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MANIPAL INSTITUTE OF TECHNOLOGY Manipal University



Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

Answer ANY FIVE FULL the questions.

✤ Missing data may be suitably assumed.

1A.	The CoM of the body is assumed to be at O(2, -5, 7) with its fixed and local frames coinciding at O. Find the new coordinates of CoM after the last transformation for the following sequence of SE(3) Transformation for a rigid body in space. (i) Rot (X, 30 ⁰) (ii) Trans(U,V,W) = (2, 5, 3) (iii)Rot (Z, 90 ⁰)	5
1 B.	List various types of programming techniques used in robot manipulation.	3
1C.	Briefly explain the salient parts of a robot manipulator.	2
2A.	For the manipulator shown in Fig Q2A., obtain the transformation matrix ${}^{\circ}T_{P}$ using DH representation.	5
2B. 2C.	 Briefly explain the following methods of assigning relative coordinate frames of the links of a robot: (i) Sheth method (ii) Hayati-Roberts method (iii)Parametrically Continuous Convention method. Give a brief note on Modified DH algorithm of forward kinematics. 	3
34	Determine the Inverse acceleration matrix of a typical $2\mathbf{R}$ planar manipulator	4
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эв.	(i) NE Algorithm (ii) LE Algorithm.	0
4A.	Design a Trapezoidal Velocity profile trajectory for a revoluting joint of a 3 DOF manipulator. Given parameters are: $\theta_i = 0, \ \theta_f = 0, \ \dot{\theta}_i = 0, \ \dot{\theta}_f = 0, \ \dot{\theta}_f = 0, \ \ddot{\theta}_{max} = 4rad / s^2$, from t=2s to t=6s with t _b =1.5s,	5
4B.	Compare Joint Space Trajectory control scheme and Cartesian Space Trajectory control scheme.	3
4C.	List the differences between serial and parallel robots with relevant diagrams.	2
5A.	Derive the relationship between piston-displacement w.r.t. time for the hydraulic drive shown in Fig.Q5A.	5

5B.	Discuss briefly on the taxonomy of manufacturing grasp adopted in robot-based manipulators.	3
5C.	Give a brief description on Affine Model of Camera with relevant diagrams.	2
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6A.	Explain various ranging techniques used in robot navigation.	5
6B.	With relevant diagrams, briefly explain the relationship of $\tau - \theta_m$ for stepper motors	3
	with (a) Permanent Magnet rotor and (b) Variable Reluctance rotor.	
6C.	Briefly explain Lobula Giant Movement Detection (LGMD) technique adopted for	2

6C. Brieffy explain Lobula Giant Movement Detection (LGMD) technique adopted for collision avoidance in robot motion.


