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:2022
Name of Course:Artificial Intelligence for Robotics	Course Code:ROB223002
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 03page(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 best first search algorithm. What are its applications in robotics?	(6)	CO2
Question No. 2			
2a)	In a neural network, input nodes for pattern 1 are (0, 1, 1) while input nodes for pattern 2 are (1, 1, 0). A perceptron having weights corresponding to the three inputs have the following values: w1 = -3 ; w2 = 2; and w3 = 4 and the activation of the unit is given by the step-function: $y = \varphi(v) = 1$ if $v \geq 0$ otherwise 0. What will be output corresponding to each pattern?	(6)	CO2, CO3
Question No. 3			
3a)	Explain with suitable example the Imaging based robot guidance.	(8)	CO2, CO3
	OR		
3b)	Determine whether pixel having intensity 201 in the image given below is on the edge. Use Sobel operator.	(8)	CO2, CO3

192	102	16
98	201	94
106	89	74

3c)	Explain region growing method for image segmentation	(8)	CO1, CO3
	OR		
3d)	A robot is used to sort five objects based on their color in two groups. The RGB values for the objects captured by vision system are as shown below. Use *K*- Means clustering to perform this task.	(8)	CO2, CO3

Object No.	Red (R)	Green (G)	Blue (B)

1	43	62	112
2	4	55	202
3	118	4	207
4	134	16	123
5	55	78	37

Question No. 4

4a) For a certain binary image, following data operates. Determine the compression ratio using run length encoding. (8) CO2, CO3

Run	Bit Value	Length
1	0	14
2	0	10
3	1	18
4	1	9
5	1	12
6	0	17

OR

4b) Explain the steps of simulated annealing algorithm to solve inverse kinematic problem of planer R-R robot configuration. (8) CO2, CO3

4c) Fuzzy logic is to be used for automatic navigation of an Autonomous Mobile Robot (AMR). (8) CO2, CO3

The Input levels and their membership functions are:

i) Distance (D) between current position of AMR and targeted position at three levels: Low (0, 0, 2), Medium (1, 3, 5), High (4, 6, 6).

ii) The angle of deviation (θ) from the targeted position at three level Negative (–30, –30, –10), Moderate (–20, 0, 20), Positive (10, 30, 30)

Determine the membership of corresponding output level for distance (D): Medium and angle of deviation (θ): Moderate if AND rule apply.

OR

4d) Explain the applications of visibility graph method to robot path planning (8) CO1, CO3

Question No. 5

5a) What is flexible manufacturing system? What are its building blocks? (8) CO5

OR

5b)	An AS/RS system performs an operation in 5 min. The Expected system throughput is 40 operations per hour. Number of storage space per system height is 15 and total number of storage spaces using a randomized policy is 2750. Assuming storage and retrieval operation take same time, determine: (i) Number of S/R machines; (ii) Number of rows (iii) Number of bays in each row.	(8)	CO3, CO5
5c)	Compare the performance of different methods of artificial Intelligence for solving complex problems in robotics	(8)	CO4

OR

5d)	Data Pertaining to the Automated Guided Vehicles (AGVs) in an Industry is as follows: • Required number of deliveries per hour = 40 • Vehicle Speed = 20 m/min • Average loaded travel distance per delivery 100 m • Average empty travel distance per delivery 75 m • Loading time = 0.18 min • Unloading time: 0.12 Determine the number of AGVs	(8)	CO3, CO5

····· End of question paper·····