Reg No.:_____   Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
B.Tech Degree S6 (R,S) Exam April 2025 (2019 Scheme)

Course Code: AIT304
Course Name: ROBOTICS AND INTELLIGENT SYSTEM

Max. Marks: 100   Duration: 3 Hours

PART A
Answer all questions, each carries 3 marks.   Marks

1	Give different types of mobile robot with an application.	(3)
2	According to structural capability of robot how are robots classified ? Explain with examples.	(3)
3	Discuss any two position sensors.	(3)
4	Explain the significance of H- Bridge & PWM in a motor driver.	(3)
5	Differentiate between Car-like mobile robot and differential drive mobile robot.	(3)
6	A point P with coordinates (2, 3, 4) in the reference frame is translated by a vector (dx, dy, dz) = (1, -2, 3). Find the coordinates of point P in new coordinate system.	(3)
7	State the differences between Visual SLAM and Graph based SLAM.	(3)
8	How can you represent the position and orientation of a Robot ?	(3)
9	Differentiate between A* Algorithm and Dijikstra's Algorithm.	(3)
10	Explain the significance of image processing in robot navigation.	(3)

PART B
*Answer one question from each module, each carries 14 marks.*

Module I

11 a) Discuss in detail the anatomy of a manipulator. Give advantages and disadvantages of any three configurations with neat sketches in a robotic manipulator.   (14)

OR

12 a) Illustrate the concept of degrees of freedom in the context of robotics with suitable examples. Sketch a robotic wrist and give its degrees of freedom.   (8)

    b) Describe in detail the applications of robots.   (6)

Module II

13 a) Discuss the different sensor traits that should be taken into account when selecting a sensor for a robotic application.   (7)

    b) Explain in detail with suitable diagrams, graphs and example the working of ON -OFF controller.   (7)
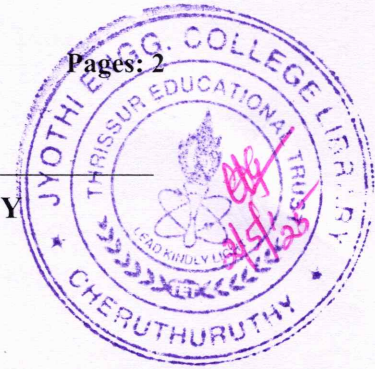
OR

14	a)	Demonstrate the control system by means of a block diagram.	(7)
	b)	Differentiate between servo motor and stepper motor.	(7)

Module III

15	a)	In the context of robot vision give an outline on the following:	(8)

  - Pre-processing, Segmentation, Description, Recognition

	b)	With help of suitable examples, explain the terms Degree of Maneuverability, Degree of Steerability, Degree of Mobility. State the relation between the same.	(6)

OR

16	a)	Derive the equation for the representation of a pure rotation about x- axis with suitable figure. Write the equations for representations for rotation about y-axis and z-axis.	(10)
	b)	Give two advantages and two applications of omni directional mobile robots ?	(4)

Module IV

17	a)	Apply the concept of Kalman filter localization for mobile robot and state the steps with a help of schematic.	(7)
	b)	What is the significance of odometric position estimation in localization? List the challenges of robot localization.	(7)

OR

18	a)	Assume, a domestic robot that is supposed to work in home environments. In this case the robot should be able to detect changes in the map due to the rearrangement of the furniture and then perform localization accordingly. Explain how localization can be done without the existence of map.	(7)
	b)	Define SLAM mathematically. Give any two open challenges of SLAM.	(7)

Module V

19	a)	In the context of robotic map representations describe in depth on decomposition strategies and the associated difficulties.	(10)
	b)	Compare and contrast the advantages and limitations of BFS and DFS in path planning scenarios, considering the factors completeness, optimality, memory usage and speed.	(4)

OR

20	a)	How is Voronoi diagram different from that of visibility graph ? Illustrate with help of suitable sketches.	(8)
	b)	One of the central criticisms of Bug-type algorithms is that the robot's behaviour at each instant is generally a function of only its most recent sensor readings. This can lead to undesirable and yet preventable problems in cases where the robot's instantaneous sensor readings do not provide enough information for robust obstacle avoidance. Explain a technique with suitable diagrams that can overcome the limitation.	(6)

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