Reg. No.															

Question Paper Code	13529

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Fourth Semester

Computer Science and Engineering (AIML)

20AMPC401 - NATURE INSPIRED COMPUTING TECHNIQUES

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Nature-inspired computing primarily draws its computational strategies from which source? (a) Human-made algorithms (b) Artificial intelligence (c) Natural processes and systems (d) Mathematical equations	1	K1	CO1
2.	Feedback in nature-inspired systems typically: (a) Encourages systems to ignore external stimuli (b) Enables systems to correct and adjust based on past experiences (c) Prevents systems from adapting (d) Is non-essential to the system's functioning	1	K1	CO1
3.	Which of the following is NOT a type of evolutionary algorithm? (a) Genetic Algorithms (b) Evolution Strategies (c) Hill-Climbing (d) Genetic Programming	1	K1	CO2
4.	Which of the following is a key challenge in genetic programming? (a) Population Size (b) Fitness Evaluation (c) Genetic Drift (d) Overfitting	1	K1	CO2
5.	Which of the following is the main inspiration behind Ant Colony Optimization (ACO)? (a) Fish schools (b) Bee foraging (c) Ant foraging behavior (d) Birds flocking behavior	1	K1	CO3
6.	What is the main advantage of using Swarm Intelligence algorithms in optimization? (a) They are computationally expensive (b) They are inspired by natural phenomena and can adapt to complex problems (c) They require complex hardware (d) They rely on a single centralized controller.	1	K1	CO3
7.	Which of the following is a characteristic of Swarm Robotics? (a) Single robot control (b) Centralized control. (c) Distributed control with cooperative behavior (d) No interaction between robots.	1	K1	CO4
8.	What happens when particles in PSO share information? (a) They move in random directions (b) They adjust their positions to improve the overall solution (c) They stop moving altogether (d) They avoid one another.	1	K1	CO4
9.	Which of the following is a key component of the immune system? (a) Kidneys (b) Heart (c) Lymphocytes (d) Red Blood Cells	1	K1	CO5
10.	What is the primary motivation behind DNA computing? (a) To increase the speed of traditional computers (b) To reduce the cost of computer hardware (c) To solve problems that are difficult for classical computers to handle (d) To replace conventional computers entirely	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

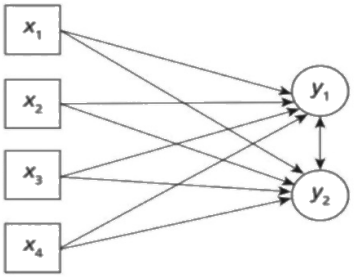
Answer ALL Questions

11.	List the branches of Natural computing.	2	K1	CO1
12.	Differentiate parallelism and distributivity.	2	K2	CO1
13.	How is Darwin's Dangerous Idea defined?	2	K1	CO2
14.	Differentiate genetic algorithm verses traditional algorithm.	2	K2	CO2
15.	List the applications of ACO.	2	K1	CO3
16.	Write about the formulation of Ant colony optimization (ACO).	2	K1	CO3
17.	Differentiate GA optimization from PSO optimization.	2	K2	CO4
18.	Which drawbacks are associated with PSO?	2	K1	CO4
19.	Define immune computing.	2	K1	CO5
20.	Which affinity measures are most commonly used for real-valued shape spaces?	2	K1	CO5
21.	Which are the main advantages of DNA computing?	2	K1	CO6
22.	Compare classical and DNA computing.	2	K2	CO6

PART - C (6 × 11 = 66 Marks)

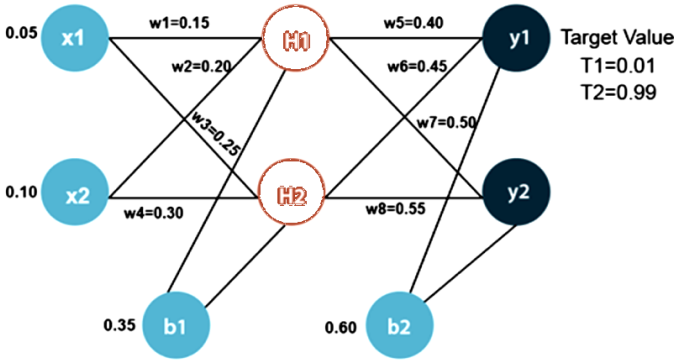
Answer ALL Questions

23.	a)	Given the training samples, x1=[1,0,1,0], x2=[1,0,0,0], x3=[1,1,1,1], x4=[0,1,1,0], the learning rate as 0.6 and the weights corresponding to unit 1 as [0.3 0.5 0.7 0.2] & unit 2 as [0.6 0.5 0.4 0.2] for the network given below, compute 1 epoch and find the alignment of the 4 training examples using self organizing maps.	11	K3	CO1



OR

	b)	Optimize the weights for the given feedforward NN, so that NN correctly map arbitrary inputs to outputs.	11	K3	CO1



24.	a)	Maximize (x^2+1) over {0, 1, … , 31} using Genetic Algorithm. Choose 1-point crossover with initial population 01101, 11000, 01000, 10010.	11	K3	CO2

OR

	b)	Solve fitness for the given chromosomes with Roulette wheel selection process: [0001100101010, 0101001010101, 1011110100101, 1010010101001].	11	K3	CO2

25.	a)	With a neat flowchart, explain the algorithm of Ant Colony Optimization	*11*	*K2*	*CO3*
		OR			
	b)	Outline foraging for food and clustering of objects.	*11*	*K2*	*CO3*
26.	a)	Explain the process of PSO with a neat flow chart and algorithm. Elucidate the velocity and position update equations.	*11*	*K2*	*CO4*
		OR			
	b)	With a neat flowchart, explain the algorithm of particleswarm optimization.	*11*	*K2*	*CO4*
27.	a)	Detail data compression and clustering.	*11*	*K2*	*CO5*
		OR			
	b)	Describe the physiology and main components of the immune system.	*11*	*K2*	*CO5*
28.	a)	Explain the splicing system and the sticking system.	*11*	*K2*	*CO6*
		OR			
	b)	Detail the DNA manipulation technique by Adleman's experiment.	*11*	*K2*	*CO6*