No. of Printed Pages : 4

Sl. No.

C9-R4 : SOFT COMPUTING

DURATION : 03 Hours **MAXIMUM MARKS : 100**

Roll No. : | | | | | | |

Answer Sheet No. : | | | | | | |

Name of Candidate : _____ **; Signature of Candidate :** _____

INSTRUCTIONS FOR CANDIDATES :

- Carefully read the instructions given on Question Paper, Answer Sheet.
- Question Paper is in English language. Candidate has to answer in English Language only.
- **Question paper contains Seven questions. The Question No. 1 is compulsory. Attempt any FOUR Questions from Question No. 2 to 7.**
- **Parts of the same question should be answered together and in the same sequence.**
- **Questions are** to be answered in the **ANSWER SHEET** only, supplied with the Question Paper.
- **Candidate cannot leave the examination hall/ room without signing on the attendance sheet and handing over his/her Answer Sheet to the Invigilator. Failing in doing so, will amount to disqualification of Candidate in this Module/Paper.**
- After receiving the instruction to open the booklet and before answering the questions, the candidate should ensure that the Question Booklet is complete in all respects.

DO NOT OPEN THE QUESTION BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. (a) Highlight some of the applications and characteristics of soft computing.

(b) How the concept of derivative can be used to find the maximum and minimum value of the given function ? Briefly discuss.

(c) What is Cooperative Neuro-Fuzzy System ? Briefly discuss.

(d) Why ANFIS is considered to be a universal estimator ? Briefly discuss.

(e) Fuzzy logic control systems find a wide range of applications in various industrial and commercial products and systems. List down at least twenty such applications.

(f) What is specialised learning ? Briefly discuss.

(g) What are the advantages of the rule-based system ?

(7x4)

2. (a) Differentiate between hard computing and soft computing.

(b) What is Genetic Algorithm? Highlight the advantages and limitations of Genetic Algorithms.

(c) Differentiate between Crisp Set and Fuzzy Set.

(6+6+6)

3. (a) Explain the significance of Neural Network in Fuzzy Logic.

(b) Construct an ANFIS that is equivalent to a two-input two-rule Mamdani fuzzy model with max-min composition and centroid defuzzification.

(c) What is Neuro-Fuzzy System ? Discuss. Also, discuss different types of Neuro-Fuzzy System.

(6+6+6)

4. (a) Briefly discuss the algorithms for the following types of Hill Climbing: Simple Hill Climbing, Steepest-Ascent Hill Climbing, and Stochastic Hill Climbing.

(b) In the context of Genetic algorithms, briefly discuss, search space, fitness score, selection operator, crossover operator, and mutation operator.

(9+9)

5. (a) What is crossover ? Using different examples, briefly discuss the following crossover in Genetic algorithms : One Point Crossover, Multi Point Crossover, Uniform Crossover, Whole Arithmetic Recombination, and Davis' Order Crossover (OX1).

(b) Find the line of best fit for the following data of heights and weights of students of a school using the least squares method: Height (in centimetres) : [160, 162, 164, 166, 168], Weight (in kilograms) : [52, 55, 57, 60, 61]

(9+9)

6. (a) Find the least-squares solution(s) of $Ax = b$ where :

$$A = \begin{pmatrix} 0 & 1 \\ 1 & 1 \\ 2 & 1 \end{pmatrix} \quad b = \begin{pmatrix} 6 \\ 0 \\ 0 \end{pmatrix}$$

Also, discuss what quantity is being minimized.

(b) Representing its block diagram, briefly discuss the Mamdani Fuzzy Inference Systems and steps for computing the output from this fuzzy inference systems.

(9+9)

7. (a) Briefly discuss fuzzy-filtered neural networks.

(b) Briefly explain the Genetic Fuzzy Hybrid Neural Network, its working, advantages, disadvantages and applications.

(9+9)

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SPACE FOR ROUGH WORK