



SF-7789

B. E. IV (Sem. VIII) (Robotics Engg.) Examination
May / June – 2011
Instrumentation & Control

Time : 3 Hours]

[Total Marks : 100

Instructions :

(1)

नीचे दर्शायेव निशानीवाणी विगतो उत्तरवही पर अवश्य लिखनी. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
<input type="text" value="B. E. 4 (Sem. 8) (Robotics Engg.)"/>	<input type="text"/>
Name of the Subject :	<input type="text"/>
<input type="text" value="Instrumentation & Control"/>	<input type="text"/>
Subject Code No. : <input type="text" value="7"/> <input type="text" value="7"/> <input type="text" value="8"/> <input type="text" value="9"/>	<input type="text" value="Student's Signature"/>
Section No. (1, 2,...): <input type="text" value="Nil"/>	

- (2) Use of non programmable calculators is allowed.
(3) Assume suitable data if required.
(4) Black figures to the right indicate full marks.
(5) Draw neat diagrams and use mathematical expressions whenever required.

- 1 (a) If R is the rotation matrix in OXYZ plane, the identity matrix **10**
 $I = \underline{\hspace{2cm}}$ and its dimension is $\underline{\hspace{2cm}}$.
(b) If a rotation matrix R is the rotation matrix representing angular displacement of μ radians about OX axis then $R = \underline{\hspace{2cm}}$.
(c) If T is a basic homogeneous translation matrix then $T = \underline{\hspace{2cm}}$.
(d) What is lead through method for robot programming ?
(e) What is direct kinematics problem ?
- 2 (a) Derive the rotation matrix for rotation about OZ axis with Ω angle. **15**
(b) A vector, $b_{uvw} = [2, 1, 3]^T$ is to be rotated by angle π about **10**
OX axis. What will be position of the vector (i.e. b_{xyz}) after rotation w.r.t basic coordinate system ?

OR

- 2 (a) Give the detailed mathematical analysis for two degree of **15**
freedom robot arm.
(b) A vector $b_{uvw} = [1, 2, 3]^T$ is to be rotated by $\beta = 90$ degree **10**
angle about OX axis followed by a translation of $c = 1$ units along rotated OV axis. Find b_{xyz} .

- 3 Explain the following in detail : (any **two**) **15**
- (1) Lead through and textual robot programming methods.
 - (2) Motion interpolation.
 - (3) Robot program as a path in space.
- 4 (a) Answer in brief : **10**
- (1) State two methods for robot programming.
 - (2) What are the four major uses of sensors in robotics.
 - (3) State four types of mechanical grippers.
 - (4) What is the importance of robot/end effector interface ?
 - (5) What is the advantage and disadvantages of using hydraulic power transmission ?
- (b) Write a short note on palletizing and related operations. **8**
- 5 (a) What is motion interpolation ? **8**
- (b) Write short note on proximity and range sensors. **8**
- OR**
- 5 (a) Explain the leadthrough methods of programming. **8**
- (b) Explain clearly touch sensors and force sensors. **8**
- 6 Attempt any **two** : **16**
- (a) A vacuum pump to be used in a robot vacuum gripper application is capable of drawing a negative pressure of 4.0 ib/in² compared to atmospheric pressure. The gripper is to be used for lifting stainless steel plates, each plate having dimensions of 15 by 35 in. and weighing 52 Ib. Determine the diameter of the suction cups to be used for the robotic gripper if it has been decided that two suction cups will be used for the gripper for greater stability. A factor of safety of 1.5 should be used in computation.
 - (b) A linear array of light sensors is to be used to determine the distance x. If the angle A representing the orientation of collimated light source is 60° and the reflection of the object reaches a position y = 42 mm, determine the value of x. What will be the effect on the accuracy of measurement if the surface of the object is not parallel to the linear sensor array ?
 - (c) Using a pen mounted in the robot's end effector, program the robot to write your first and last initials in rectangular letters.