U.S.N.										

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

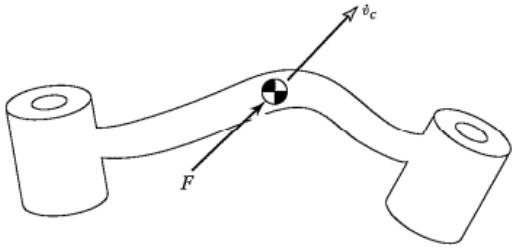
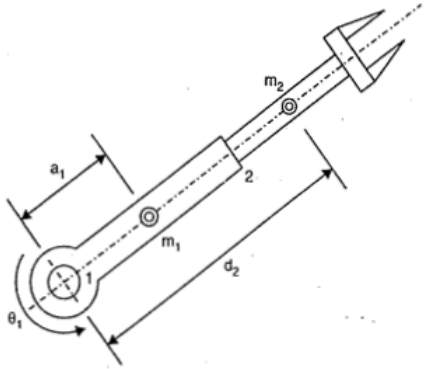
Autonomous Institute Affiliated to VTU

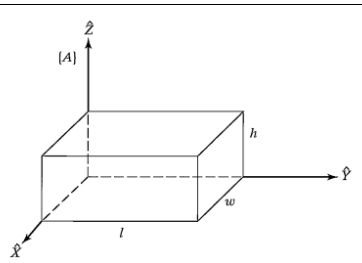
January 2024 Semester End Main Examinations

Programme: B.E. **Semester: VII**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 20ME7DEARB **Max Marks: 100**
Course: Advanced 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 Newton's Equation and Euler's Equation for a rigid body shown in Fig 1.a. where, force F acting at the center of mass of a body causes the body to accelerate at $\dot{v}_c$  Fig 1.a	CO1	PO3	**08**
	b)	Using L-E formulation determine the equation of motion for RP manipulator shown in Fig 1.b.  Fig 1.b	CO2	PO4	**12**
		OR			

	2	a)	Find the inertia tensor for the rectangular body of uniform density ρ with respect to the coordinate system shown in Fig. 2.a  Fig. 2.a	*CO2*	*PO4*	**10**
		b)	The force and the torque in the base coordinate frame is given by $f = 10i + 0j + 0k$ $m = 0i + 10j + 0k$ Determine the force and the torque at the tool tip frame described by $A = \begin{bmatrix} 0 & 0 & 1 & 10 \\ 1 & 0 & 0 & 5 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$	*CO1*	*PO3*	**10**
			UNIT - II			
	3	a)	Explain how a feed-forward Control System works by highlighting its advantages and disadvantages.	*CO3*	*PO2*	**10**
		b)	With a block diagram, explain adaptive control system. Explain its advantages over the conventional system.	*CO3*	*PO2*	**10**
			OR			
	4	a)	Explain in detail PCB design considerations for feedforward control systems.	*CO3*	*PO3*	**10**
		b)	Discuss the implementation of the Cartesian model-based control scheme.	*CO3*	*PO3*	**10**
			UNIT - III			
	5	a)	Explain the following segmentation techniques i. Edge detection ii. Region growing	*CO4*	*PO2*	**10**
		b)	What is object recognition? Explain template matching and structure technique using block diagram of a Cartesian-based decoupling and linearizing controller.	*CO4*	*PO2*	**10**
			UNIT - IV			
	6	a)	Discuss desirable features for sensors of industrial robot.	*CO5*	*PO3*	**10**
		b)	Write a note on following in relation with its application in robot. i. Pulse Width Modulation ii. Directional control with H-Bridge.	*CO5*	*PO4*	**10**

			UNIT - V			
	7		In the automotive industry, vehicle fog lights have previously been adjusted manually by human operators. Presently a sensitive robot adjusts the fog light fully automatically. Discuss a case study on "Assisted human-robot interaction during headlamp calibration describing concept that can be adopted."	*CO6*	*PO5*	**20**

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