U.S.N.										

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

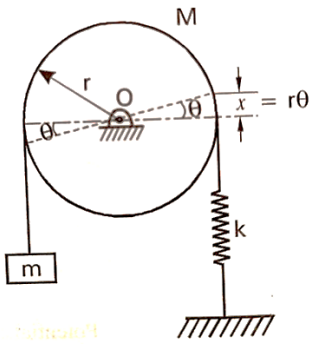
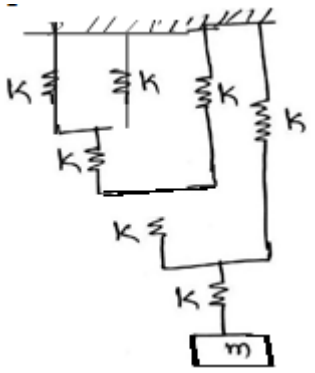
Autonomous Institute Affiliated to VTU

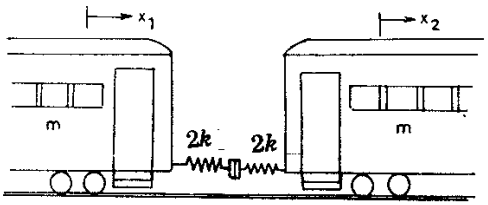
July / August 2024 Semester End Main Examinations

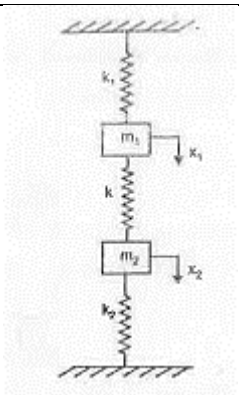
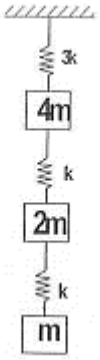
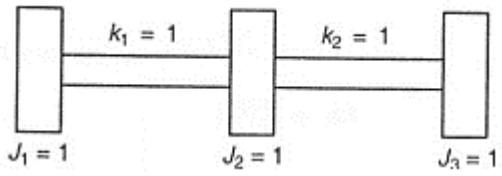
Programme: B.E. **Semester: VI**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 20ME6DCMEV **Max Marks: 100**
Course: Mechanical Vibrations

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)	Split the harmonic motion X= 5Sin (ωt+π/6) into two harmonic motions one having phase of zero and the other of 45° by analytical method.	CO1	PO2	**06**
	b)	Using energy method find the natural frequency of the system shown in Fig. Q1(b).  Q 1 (b)	CO1	PO2	**08**
	c)	Find the natural frequency of the system shown in Fig.Q.1(c), K = 2 x 10^5 N/m, m = 20kg.  **Fig Q 1(c)**	CO2	PO2	**06**
		UNIT - II			
2	a)	Define logarithmic decrement. Derive the equation for the logarithmic decrement.	CO1	PO2	**10**

		b)	A vibrating system is defined by the following parameters m=3 kg, k = 100 N/m, C= 3 N-sec/m. Determine (I) the damping factor, (II) the natural frequency of damped vibration (III) logarithmic decrement, (IV) the ratio of two consecutive amplitudes and (V) the number of cycles after which the original amplitudes is reduced to 20 percent.	*CO2*	*PO2*	**10**
			UNIT - III			
	3	a)	With usual notations, obtain an expression for motion transmissibility for a system with base excitation.	*CO1*	*PO2*	**10**
		b)	A 35 kg block is connected to a support through a spring of stiffness 1.5×10^6 N/m in parallel with a dash pot of damping coefficient 2×10^3 Ns/m. The support is given a harmonic displacement of amplitude 20 mm at a frequency of 35 Hz. Determine I) Steady state amplitude of the absolute displacement of the block II) Steady state amplitude of the displacement of the block relative to its support.	*CO2*	*PO2*	**10**
			OR			
	4	a)	What is Magnification Factor? Derive an expression for the same and discuss the variation with frequency ratio.	*CO1*	*PO2*	**10**
		b)	A machine of total mass 200 kg is supported on springs of total stiffness 1600 kN/m has an unbalanced rotating element which results in a disturbing force 800 N at a speed of 3000 rpm. Assuming ξ= 0.2. Determine (i) Amplitude of motion due to unbalance and its phase angle. (ii) Transmissibility ratio. (iii) Force transmitted to the foundation and its phase angle	*CO2*	*PO2*	**10**
			UNIT - IV			
	5	a)	An electric train made of two cars each of mass 2000 kg is connected by couplings of stiffness equal to 40×10^6 N/m, as shown in Fig Q 5 (a). Determine the natural frequency of the system.  Fig Q 5(a)	*CO3*	*PO2*	**10**
		b)	Determine the natural frequency of the system as shown in fig Q5 (b) K= 60 N/m, $K_1=K_2$= 40 N/m, $m_1=m_2$= 10 kg.	*CO3*	*PO2*	**10**

			 Fig Q 5(b)			
			UNIT - V			
	6		Using Matrix iteration method find the natural frequency of the system shown in Fig Q6 (a). (carryout 3 iterations)  Fig Q6 (a)	*CO4*	*PO3*	**20**
			OR			
	7	a)	State Maxwell's reciprocal theorem with an example.	*CO4*	*PO3*	**5**
		b)	For the system shown in Figure.7(b), determine the natural frequencies and corresponding modes by using Holzer's method.  Fig. 7(b)	*CO4*	*PO3*	**15**

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