

Soft Computing
(CSEN 5223)

Time Allotted : 3 hrs

Full Marks : 70

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group - A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: 10 x 1=10
- (i) Let A be a classical set and $\chi_A(\cdot)$ be the characteristic function. Then
(a) $\chi_A(x) \in [0,1]$ (b) $\chi_A(x) \in (0,1)$
(c) $\chi_A(x) \in \{0,1\}$ (d) none of these.
- (ii) In conjunction system of rules, rules are connected by
(a) XOR (b) AND
(c) OR (d) NAND.
- (iii) Approximate Reasoning consists of
(a) categorical Reasoning (b) qualitative reasoning
(c) dispositional (d) all of these.
- (iv) Centroid defuzzification method finds a point representing the centre of gravity of the fuzzy set, A
(a) in the interval, $[a,b]$, $0 \leq a, b \leq 1$ (b) outside the degree of Discourse
(c) NULL (d) none of these.
- (v) A FIS is constructed of functional blocks of
(a) decision making unit (b) fuzzy interface unit
(c) both (a) and (b) (d) None of these.
- (vi) Fuzzy expert system consists of
(a) knowledge base (b) inference engine
(c) user Interface (d) all of these.
- (vii) The probability of performing mutation in genetic algorithm is considered to be very low because
(a) mutation helps to maintain the diversity in the population
(b) high mutation rate affects the convergence of the algorithm
(c) mutation does not generate new solution
(d) none of these.

- (viii) The decision line is called
(a) decision support line (b) decision separable line
(c) both (a) & (b) (d) none of these.
- (ix) Soft computing techniques resemble biological processes more closely than traditional techniques, which are largely based on
(a) formal logical systems (b) sentential logic
(c) predicate logic (d) all of these.
- (x) Synaptic Connections are usually formed from
(a) axons to dendrites (b) Nucleus to axons
(c) Nucleus to dendrites (d) None of the above.

Group - B

2.(a) Consider $X = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$; A fuzzy set A = "large" is given as = $\{(0,6), (0.7,7), (0.8,8), (.9,9), (1,10)\}$. Given a function $f : y = f(x) = x^2, x \in X$, find the fuzzy set B = "large"²

(b) Explain with example α -cut of a Fuzzy Set.

7+5=12

3.(a) Consider the following two fuzzy sets:

$$A = \{ 1/2 + .5/3 + .3/4 + .2/5 \}$$

$$B = \{ .5/2 + .7/3 + .2/4 + .4/5 \}$$

i) Find the difference A - B

ii) State De Morgan's law and show that it holds for the sets A and B.

iii) Find the Support of a Fuzzy Set B.

(b) What is Normal Fuzzy Set?

(4+4+2)+2=12

Group - C

4. Explain training mechanism in a 2-layer artificial neural network (perceptron) for multi-class data sets using back propagation technique.

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5.(a) Draw the flowchart of Kohonen Self Organization Map. Explain the architecture and training algorithm.

(b) In a simple Neural network, Calculate Net Input to Output Neuron for $[x_1, x_2, x_3] = [.3, .7, .9]$, $[w_1, w_2, w_3] = [.2, .1, -.3]$ with bias = .45

(3+5)+4=12

Group - D

6.(a) Given $A = \{(0.3, 1), (0.5, 2), (1,3)\}$; $B = \{(0.5,1), (0.55,2), (1,3)\}$.

(i) Find the Cardinality of A and B.

(ii) Explain Max-min composition and Max product composition with examples.

(b) What is non-dominated solution in a Multi Objective Optimization problem? Explain Pareto front.

6+6=12

7.(a) Write short notes on (i) Roulette Wheel selection method and (ii) elitism in genetic algorithm.

(b) Discuss the importance of mutation operation in genetic algorithm?

(4+4)+4 = 12

Group - E

8.(a) Explain either of Mamdani method or Sugeno method for fuzzification.

(b) Write Fuzzy C-Means Algorithm and explain it with an application.

6+6=12

9. Write short notes on the following:

i) Chaos theory and its application

ii) Neuro-fuzzy approach and its application

(2x6)=12