U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. — **Semester: V/VI**

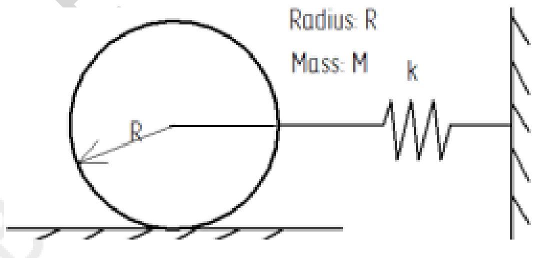
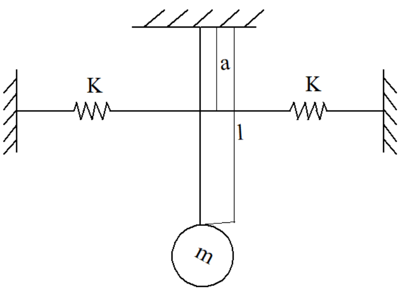
Branch: Mechanical Engineering — **Duration: 3 hrs.**

Course Code: 23ME5PCMEV/22ME6PCMEV/20ME6DCMEV — **Max Marks: 100**

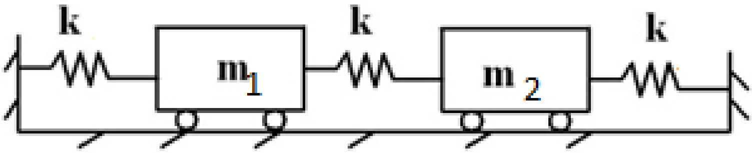
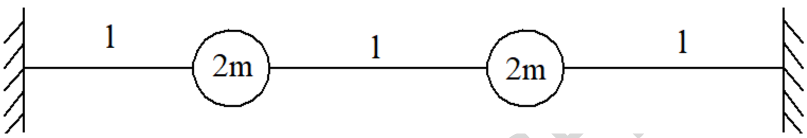
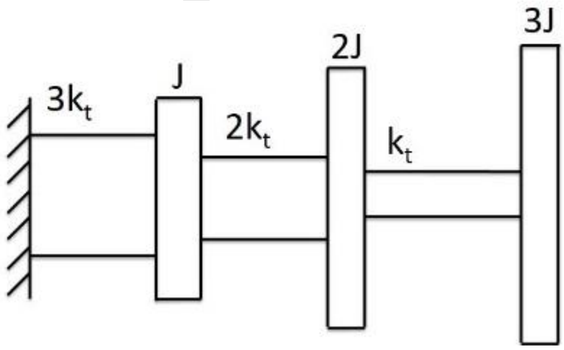
Course: Mechanical Vibrations

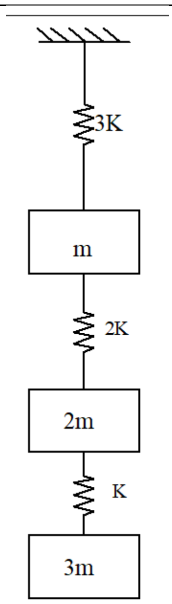
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

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)	Explain the following terms. Include relevant formulae wherever applicable: i) Natural frequency ii) Stiffness iii) Damping iv) Degrees of freedom v) Restoring force	*CO1*	*PO1*	**10**
	b)	A sphere of mass 'M' and radius ' r' rolls without slipping on a spherical surface of radius R. Determine the natural frequency of oscillation when the cylinder is displaced slightly from its equilibrium position.	*CO1*	*PO2*	**10**
		OR			
2	a)	Analyze and determine natural frequency of a cylindrical system that rolls without slipping as shown in Fig. 2a.  Fig. 2a  Fig. 2b	*CO1*	*PO2*	**10**

		b)	A pendulum consists of a stiff weightless rod of length *l* carrying mass *m* at its end as shown in Fig. 2b. Two springs of each stiffness *k* are attached to the rod at a distance *a* from the upper end. Determine the natural frequency for small oscillations.	*CO1*	*PO2*	**10**
			UNIT - II			
	3	a)	Define logarithmic decrement. Also, obtain an equation for logarithmic decrement in terms of damping ratio.	*CO2*	*PO1*	**10**
		b)	The torsional pendulum with a disc of moment of inertia 0.1 kg-mm^2 is immersed in a viscous fluid. During torsional vibration, the observed amplitudes on the same side of the neutral axis for successive cycles are found to be decreased by 50% of initial value. Determine a) logarithmic decrement, b) damping torque per unit velocity and c) damped natural frequency	*CO2*	*PO2*	**10**
			OR			
	4	a)	Derive the response equations for critically damped and overdamped vibration systems. Illustrate their behavior using response curves and explain a practical application for each case.	*CO2*	*PO2*	**14**
		b)	When a Single degree freedom system piston of the dashpot is subjected to force of 60 N with velocity 0.12 m/sec. deter mine (i) Damping coefficient (ii) check whether the system is periodic or aperiodic.	*CO2*	*PO2*	**06**
			UNIT - III			
	5	a)	Derive response equation for Forced vibration of damped SDOF system using graphical method.	*CO2*	*PO2*	**10**
		b)	A refrigerator unit having a mass of 35 kg is to be supported on three springs, each having stiffness *k*. Unit operates at 480 rpm. Find the stiffness value *k*, if only 10% of the shaking force is allowed to be transmitted to the supporting structure.	*CO2*	*PO2*	**10**
			OR			
	6	a)	Define transmissibility. With usual notations, obtain expression for motion transmissibility and phase lag for system with base excitation. With the help of response curves, recommend the condition for vibration isolation.	*CO2*	*PO1*	**10**
		b)	A machine of total mass 17 kg is mounted on springs having stiffness *k*=11,000 N/cm. A piston within the machine has a mass of 2 kg, has reciprocating motion with a stroke of 75 mm and speed 6,000 rpm. Assuming the motion to be SHM, Determine i) Amplitude of machine ii) Transmissibility and iii) Force transmitted to the ground or foundation. Take $\zeta = 0.2$	*CO2*	*PO2*	**10**

			UNIT - IV			
	7	a)	Propose equation of motion, obtain natural frequencies and draw mode shapes of system shown in Fig. 7a.  Fig. 7a	*CO3*	*PO2*	**15**
		b)	With the help of response equation and graph, explain vibration absorber.	*CO3*	*PO1*	**05**
			OR			
	8		Obtain natural frequency, draw mode shapes and locate node for the system shown in Fig. 8a.  Fig. 8a	*CO3*	*PO2*	**20**
			UNIT - V			
	9		Predict the natural frequencies of the system shown in Fig. 9a using Holzer's method.  Fig. 9a	*CO4*	*PO2*	**20**
			OR			
	10		Determine the natural frequencies of system shown in Fig. 10 by using Stodola's method. Assusme k= 1N/m and m=1kg.	*CO4*	*PO2*	**20**

			Fig. 10			

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