

Total No. of Questions : 8]

SEAT No. :

PD-4446

[Total No. of Pages : 3

[6403]-251

**T.E. (Robotics and Automation)**  
**ARTIFICIAL INTELLIGENCE FOR ROBOTICS**  
**(2019 Pattern) (Semester - VI) (311509 - A)**

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Neat diagrams must be drawn wherever necessary.
- 2) Figures to the right indicate full marks.
- 3) Assume Suitable data if necessary.
- 4) Use of Calculator is allowed.

**Q1) a)** Explain with suitable example the greedy search method. [9]

- b) Using a simulated annealing algorithm to solve minimization problem, function value of 15 is updated to new value of 25 at temperature 20°C. What is the probability of accepting the new solution? What is criterion of accepting this new solution? [8]

OR

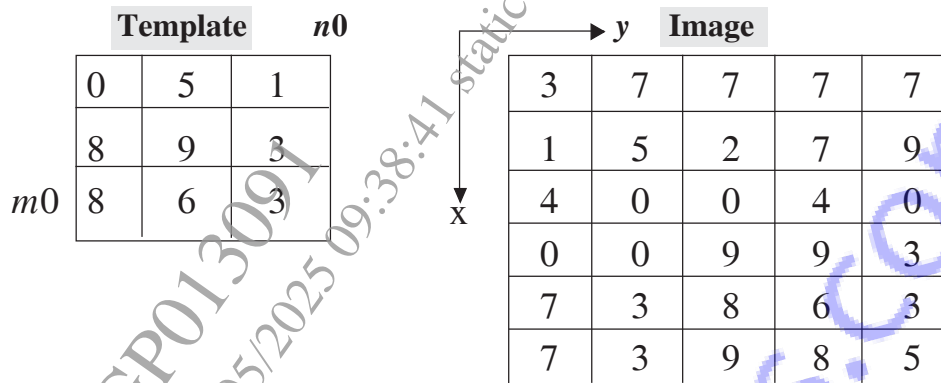
**Q2) a)** Explain crossover and mutation operator in genetic algorithm. [7]

- b) Ant colony optimization is used to solve a travelling salesmen problem with 5 stations. The distance matrix is given below. Considering starting station as A, what is the initial % probability that an ant will choose the path 1 to 4? Assume initial pheromone deposition level as 1. [10]

|   | 1  | 2  | 3  | 4  | 5  |
|---|----|----|----|----|----|
| 1 | 0  | 10 | 12 | 11 | 14 |
| 2 | 10 | 0  | 13 | 15 | 8  |
| 3 | 12 | 13 | 0  | 9  | 14 |
| 4 | 11 | 15 | 9  | 0  | 16 |
| 5 | 14 | 8  | 14 | 16 | 0  |

P.T.O.

- Q3) a)** For the image and template shown in Figure, determine the performance index for translation (2, 1) using template matching method. [10]



- b) Explain with suitable example region growing method for image segmentation. [7]

OR

- Q4) a)** Determine the gradient of intensity of a pixel having intensity 3 in the image given below, Use Prewitt operator. [10]

|   |   |   |
|---|---|---|
| 4 | 6 | 3 |
| 6 | 3 | 4 |
| 8 | 5 | 1 |

- b) Explain run length encoding method for image compression. [7]

- Q5) a)** Explain with suitable example, the path planning robot control in dynamic environments. [10]

- b) Write note on visibility graph method for robot path planning. [8]

OR

- Q6) a)** What are different methods to deal with moving obstacles? [8]

- b) With suitable examples, the bug 0 and bug 1 strategies for obstacle avoidance in mobile robot navigation. [10]

- Q7) a)** Use A\* algorithm to determine the shortest path for an automated guided vehicle while moving from work station at (4, 6) to workstation at (1, 1) shown in Fig. below. The obstacles are in the form of tool storage racks at locations (3, 3), (1,4) and (4, 2). [9]

|       |       |       |       |
|-------|-------|-------|-------|
| (1,1) | (2,1) | (3,1) | (4,1) |
| (1,2) | (2,2) | (3,2) | (4,2) |
| (1,3) | (2,3) | (3,3) | (4,3) |
| (1,4) | (2,4) | (3,4) | (4,4) |
| (1,5) | (2,5) | (3,5) | (4,5) |
| (1,6) | (2,6) | (3,6) | (4,6) |

- b) Write note on: Route optimization for AS/RS systems [9]

OR

- Q8) a)** Explain with suitable example techniques for automatic tool path generation. [9]
- b) Write note on: Flexible manufacturing system. [9]