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

## **END SEMESTER EXAMINATIONS, DEC 2018**

SUBJECT: Introduction to Industrial Robots [MTE 5102]

Time: 3 Hours

MAX. MARKS: 50

## Instructions to Candidates:

- ✤ Answer any 5 questions.
- Data not provided may be suitably assumed
- 1A. Identify the joint notations of the following configurations of industrial 04 manipulators and draw the neat sketches of their workspaces.



- 1B. Suppose a reduction factor of 0.02 is essential for an end effector operation by using a harmonic drive as a power transmission system. If the circular spline has 202 teeth, then what must be number of teeth on flex spline?
- 1C. What could be the features and capabilities of future industrial robots. Explain in 03 detail.
- 2A. Explain the different holding methods in mechanical gripper with suitable 04 examples.
- **2B.** If the parameters of the system in Figure Q2B are m = 1, b = 1, and k = 1, find  $\alpha$ ,  $\beta$  and the gains k<sub>p</sub>, k<sub>v</sub> for a position-regulation control law that results in the system's being critically damped with a closed-loop stiffness of 9.0.



Figure Q2B

[MTE 5102]

2C.	Explain industrial objectives of future robots in terms of perception, processing, power and planning.							
3A.	Sketch the following manipulator configurations-							
	(a) TRT (b) TVR (c) RR							
	(Note: Standard notations has been used)							
3B.	<ul> <li>Explain the following methods of segmentation in robot vision and processing-</li> <li>a) Thresholding</li> <li>b) Region Growing</li> <li>c) Edge Detection</li> </ul>	03						
3C.	Explain the utility of optical encoders in the industrial manipulators.							
4A.	If an industrial robot has 6 hours as mean time to repair. What could be the mean time between failure if availability of the robot is considered to be 95 percent.							
4B.	Obtain the euler lagrange dynamic equation for the system shown in Figure 4B $Y$	03						

 $\begin{array}{c} x \\ f \\ \hline f \\ \hline m \\ \hline Figure 4B \end{array} X$ 

- 4C. Write the objective of handling and flexible manufacturing systems for the future 03 robots.
- 5A. Define industrial robots and classify them based on the RIA classification. What 04 are the parts of robots?
- 5B. 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 8 volts. The A/D converter has 12-bit capacity. Determine the number of quantization levels, the quantization level spacing
- 5C. Explain the servo and non-servo control systems used in industrial automation and robotics with neat schematic diagram.