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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA
(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2025 - 2026)

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

20

1. Attempt all parts:-

- | | | |
|-------|--|---|
| (1.1) | Identify the key feature distinguishing Soft Computing from Conventional AI:(CO1,K2) | 1 |
| | (a) Deterministic processing | |
| | (b) Exact reasoning | |
| | (c) Tolerance for imprecision | |
| | (d) Binary logic | |
| (1.2) | Identify real-world application of clustering.(CO1,K2) | 1 |
| | (a) Market segmentation | |
| | (b) Compilation | |
| | (c) Networking | |
| | (d) Encryption | |
| (1.3) | Fuzzy set theory allows elements to have (CO2, K1) | 1 |
| | (a) Only binary values | |
| | (b) Partial membership | |
| | (c) Negative membership | |
| | (d) Infinite membership | |
| (1.4) | Defuzzification methods include (CO2, K1) | 1 |
| | (a) Mean of maxima | |
| | (b) Sorting | |
| | (c) Searching | |
| | (d) Encoding | |

- (1.5) Too many hidden neurons can result in (CO3, K1) 1
- (a) Underfitting
 - (b) Overfitting
 - (c) Faster learning only
 - (d) Reduced complexity
- (1.6) Backpropagation performance depends on (CO3, K2) 1
- (a) Input size only
 - (b) Learning rate and initialization
 - (c) Output only
 - (d) Bias only
- (1.7) A Genetic Algorithm operates on a set of solutions instead of a single solution at a time. This characteristic refers to (CO4, K2) 1
- (a) Deterministic search
 - (b) Population-based search
 - (c) Sequential processing
 - (d) Linear optimization
- (1.8) A condition that stops the algorithm after certain criteria is satisfied is known as (CO4, K1) 1
- (a) Fitness condition
 - (b) Termination condition
 - (c) Selection condition
 - (d) Mutation condition
- (1.9) MATLAB allows users to input commands and programs through which of the following methods? (CO5, K1) 1
- (a) Only script files
 - (b) Command window and script files
 - (c) Only GUI
 - (d) None
- (1.10) The graphical tool used for designing and visualizing neural network models is: (CO5, K2) 1
- (a) fuzzy
 - (b) nntool
 - (c) plot
 - (d) ga

2. Attempt all parts:-

- (2.1) Difference between hard and soft computing.(CO1,K2) 2
- (2.2) Explain role of membership function in fuzzy systems. (CO2, K2) 2
- (2.3) Explain supervised learning with an example. (CO3, K2) 2
- (2.4) Discuss the limitations of Genetic Algorithm in terms of convergence and computation. (CO4, K2) 2
- (2.5) Outline major features of MATLAB that make it suitable for engineering 2

applications. (CO5, K2)

SECTION-B

30

Answer any one of the following:-

- (3.1) Explain the density estimation method used in Mountain Clustering for identifying cluster centers. Describe the mountain function and the process of selecting clusters.. (CO1,K2) 6
- (3.2) Explain the convergence behavior of K-Means Clustering and describe how it attains stable clusters after repeated iterations. (CO1,K2) 6

Answer any one of the following:-

- (3.3) Compute union, intersection, and complement for given fuzzy membership values and interpret results. (CO2, K3) 6
- (3.4) Differentiate fuzzy logic and crisp logic based on reasoning process and representation. (CO2, K2) 6

Answer any one of the following:-

- (3.5) Describe Radial Basis Function Network and compare it with perceptron networks. (CO3, K4) 6
- (3.6) Discuss the architecture and applications of the Hopfield Network. (CO3, K2) 6

Answer any one of the following:-

- (3.7) Compare and analyze traditional search techniques and Genetic Algorithm in terms of working mechanism and efficiency.. (CO4, K3) 6
- (3.8) Explain the classification of Genetic Algorithm and show how different types are applied in solving problems. (CO4, K3) 6

Answer any one of the following:-

- (3.9) Describe different types of operators available in MATLAB with examples. (CO5, K3) 6
- (3.10) Compare Neuro-Fuzzy and GA-Fuzzy systems. (CO5, K4) 6

SECTION-C

50

4. Answer any one of the following:-

- (4.1) Discuss a case study on customer segmentation using K-Means Clustering and illustrate cluster formation for targeted marketing applications.(CO1,K2) 10
- (4.2) Solve genetic algorithm operations including selection, crossover, and mutation with numerical example.(CO1,K3) 10

5. Answer any one of the following:-

- (5.1) Construct triangular, trapezoidal, and Gaussian membership functions for given inputs and compute membership values. (CO2, K3) 10
- (5.2) Compare different defuzzification methods based on accuracy and computational complexity. (CO2, K3) 10

6. Answer any one of the following:-

- (6.1) "A company wants to build a system that identifies spam emails automatically." Analyze how a neural network can be used for this task and compare suitable learning methods. Explain neural networks with biological inspiration, components, and architecture using diagrams. (CO3, K4) 10

- (6.2) Compare Hebbian learning and backpropagation based on learning mechanism, efficiency, and applications. (CO3, K4) 10
7. Answer any one of the following:-
- (7.1) Apply the concept of Genetic Algorithm to solve a real-world optimization problem and explain its step-by-step working. (CO4, K3) 10
- (7.2) "A logistics company wants to minimize delivery time by finding the best route between multiple cities." (CO4, K3) 10
- a)** Apply Genetic Algorithm to solve this problem.
- b)** Explain encoding of solution and fitness function.
- c)** Describe how selection, crossover, and mutation are used.
8. Answer any one of the following:-
- (8.1) Justify the use of GA-NN systems instead of standalone neural networks and explain how Genetic Algorithms improve neural network performance in optimization problems. (CO5, K5) 10
- (8.2) Evaluate the role of MATLAB in implementing hybrid soft computing systems. MATLAB. (CO5, K5) 10