Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E Sem-II Remedial Examination December 2010

Subject code: 720906 **Subject Name: ROBOTICS**

Date: 22 /12 /2010 **Time: 02.30 pm – 05.00 pm**

Total Marks: 60

Instructions:

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

Q.1 (a) **06**

(i) How are robots different than conventional m/c tool?

(ii) Illustrate reasons for the commercial & technological importance of industrial robots.

(iii) Give detailed classification of robots.

(b) **06**

(i) Develop joint notation scheme for designating most common robot configurations.

(ii) Why is SCARA arm more ideal for assembly operation?

(iii) List of criterion for robot selection.

Q.2 (a) Explain why homogeneous coordinates are required in modeling of robots manipulation. **06**

(b) Suppose that we desire to place the origin of hand frame of a cylindrical robot at [3 4 7]. Calculate the joint variable of robot. **06**

OR

(b) The end point of a link of manipulator is at [2 2 6 1]. The link is rotated by 90^0 about x-axis, than by -180^0 about its own z-axis & finally by 90^0 about its own y-axis. Find the resulting homogeneous transformation matrix & final location of end points. **06**

Q.3 (a) What are parameters for link for a kinematic modeling? **06**

(b) For three d.o.f articulated arm Fig.1.Determine the joint displacement for known position and orientation of the end of arm position. **06**

OR

Q.3 (a) Explain why homogeneous coordinates are required in modeling of robotic manipulators. **06**

(b) Obtain the direct kinematics equation of 4-d.o.f selective compliance assembly robot arm robots as Fig.2

Q.4 (a) Give a short over view of Langrangian machines with expressions. **06**

(b) A 5 Kg rectangular block is gripped in the middle and listed vertically at a velocity of 1 m/s. If it accelerates to this velocity at 27.5m/s and between gripped pad and block is 0.43, calculate the minimum force that will prevent slippage. **06**

OR

Q.4 (a) Derive the equation of motion for two link mechanism shown in Fig.3. **06**

(b) Illustrate different type of grippers used in industrial robots. What are general characteristics that end of effectors must satisfy.

Q.5 (a) Its desired to have the first joint of a six axis robot go from a initial angle of 40^0 to 60^0 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 110^0 in another 3 seconds. Draw the position velocity and acceleration curve. **06**

(b) Classify transducers and sensors with suitable examples. **06**

OR

Q.5 **(a)** What are robot programming languages? Describe teach pendant programming. **06**

(b) What is robot vision? Explain different types of vision sensors. **06**

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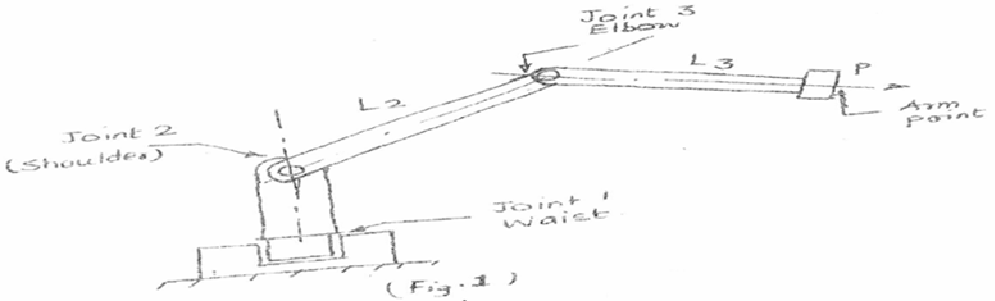
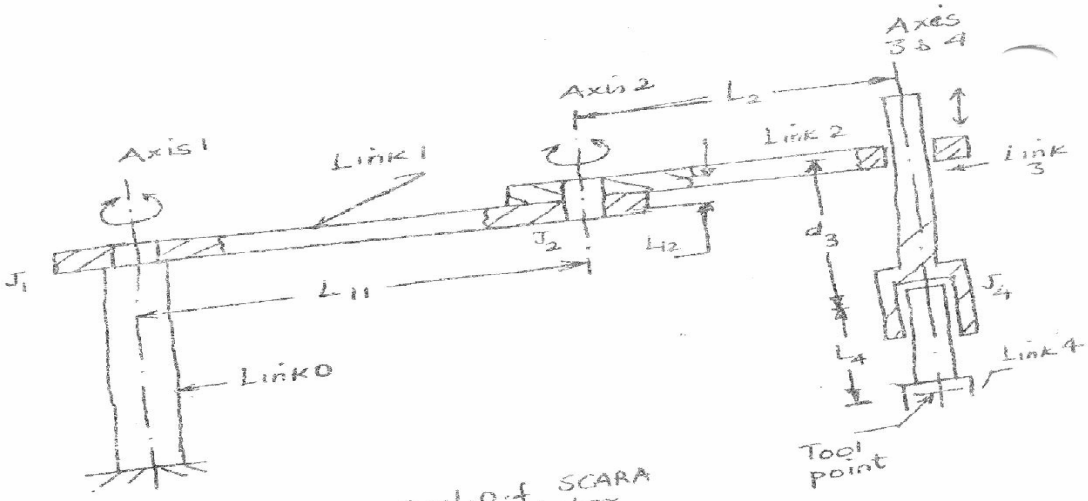
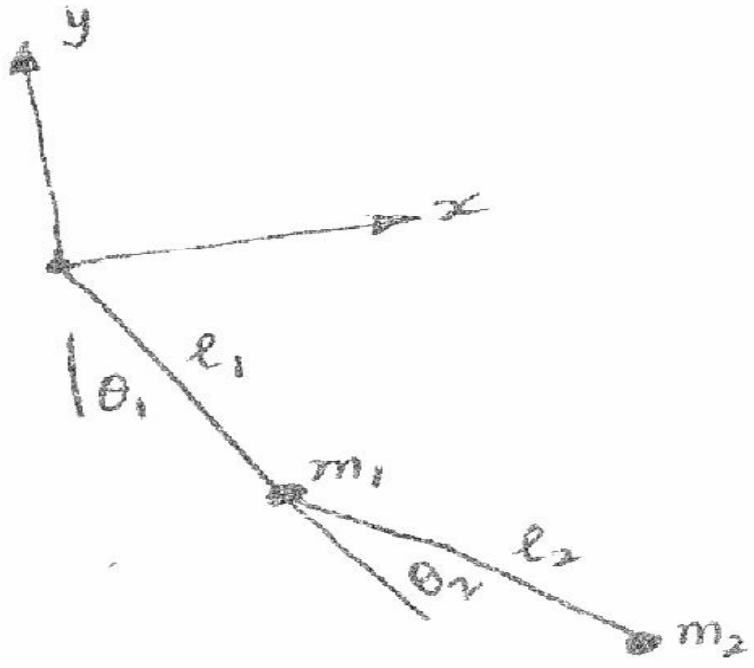


(Fig. 1)

A 3-d.o.f articulated robot



A 4-d.o.f SCARA manipulator (Fig. 2)



A 2-Link mechanism with concentrated mass
Fig. 3