U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

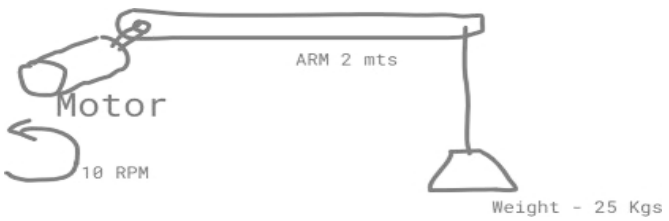
Autonomous Institute Affiliated to VTU

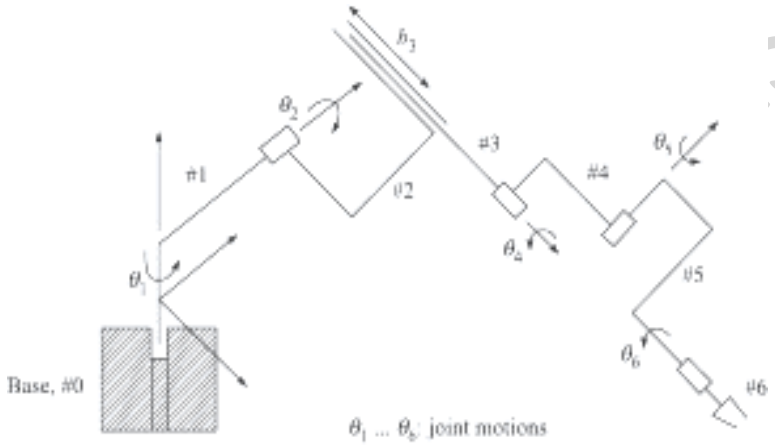
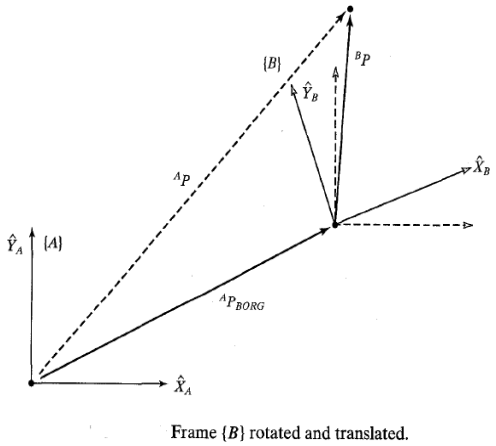
October 2024 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Institutional Elective **Duration: 3 hrs.**
Course Code: 22EC6OE1IR **Max Marks: 100**
Course: Introduction To Robotics

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT – I	*CO*	*PO*	Marks
1	a)	Illustrate selection to consider a person, a robot, or a specialized machine to perform a certain job? Also, explain thumb rules applied for deciding about robot-usage in an industry.		*CO* 1	*PO1*	**10**
	b)	Assume a pair of spur gears shown in Fig 1. below has 20 and 100 teeth, respectively. If the smaller gear (pinion) rotates at 200 rpm (revolutions per minute), find the speed of the larger gear (w_g).  Fig 1		*CO* 1	*PO1*	**04**
	c)	Analyze the main types of grippers used in industrial robots.		*CO* 2	*PO2*	**06**
		OR				
2	a)	Review the actuating systems used in Robotics. Justify which actuating system is preferred most for industrial applications.		*CO* 1	*PO1*	**10**
	b)	What kilowatt or horsepower is required in a motor used to drive a 2-meter robot arm lifting a 25 kg mass at 10 rpm? Select a motor for the specifications for the Fig 2.  Fig-2		*CO* 1	*PO1*	**04**
	c)	Analyze the Robot end effectors (based on different applications).		*CO2*	*PO2*	**06**

			UNIT – II			
	3	a)	"The displacement of one of the prismatic joints in a Cartesian Robot used for a **precision** machining application is to be measured". Which sensor would you use? Briefly describe the mechanism and operation of this sensor.	***CO*** 2	***PO2***	**10**
		b)	Analyze the Robot Vision ecosystem, providing aspects of front-end and backend processing.	***CO*** 2	***PO2***	**10**
			OR			
	4	a)	Analyze why signal conditioning circuits are used in robotics? Elaborate.	***CO*** 2	***PO2***	**10**
		b)	Analyze the important characteristics to be considered for selecting a sensor.	***CO*** 2	***PO2***	**10**
			UNIT - III			
	5	a)	Derive and Calculate the DOF for the Manipulators shown in **Fig 3.**  Fig 3	***CO*** 1	***PO1***	**10**
	5	b)	A frame {B} that is rotated by 60 degrees about the Xˆ Axis. If a point is given by [0 10 2 0] in the frame {B}, find its coordinates in frame {A}. **Fig 4.** shows a frame {B} which is rotated relative to frame {A}. by 30 degrees, translated 10 units in XAˆ, and translated 5 units in ŶA. Find ^{A}P, where $^{B}P = [3.0 \quad 7.0 \quad 0.0]^{T}$.  Fig 4	***CO*** 1	***PO1***	**10**

			UNIT – IV			
	6	a)	Identify and describe briefly the various classification categories of UAV	***CO*** 1	***PO1***	**06**
		b)	Elaborate the UAS regulations in India.	***CO*** 1	***PO1***	**06**
		c)	Analyze the Quadcopter Controls for Roll, Pitch and Yaw and flight modes with a neat diagram.	***CO*** 2	***PO2***	**08**
			UNIT – V			
	7	a)	Enumerate characteristics related to ROS (a) Messages (b) Services (c) Nodes and Nodelets (d) Topics (e) Actions (f) Bags	***CO*** 1	***PO1***	**10**
		b)	Analyze how the URDF supports 3D modeling and simulation in ROS.	***CO*** 2	***PO2***	**10**

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