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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B,Tech.

SEM: III - THEORY EXAMINATION (2022 - 2023)

Subject: Soft Computing

Time: 3 Hours

Max. Marks: 100

General Instructions:

IMP: Verify that you have received the question paper with the correct course, code, branch etc.

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.
2. Maximum marks for each question are indicated on right -hand side of each question.
3. Illustrate your answers with neat sketches wherever necessary.
4. Assume suitable data if necessary.
5. Preferably, write the answers in sequential order.
6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION A

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1. Attempt all parts:-

- 1-a. The Pros of neural networks over computers is / are _____. (CO1) 1
- (a) they have ability to learn by examples
 - (b) they have real time high computational rates
 - (c) they have more tolerance
 - (d) all of the mentioned
- 1-b. Conventional Artificial Intelligence is different from Soft computing in the sense . (CO1) 1
- (a) Conventional Artificial Intelligence deal with predicate logic where as soft computing deal with fuzzy logic
 - (b) Conventional Artificial Intelligence methods are limited by symbols where as soft computing is based on empirical data
 - (c) Both of above
 - (d) None of the above
- 1-c. The perceptron is _____. (CO2) 1

- (a) a neural network that contains feedback
- (b) a double layer auto-associative neural network
- (c) an auto-associative neural network
- (d) a single layer feed-forward neural network with pre-processing

- 1-d. Which is true for neural networks? (CO2) 1
- (a) It has set of nodes and connections
 - (b) Each node computes it's weighted input
 - (c) Node could be in excited state or non-excited state
 - (d) All of the mentioned
- 1-e. The truth values of traditional set theory is _____ and that of fuzzy set is _____ (CO3) 1
- (a) Either 0 or 1, Between 0 & 1
 - (b) Between 0 & 1, either 0 or 1
 - (c) Between 0 & 1, between 0 & 1
 - (d) Either 0 or 1, either 0 or 1
- 1-f. The room temperature is hot. Here the hot (use of linguistic variable is used) can be represented by _____. (CO3) 1
- (a) Fuzzy Set
 - (b) Crisp Set
 - (c) Fuzzy & Crisp Set
 - (d) None of the mentioned
- 1-g. Generalized Modus Tollen (GMT)" rule which is as follows: (CO4) 1
- (i) If x is A then y is B .
- (ii) If y is B'
-
- x is A'.
- A' can be calculated as:
- (a) $A' = B' \circ R(x,y)$
 - (b) $A' = (A \times B) \cup B'$
 - (c) $A' = B' \times R(x,y)$
 - (d) None of the above
- 1-h. Fuzzy rules is usually represented as : (CO4) 1

- (a) IF-THEN-ELSE rules
- (b) IF-THEN rules
- (c) Both IF-THEN-ELSE rules & IF-THEN rules
- (d) None of the Above

- 1-i. Which of the following(s) is/are found in Genetic Algorithms? (CO5) 1
- (i) Evolution. (ii) Selection. (iii) Reproduction. (iv) Mutation.
- (a) i & ii only.
 - (b) i, ii & iii only.
 - (c) ii, iii & iv only.
 - (d) All of these.
- 1-j. Genetic Algorithms are: (CO5) 1
- (a) a part of Evolutionary Computing
 - (b) inspired by Darwin's theory about evolution - "survival of the fittest"
 - (c) adaptive heuristic search algorithm based on the evolutionary ideas of natural selection and genetics
 - (d) All of the above

2. Attempt all parts:-

- 2.a. Define term "Soft computing". (CO1) 2
- 2.b. Define term the Perceptron. (CO2) 2
- 2.c. Write short notes on the Fuzzy relations. (CO3) 2
- 2.d. Explain the term Fuzzy Propositions. (CO4) 2
- 2.e. Draw the Flow chart of Genetic Algorithm. (CO5) 2

SECTION B 30

3. Answer any five of the following:-

- 3-a. Write the difference between Hard Computing and Soft Computing. (CO1) 6
- 3-b. Describe the Various types of Soft Computing Techniques. (CO1) 6
- 3-c. Explain the different learning mechanisms used in Artificial Neural Networks with the help of necessary diagrams. (CO2) 6
- 3-d. With graphical representations, Explain the different types of Activation functions used in Artificial Neural Networks. (CO2) 6
- 3.e. Consider fuzzy sets $\tilde{A}$ and B defined on the interval $X = [0,5]$ of real number by the membership grade functions : (CO3) 6

$$\mu_A(X) = X/X+1,$$

$$\mu_B(X) = 2-X$$

Determine the mathematical formulas and graphs of the membership grade functions for following set:

i) A^c , B^c ii) $A \cup B$ iii) $A \cap B$

- 3.f. Define fuzzy logic and its importance in our daily life. What is role of crisp sets in fuzzy logic ? (CO4) 6
- 3.g. Compare Roulette-Wheel Selection method with Rank Selection Method. (CO5) 6

SECTION C

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4. Answer any one of the following:-

- 4-a. Discuss the different characteristics and applications of Soft computing. (CO1) 10
- 4-b. Discuss the role of MATLAB Environment for Soft Computing Techniques. (CO1) 10

5. Answer any one of the following:-

- 5-a. Explain Artificial Neural Network . Discuss Single layer and Multilayer ANN systems with the help of diagram. (CO2) 10
- 5-b. Explain Linear Separability. Describe the Adaline and Madaline Network with diagram. (CO2) 10

6. Answer any one of the following:-

- 6-a. What is fuzzy set theory ? Explain different fuzzy sets and its operations. (CO3) 10
- 6-b. Design a fuzzy based system to recognize English alphabetical characters (F, E, X, Y, I, T) in an image processing system. Two fuzzy sets I and F are defined to represent the identification of characters I and F. (CO3) 10

$$I = \{(F, 0.4), (E, 0.3), (X, 0.1), (Y, 0.1), (I, 0.9), (T, 0.8)\}$$

$$F = \{(F, 0.99), (E, 0.8), (X, 0.1), (Y, 0.2), (I, 0.5), (T, 0.5)\}$$

Find the following: (i) $I \cup F$ (ii) $(I - F)$ (iii) $F \cup F^C$ (iv) Verify de Morgan's law

7. Answer any one of the following:-

- 7-a. Explain membership function in fuzzy logic. Explain the fuzzy inference in detail with suitable Example. (CO4) 10
- 7-b. Explain Air Conditioner Control using fuzzy logic. (CO4) 10

8. Answer any one of the following:-

- 8-a. Describe the basic Genetic Algorithm Operators. What are the roles of genetic operators in GA ? (CO5) 10
- 8-b. List and Explain in brief various Selection methods of Reproduction in GA. (CO5) 10