

(3 Hours)

[Total Marks:80]

- N.B.
1. Question no. 1 is compulsory.
  2. Attempt ANY **THREE** questions out of remaining **FIVE** questions.
  3. Illustrate your answer **with neat sketch** wherever necessary.
  4. Figures to the right indicate full marks.

**Q1.** Attempt any **FOUR** of the followings: (20)

- What is redundant manipulator? Explain with a simple sketch.
- Construct 2 views of workspace for a 4 axis SCARA robot given in Q3 (a). Take and state suitable values for link and joint variables.
- Degrees of freedom for robots
- Comment on Holonomic robot with sketch.
- Robots applications

**Q2.** a) How facial features of a human are mapped to humanoid robots and explain parts and components used to control facial features in robots? (10)

- b) Locomotion for mobile robot chassis depends on wheel configuration. (10)  
Tabulate a matrix to describe a wheel configuration with 2 examples for each as given below.

For, No. of wheels	Wheel Arrangement (sketch)	Description	Typical example
2			
3			
4			

**Q3.** a) Given 4-DOF Selective Compliance Assembly Robot Arm as shown in the figure below, Represent its DH notations matrix and obtain the overall Transformation matrix using Direct kinematics. (12)

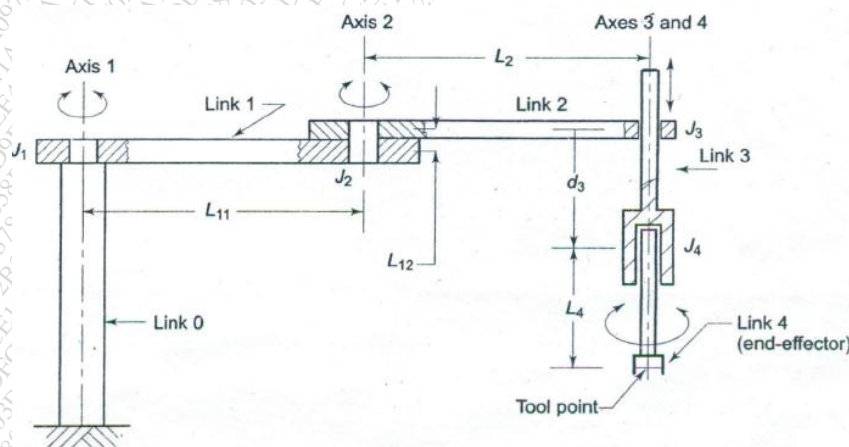


Fig. 1 A SCARA robot

- b) State the principles of materials handling system? Also discuss about important considerations while designing the materials handling system for any packing industry. (8)
- Q4.**
- a) What is compliance in Robotic manipulator. Explain with a RCC device with neat sketch (7)
- b) Draw a neat sketch of a stepper motor to explain its working principle using programming logic to illustrate different angular stepping. (7)
- c) Classify the various types of sensors used in robotics and explain construction, working principle and applications of any one displacement sensor. (6)
- Q5.**
- a) Discuss on sound and speech generation technologies for humanoids. (7)
- b) A 2-DOF manipulator with link  $L_1=40\text{mm}$  and  $L_2=25\text{mm}$  with joint limits as follows;  $-50 \leq \theta_1 \leq 50$  and  $-110 \leq \theta_2 \leq 110$ . Draw the workspace traced by the links (7)
- c) Explain Tolman's Sowbug as a basis of Emotion model. Write down the advantages and disadvantages due to providing of emotions in robots (6)
- Q6.** Write a short notes on the followings (**ANY FOUR**) (20)
- a) Bar code technology or RFID technology in robots for material handling.
- b) Compare hydraulic, pneumatic and electrical actuators with reference to their relative merits and demerits.
- c) Automated Guided Vehicle System (AGVS)
- d) Social aspects and future challenges for humanoid robots
- e) Distinguish between Joint space technique and Cartesian space technique in trajectory planning.
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