective function $f(x_1, x_2) = x_1^2 - x_1 x_2 + x_2^2$ such that $\lvert f(X_{k+1}) - f(X_k) \rvert < 0.05$. Let the initial solution be $X_0 = (1, 0.5)^T$ and learning rate is 0.5.	7	2	L3
ii)	Describe the various operations performed in the downhill simplex search for the replacement of a point.	6	2	L2
	OR			
12 (b) i)	Describe the framework for binary genetic algorithm. Generate the real variable representation of the population from the chromosomes with five bits for the variable x = [{01000}, {11010}, {01101} , {11100}], for the function $f(x) = x^2$ with bound $0 \leq x \leq 31$. Evaluate the offspring population by performing mutation for this population with probability p_m = 0.2, and the random numbers to perform mutation are 0.1 (4th bit) , 0.3 (2nd bit), 0.15 (3rd bit) and 0.01 (5th bit).	7	2	L3
ii)	Describe how optimization is done using Simulated annealing algorithm with appropriate equations and diagram.	6	2	L2
13 (a)	Develop an ADALINE network for the ANDNOT function with bipolar inputs and bipolar targets for 5 epochs with initial weights, bias equal to 0.2 and learning rate equal to 0.2.	13	3	L3
	OR			

13 (b)	Using the Hebb rule, find the weights required to perform the following classifications: vectors (1 1 1 1) and (-1 1 -1 -1) are members of class with target value of 1; vectors (1 1 1 -1) and (1 -1 -1 1) are not members of class with target value of -1. Using each of the training x vectors as input, test the response of the net for one epoch.	**13**	3	L3
14 (a)	Explain the ANFIS framework based on Takagi and Sugeno's approach. Assume the model has two inputs with triangular membership function distribution, one output and four firing rules. Describe the functions of various layers with appropriate expressions and diagram.	**13**	4	L2
	OR			
14 (b)	Explain CANFIS framework with relevant diagram. How CANFIS differs from MANFIS.	**13**	4	L2
15 (a)	Describe the implementation of character recognition system using soft computing techniques.	**13**	5	L4
	OR			
15 (b)	Discuss the application of ANFIS in automobile fuel consumption in terms of Miles per gallon. Consider any four attributes.	**13**	5	L4

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	Describe back propagation algorithm and find the new weights when the net shown in Figure 2 is presented the input pattern (-1, 1) and the target output is 1. Assume a learning rate of 0.25 and the bipolar sigmoid activation function.  Figure 2	**15**	3	L4