Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2013

Subject code: 1720803 **Date: 03-06-2013**

Subject Name: Robotic Engineering

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 indicates full marks.**
4. **Design data book is permitted.**

Q.1. **(a)** What is degree of freedom for a robot manipulator? Explain Polar and jointed arm configuration of robot. **07**

(b) Explain following terms in brief for robot: Resolution , Accuracy , Repeatability, Work volume **07**

Q.2. **(a)** What is Danavit Hartenberg notation.Explain D-H parameter for forward kinematics of robot. **07**

(b) Explain various types of gripper mechanism. Explain design procedure of any one in detail. **07**

OR

(b) What is closed loop form of solution to inverse kinematic problem? Explain method of obtaining closed form solution. **07**

Q.3. **(a)** Explain Optical Encoders for the robotic application. **07**

(b) The second joint of SCARA manipulator is required to move from ⍰2=40° to 160° in five seconds. Find the cubic polynomial to generate the smooth trajectory of joint? What is the maximum velocity and acceleration for these joints. **07**

OR

Q.3. **(a)** Enlist dynamic model used for robot. Determine the dynamic model for 1degree of freedom, 1 axis planer manipulator with one rotary joint. Assume the link to be a thin cylinder with length L and mass m acting at the centroid of the link **07**

(b) Find transformation matrix for end effector for 3 degree of freedom (RRR-configuration) manipulator with three revolute joints. The D-H parameter is given as bellow having usual notations. Where ai = link length, Ŭi=link twist,di= joint distance, ⍰i= joint angle. **07**

Link i	ai	Ŭi	di	⍰i
1	0	90°	0	⍰1
2	L2	0	0	⍰2
4	L3	0	0	⍰3

Q.4. **(a)** Describe the steps used for image processing **07**

(b) Enlist robot programming method and explain lead trough programming method in detail. **07**

OR

Q.4.	**(a)**	Explain stepper motor control system.	**07**
	(b)	Explain Remote centered compliance (RCC) device for assembly operation.	**07**
Q.5.	**(a)**	Write a short note on : Inline Robot Cell Design	**07**
	(b)	Write a short note on ñ Robot intelligenceò	**07**

OR

Q.5.	**(a)**	Explain application of robot assembly and inspection.	**07**
	(b)	Explain model based control for robot manipulator.	**07**

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