K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:V
Class:TY	Program:B.Tech
Branch Code:ROB	Pattern:2023
Name of Course:Evolutionary Computation	Course Code:2312309
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 04page(s).
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Marks CO

Question No. 1

1a) Explain with suitable examples following mutation operators in genetic algorithm: (6) CO1

i) Bitwise mutation

ii) Swap

iii) Scramble

Question No. 2

2a) Explain the application of particle swarm optimization to solve inverse kinematics problem in robotics. (6) CO3

Question No. 3

3a) An ABC algorithm is employed to minimize the function $z = 3x_1.x_2 - x_1^{1.3.}$ If the initial six food source positions are as given in Table below, calculate the probability of assigning onlooker bees to each food source. (8) CO1, CO3

Food source	x_1	x_2
1	5	13
2	4	24

3	3	12
4	2	17
5	5	19
6	8	16

OR

3b) What are algorithm specific parameters in artificial bee colony algorithm? How they are chosen? (8) CO2

3c) In an Artificial bee colony algorithm, the objective function to minimize is $Z = x.y - y^{1.2}$. Number of employed bees are 6 and number of onlooker bees are 20. The food source positions are shown in Table. Update the food source 4 if the bees selected for knowledge sharing are {3, 2} and random number is 0.74. (8) CO1, CO3

food source	1	2	3	4	5	6
x	3.3	2.7	4.9	8.2	6.1	5.5
y	15	17	24	30	11	27

OR

3d) Demonstrate with suitable example, the use of Taguchi method to select most significant variables to be optimized using artificial bee colony algorithm (8) CO3, CO4

Question No. 4

4a) Ant colony optimization is used to determine the path of autonomous mobile robot for an environment having 5 stations. The distance between the stations are given in Table below. Considering starting station as 1, what is the % probability that an ant will choose the path 1 to 3? Assume initial pheromone deposition level as 0.5. (8) CO1, CO3

Stations	1	2	3	4	5
1	2.56	1.07	1.93	1.97	2.78

OR

4b) Explain the applications of ant colony optimization to solve combinatorial problems. (8) CO3

4c) Explain any two hybrid ant colony optimization algorithms. (8) CO1, CO4

OR

4d) In an Ant Colony Algorithms having 3 ants, the path travelled by each ant is as follows: (8) CO1, CO3

Ant 1: A-C-B-D-A

Ant 1: A-B-D-C-A

Ant 1: A-D-C-B-A

If the initial pheromone deposition on all paths is 1 and the evaporation rate is 0.40, determine the new pheromone level along path B-D after all ants traveled along their paths. The distance between the stations are as given below.

	A	B	C	D
A	0	1.2	0.96	1.7
B	1.2	0	0.87	1.4
C	0.96	0.87	0	1.6
D	1.7	1.4	1.6	0

Question No. 5

5a) In an image detection problem using artificial neural networks, the weights for the three attributes of the input image (A1, A2, and A3) are w1 = 2 ; w2 = −4; and w3 = 1 respectively. The values of these attributes for the four different patterns captured are as shown in Table below and the activation of the unit is given by the step-function: $\varphi(v) = 1$ if $v \geq 0$ otherwise 0. Determine which image pattern matches with the input image. (8) CO3, CO4

Pattern	P1	P2	P3	P4
X1	1	0	1	1
X2	0	1	0	1
X3	0	1	1	1

OR

5b) Define following terms related to fuzzy logic: (8) CO1

i) Membership function

ii) Fuzzification

iii) Defuzzification

iv) Inference engine

v) Support

vi) Alfa cut

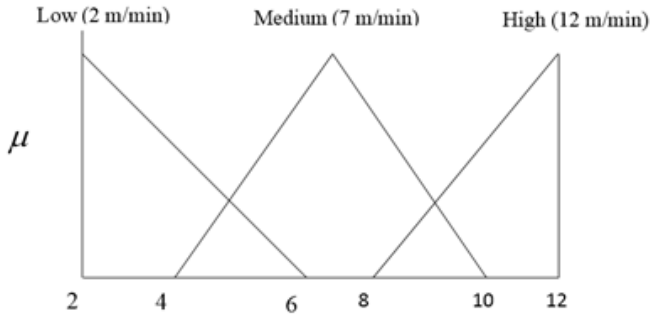
vii) Boundary

viii) Bandwidth

5c) Explain with suitable examples, applications of fuzzy logic in robotics (8) CO1

OR

5d) In a mobile robot application, the linear speed of robot is an output parameter which is considered at three levels as shown in Fig. The membership values are evaluated as 0.6 for medium and 0.4 for high. Determine the crisp value of the linear speed. (8) CO3



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