

# CBCS SCHEME

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15EE661

## Sixth Semester B.E. Degree Examination, July/August 2022 Artificial Neural Networks and Fuzzy Logic

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- 1 Illustrate the following neural network architectures :
- Single Layer Feed Forward Network
  - Multilayer Feed Forward Network
  - Recurrent Network
  - Rosenblatt's Perceptron
  - Adaline Network
  - Madaline Network.
- (16 Marks)

OR

- 2 a. Summarize the learning methods used in neural networks. (06 Marks)  
b. Discuss Back propagation learning algorithm in detail. (10 Marks)

### Module-2

- 3 a. Outline variations of standard back propagation algorithm. (06 Marks)  
b. Discuss the following in detail :  
i) Autocorrelators  
ii) Heterocorrelators  
iii) Wang's strategy  
iv) Exponential BAM. (10 Marks)

OR

- 4 a. List the selection of various parameters in BPN. (05 Marks)  
b. Construct the Simplified Bidirectional Associative Memory (SBAM) algorithm in detail. (11 Marks)

### Module-3

- 5 Develop ART1 algorithm along with architecture and special features. (16 Marks)

OR

- 6 Let us consider a set of three input vectors as

$$[I] = \begin{bmatrix} 0.2 & 0.7 & 0.1 & 0.5 & 0.4 \\ 0.8 & 2.8 & 0.4 & 2.0 & 1.6 \\ 0.1 & 0.3 & 1.2 & 2.0 & 4.0 \end{bmatrix}$$

Variables  $\rho = 0.9$ ,  $\theta = 0.7$ ,  $a = 10$ ,  $b = 10$ ,  $c = 0.1$ ,  $d = 0.9$ ,  $\text{tol} = 0.001$  and the dimensions of  $F_1$  and  $F_2$  as  $M = 5$ ,  $N = 6$  respectively. Demonstrate that ART2 network varies from ART 1 network primarily in the implementation of  $F_1$  layer. (16 Marks)

**Module-4**

- 7 a. Compare the following :
- Fuzzy versus crisp
  - Crisp sets and fuzzy sets. (06 Marks)
- b. Consider the fuzzy sets  $\tilde{A}$  and  $\tilde{B}$  defined on the interval  $X = [0, 5]$  of real numbers by the membership grade functions  $\mu_{\tilde{A}}(x) = \frac{x}{x+1}$ ,  $\mu_{\tilde{B}}(x) = 2^{-x}$ . Determine the mathematical formulae and graphs of the membership grade functions of each of the following sets :
- $A^c$ ,  $B^c$
  - $A \cup B$
  - $A \cap B$
  - $(A \cup B)^c$ . (10 Marks)

**OR**

- 8 a. Organize the basic fuzzy set operations with examples. (12 Marks)
- b. Let  $\tilde{A} = \{(x_1, 0.2), (x_2, 0.7), (x_3, 0.4)\}$  and  $\tilde{B} = \{(y_1, 0.5), (y_2, 0.6)\}$  be two fuzzy sets defined on the universes of discourse  $X = \{x_1, x_2, x_3\}$  and  $Y = \{y_1, y_2\}$  respectively find the fuzzy Cartesian product  $\tilde{A} \times \tilde{B}$ . (04 Marks)

**Module-5**

- 9 a. Brief out the following :
- Crisp logic
  - Predicate logic
  - Fuzzy logic
  - Fuzzy Rule Based System. (08 Marks)
- b. Let  $X = \{a, b, c, d\}$ ,  $Y = \{1, 2, 3, 4\}$  and
- $$\tilde{A} = \{(a, 0), (b, 0.8), (c, 0.6), (d, 1)\}$$
- $$\tilde{B} = \{(1, 0.2), (2, 1), (3, 0.8), (4, 0)\}$$
- $$\tilde{C} = \{(1, 0), (2, 0.4), (3, 1), (4, 0.8)\}$$
- Determine the implication relations :
- IF x is  $\tilde{A}$  THEN y is  $\tilde{B}$
  - IF x is  $\tilde{A}$  THEN y is  $\tilde{B}$  ELSE y is  $\tilde{C}$ . (08 Marks)

**OR**

- 10 a. Explain defuzzification methods used to convert a fuzzy set to single crisp value. (06 Marks)
- b. Given :
- Every soldier is strong-willed
  - All who are strong-willed and sincere will succeed in their career
  - Indira is a soldier
  - Indira is sincere
- Prove : will Indira succeed in her career? (10 Marks)

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