GUJARAT TECHNOLOGICAL UNIVERSITY M.E. SEMESTER III-EXAMINATION - WINTER 2015

Subject code: 2730808

No.

Subject Name: Robotics Engineering

Time: 2:30 PM to 5:00 PM

Instructions:

- 1. Attempt all questions.
- 2. Make suitable assumptions wherever necessary.
- 3. Figures to the right indicate full marks.
- Q.1 **(a)** Sketch the work space of cylindrical arm robot and spherical arm robot. 07 07
 - Write the difference between direct kinematics and inverse kinematics. **(b)**
- A frame was rotated about the x-axis 90°, then it was translated about the Q.2 **(a)** 07 current a-axis 3 mm before it was rotated about the z-axis 90°. Finally, it was translated about current o-axis 5 mm. Formulate the equation describes the motions and find the final location of point $(1, 5, 4)^T$ attached to the frame relative to the reference frame. The sets of "xyz" and "noa" are represents the universe reference frame and moving frame respectively.
 - What do you mean by performance measurement indices? Describe about **(b)** 07 reciprocal condition number and global stiffness index.

OR

Distinguish between Lagrangian and Newtonion methods of dynamics **(b)** 07 formulations for robotic manipulators.

O.3 (a)	Exp	lain the	Lagrangian	and Ha	milton's	princip	ole.
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Derive the force-acceleration relationship **(b)** for the 1-DOF system as shown "right-handside" using both Lagrangian and Newtonian mechanics. Mentions assumptions. Where, m = mass, F = force and k = spring constant.



OR

Q.3	(a)	Explain the kinetic energy and potential energy as applied to robot arm dynamics analysis.			
	(b)	Discuss the properties of dynamic equations in brief.	07		
Q.4	(a)	Write the difference between path and trajectory.	07		
	(b)	Enlist the different types of grippers and describe any two.			
		OR			
Q.4	(a)	It is desired to have the first joint of a 6-axis robot go from initial angle of 30° (to final angle of 75° in 5 seconds. Using third-order polynomial, calculate the joint angle, velocity and acceleration at 1 and 2 seconds.			
	(b)	Write the require properties of sensors.	07		
Q.5	(a)	Through the block diagram represent the difference between open-loop and close-loop robot control systems.	07		
	(b)	Define the tracking error and discuss the importance of it.	07		
		OR			
Q.5	(a)	Classify the robotic motion control systems and describe any two in brief.	07		
	(b)	Describe the types of force control of robot manipulator.	07		

Date: 04/12/2015

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