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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**

Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**

Course Code: 24AM5PCNIC **Max Marks: 100**

Course: Nature Inspired Computing

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Elaborate the two main approaches for the simulation and emulation of nature in computers	*CO1*	*PO1*	**06**
	b)		Illustrate the workflow and outcomes of natural computing with a neat diagram.	*CO1*	*PO1*	**08**
	c)		with a neat sketch depict and explain the divisions of computing with natural materials.	*CO1*	*PO1*	**06**
			OR			
2	a)		Elaborate three main branches of natural computing with a neat sketch.	*CO1*	*PO1*	**06**
	b)		Illustrate the mechanisms of positive and negative feedback function in natural system.	*CO1*	*PO1*	**06**
	c)		Illustrate the main components of computing inspired by nature branch.	*CO1*	*PO1*	**08**
			UNIT - II			
3	a)		Illustrate the working of Ant Colony Optimization (ACO) algorithm considering distribution of pheromones. Apply the ACO to find the pheromone deposit on each path for the given graph in figure 3a with the following parameters given in the table.	*CO3*	*PO2*	**10**

Parameters	Value
Population Size	4
Maximum Iteration	1
Pheromone evaporation rate	0.05
Initial Pheromone	0.5
Alpha, Beta	1
Q(Constant)	4(for Q/L in in $\Delta\tau$)
Random number	0.8 for first iteration

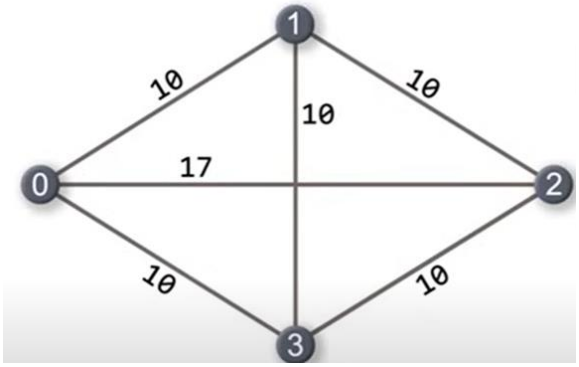

Figure 3a

	b)	Outline the pseudocode for Employed Bee Phase in Artificial Bee Colony. Analyze the generation of new solution and the factors to consider while evaluating their effectiveness.	*CO3*	*PO1*	**10**
		OR			
4	a)	Solve the given particle swarm optimization (PSO) problem to find global best(*g*best) and particle's best(*p*Best) using the following data.	*CO3*	*PO2*	**10**

Parameters	Value
Objective function	x^2+1
Number of Particles	3
Initial positions of particles	$x_1= -2$, $x_2= 1$, $x_3= -1$
Initial velocity of particles	$v_1= 0.5$, $v_2 = -0.3$, $v_3= 0.1$
Inertia weight (w)	0.5
Cognitive coefficient(c_1)	1.5
Random values	r1 = r2 as 0.6 for first iteration r1=r2 as 0.7 for second iteration

	b)	Analyze Outlooker Bee phase and Scout phase working in ABC algorithm by considering the factors to choose the food source.	*CO3*	*PO1*	**10**
		UNIT - III			
5	a)	Apply Genetic Algorithm to optimize the function $f(x)=x^3$, where the value of x ranges from 0 to 15. Consider the Crossover point as 3 for the given population.	*CO3*	*PO2*	**10**

String No.	Initial Population
1	0010
2	0100
3	1001
4	1110

	b)	Explain five phases of Genetic Algorithm with relevant example.	*CO1*	*PO1*	**05**
	c)	Illustrate various encoding techniques in Genetic Algorithm.	*CO2*	*PO1*	**05**
		OR			

	6	a)	Explain Three parent crossover method to generate offspring. Consider the following parent chromosomes to generate offsprings using: P1: 15.65 | 12.76 | 13.47 P2: 18.83 | 19.41 | 16.28 i. Single arithmetic crossover with k(random value)=2 , $\alpha = 0.5$. ii. Linear crossover with K(random value)=2, $\alpha_1=0.5$, $\alpha_2=1.5$, $\alpha_3=-0.5$, $\beta_1=0.5$, $\beta_2=-0.5$, $\beta_3= 1.5$.	*CO3*	*PO1*	**10**
		b)	Illustrate five mutation operators for chromosome(string) manipulation in Genetic Algorithm.	*CO2*	*PO1*	**05**
		c)	In detail explain the stopping condition for Genetic Algorithm.	*CO1*	*PO1*	**05**
			UNIT - IV			
	7	a)	Provide Firefly Algorithm. Analyse the movement of firefly based on light intensity and attractiveness function. Include the relevant equations with assumptions and provide an example to demonstrate how the algorithm identifies the optimal solution for a given population.	*CO3*	*PO1*	**10**
		b)	Analyse the working of Cuckoo Search Algorithm with its three basic principles. Also, elobrate how the cuckoo bird selects a host nest during the process of generating a new solution in optimization with an example.	*CO3*	*PO3*	**10**
			OR			
	8	a)	Provide Social Spider Algorithm (SSA) and explain how information among community is shared through the communal web.	*CO1*	*PO1*	**10**
		b)	Illustrate Intelligent Water Droplet (IWD) algorithm along with its the key concepts.	*CO2*	*PO1*	**10**
			UNIT - V			
	9	a)	Apply Gray Wolf Optimization for the given parameters and find x(t+1), Where t is the iteration, x is position of Gray wolf. Initial Population=12, alpha(α)=2, x(t)=1. Coefficient vectors: $A_1=9$, $A_2= 6$ $A_3=3$ $C_1=2$, $C_2=4$, $C_3=6$ Initial Fitness value: $X_\alpha=5$, $X_\beta=11$ $X_\delta=15$	*CO3*	*PO3*	**10**
		b)	Analyze the hierarchical structure of a wolf pack and Outline the Gray Wolf Optimization (GWO) algorithm and discuss how the wolf pack hierarchy is simulated within the algorithm to solve optimization problems.	*CO2*	*PO2*	**10**
			OR			

	10	a)	Provide Dragon fly algorithm and considering population size of 25. Analyse the mathematical model in each step.	*CO3*	*PO2*	**10**
		b)	Provide Whale optimization algorithm and explain Exploration phase during the search for prey.	*CO2*	*PO1*	**10**

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