Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. Sem. – IInd - Examination – June/July- 2011

Subject code: 1720906

Subject Name: Robotics

Date:29/06/2011 **Time: 10:30 am – 01:00 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** What is robot configuration? Explain 2P, 2PR, and 3R Configuration with neat figures. **07**

(b) Discuss considerations in gripper selection and design. **07**

Q.2 **(a)** Determine the homogeneous transformation matrix to represent a rotation of 30° about OX-axis and a translation of 8 units along the OB-axis of the mobile frame. **04**

(b) Define and illustrate the link and joint parameters with figure and uses. **10**

OR

(b) Tabulate kinematic joint and link parameters of SCARA robot (Fig.-1) by using D-H representation and derive kinematic equations by using arm matrices. **10**

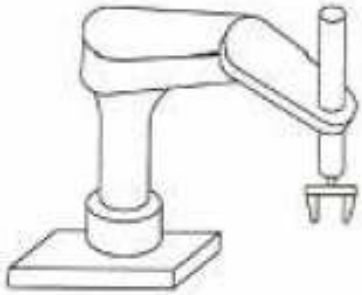
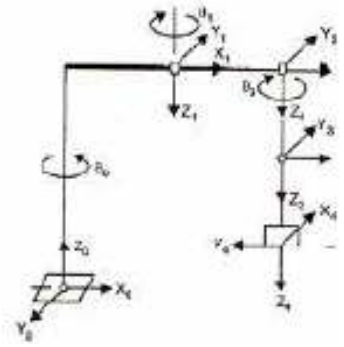


Fig.-1



Q.3 **(a)** Explain 'lead through programming methods'. **07**

(b) The end point of a link of manipulator is at [3 3 6 1]. The link is rotated by 60° about x-axis, than by -180° about its own z-axis & finally by 900 about its own yaxis. Find the resulting homogeneous transformation matrix & final location of end points. **07**

OR

Q.3 **(a)** Explain 'Roll, Pitch & Yaw (RPY)' angle configuration **07**

(b) What do you mean by robotic vision? Explain different types of vision sensors. **07**

Q.4 **(a)** Explain robot centered compliance (RCC) device for assembly operation. **07**

(b) Explain with Example "Forward and Inverse kinematics". **07**

OR

Q.4	**(a)**	Explain Tactile Sensors.	**07**
	(b)	Distinguish between Lagrangian mechanics and Newtonian mechanics giving suitable examples for each.	**07**
Q.5	**(a)**	Its desired to have the first joint of a six axis robot go from a initial angle of 45° to 60° in 5 seconds using a third order polynomial calculate the joint angles at 1,2,3 and 4 seconds. Suppose that robot arm is continues to next point where the joint is to reach 100° in another 3 seconds. Draw the position velocity and acceleration curve.	**07**
	(b)	Write a short note on hydraulic motors.	**07**

OR

Q.5	**(a)**	The second joint of a SCARA manipulator is required to move from 60° to 180° in 6 seconds. Find the cubic polynomial to generate the smooth trajectory for the joint. What is the maximum velocity and acceleration for this trajectory?	**07**
	(b)	Explain "Remote Center Compliance (RCC) Device" for Assembly Operation.	**07**

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