01-12-2023

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

	Nov – Dec 2023 (B.Tech) Program: EX Examination: LY Semester: VII Course Code: EXDLC7043 and Course Name: ROBOTICS			
Duration: 2.5 Hours				Max. Marks: 60

Instructions:
(1) All questions are compulsory.
(2) Draw neat diagrams wherever applicable.
(3) Assume suitable data, if necessary.

		Max. Marks	CO	BT level
Q 1	Solve any six questions out of eight:	12		
i)	List down methods of Graph deterministic search.	2	1	U
ii)	Explain working of mechanical gyroscope.	2	1	U
iii)	State theorem of total Probability	2	3	AP
iv)	State laws of Robotics.	2	3	U
v)	Explain problem of Localization in Robotics.	2	5	U
vi)	Which of the Kinematic parameter are variable for revolute joint? Which are variable for a prismatic joint?	2	2	U
vii)	Define Following 1) Accuracy 2) Precision.	2	6	U
viii)	State baye's rules	2	5	U
Q.2	Solve any four questions out of six.	16		
i)	Define Prediction (action) update and Perception (measurement) update.	4	1	AP
ii)	Find a Composite Rotation Matrix for robots if its Mobile coordinate frame is rotated by angle 60 degree about f1, 30 degree about f2.	4	2	AP
iii)	Classify robots based on Drive technologies, Motion control method and work envelope Geometry.	4	1	AP

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iv)	Explain Cost effectiveness of soft automation in comparison with Hard Automation and Manual Labour.	4	3	AP
v)	Consider following coordinate transformation matrix R, representing fundamental rotation. What is the axis of rotation (1,2 or 3), and what is the angle of rotation? $$R = \begin{bmatrix} 0.866 & 0 & -0.5 \\ 0 & 1 & 0 \\ 0.5 & 0 & 0.866 \end{bmatrix}$$	4	2	AP
vi)	Formulate mathematical Definition of SLAM	4	5	U
Q.3	Solve any two questions out of three.	16		
i)	Explain A* algorithm with example for path planning.	8	1	U
ii)	Explain the file system level of ROS files organized on the hard disk.	8	4	U
iii)	Explain Fundamental Rotation matrix and rules to obtain composite rotation matrix.	8	5	U
Q.4	Solve any two questions out of three.	16		
i)	Illustrate working principal of markov localization	8	3	U
ii)	For a given Link transformation matrix; For Microbot alpha $$T_{k-1}^{k} = \begin{matrix} C\theta_k & -C\alpha_k S\theta_k & S\alpha_k S\theta_k & a_k C\theta_k \\ S\theta_k & C\alpha_k C\theta_k & -S\alpha_k C\theta_k & a_k S\theta_k \\ 0 & S\alpha_k & C\alpha_k & d_k \\ 0 & 0 & 0 & 1 \end{matrix}$$ Derive for T_{base}^{Wrist}	8	2	AP
iii)	Explain PID controller and write a Pseudo code for PID controller	8	6	U

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