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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S, FE) Examination January 2024 (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		List and explain the features of four basic wheel types used for a robotic application.	(3)
2		List and define the factors influencing the design of a robot.	(3)
3		Define the terms Dynamic range, Linearity, and Resolution for a Sensor.	(3)
4		Position sensors are not preferred to obtain the velocity and acceleration, Give reason.	(3)
5		Differentiate between holonomic and nonholonomic robots.	(3)
6		Write the significance of differential drive, in mobile robotics?	(3)
7		Identify mobile robot localization problems.	(3)
8		Describe the concept of mobile robot localization with suitable Block diagram.	(3)
9		Explain the bug algorithm for obstacle avoidance in mobile robotics.	(3)
10		Compare any two traversal algorithms.	(3)

PART B

Answer one question from each module, each carries 14 marks.

Module I

11	a)	Explain the anatomy of a robotic manipulator.	(6)
	b)	Describe the various joint configurations possible in a robotic manipulator.	(8)

OR

12	a)	Explain the principle of operation of various grippers used in robotic systems.	(8)
	b)	Explain the general features of a legged robot and differentiate the terms static and dynamic stability in the context of a legged robot.	(6)

Module II

13	a)	Explain the various sensor characteristics to be considered in the choice of the sensor for robotic application.	(6)

b) Explain the working principle of Hall effect sensor and any one application of the same. (8)

OR

14 a) Compare the performance characteristics of a hydraulic and pneumatic actuator. (6)

b) Explain with a neat circuit diagram the working principle behind a permanent magnet stepper motor (8)

Module III

15 a) Explain the seven stages of robotic vision. (10)

b) Differentiate and explain the working of a CCD and CMOS camera in a robotic vision system (4)

OR

16 a) List the different co-ordinate frames used in robotic systems and explain the need for mapping or transformation of co-ordinate systems for the same. (6)

b) Frame {1} and {2} have coincident origins and differ only in orientation. Frame {2} is initially coincident with frame {1}. Certain rotations are carried out about the axis of the fixed frame {1}. First rotation about X axis by 45^0 then about Y axis by 30^0 and finally about X axis by 60^0. Obtain the equivalent rotation matrix ${}^1R_2$. (8)

Module IV

17 a) Define the term odometry and explain the various error sources in odometric data. (4)

b) Derive error model for odometric position estimation. (10)

OR

18 a) Give the mathematical definition of SLAM and elaborate the concept. (6)

b) Compare and Contrast graph-based and particle SLAM (8)

Module V

19 a) Explain the potential field method-based path planning in robotic systems (6)

b) Illustrate the working of Dijkstra's algorithm with a suitable example. (8)

OR

20 a) Explain the need for control decomposition in a robotic system. (6)

b) With an example, elaborate the process of horizontal decomposition of a robotic control system. (8)

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