

Code No: 07A81002

**R07****Set No. 2**

IV B.Tech II Semester Examinations, APRIL 2011

**ROBOTICS AND AUTOMATION**Common to Bio-Medical Engineering, Electronics And Instrumentation  
Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
All Questions carry equal marks

\*\*\*\*\*

1. Explain the principle of working of polymer tactile sensors. [16]
2. (a) Explain the differences between robot programming and traditional programming.  
(b) A single cubic trajectory is given by  $\theta(t) = 10 + 90t^2 - 40t^3$ , and is used over a time interval from  $t = 0$  to  $t = 2$  seconds. What are the starting and final positions, velocities and accelerations? [6+10]
3. Discuss about the compensation of digitally controlled system. [16]
4. Draw the block diagram of hydraulic motor with servo valve and distributor and explain the procedure. [16]
5. (a) What are the desirable features of a robot for successful machine tool load/unload application?  
(b) Describe the applications of a robot in press working operation? [8+8]
6. (a) Distinguish between flexible automation and programmable automation.  
(b) Explain the dynamic stabilization of robots. [8+8]
7. Solve the inverse kinematics for the cylindrical arm shown in Figure 7. [16]

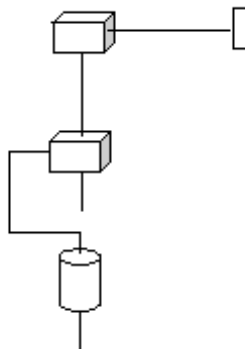


Figure 7

8. Consider a two-degree of freedom manipulator shown in figure 8. Assuming that the inertia of the first moving link is negligible and that the second moving link is a slender homogeneous rod of mass  $m$ , determine the dynamical equations of motion by the Lagrangian method using  $\theta_1$  and  $\theta_2$  as the generalized coordinates. [16]

Code No: 07A81002

R07

Set No. 2

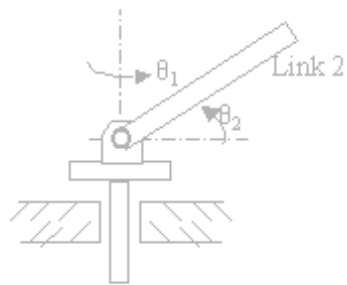


Figure 8

\*\*\*\*\*

FIRSTRANKER

Code No: 07A81002

**R07****Set No. 4**

IV B.Tech II Semester Examinations, APRIL 2011

**ROBOTICS AND AUTOMATION**Common to Bio-Medical Engineering, Electronics And Instrumentation  
Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
All Questions carry equal marks

\*\*\*\*\*

1. Determine the dynamic equations for the two-link manipulator shown in Figure 1, when each link is modeled as a rectangular solid of uniform density. Each link has dimensions  $a_i$ ,  $b_i$  and  $h_i$  and total mass  $m_i$ . [16]

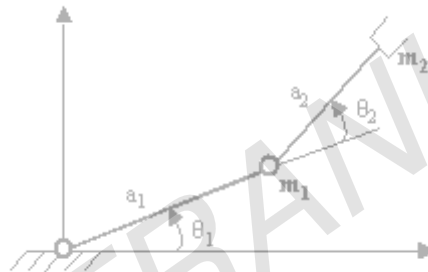


Figure 1

2. (a) Explain the WAIT, SIGNAL and DELAY commands used in robot programming. [6+10]  
(b) Explain the two generations of textual robot languages.
3. (a) Find the D-H parameters for the two-link arm shown in Figure 3b, and also obtain the kinematic equations. [10+6]  
(b) Rotate the vector  $-2\hat{i} + 5\hat{j} - 7\hat{k}$  by an angle of 90 degrees about x-axis. [10+6]

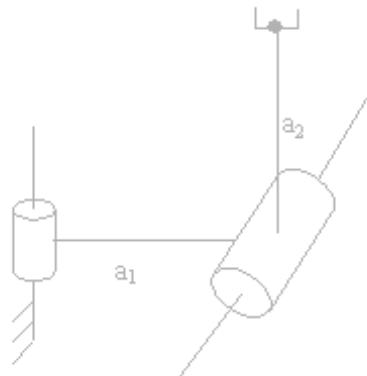


Figure 3b

4. (a) Explain the Articulated robot with a neat sketch. Discuss the relative merits and demerits of articulated robots. Name any two industrial robots having this geometric structure.

Code No: 07A81002

**R07****Set No. 4**

- (b) What do you mean by load carrying capacity? Discuss the load carrying capacities of various robot anatomies. [10+6]
5. Discuss the performance of a closed loop second order control system. [16]
6. (a) What are the three types of sensors used in vision systems? Explain  
(b) Describe the operation of vidicon and solid-state camera. [8+8]
7. (a) Discuss the issues to be considered in robot workcell design.  
(b) What is an interlock in robotic workcell design? Explain. [8+8]
8. A vacuum pump to be used in a robot. Vacuum gripper application is capable of drawing the negative pressure of 32 kPa compared to 1 atm pressure. The gripper is to be used for gripping stainless steel plates, each plate having dimensions of 75×875 mm and weighing 260 N. Determine the diameter of the suction cups to be used for the robot gripper if it has been decided that 2 suction cups will be used for the gripper for greater stability. A factor of safety of 1.5 should be used in the design computations. [16]

\*\*\*\*\*

Code No: 07A81002

**R07****Set No. 1**

IV B.Tech II Semester Examinations, APRIL 2011

**ROBOTICS AND AUTOMATION**Common to Bio-Medical Engineering, Electronics And Instrumentation  
Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
All Questions carry equal marks

\*\*\*\*\*

- Discuss the robots on military and fire fighting operations.
  - Explain about walking machines. Show by means of neat sketch the possible gaits used by walking machines. [8+8]
- Explain the 4- 3- 4 trajectory plan for robot motion. [16]
- Explain the principle of working of optical proximity sensors with the help of neat sketches. [16]
- Discuss the non manufacturing robot applications with regard to coal mining, fire fighting and undersea operations?
  - Discuss the applications of a robot in automated assembly operations? [6+10]
- Find the dynamic model of the two link planar arm with a prismatic joint and revolute joint as shown in figure 5 by using the recursive Newton-Euler algorithm. [16]

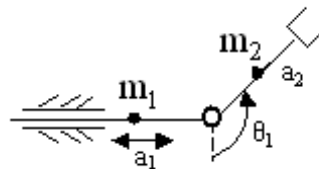


Figure 5

- Discuss the power and signal transmission of the End Effector of the robot/End Effector Interface. [16]
- What do you mean by adaptive control? Draw the block diagram of direct adaptive impedance control scheme. [16]
- A spatial 3-R manipulator is shown in Figure 8. Obtain the D-H parameters and the kinematic equations. [16]

Code No: 07A81002

R07

Set No. 1

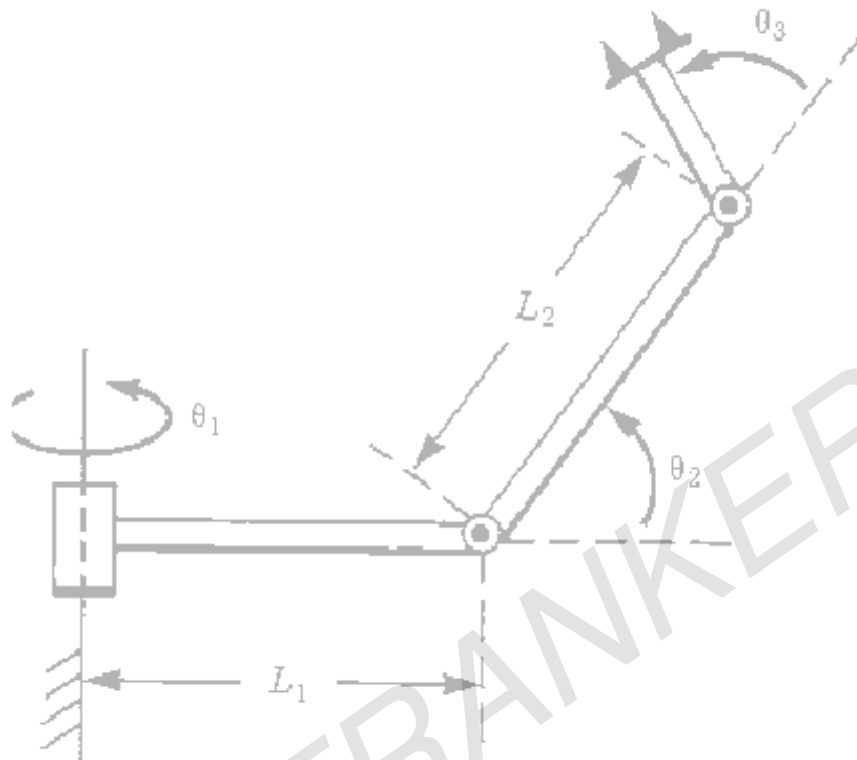


Figure 8

\*\*\*\*\*

Code No: 07A81002

**R07****Set No. 3**

IV B.Tech II Semester Examinations, APRIL 2011

**ROBOTICS AND AUTOMATION**Common to Bio-Medical Engineering, Electronics And Instrumentation  
Engineering

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions  
All Questions carry equal marks

\*\*\*\*\*

- Discuss the material transfer applications of robot?
  - Discuss the machine loading/unloading applications of robot? [8+8]
- What are D-H parameters? Obtain the transformation matrix from frame  $i$  to frame  $i-1$  attached to the ends of  $i^{th}$  link in a manipulator in terms of the D-H parameters.
  - Perform a translation on the vector  $\hat{a} = 5\hat{i} + 2\hat{j} - 2\hat{k}$  by a distance of 2 units in the x-direction, -4 units in the y-direction and -1 unit in z-direction. [10+6]
- What do you mean by tactical sensing? Discuss about touch type and force type tactile sensors. [16]
- Explain the polar coordinate robot with a neat sketch. Discuss the relative merits and demerits of this structure. Name any two industrial robots having this geometric structure.
  - Discuss about the three laws of robotics. [10+6]
- Determine the coefficients of two cubic polynomials that are connected in a two-segment spline with continuous acceleration at the intermediate point. The initial point is  $\theta_i$ , the intermediate point is  $\theta_v$  and the final point is  $\theta_g$ .
  - Explain briefly the characteristics of robot task-level languages [8+8]
- Draw the control circuit of the two d.o.f planar robot with pneumatic actuator control circuit and explain the procedure. [16]
- Determine the dynamic equations for the two-link manipulator shown in Figure 7. Assume that the whole mass of the link can be considered as a point mass located at the outermost end of each link. The masses are  $m_1$  and  $m_2$  and the link lengths are  $a_1$  and  $a_2$ . [16]

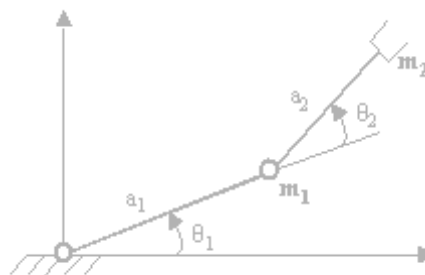


Figure 7

Code No: 07A81002

R07

Set No. 3

8. Discuss about the Pneumatic manipulators and electronic manipulators. [16]

\*\*\*\*\*

FIRSTRANKER