U.S.N.										

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

Autonomous Institute Affiliated to VTU

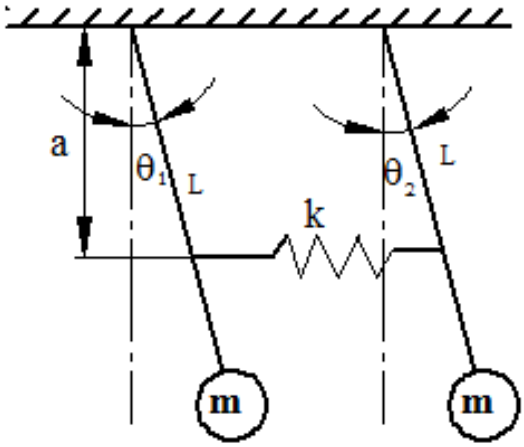
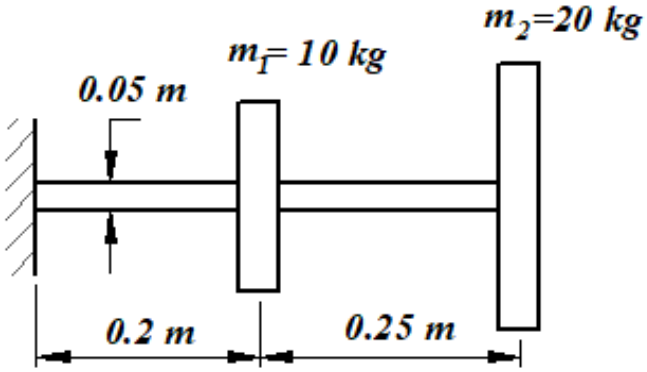
September / October 2024 Supplementary Examinations

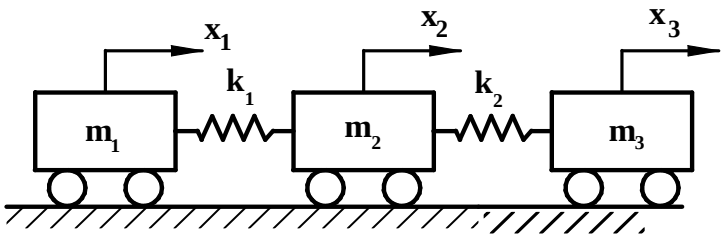
Programme: B.E. **Semester: VI**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 20ME6DCMEV **Max Marks: 100**
Course: Mechanical Vibrations

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)		Briefly discuss the types of mechanical vibrations.	*CO1*		**06**
	b)		A cylinder of mass 'm' and radius 'r' rolls without slipping on a circular surface of radius 'R'. When the cylinder is replaced by sphere of same mass 'm' and radius 'r', compare the natural frequencies and comment on results.	*CO1*	*PO2*	**14**
			UNIT - II			
2	a)		Starting from the fundamentals, obtain an expression for the response of an underdamped spring-mass system subjected to viscous damping.	*CO1*	*PO2*	**10**
	b)		A body of mass 10 kg is suspended freely from a spring of stiffness 2 N/mm. A damper having a resistance of 5 N at a velocity of 0.1 m/sec is connected between the mass and the fixed end of the spring. Determine; (i) Damping factor & log decrement (ii) Ratio of successive amplitudes (iii) Amplitude of body after 10 cycles if the initial amplitude is 15 mm.	*CO1*	*PO2*	**10**
			UNIT - III			
3	a)		Define vibration isolation and force transmissibility. Obtain an expression for TR in terms of damping ratio and ratio of frequencies. Discuss the limitation of using damping for vibration isolation beyond ratio of frequencies $r < \sqrt{2}$	*CO2*	*PO2*	**10**
	b)		A single cylinder vertical diesel engine has a mass of 400 kg and is mounted on a steel chassis frame. The static deflection owing to weight of the chassis is 2.4 mm. The reciprocating masses of the engine amount to 18 kg and the stroke of the engine is 160 mm. A dashpot with a damping coefficient of 2 N/mm/sec is also used to dampen the vibrations. In the steady-state of vibrations, determine;	*CO2*	*PO2*	**10**

			(i) Amplitude of vibration at 500 rpm of driving shaft (ii) The speed of the driving shaft at resonance			
			OR			
	4	a)	With usual notations and a neat sketch, derive an expression for the dynamic amplitude of a shaft subjected to air damping.	*CO2*	*PO2*	**10**
		b)	A disc of mass 5 kg is mounted midway between two simple bearing supports which are 480 mm apart, on a horizontal steel shaft 9 mm in diameter. The CG of the disc is displaced by 3 mm from its geometric center. Equivalent viscous damping at the center of the disc is 48 N-s/m. If the shaft rotates at 675 rpm determine the maximum stress in the shaft. Take E= 200 Gpa.	*CO2*	*PO2*	**10**
			UNIT - IV			
	5	a)	Briefly explain the principle of dynamic vibration absorber.	*CO3*	*PO1*	**08**
		b)	Two simple pendulums are connected by a spring as shown in fig. Determine the natural frequencies of the pendulum. 	*CO3*	*PO2*	**12**
			UNIT - V			
	6	a)	State and prove Maxwell's reciprocal theorem.	*CO4*	*PO1*	**08**
		b)	Determine the lowest natural frequency of the cantilever beam shown in fig using **Stodola method.** Take E=210 Gpa. 	*CO4*	*PO2*	**12**
			OR			
	7	a)	Explain the Principle of orthogonality as applied to multi degrees of freedom systems.	*CO4*	*PO1*	**04**

		b)	Using **Holzer's method**, determine the natural frequencies of the system shown in fig given; m_1=2 kg, m_2=4kg, m_3=2kg, k_1=5N/m, k_2=10N/m 	*CO4*	*PO2*	**16**

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