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MCA
(SEM IV) THEORY EXAMINATION 2024-25
SOFT COMPUTING

TIME: 3 HRS**M.MARKS: 100****Note:** Attempt all Sections. In case of any missing data; choose suitably.**SECTION A****1. Attempt all questions in brief. 2 x 10 = 20**

Q No.	Question	CO	Level
a.	What are the key differences between soft computing and hard computing?	1	K1, K2
b.	Define an artificial neuron and describe its basic structure.	2	K2
c.	What is the role of activation function in a neural network?	2	K4
d.	Explain the concept of fuzzification and its purpose.	3	K3
e.	List different types of learning in neural networks.	2	K4
f.	What are the key operations in a genetic algorithm?	4	K5
g.	Define membership function in fuzzy logic.	3	K3
h.	What is crossover in genetic algorithms and why is it important?	4	K5
i.	Explain the term 'swarm intelligence'.	5	K3
j.	What are hybrid soft computing techniques? Give an example.	5	K3

SECTION B**2. Attempt any three of the following: 10 x 3 = 30**

Q No.	Question	CO	Level
a.	Critically evaluate how the choice of activation function affects the learning capability, convergence, and performance of a neural network in real-world applications such as image recognition or language processing. Justify your reasoning with suitable examples.	2	K4
b.	Explain the architecture and training process of multilayer perceptron.	2	K4
c.	Various Fuzzy set operations extend classical set theory to handle uncertainty and vagueness. Critically analyze how these operations enable better modeling of real-world problems compared to crisp logic. Choose a real-life scenario (e.g., air conditioner control, risk assessment, or medical diagnosis) and demonstrate how fuzzy set operations enhance decision-making in that context.	3	K3
d.	Explain the structure and working of a Kohonen Self-Organizing Map.	2	K4
e.	Explain the concepts of Genetic Algorithm. Analyze and evaluate how each step of a GA—selection, crossover, and mutation—contributes to finding optimal or near-optimal solutions. Also, discuss potential challenges in applying GAs effectively.	4	K5

SECTION C**3. Attempt any one part of the following: 10 x 1 = 10**

Q No.	Question	CO	Level
a.	Explain supervised, unsupervised, and reinforcement learning with suitable examples.	1	K1, K2
b.	Critically analyze how soft computing differs from hard computing in dealing with real-world complexity. Choose a practical application domain (such as medical diagnosis, autonomous vehicles, or financial prediction) and argue why soft computing is better suited than traditional hard computing approaches.	1	K1, K2



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4. Attempt any one part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Compare and contrast Perceptron and Backpropagation networks. Also, Design a perceptron that implements the logical AND function. Provide the weight updates for each training step using a learning rate of 1.	2	K4
b.	Explain the architecture and features of a Hopfield Network.	2	K4

5. Attempt any one part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Explain fuzzy inference system with a diagram. Describe its components. Also, Given fuzzy set $A = \{(1, 0.3), (2, 0.5), (3, 0.7), (4, 1)\}$, compute the α -cut for $\alpha = 0.6$ and the complement of A.	3	K3
b.	Differentiate between Mamdani and Sugeno inference systems.	3	K3

6. Attempt any one part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Explain the process of encoding, crossover, and mutation in GA with examples. Also, Apply single-point crossover and mutation on: Parent 1: 11010101 Parent 2: 10101011 Crossover after 4th bit; flip 3rd bit of offspring.	4	K5
b.	Compare and contrast Genetic Algorithms (GAs), Genetic Programming (GP), and Evolutionary Strategies (ES) in the context of solving real-world optimization problems. Choose one real-world problem (e.g., route optimization, financial forecasting, robotic control, etc.) and justify which of the three would be the most appropriate approach and why.	4	K5

7. Attempt any one part of the following: 10 x 1 = 10

Q No.	Question	CO	Level
a.	Describe the neuro-fuzzy hybrid system with a suitable application.	5	K3
b.	Swarm Intelligence algorithms such as Particle Swarm Optimization (PSO) and Ant Colony Optimization (ACO) are inspired by collective behavior in nature. Critically evaluate how these algorithms mimic real-world swarm behavior to solve optimization problems. Choose a specific application (e.g., network routing, task scheduling, or vehicle routing) and analyze the advantages and limitations of using swarm intelligence for that problem.	5	K3