U.S.N.										

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

Autonomous Institute Affiliated to VTU

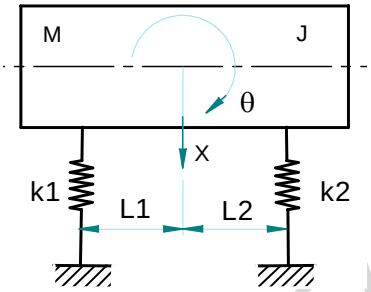
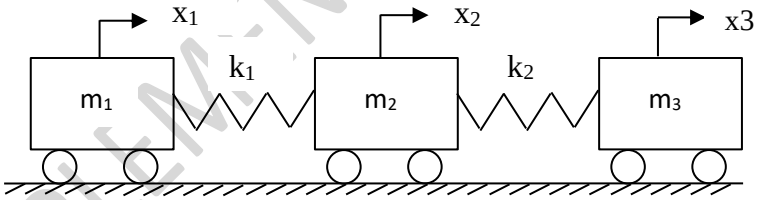
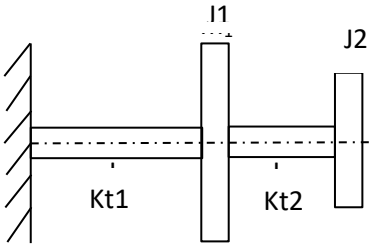
October 2024 Supplementary Examinations

Programme: B.E. **Semester: VI**
Branch: Mechanical Engineering **Duration: 3 hrs.**
Course Code: 22ME6PCMEV / 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)		Mention and explain in detail classification of vibrations.	CO1	PO2	**08**
	b)		A spring mass system has spring constant of *k* N/m and the mass *W* kg. It has a natural frequency of vibration as 12 c. p. s. An extra 2 kg mass is coupled to W and natural frequency reduces by 2 c. p. s. Find k and W.	CO1	PO2	**08**
	c)		Derive the natural frequency expression for a system having a rotor of mass moment of Inertia *I* connected to a shaft (at its end) of torsional stiffness $k_T$twisted by an angle θ. What would the frequency equation be if the torsional stiffness of the shaft is reduced by 50%.	CO1	PO2	**04**
			UNIT – II			
2	a)		Define logarithmic decrement and derive an expression for logarithmic decrement. State the significance of the logarithmic decrement.	CO2	PO1	**10**
	b)		A vibrating system is defined by the following parameters: m =3 kg, k=100 N/m, C = 3 N-s/m. Determine: i) Damping factor (ii) Frequency of damped vibrations (iii) Logarithmic decrement (iv) Ratio of successive amplitudes (v) Number of cycles after which the original amplitude is reduced by 20%.	CO2	PO2	**10**
			UNIT - III			
3	a)		What are frequency response curves? With a neat sketch, explain the salient features.	CO3	PO2	**10**
	b)		A machine having a mass of 100 kg and supported on springs of total stiffness 7.84 x 10^5 N/m has an unbalanced rotating element which results in a disturbing force of 392 N at a speed of 3000 rpm. Assuming a damping factor of 0.2, determine, i) The amplitude of motion due to unbalance ii) The transmissibility iii) The transmitted force	CO3	PO3	**10**
			OR			
4	a)		Sketch and explain the vector diagram for a forced vibration system for the following operating conditions: i) $\omega \ll \omega_n$ ii) $\omega = \omega_n$ iii) $\omega \gg \omega_n$	CO3	PO2	**12**

		b)	A machine part of mass 4kg suspended in a viscous medium. A harmonic exciting force of 40 N acts on the machine and causes a resonant amplitude of 15 mm with a period of 0.2 seconds. Determine the damping coefficient. If the system is excited by a harmonic force of frequency 4 Hz, what will be the percentage increase in the amplitude of forced vibration when damper is removed.	*CO3*	*PO3*	**08**
			UNIT – IV			
	5	a)	Explain principal modes and normal modes of vibration of two-degree undamped system.	*CO4*	*PO2*	**06**
		b)	Fig. 5(b) shows an automobile chassis model with two degrees of freedom X and Θ. Determine the two natural frequencies.  Fig. 5(b)	*CO4*	*PO3*	**14**
			UNIT – V			
	6		Determine the natural frequency and the mode shape of the system shown in figure below, by Holzer's method. Take m_1=2kg, m_2=4kg, m_3=2kg, k_1=5N/m, k_2=10N/m.  	*CO5*	*PO2*	**20**
			OR			
	7	a)	Write a short note on (i) Influence co-efficient (ii) Orthogonality Principle.	*CO5*	*PO1*	**06**
		b)	Use Stodola's method to find the natural frequency of the system shown below.  	*CO5*	*PO2*	**14**

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