

**T.E (Electronics & TC & Electronics Comm Engg) Semester-V (Revised Course 2019-20)**  
**EXAMINATION FEBRUARY 2022**  
**Soft Computing**

[Duration : Three Hours]

[Total Marks :100]

**Instructions:**

1. Assume suitable data wherever necessary
2. Answer any **five** questions taking **two** questions from **PART-A**, any **two** questions from **PART-B** and any **one** question from **PART-C**.

**PART A**

- Q.1
- a) Compare and contrast hard and soft computing. 6
  - b) Design two input OR gate and NAND gate using bias. 6
  - c) Train the network for one epoch using Hebbian learning rule for initial weights  $W^0 = [1 \ -1]$ ,  $C = 1$ , Unipolar Continuous neuron and following training data  $X1 = [1 \ -2]$ ,  $X2 = [0 \ 1]$ ,  $X3 = [2 \ 3]$ ,  $X4 = [1 \ -1]$ . 8
- Q.2
- a) Explain difference between crisp and fuzzy sets 4
  - b) Consider two fuzzy sets A and B  

$$\tilde{A} = \frac{0.1}{0} + \frac{0.2}{1} + \frac{0.3}{2} + \frac{0.4}{3} + \frac{0.5}{4} \text{ and}$$

$$\tilde{B} = \frac{0.5}{0} + \frac{0.4}{1} + \frac{0.3}{2} + \frac{0.2}{3} + \frac{0.1}{4}$$
 Find the following sets of combinations for these two sets:  
 (a)  $\tilde{A} \cup \tilde{B}$  (b)  $\tilde{A} \cap \tilde{B}$  (c)  $\tilde{A} \cup \tilde{A}$  (d)  $\tilde{B} \cap \tilde{B}$   
 (e)  $\tilde{A} \cap \tilde{A}$  (f)  $\tilde{B} \cup \tilde{B}$   
 c) For the speed control of DC motor, the membership functions of series resistance, armature current and speed are as given below, 8  

$$\tilde{RS} = \frac{0.4}{30} + \frac{0.6}{60} + \frac{1.0}{100} + \frac{0.1}{120}$$

$$\tilde{N} = \frac{0.35}{500} + \frac{0.67}{1000} + \frac{0.97}{1500} + \frac{0.25}{1800}$$

$$\tilde{IR} = \frac{0.2}{20} + \frac{0.3}{40} + \frac{0.6}{60} + \frac{0.8}{80} + \frac{1.0}{100} + \frac{0.2}{120}$$
 Compute  
 (a) Relation between  $\tilde{RS}$  and  $\tilde{IR}$   
 (b) Relation between  $\tilde{IR}$  and  $\tilde{N}$   
 (c) Max-min composition  
 (d) Max product composition

- Q.3 a) For the fuzzy relation R, find  $\lambda$ - cut relation for  $\lambda = 0^+, 0.1, 0.4$  and  $0.8$  4
- $$R_{\sim} = \begin{bmatrix} 1.0 & 0.1 & 0.0 & 0.5 & 0.3 \\ 0.02 & 0.1 & 0.55 & 1.0 & 0.6 \\ 0.2 & 1.0 & 0.6 & 1.0 & 0.0 \\ 0.03 & 0.5 & 1.0 & 0.3 & 0.0 \end{bmatrix}$$
- b) Why activation function is required in neural network? Explain any four activation functions. 4
- c) Explain the methods of selection of learning constant and initial weights for training the neural network. 6
- d) Explain general methodology of problem solving with Fuzzy Inference System. 6

### PART B

- Q.4 a) Explain following Genetic Algorithm operators (a) Insert and delete (b) Repair (C) Elitism 6
- c) Explain different methods of Mutation w.r.t Genetic Algorithm. 6
- c) What is inspiration behind Genetic Algorithm? Explain general methodology of problem solving in Genetic Algorithm. 8
- Q.5 a) What is Genetic Algorithm based Back Propagation algorithm? 4
- b) Explain various methods of Pooling with suitable example. 6
- c) What is inspiration behind Neuro-Fuzzy systems? Explain different types of Co-operative Neuro-Fuzzy systems. 10
- Q.6 a) What are different stopping criterions for Genetic Algorithm? 4
- b) List different types of Autoencoder. Explain working of Under complete Autoencoder. 8
- c) With suitable diagram explain Ant Colony Algorithm. 8

### PART C

- Q.7 a) Explain the problem of local minima w.r.t Error Back Propagation Algorithm? How to over-come the local minima problem? 6
- b) The following identities hold true for Boolean logic. Do they hold true for fuzzy logic? 6
- $a \text{ OR } b = b \text{ OR } a$
  - $a \text{ OR } (b \text{ OR } c) = (a \text{ OR } b) \text{ OR } c$
  - $\text{NOT}(a \text{ OR } b) = (\text{NOT } a) \text{ OR } (\text{NOT } b)$

c) Let X be the universe of satellites of interest, as defined below

8

$X = \{a_{12}, f_{15}, b_{16}, f_{14}, f_{900}, v_{111}\}$ . Let A and B be the fuzzy sets of INSAT~V satellite and INSAT~B satellite respectively.

$$A = \frac{0.2}{a_{12}} + \frac{0.3}{f_{15}} + \frac{1}{b_{16}} + \frac{0.1}{f_4} + \frac{0.5}{v_{111}} \text{ and}$$

$$B = \frac{0.1}{a_{12}} + \frac{0.25}{f_{15}} + \frac{0.9}{b_{16}} + \frac{0.7}{f_4} + \frac{0.3}{f_{900}} + \frac{0.2}{v_{111}}$$

Find the following sets of combinations for these two sets:

(a) Algebraic sum (b) Algebraic difference (c) Bounded sum (d) Bounded difference.

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|-----|---|---|
| Q.8 | a) Compare and contrast ANN and DNN.  | 4 |
|     | b) Explain different methods of Selection w.r.t Genetic Algorithm.  | 8 |
|     | c) What is inspiration behind Particle Swarm Optimization algorithm? Explain Particle Swarm Optimization algorithm in detail. | 8 |