

**SOFT COMPUTING APPLICATION  
(INFO 4282)**

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 × 1 = 10**
- (i) An artificial neuron receives  $n$  inputs  $x_1, x_2, x_3, \dots, x_n$  with weights  $w_1, w_2, \dots, w_n$  attached to the input links. The weighted sum \_\_\_\_\_ is computed to be passed on to a non-linear filter  $\Phi$  called activation function to release the output.  
 (a)  $\sum w_i * x_i$                       (b)  $\sum w_i + \sum x_i$                       (c)  $\sum x_i$                       (d)  $\sum w_i$ .
- (ii) Which of the following can be used for clustering of data?  
 (a) Single layer perception                      (b) Multilayer perception  
 (c) Self organizing map                      (d) Radial basis function.
- (iii) A four input neuron has weights 1, 2, 3 and 4. The transfer function is linear with the constant of proportionality being equal to 2. The inputs are 4, 10, 5 and 20 respectively. The output will be \_\_\_\_\_.  
 (a) 76                      (b) 238                      (c) 119                      (d) 216.
- (iv) Ability to learn how to do tasks based on the data given for training or initial experience is called \_\_\_\_\_.  
 (a) self organization                      (b) robustness  
 (c) adaptive learning                      (d) fault tolerance.
- (v) "Fittest will be survivor" is true for \_\_\_\_\_.  
 (a) Simulated annealing                      (b) Tabu search  
 (c) Genetic Algorithm                      (d) ACO.
- (vi) Which of the following neural networks uses supervised learning?  
 (A) Multilayer perceptron  
 (B) Self organizing feature map  
 (C) Hopfield network  
 (a) (A) only                      (b) (B) only  
 (c) (A) and (B) only                      (d) (A) and (C) only.

- (vii) Fuzzy logic is a form of \_\_\_\_\_  
 (a) two-valued logic                      (b) crisp set logic  
 (c) many-valued logic                      (d) binary set logic.
- (viii) A fuzzy set whose membership function has at least one element  $x$  in the universe having membership value unity is called \_\_\_\_\_.  
 (a) sub normal fuzzy set                      (b) normal fuzzy set  
 (c) convex fuzzy set                      (d) concave fuzzy set.
- (ix) The region of universe that is characterized by complete membership in the set is called \_\_\_\_\_.  
 (a) core                      (b) support  
 (c) boundary                      (d) fuzzy.
- (x) What kind of learning is back-propagation?  
 (a) Supervised                      (b) Unsupervised  
 (c) Semi-supervised                      (d) Reinforcement.

**Group - B**

2. (a) Draw the flow chart of the basic Genetic Algorithm.  
 (b) Using an example, show why it is important to have a mutation operator in a Genetic Algorithm. **6 + 6 = 12**
3. (a) Explain any three selection techniques in Genetic Algorithm.  
 (b) Why do we prefer Rank selection over Roulette-Wheel selection in Genetic Algorithm? **(3 × 3) + 3 = 12**

**Group - C**

4. (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 sets:  
 $A = 0/0 + 0.2/1 + 0.4/2 + 0.6/3 + 0.8/4 + 1.0/5$ .  
 $B = 1/0 + 0.8/1 + 0.6/2 + 0.4/3 + 0.2/4 + 0/5$ .  
 (b) What do you mean by Convex and Non-convex fuzzy set? Explain with proper diagram. **8 + 4 = 12**
5. (a) 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 'Slightly Costly', 'Very Very High Speed', and 'Not Very High Speed and Not Costly'.

- (b) What do you mean by De-fuzzification? Explain a de-fuzzification technique with suitable diagram.

$$(2 + 2 + 3) + (1 + 4) = 12$$

### Group - D

6. (a) Solve the following fuzzy relation equations by Zadeh Max-Min composition:

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

$$X = \{1, 2, 3, 4\}, Y = \{1, 2, 3\}.$$

- (b) Explain two fuzzy implication operators.

$$8 + 4 = 12$$

7. (a) Explain the basic difference between supervised and unsupervised learning.

- (b) Write the perceptron training algorithm (consider single node in output layer).

$$3 + 9 = 12$$

### Group - E

8. (a) What are merits and demerits of Back Propagation Algorithm?

- (b) What is learning rate?

- (c) Explain any four activation functions.

$$4 + 2 + 6 = 12$$

9. (a) A two-input, single-output and two-layer feed forward neural network(NN) has the hidden layer weights  $[0.3, 0.4, 0.2, 0.8, 0.1, 0.6]$  and output layer weights  $[0.22, 0.47, 0.36]$ . The bias values are 0.5 and 0.45. Consider a sigmoidal function with  $s = 0.2$  as activation function. What is the output of the NN if the input is  $[0.5, 0.2]^T$ ?

- (b) Show that the derivation of unipolar sigmoidal function is  $\lambda f(x) [1 - f(x)]$ .

$$8 + 4 = 12$$