(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)

a) What is redundant manipulator? Explain with a simple sketch.
b) 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.
c) Degrees of freedom for robots
d) Comment on Holonomic robot with sketch.
e) Robots applications

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

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   (12)
the figure below, Represent its DH notations matrix and obtain the overall Transformation matrix using Direct kinematics.
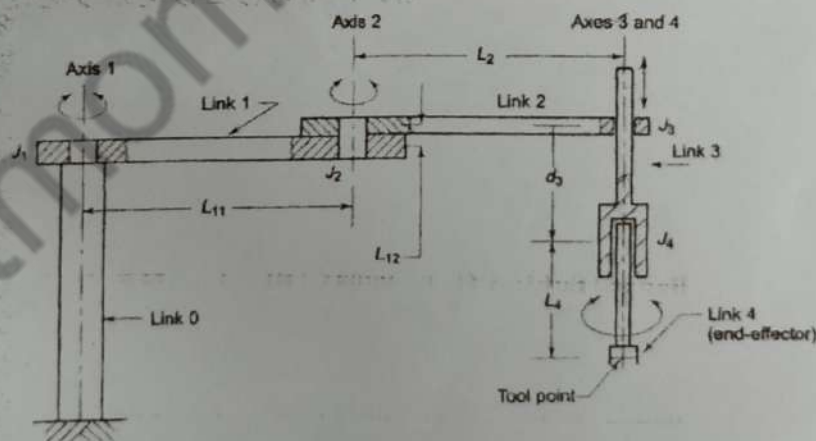

Fig. 1 A SCARA robot

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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 L1=40mm and L2=25mm with joint limits as follows; $-50 \le \Theta_1 \le 50$ and $-110 \le \Theta_2 \le 110$. 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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