COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)
SHIVAJI NAGAR, PUNE - 411 005

END Semester Examination

(PE(DE)-14001) Robotics

Course: B.Tech

Branch: Production Engineering (Sandwich)

Semester: Sem VII

Year: 2014-2015

Max.Marks:60

Duration: 3 Hours Time:- 2.00 -5.00 PM

Date:30/11/2014

Instructions:

MIS No. | | | | | | | | | |

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of anything like stationery, calculator is not allowed.
5. Assume suitable data if necessary.
6. Write your MIS Number on Question Paper
7. Attempt any Six Questions.

Q.1 a) How the robots are classified on the basis of Motion control. Draw Robot Manipulator with TRL configuration. Give its applications. (5)

b) State the characteristics for specifying the robot. Explain with suitable sketch three degrees of freedom associated with robot wrist. (5)

Q.2 a) Explain position and velocity sensors in control system. How these are playing role in robot programming. (5)

b) A DC Tachometer is to be used as a velocity feedback device on a certain twisting joint. The joint actuator is capable of driving the joint at a maximum velocity of 0.60 rad/sec and the tachometer constant is 6 V/rad/s. What is the maximum output voltage that can be generated by the device, if the tachometer is geared with the joint so that it rotates with twice the angular velocity of the joint? If the joint rotates at a speed of 30^0/s, determine the output voltage of DC Motor. (5)

Q.3 a) Classify Mechanical Grippers of robot. A 20 kg rectangular block is to be gripped in the Four finger gripper and coefficient of friction between gripper pads and block is 0.28. Calculate the minimum force that would prevent slipping of block. Consider g factor as 3. (5)

b) Discuss sources of illumination in vision system. Compare front & Back illumination. (5)

Q.4 a) The link parameters are given for YasukawaL-3 Robot. Obtain the transformation for origin of gripper w.r.t. base frame indicating all the intermediate steps. (5)

i	α_{i-1}	a_{i-1}	d_i	θ_i
1	0	0	0	60
2	90	2	0	0
3	0	0	2	90

b) Explain the Remote Center Compliance unit in Robot used for assembly application (5)

Q.4 a) A certain potentiometer is used as a feedback device to indicate position of the output link of a rotational robot joint. The excitation of potentiometer equals 6 volt and total wiper travel of the potentiometer is 300^0. The wiper arm is directly connected to the rotational joint so that a given rotation of the joint corresponds to an equal rotation of the wiper arm. I) determine the voltage constant of the potentiometer (Kp) and ii) The robot joint is actuated to a certain angle causing the wiper position to be 60 degree . Determine the resulting output voltage of potentiometer. (5)

b) Explain the applications of sensors used in robot system. (5)

Q.5 a) A Joint of a robot manipulator traverses from an initial position of 25^0 to a final position of 75^0 in 5 seconds. Assuming a three degree polynomial, derive Position, velocity and acceleration function. Construct the plots for position, velocity and acceleration against time. (5)

b) Derive an expression for blending time assuming initial position at t=0 as θ_0 and final position as θ_f at $t= t_f=T$. (5)

Q.6 a) Explain the robot language operating system for programming the robot. (5)

b) The cost of robot and accessories Rs. 20,00,000 and yearly depreciation with straight line method for a life of 10 years. Annual operating & maintenance cost is Rs. 3,00,000/-, Annual value of increased output is Rs. 2,00,000. A one man is replaced working 2000 hrs in one shift operation having salary Rs.100/hr. Calculate annual rate of return for (i) One shift operation. (ii) Two shift operation where operating cost increases 50% more than that of operating & maintenance cost for one shift (5)

Q.7 a) Explain the material transfer application of Robot in detail. (5)

b) Explain the RS 232 Interface in robotic system. (5)

Q.8 a) Discuss considerations of safety of robot in designing a workplace layout of robot. (5)

b) Explain the motion commands and gripper commands used in VAL Language with suitable example. (5)
