SOFT COMPUTING FUNDAMENTALS
(CSBS 4121)

Time Allotted : 2½ hrs   **Full Marks : 60**

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
<u>any 4 (four)</u> from Group B to E, taking <u>one</u> from each group.*

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

Group – A

1. Answer any twelve: **12 × 1 = 12**

    Choose the correct alternative for the following

    (i)   Which of the following algorithms can be used to train a single-layer feed forward network?
          (a) Hard competitive learning   (b) A genetic algorithm
          (c) Soft competitive learning   (d) All of (a), (b) & (c).

    (ii) The algorithm operates by iteratively updating a pool of hypotheses, called the
          (a) Population   (b) Fitness
          (c) Both (a) and (b)   (d) None of (a), (b) & (c).

    (iii) What are general limitations of back propagation rule?
          (a) Local minima problem   (b) Slow convergence
          (c) Scaling   (d) All of (a), (b) & (c).

    (iv) Artificial neural network used for
          (a) Pattern Recognition   (b) Classification
          (c) Clustering   (d) All of (a), (b) & (c).

    (v)   In artificial Neural Network interconnected processing elements are called.
          (a) nodes or neurons   (b) weights
          (c) axons   (d) none of (a), (b) & (c).

    (vi) Fuzzy logic is usually represented as
          (a) IF-THEN-ELSE rules   (b) IF-THEN rules
          (c) Both (a) and (b)   (d) None of (a), (b) & (c).

    (vii) Fuzzy logic is a form of
          (a) Two-valued logic   (b) Crisp set logic
          (c) Many-valued logic   (d) Binary set logic

    (viii) The crossover points of a membership function are defined as the elements in the universe for which a particular fuzzy set has values equal to
          (a) Infinity   (b) 0   (c) 1   (d) 0.5.

(ix) Perceptron can learn
(a) AND   (b) XOR
(c) Both (a) and (b)   (d) None of (a), (b) & (c).

(x) Produces two new offspring from two parent string by copying selected bits from each parent is called
(a) Mutation   (b) Inheritance
(c) Crossover   (d) None of (a), (b) & (c).

Fill in the blanks with the correct word

(xi) Neuron can send _____ signal at a time.

(xii) _____ is/are the way/s to represent uncertainty.

(xiii) The room temperature is hot. Here the hot (use of linguistic variable is used) can be represented by _____.

(xiv) "Fittest will be survivor" is true for_____.

(xv) Pheromone quantity in ACO is _____ proportional to path selection.

Group - B

2. (a) Explain different conventional binary crossover operator in GA.
[(CO2)(Understand/LOCQ)]
   (b) Explain different selection techniques in Genetic Algorithm. *[(CO2)(Understand/LOCQ)]*
   6 + 6 = 12

3. (a) Explain schema theorem.   *[(CO2)(Understand/LOCQ)]*
   (c) Explain different mutation operators.   *[(CO2)(Understand/LOCQ)]*
   (b) Explain why do we prefer Rank selection over the method of Roulette-Wheel selection in Genetic Algorithm?   *[(CO2)(Understand/LOCQ)]*
   3 + 3 + 6 = 12

Group - C

4. (a) Consider a single layer perceptron having 2 inputs and 1 output. Let thresold be 0.5,learning rate be 0.6, bias be -2 and weight values are w_1=0.3 and w_2 = 0.7. Given the input patterns in the table, compute the value of the output and train using perceptron learning rule for one epoch. *[(CO3)(Apply/IOCQ)]*

X_1	X_2	t
1	1	1
1	0	1
0	1	-1
0	0	1

   (b) Explain any four activation function used in neural network.
[(CO3)(Understand/LOCQ)]
   6 + 6 = 12

5. (a) What is forward pass and backward pass in the training of BPNN?
   [(CO3)(Understand/LOCQ)]
   (b) Write down the simple perceptron training algorithm. *[(CO3)(Understand/LOCQ)]*

   6 + 6 = 12

Group - D

6. (a) Perform the following fuzzy arithmetic operation C = A*B through extension principle by fuzzifying the function z (x *y) = x * y for the given fuzzy set:
   A = 0/0 + 0.2/1 + 0.4/2 + 0.6/3 + 0.8/4 + 1.0/5.
   B = 1/0 + 0.8/1 + 0.6/2 + 0.4/3 + 0.2/4 + 0/5. *[(CO4)(Apply/IOCQ)]*
   (b) Write short notes on Fuzzy composition. *[(CO4)(Understand/LOCQ)]*

   8 + 4 = 12

7. (a) Solve the following fuzzy relation equations by Mamdani Min operator:
   If rainfall is 'High', drought is 'Low'. Deduce the drought level when the rainfall is very high. Take High (rainfall) = {0.5/2 + 0.8/3 + 1/4} and Low (drought) = {1/1 + 0.6/2 + 0.2/3}. The universe discourse for the rainfall rate is X and drought level is Y as X ={1,2,3,4} , Y={1,2,3}. *[(CO4)(Apply/IOCQ)]*

   (b) The mobile characteristics are defined as speed and cost. The fuzzy set for 'High Speed' and 'Costly' linguistic variables is given as: High Speed = {1/1 + 0.8/2 + 0.5/3 + 0.3/4 + 0.1/5} and Costly = {0/1 + 0.2/2 + 0.4 /3 + 0.7 / 4+ 0.9/5}, respectively. Determine the linguistic variable 'Not Costly', 'Very Very High Speed', and 'Not Very High Speed and Not Costly'. *[(CO4)(Apply/IOCQ)]*

   6 + 6 = 12

Group - E

8. (a) What do you mean by indiscernibility? *[(CO5)(Understand/LOCQ)]*
   (b) Define the term reduct and core with a suitable example. *[(CO5)(Understand/LOCQ)]*
   (b) What is pareto optimal solution? *[(CO6)(Understand/LOCQ)]*

   4 + (3 + 3) + 2 = 12

9. (a) What do you mean by dominated set? *[(CO6)(Understand/LOCQ)]*
   (b) Describe Ant colony optimization algorithms in brief. *[(CO6)(Understand/LOCQ)]*
   (c) What do you mean by multi-objective optimization? Explain with an example.
   [(CO6)(Understand/LOCQ)]

   3 + 6 + 3 = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	72.92	27.08	0

Course Outcome (CO):

1. Describe about soft computing concepts, technologies and their role in problem solving.
2. Analyze the genetic algorithms and their applications to solve optimization problems.
3. Demonstrate different neural network architectures, algorithms, applications and their limitations.
4. Apply the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic.
5. Identify the need for approximation analysis and rough set theory in developing applications.
6. Inspect various soft computing techniques in order to solve Multi-Objective Optimization Problem (MOOP).

LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.