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PAPER CODE	U315-264BCSE

(AY: 2025-26) December 2025 (ENDSEM) EXAM

TY (SEMESTER - I)

COURSE NAME:SOFT COMPUTING **BRANCH: CSE DATA SCIENCE** **COURSE CODE: CD31234B**

(T.Y (Pattern 2023)

Time: [1Hr 30 Min] **[Max. Marks: 40]**

Instructions to candidates:

1) **Figures to the right indicate full marks. Use of scientific calculator is allowed**
2) **Use suitable data wherever required**
3) **All questions are compulsory. Solve any two sub question each from Questions 1 and 2**
4) **Solve any one sub question (2 marks) from Questions 3 ,4 ,5 and 6 and sub question of 4 marks is compulsory from questions 3,4,5,and 6**

Q. No.	Question Description	Max. Marks	CO mapped	BT Level
Q.1	a) An automated stock trading system requires both Hard Computing for high-frequency transaction logging and Soft Computing for predicting market trends based on noisy historical data. Analyze and contrast the core philosophical differences (Paradigms, Reliability, and Model type) between these two approaches in the context of this single application.	[4]	CO1	BT 2
	b) Briefly describe the different Environments in which an Intelligent Agent might operate (e.g., fully observable, partially observable, episodic, continuous). Give an example of a Simple Reflex Agent and its specific function.	[4]	CO1	BT 2
	c) Explain the relationship among Fuzzy Logic, Neural Networks, and Evolutionary Algorithm. Give a specific, practical example of an application that requires the integration of at least two of these components to achieve an intelligent outcome.	[4]	CO1	BT 2

Q2	a) What is the significance of an Activation Function in an Artificial Neuron? Explain the characteristics and primary use-cases of the Sigmoid and ReLU activation functions.	[4]	CO2	BT 2
	b) Differentiate between the three main learning techniques in Neural Networks: Supervised Learning, Unsupervised Learning, and Reinforcement Learning, giving an application example for each.	[4]	CO2	BT 2
	c) Explain why a Single-layer Perceptron is limited to solving only linearly separable problems. How does the architecture of a Multi-layer Perceptron (MLP) overcome this fundamental limitation?	[4]	CO2	BT 2
Q3	a) State the basic rules for Fuzzy OR (Union) and Fuzzy AND (Intersection) operations. Briefly explain the concept of Fuzzy Reasoning. OR	[2]	CO3	BT 2
	b) Explain the concept of a membership function in Fuzzy Set Theory. Provide an illustrative example of a linguistic term (e.g., "tall," "hot") .	[2]	CO3	BT 2
	c) A hospital is designing a Fuzzy Inference System (FIS) to assess a patient's risk level (Output: Low, Medium, High) based on two inputs: Fever (Normal, High) and Fatigue (Low, Moderate, Severe). i. Explain the roles of Fuzzification and Defuzzification in this system, stating what they convert. ii. Formulate two representative Fuzzy Rules that the system might use (e.g., IF Fever is HIGH AND Fatigue is SEVERE THEN Risk is HIGH).	[4]	CO3	BT 2
Q4	a)Distinguish between Single-variable optimization and Multi-variable optimization based on the number of parameters involved and the solution space complexity. OR	[2]	CO4	BT 2
	b) Briefly explain the role of Direct Search Methods in solving unconstrained optimization problems. Name one such method	[2]	CO4	BT 2
	c) A manufacturing company wants to minimize the cost of producing a specific component. The production process involves two main machines, M1 and M2. i. Formulate this as a constrained optimization problem by identifying the likely Objective Function and at least two potential Constraints (e.g., time, resources, quality limits). ii. Given the problem has multiple non-linear constraints, which category of Classical Optimization Method (e.g., single-variable, multi-variable, constrained) would be most appropriate to solve this?	[4]	CO4	BT 2

Q.5	a) Explain the concept of Evolutionary Principles and how they are applied to probabilistic search in the basic Genetic Algorithm framework. OR	[2]	CO5	BT 2
	b) Describe the purpose and mechanism of the Mutation operator in Genetic Algorithms, explaining its role in preventing stagnation.	[2]	CO5	BT 2
	c) A telecommunications company uses a Genetic Algorithm (GA) to optimize the placement of new cell towers (location coordinates and power settings) to maximize network coverage while minimizing installation cost. i. Describe how the encoding of a candidate solution (chromosome) would be structured for this problem. ii. Explain how a Crossover operation (like two-point crossover) would work on two potential cell tower placement solutions (parents) to generate a new candidate solution (offspring).	[4]	CO5	BT 2
Q.6	a) What is Swarm Intelligence? Name two Bio-Inspired Optimization Techniques and state their source of inspiration. OR	[2]	CO6	BT 2
	b) Outline the key differences in formulation between real-valued PSO and binary PSO. State where binary PSO is typically used.	[2]	CO6	BT 2
	c) A research team is using a Swarm Intelligence algorithm to tune the hyperparameters (e.g., learning rate, regularization strength) of a complex Machine Learning model to maximize its accuracy. The search space is continuous. i. Which algorithm, Ant Colony Optimization (ACO) or Particle Swarm Optimization (PSO), is generally better suited for this continuous optimization task? Justify your choice. ii. Briefly explain the role of Velocity in the chosen algorithm for exploring the hyperparameter space.	[4]	CO6	BT 2