MMCM/MMPD - 204

M.E./M.Tech., II Semester

Examination, June 2014

Robotics and Automated Material Handling

Time : Three Hours

Maximum Marks : 70

Note : i) Attempt any five questions.

ii) All questions carry equal marks.

1. a) Define a Robot and with a diagram explain the anatomy of a Robot?

   b) Compare three basic types of drives enlisting their merits and demerits?

2. a) Illustrate the geometric interpretation of the rotation transformations?

   b) Explain the homogeneous transformations matrix and interpret the partitioning with application?

3. The mechanical gripper uses friction to grasp a part weighing 25N. The co-efficient of friction between the part and the gripper pad is 0.3. The gripper is accelerating down with a acceleration = 9.81 m/s². The diameter of the piston of pneumatic cylinder is 65 mm. Assume a factor of safety = 1.5 and assume lengths $L_1 = 55mm$, $L_2 = 35mm$, $L_3 = 10mm$ and $L_4 = 40mm$.

   Calculate the following:

   a) The gripping force to retain the part.

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   b) Actuation force required to achieve this gripping force.

   c) The pressure of air needed to operate the piston.

   d) The power required if the discharge is 0.015 m³/sec.

4. Write a program in VAL for palletization of parts in a Pallet having 6 rows that are 60mm apart and 8 columns 80mm apart. The robot must pick parts from an incoming chute and are 30mm tall?

5. a) Explain with a neat sketch the optical proximity sensors?

   b) Discuss in brief the performance specifications for the force sensors.

6. a) Explain the illumination technique used in robot vision system?

   b) What is object recognition? Explain template matching?

7. The co-ordinates of point θ with respect to base reference frame is given by $[4, 2\sqrt{3}, 5]^T$. Determine the co-ordinates of θ with respect to mobile rotated frame of the robot if the angle of rotation with the OX is 60°.

8. a) Explain in brief carousel storage system. Enlist its advantages?

   b) Discuss the advantages and limitations of using AGV's in material handling?

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