

I SEMESTER M.TECH. (INDUSTRIAL AUTOMATION AND ROBOTICS)

END SEMESTER EXAMINATIONS, NOV 2018

SUBJECT: Introduction to Industrial Robots [MTE 5102]

(22/11/2018)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

✤ Answer all the questions.

✤ Data not provided may be suitably assumed

1A.	Sketch the manipulators for LLL, TLL, TRL and TRR joint schemes. Draw the work envelops and give an example for each.	04
1B.	Determine the motion (i.e. $x(t)$) of a joint modeled by a spring mass system shown in Figure Q1B. Parameter values are m=1, b = 5, and k = 6 and the block (initially at rest) is released from the position x = 1.	03
1C.	Describe magnetic grippers. Explain different types of magnetic grippers.	03
2A.	One of the link of a manipulator has an arm with a stroke (range of movement) of 768 mm. the control memory of the robot has 8-bit storage capacity. Determine the control resolution for the same.	04
2B.	Consider an industrial vision system having a pixel density of 350 pixels per lines, 280 lines. A 6-bit register for each picture element to represent various gray scale levels. If image data reduction technique is applied and the size of the register is changed to 4-bit register, then estimate the percentage amount of data reduction(bits).	03
2C.	Explain the feature of future robots in terms of mobility? Explain the problems associated with it.	03
3A.	An industrial robot has a shutdown period of 10 hours before starting a project. if the mean time of the industrial robot is 50 hours (excluding shutdown/repair time). Calculate the availability of an industrial robot.	04

3B.	Consider the two link manipulator shown in Figure y_0 3B. y_1 y_2 P_2 P_2	06
	If coordinates are given as- P_1 , P_2 , P_3 , P_1 , P_2 , P_3 , P_1 , P_3 ,	
	$O(0,0), P_1(\sqrt{3},1), P_2(1+\sqrt{3},1+\sqrt{3})$	
	Obtain the link lengths L_1 and L_2 . <i>The second se</i>	
4A.	Explain different component of strain wave gear used in industrial manipulators wrist. if there are 202 teeth on the circular spline and 200 on the flex spline, then calculate the reduction ratio.	04
4 B .	Consider a Machine Vision System in which a continuous video signal is converted into a discrete signal for image processing. The range of the signal after amplification is 0 to 5 volts. The A/D converter has an 12-bit capacity. Determine the number of quantization levels, the quantization level spacing, the resolution.	03
4C.	What are the advantages and disadvantages of direct drive robots? Explain methods to overcome the disadvantages.	03
5A.	Explain different motion types generally considered for path control of an industrial manipulator with suitable examples.	04
5B.	Determine the time required to complete the move and the velocity of each joint for three axes RRR to travel the following distances: Joint1 rotates 30 degrees, joint2 rotates 60 degrees and joint3 rotates 90 degrees under Joint Interpolation motion. Maximum velocity of any joint is 30 degree/sec. Joint velocity must not exceed 90 percent of maximum velocity (Neglect acceleration and deceleration).	03
5 C.	Write a short note on flexible manufacturing system associated with the capabilities of future robots.	03