U.S.N.										

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

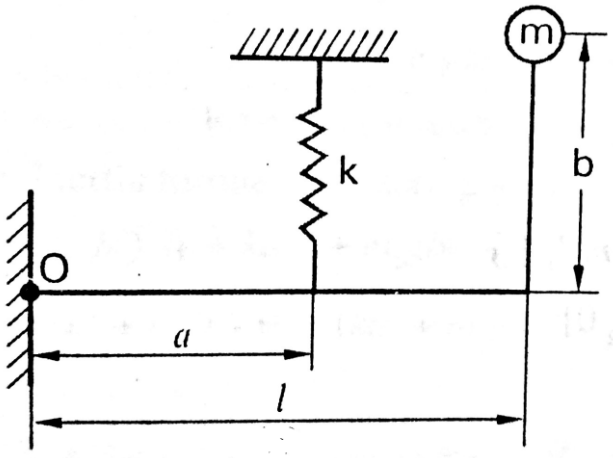
Autonomous Institute Affiliated to VTU

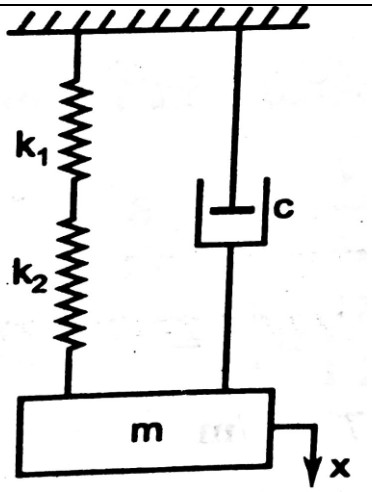
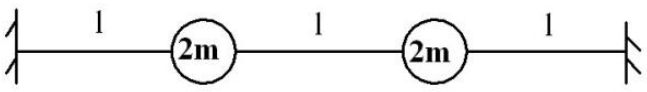
July 2023 Semester End Main Examinations

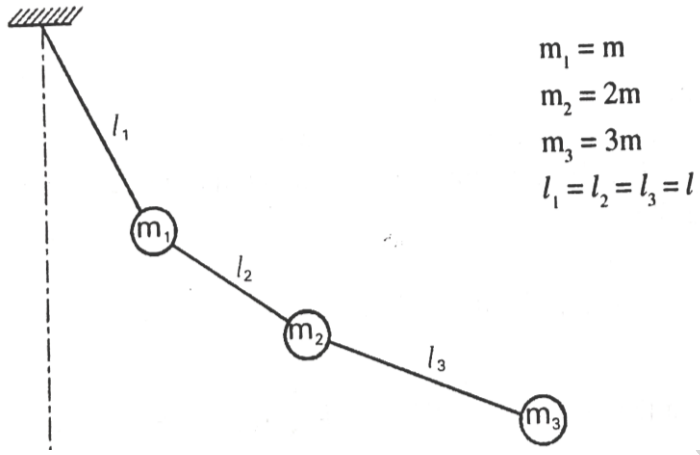
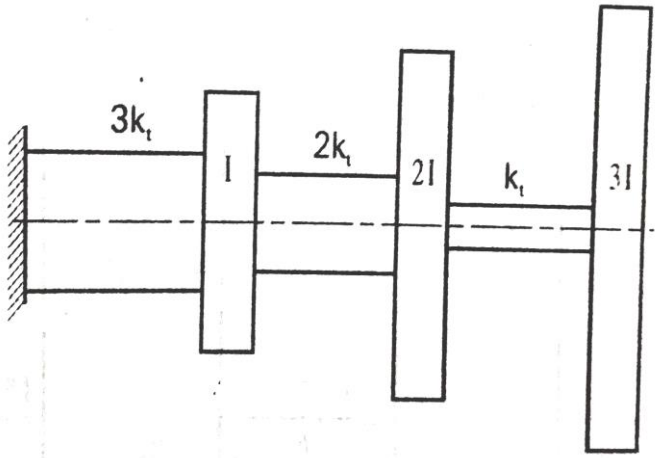
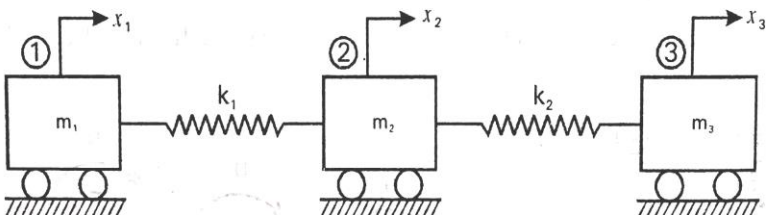
Programme: B.E. **Semester: VI**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 20ME6DCMEV / 16ME6DCMEV **Max Marks: 100**
Course: Mechanical Vibrations **Date: 10.07.2023**

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)	The solution to the differential equation for single degree freedom motion is given by x=Xcos(100t+φ) with initial condition $\dot{x}_{(0)}$ =1250 mm/sec and $x_{(0)} = 0.25mm$ find the values of X and φ, express the given equation in the form of $x=A\sin\omega_n t+B\cos\omega_n t$	*CO1*	*PO1*	**10**
	b)	Determine the differential equation of motion of the system shown in fig1b, where the moment of inertia of the mass m and the bar about the pivot point is I_0. Also show that the system becomes unstable when $b \geq \frac{ka^2}{mg}$.  figure 1b	*CO1*	*PO2*	**10**
		UNIT - II			
2	a)	Set up differential equation for spring-mass-damper system and obtain the complete solution for critically damped condition.	*CO2*	*PO2*	**10**
	b)	Find the response of the system shown in fig 2b if block of mass m pulled down by 0.15m and then released from rest. Take m=2kg, k_1=0.5 N/m, k_2=0.25 N/m, c=0.5 N-s/m.	*CO2*	*PO2*	**10**

			 figure 2b			
			UNIT - III			
3	a)		Analyze the under damped system subjected to constant harmonic excitation and obtain the complete solution.	*CO2*	*PO2*	**10**
	b)		A centrifugal fan weighs 430N and has a rotating unbalance of 225 N-cm. when dampers having damping factor ξ=0.2 are used, specify the springs for mounting such that only 10% of the unbalanced force is transmitted to the floor. Also determine the magnitude of transmitted force. The fan is running at a constant speed of 1000 rpm.	*CO2*	*PO2*	**10**
			OR			
4	a)		Derive an expression for the critical speed of light shaft with single disc with damping.	*CO2*	*PO1*	**10**
	b)		A shaft carrying a rotor of mass 50 kg and eccentricity 2 mm rotates at 12000rpm. Determine i) steady state whirl amplitude ii) maximum whirl amplitude during startup conditions of the system. Assume stiffness of the shaft as $40x10^6$ N/m and external damping ratio as 0.1	*CO2*	*PO1*	**10**
			UNIT - IV			
5	a)		Formulate an expression for the natural frequency, draw mode shapes and locate the node for system shown in Figure 5a subjected to vibration.	*CO3*	*PO2*	**10**
			 Fig 5a			
	b)		What are vibration absorber? Show that spring force of the absorber system is equal and opposite to the exciting force when the main system is stationary.	*CO3*	*PO1*	**10**

			UNIT - V			
	6	a)	Determine the influence coefficient of the system shown in figure 6a.  figure 6a	*CO4*	*PO2*	**08**
		b)	Using stodala's method, determine the lowest natural frequency of the torsional system shown in figure 6b.  figure 6b	*CO4*	*PO2*	**12**
			OR			
	7	a)	Determine the natural frequency and the mode shapes of the system shown in figure 7a by Holzer's method  m_1=2kg, m_2=4kg, m_3=2 kg, k_1=5 N/m, k_2= 10N/m Figure 7a	*CO4*	*PO2*	**15**
		b)	State and prove Maxwell's reciprocal theorem with usual notations.	*CO4*	*PO1*	**05**

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