Question Paper Code	14030

M.E. / M.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025
Third Semester

M.E. - Computer Science and Engineering
24PCSEL309 – BIO-INSPIRED COMPUTING
Regulations - 2024

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

		Marks	K–Level	CO

1. What does the time complexity of an algorithm typically measures? — 1, K1, CO1
   a) The amount of memory used by the algorithm.
   b) The speed of the algorithm's execution relative to input size.
   c) The number of lines of code in the algorithm.
   d) The number of variables used in the algorithm.

2. The field of bio-inspired computing mainly focuses on — 1, K1, CO1
   a) Human-computer interfaces   b) Operating system design
   c) Mimicking natural evolutionary and behavioral processes   d) Data compression

3. What characterizes an isotropic random walk? — 1, K1, CO2
   a) It has a fixed direction and step length.
   b) The step direction is uniformly distributed, and the step length is constant.
   c) The direction and step length are predetermined.
   d) It only moves in one direction.

4. Which one is the trajectory-based search? — 1, K1, CO2
   a) Firefly algorithm   b) Simulated annealing
   c) Particle swarm optimization   d) Genetic algorithm

5. In a Genetic Algorithm, the fitness function is primarily used to — 1, K1, CO3
   a) Select parents for reproduction   b) Mutate offspring
   c) Initialize population   d) Control crossover rate

6. Which operation in Genetic Algorithms introduces new genetic material into the population? — 1, K1, CO3
   a) Selection   b) Crossover   c) Mutation   d) Fitness evaluation

7. In Particle Swarm Optimization, particles update their velocity based on — 1, K1, CO4
   a) Only global best position   b) Their own experience and the swarm's best
   c) Random initialization   d) Mutation probability

8. In Ant Colony Optimization, pheromone evaporation helps to — 1, K1, CO4
   a) Increase convergence speed   b) Avoid premature convergence
   c) Strengthen all paths equally   d) Ignore previously found paths

9. Which of the following best describes a Probabilistic Neural Network (PNN)? — 1, K1, CO5
   a) A type of unsupervised neural network
   b) A classifier based on Bayesian decision theory and Parzen window estimation
   c) A deep learning network using convolutional filters
   d) A recurrent model used for time series prediction

10. The Bat Algorithm used in this method is inspired by which natural behavior? — 1, K1, CO5
    a) The flocking of birds   b) The echolocation behavior of bats
    c) The migration of fish   d) The food foraging of ants

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

11. Give an example and write how parameter tuning affects the performance of a bio-inspired algorithm. — 2, K1, CO1

12. Differentiate between isotropic and anisotropic random walks. — 2, K2, CO1

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **14030**

13. Compare discrete random variable and continuous random variable.	2	K2	CO2
14. Define Intermittent Search Strategy.	2	K1	CO2
15. Define crossover and mutation in Genetic Algorithms.	2	K1	CO3
16. How to formulate the fitness function?	2	K1	CO3
17. What is the objective of Ant Colony Optimization (ACO)?	2	K1	CO4
18. List the two variants of the Firefly algorithm.	2	K1	CO4
19. Show how meta-heuristic optimization is used in neural network fine-tuning.	2	K2	CO5
20. Outline any two bio-inspired algorithms commonly used in image processing.	2	K2	CO5
21. Infer the goal of mobile object tracking in computer vision.	2	K2	CO6
22. Show the Ground-Glass Opacity (GGO) nodules.	2	K2	CO6

PART - C (6 × 11 = 66 Marks)
Answer ALL Questions

23. a) i) Discuss the general framework of a nature-inspired metaheuristic algorithm and explain its major components with an example.	5	K2	CO1
ii) Explain the difference between traditional optimization algorithms and bio-inspired optimization algorithms with suitable examples.	6	K2	CO1
OR			
b) List various nature-inspired algorithms and explain their parameter tuning mechanisms.	11	K2	CO1
24. a) i) Illustrate the concept of random walk to show how search agents explore the solution space in an optimization problem.	5	K2	CO2
ii) Demonstrate how the simulated annealing algorithm can be used to find the minimum of a nonlinear function.	6	K2	CO2
OR			
b Discuss in detail about Levy distribution and Flights with suitable example.	11	K2	CO2
25. a) Make use of the Schema theorem in Genetic Algorithms and explain the evolution of building blocks over generations.	11	K3	CO3
OR			
b) Experiment with Genetic Algorithm (GA) and Differential Evolution (DE) in terms of parameter selection, convergence behavior, and computational efficiency. State the situations in which one algorithm performs better than the other.	11	K3	CO3
26. a) Outline the analysis of PSO algorithm in detail.	11	K2	CO4
OR			
b) Demonstrate how Ant Colony Optimization can be applied to a traveling salesman problem with 3 cities. Show how the best path is selected after one iteration.	11	K2	CO4
27. a) Apply metaheuristic-driven optimization to fine-tune an Enhanced Probabilistic Neural Network for improved image classification accuracy.	11	K3	CO5
OR			
b) Identify how the Cuckoo search algorithm can be applied for image thresholding in segmentation. Assume three nests representing possible threshold values. Show how one new solution is generated using Lévy flight and how the best threshold is selected after one iteration.	11	K3	CO5
28. a) Inspect the process of detecting and segmenting Ground Glass Opacity nodules using the Snake Model.	11	K4	CO6
OR			
b) Analyze Improved Weighted Thresholded Histogram Equalisation Algorithm using BAT algorithm.	11	K4	CO6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create