



Name :

Roll No. :

Invigilator's Signature :

CS/M.Tech (AUE)/SEM-2/MAE-201/2013
2013
INDUSTRIAL ROBOTICS

Time Allotted : 3 Hours

Full Marks : 70

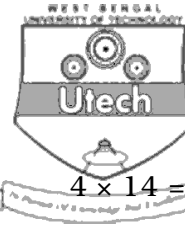
The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

Answer any *seven* of the following. $7 \times 2 = 14$

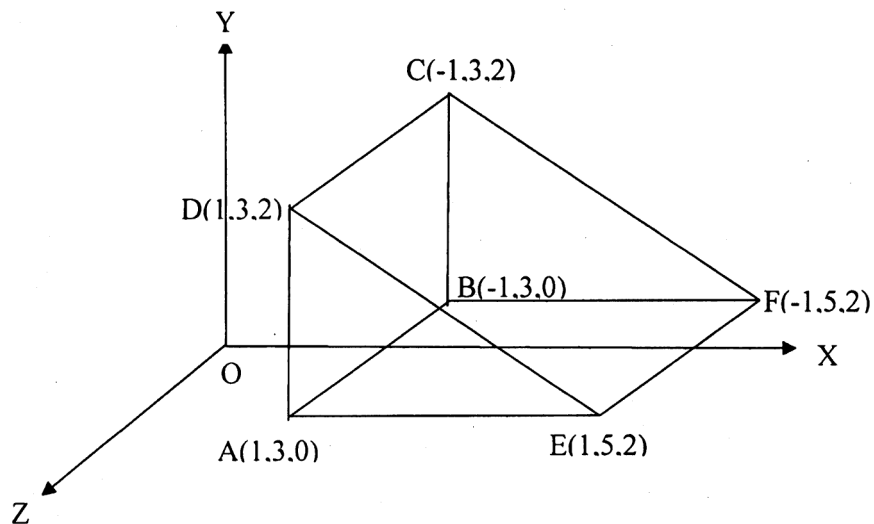
1.
 - a) Define Robot and state the law of Robot.
 - b) What is Industrial Automation ? What are its types ?
 - c) Define repeatability, resolution of a robot.
 - d) What is robot wrist ? Show pitch, yaw and roll motion of a robot wrist with a sketch.
 - e) Define robot kinematics and classify it.
 - f) What do you mean by open loop and closed loop control system ?
 - g) What is joint co-ordinate system and world co-ordinate system ?
 - h) Write down the criteria for selecting drive system.
 - i) What is vacuum gripper ?
 - j) Write down the basic component of Robot.



GROUP – B

Answer any *four* of the following. $4 \times 14 = 56$

2. Explain different types of gripper with a suitable sketch.
3. A mobile body reference frame $OABC$ is rotated about 60° about OY axis of the fixed reference frame $OXYZ$. If $P_{xyz} = (2, 4, 6)^T$ and $Q_{xyz} = (3, 5, 7)^T$ are the co-ordinates with respect to $OXYZ$ frame, what are the corresponding co-ordinates of P and Q with respect to $OABC$ frame ?
4. A triangular prism with co-ordinates of its vertices indicates relative to the fixed reference $OXYZ$ is shown in figure. The prism is moved to the new position with a rotation of $+90^\circ$ about X -axis, a rotation of -90° Z -axis and a translation of 5 units in the y -direction. Determine
 - a) The homogeneous transformation matrix describing the change in position of the prism. 7
 - b) The new co-ordinates of the vertices of the prism. 7

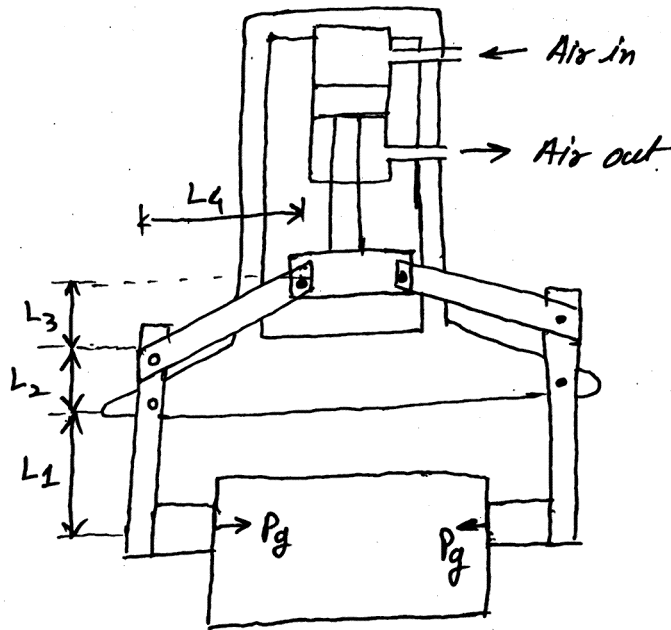




5. The mechanical gripper uses friction to grasp a part weight 25N, the co-efficient friction between the part and the gripper pad shown in figure is 0.3. The gripper is accelerating down with a acceleration 9.81 m/s^2 . The diameter of the piston of pneumatic cylinder is 65 mm. Assume a factor of safety = 1.5 and assume the lengths $L_1 = 60 \text{ mm}$, $L_2 = 40 \text{ mm}$, $L_3 = 15 \text{ mm}$, $L_4 = 45 \text{ mm}$.

Calculate the following :

- The gripping force to retain the part
- Actuation force required to achieve this gripping force
- The pressure of air need to operate the piston
- The power required if the discharge is $0.015 \text{ m}^3/\text{s}$.



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6. Why sensors are used in robot ? Give the classification of sensor with example. What is binary sensor, analog sensor and proximity sensor ?

3 + 4 + 7

7. Write short notes of the following :

$4 \times 3 \frac{1}{2}$

- a) Robot vision
- b) Euler's angle representation
- c) Vacuum gripper
- d) Kinematics of 2 DOF robots.

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