RollNo.

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

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

B.Tech INFORMATION TECHNOLOGY
VI Semester
IT5019 & Soft Computing
(Regulation 2019)

Time:3 hrs Max.Marks: 100

CO1	Identify and describe soft computing techniques and their roles in building intelligent machines.
CO2	Recognize the feasibility of applying a soft computing methodology for a particular problem.
CO3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
CO4	Apply genetic algorithms to optimization problems.
CO5	Design neural networks for pattern classification and regression problems.
CO6	Compare different neural network approaches

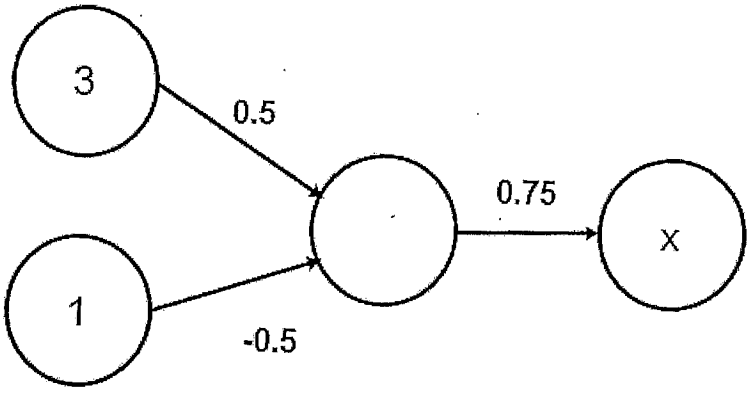
BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A (10x2=20Marks)
(Answer all Questions)

Q. No.	Questions	Marks	CO	BL
1	What is the role of soft computing in building intelligent system?	2	CO1	L2
2	What is Fuzzy Associative Memory (FAM)? Give an example	2	CO3	L1
3	Name any 2 recurrent networks and differentiate it with feedforward network	2	CO6	L2
4	A neural network is trained with a data set having 10 features and 5 target classes. Design a sample feedforward neural network with single hidden layer for this classification problem	2	CO5	L2
5	What do you mean by bias and variance?	2	CO6	L1
6	What is the advantage of back propagation of error in a neural network during training? Is the errors back propagated in a multilayer perceptron neural network?	2	CO5	L2
7	What do you mean by epoch in neural network? What will happen to the learning process if the number of epochs is increased?	2	CO5	L1
8	Differentiate supervised and unsupervised learning with examples	2	CO5	L1
9	What is the purpose of mutation in genetic algorithm? Does it improve the final solution? From the initial population of [1 1 0 1 1; 0 1 0 0 1] generate a crossover and mutation children	2	CO4	L3
10	What is the difference between Roulette Wheel selection and tournament selection?	2	CO4	L2

PART- B (5x 13=65Marks)
(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a) (i)	Explain the fuzzy logic process with complete steps starting from fuzzification of crisp input to defuzzification. What is the output of fuzzy logic process – crisp or fuzzy? Justify	8	C03	L1

(ii)	Design a fuzzy logic controller for an automatic room temperature control system with two inputs namely the room temperature, fan speed and ac temperature as output. Design appropriate fuzzy if-then rules, fuzzification and defuzzification process with proper membership function design	5	C03	L3
OR				
11 (b) (i)	Explain the defuzzification methods used to find out the crisp output in fuzzy logic. Write the formulas used and the commonly preferred method for defuzzification with justification	8	C03	L1
(ii)	Differentiate fuzzy and crisp set with an example and explain the necessity of including fuzziness in computing	5	C03	L3
12 (a) (i)	Explain the biological neural network structure with a neat diagram. Explain the chemical action in the neuron and the explain the condition under which a neuron is triggered	8	CO5	L2
(ii)	What do you mean by linear separable and nonlinear separable data? Explain with an example	5	CO5	L3
OR				
12 (b) (i)	Explain McCulloh-Pitts Neuron model with neat architecture diagram. Design an AND gate with Mcculloh Pitts neuron model	8	CO5	L2
(ii)	Use the Hebb rule to store the vector (1 1 -1 -1) in an auto associative neural net. (a) Find the weight matrix (b) Test the inpu t vector x=(1 1 -1 -1) (c) Test the net with one mistake in the input vector	5	CO5	L3
13 (a) (i)	Explain perceptron learning rule and delta learning rule with proper equations and derivation. Analyze the necessity of delta learning rule for any neural network	8	CO5	L4
(ii)	 Figure 1 Find the output of a 2 layer feed forward network shown in Figure 1 for sigmoid activation function assuming steepness factor as 1.	5	CO5	L3
OR				
13 (b) (i)	Explain the back propagation neural network BPN architecture and algorithm. What are the factors associated with BPN training algorithm? Analyze the influence of bias in the network	8	CO5	L4
(ii)	For the feed forward network with the initial weight and bias values given in Figure 2 with a learning rate of 0.9 and sigmoid activation function, with a training tuple X=(1,0,1) and a class label of 1, find the updation in weight and bias after first round of error back propagation	5	CO5	L3

x1	x2	x3	w14	w15	w24	w25	w34	w35	w46	w56	θ4	θ5	θ6
1	0	1	0.2	-0.3	0.4	0.1	-0.5	0.2	-0.3	-0.2	-0.4	0.2	0.1

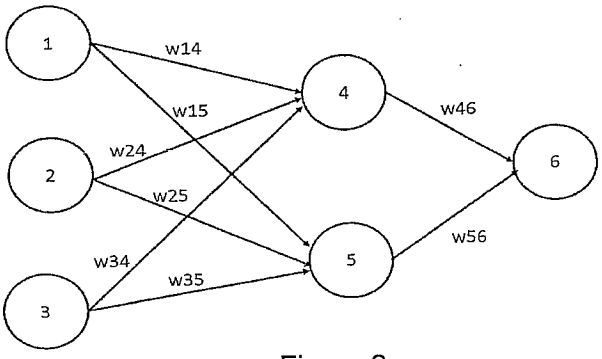


Figure 2

14 (a) (i)	In what way a SOM network differs from a multilayer perceptron? With neat diagram and algorithmic steps explain the architecture and the training process in Self Organizing Map	8	CO6	L3
(ii)	Construct and test LVQ with four vectors assigned to 2 classes. Assume learning rate=0.025 and continue iteration for 2 steps. Initialize the reference vectors using the first 2 entries of the table 1 given below. Assume the last 2 vectors as training data Table 1 (1 0 10) → 1; (0 0 1 1) → 2; (1 1 0 0) → 1; (1 0 0 1) → 2	5	CO5	L4
	OR			
14 (b) (i)	Explain how an Adaptive Resonance Theory ART1 network support learning of new inputs and support the plastic property? In what way it differs from a conventional neural network? Justify the answers with architecture and algorithm	8	CO6	L3
(ii)	Consider a Kohonen net with two cluster units and three input units. The weight vector for the cluster unit are (0.9,0.7,0.6) and (0.4,0.3,0.5). Find the winning cluster unit for the input vector (0.4,0.2,0.1). Use the learning rate of 0.2. Find the new weights for the winning unit	5	CO5	L4
15 (a) (i)	Explain the procedure of Genetic algorithm with a flow chart. Give an example for a genetic algorithm application in real world problem	8	CO4	L3
(ii)	Assume a population size of 5, and accuracy as the objective function to be maximized for a neural network multiclass prediction. Create required mutation, crossover and elite children for the next generation assuming the initial population as [1 1 0 1 1 0; 0 0 1 0 1 1; 0 0 1 1 0 0; 1 1 1 1 0 0; 0 1 1 1 1 1]. Assume the accuracy of the initial population as [92; 87; 91; 89; 74].	5	CO4	L5
	OR			
15 (b) (i)	Explain in detail what is the necessity of mutation and crossover children in the population? How will you fix the maximum number of generations an algorithm should be run for getting an optimal solution?	8	CO4	L3
(ii)	Why genetic algorithm is termed as stochastic process? What will be the changes in the output of the algorithm when the genetic algorithm is run for several times? Explain with an example	5	CO4	L5

PART- C (1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16. (i)	Implement an Exclusive OR function using any one neural network. Plan the architecture with required number of layers. Assume proper threshold and weight values and justify the use of soft computing for the logic gates design	10	CO2	L5
(ii)	Design a hybrid soft computing model for traffic signal control using neural network, fuzzy logic and genetic algorithm. The goal of the hybrid algorithm is to dynamically adjust traffic signal timings to minimize traffic congestion at intersections, reduce wasting time and improve traffic flow. The inputs are traffic density on each road from sensors, average vehicle speed, pedestrian crossing demand and emergency vehicle detection. The output is signal duration for each direction with priority for emergency vehicles	5	CO4	L6