

CBCS Scheme

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16MAR/IAR21

Second Semester M.Tech. Degree Examination, June/July 2017 Robotics for Industrial Automation

Time: 3 hrs.

Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

- Define Automation. Discuss the types of automation along with their merits and demerits. (08 Marks)
 - Explain the following basic robot configuration :
 - Cartesian
 - Spherical.(08 Marks)

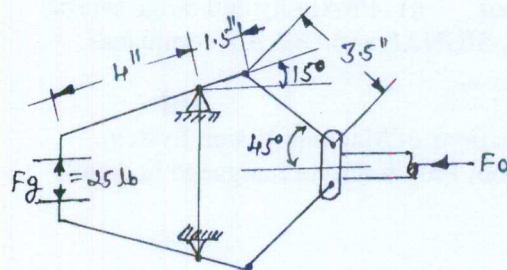
OR

- List various drive systems in robot. Explain briefly. (08 Marks)
 - With neat block diagram, explain control approaches of robots. (08 Marks)

Module-2

- With neat sketch, explain the following :
 - Screw type gripper
 - Vacuum gripper.(08 Marks)
 - The diagram Q3(b) shows the linkage mechanism and dimensions of the gripper used to handle a work part for a machining operation. Suppose it has been determined that the gripper force is to be 25 lb. What is required to compute the actuating force to deliver this force of 25 lb? (08 Marks)

Fig.Q3(b)



OR

- Explain briefly, Point to Point control and continuous path control. (08 Marks)
 - Explain the following feedback devices :
 - Encoder
 - Resolver(08 Marks)

Module-3

- Distinguish between one dimensional and multidimensional trajectories. (06 Marks)
 - Explain the Cartesian space trajectories with suitable example also discuss Joint space trajectory planning. (10 Marks)

OR

- Explain the Trajectory planning for PTP robots. (08 Marks)
 - What are the boundary and blending conditions used in trajectory planning? (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8=50, will be treated as malpractice.

Module-4

- 7 a. With example differentiate forward and inverse kinematics. (06 Marks)
 b. A Six Joint Robotic Manipulator equipped with a digital TV camera is capable of continuously monitoring the position and orientation of an object. The position and orientation of object with respect to camera is equipped by a matrix $[T_1]$. The origin of the robots base co-ordinates. With respect to the camera is given by $[T_2]$ and position and orientation of the gripper with respect to base co-ordinates frame is given by $[T_3]$.

$$T_1 = \begin{bmatrix} 0 & 1 & 0 & 5 \\ 1 & 0 & 0 & 6 \\ 0 & 0 & -1 & 10 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad T_2 = \begin{bmatrix} 1 & 0 & 0 & -20 \\ 0 & -1 & 0 & 10 \\ 0 & 0 & -1 & 12 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad T_3 = \begin{bmatrix} 1 & 0 & 0 & 8 \\ 0 & 1 & 0 & 6 \\ 0 & 0 & 1 & 6 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

- Determine : i) The position and orientation of the object with respect to base coordinate.
 ii) The Position and orientation of the object with respect to gripper. (10 Marks)

OR

- 8 a. Write a note on Euler angle and Euler transformation. (08 Marks)
 b. A point $P(7, 3, 2)$ T is attached to frame $(\bar{n} \bar{o} \bar{a})$ and is subjected to the transformation described next. Find the coordinates of points relative to the reference frame at the conclusion of transformation :
 i) Rotation of 90° about Z – axis.
 ii) Followed by a rotation of 90° about the Y axis.
 iii) Followed by a translation of $[4, -3, 7]$. (08 Marks)

Module-5

- 9 a. Explain the following sensors used in robot system :
 i) Tactile sensor ii) Proximity and range sensor. (08 Marks)
 b. Explain WAIT, SIGNAL and DELAY commands. (08 Marks)

OR

- 10 a. Explain the functions of Machine Vision System. (08 Marks)
 b. Explain the Robot Programming Language in detail. (08 Marks)

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