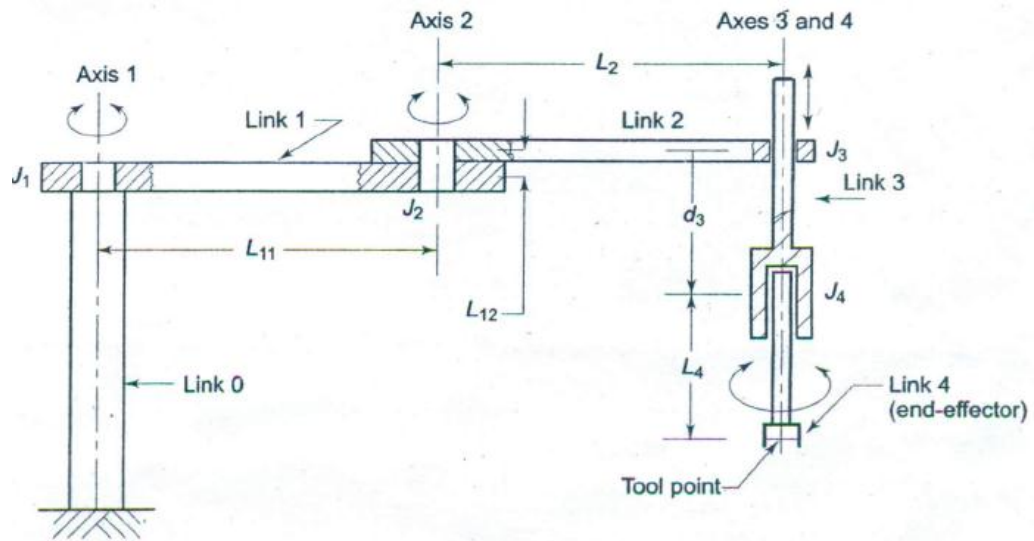


**(3 Hours)**

**[Total Marks: 80]**

Instructions: **1. Question 1 compulsory.**  
**2. Attempt any 3 questions from the remaining 5 questions.**

- Q1) a Explain Adaptive control in robots. 5  
 b Why is SCARA arm more ideal for Assembly applications? 5  
 c Compare hydraulic, pneumatic and electrical actuators with reference to their relative merits and demerits. 5  
 d Comment on social issues and Economics of Robotics 5
- Q2) a What are shrink and swell operators? Define them. How are they applied in the processing of digital images? Why are shrink (i) for  $i > 4$  and swell  $i > 4$  more useful than  $i < 4$ ? 10  
 b Explain with suitable Example WAIT, DELAY and SIGNAL Commands. 10
- Q3) a What is the need of sensors in robotics? Explain different types of sensors used in Robotics. 10  
 b Explain Denavit-Hartenberg algorithm. 10
- Q4) a Obtain the Direct Kinematics equation of the 4-DOF Selective Compliance Assembly Robot Arm as shown in the figure below. 10



- b Draw and represent Robotic cell design and its control. 10
- Q5) a Incremental and Absolute Encoders used in drives. 8  
 b Feature recognition in vision systems. 7  
 c Enlist any five applications of robotics. 5

- Q6) a Consider the grey scale image of size (4x4) and a template of size (2x3) as shown in the figure below. Find at what position the best match occurs using the performance index values and what is the value at that position? 10

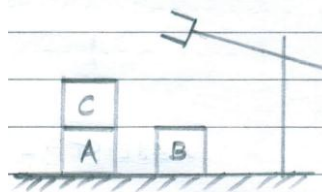
1	0	0	2
0	1	2	0
2	0	2	1
0	1	0	0

Image I (Kij)

0	2	0
1	2	3

Template T (Kij)

- b Using AI concept provide optimum solution for the following stack Data structure problem. 10



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