U.S.N.										

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

Autonomous Institute Affiliated to VTU

April 2025 Semester End Make-Up Examinations

Programme: B.E. **Semester: V/VI**

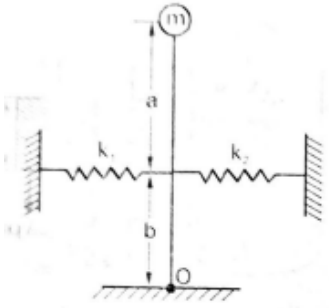
Branch: Mechanical Engineering **Duration: 3 hrs.**

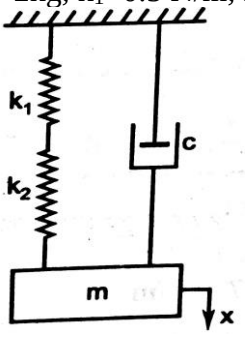
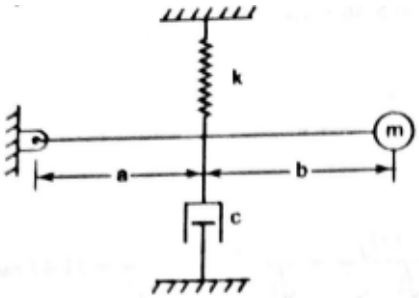
Course Code: 23ME5PCMEV/22ME6PCMEV **Max Marks: 100**

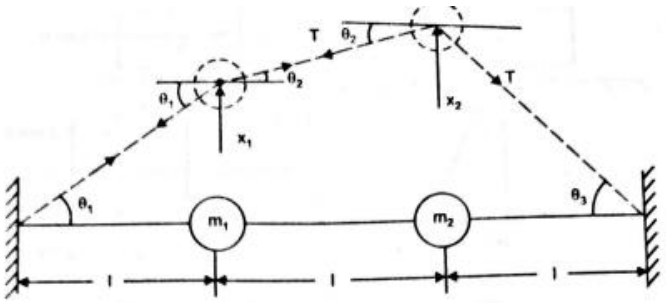
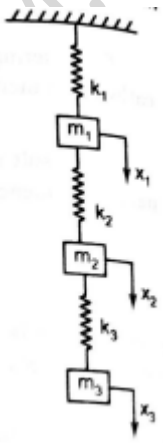
Course: Mechanical Vibrations

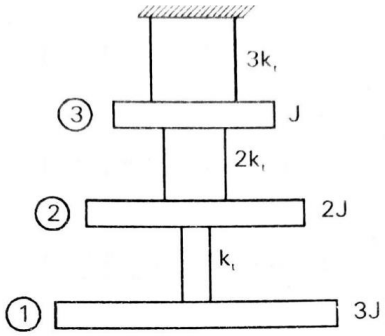
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

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)	Derive an expression for work done by harmonic force on a harmonic motion	CO1	PO2	**10**
	b)	Obtain complete solution for displacement x(t) for undamped spring mass system in horizontal position.	CO1	PO2	**10**
		OR			
2	a)	A homogenous cylinder of mass *'M'* and radius *'r'* rests at the bottom of a cylindrical surface of radius *'R'*. For small oscillations of the smaller cylinder at the contact point, determine the natural frequency.	CO1	PO2	**10**
	b)	Determine the natural frequency of the system shown in figure for small amplitudes of vibration. 	CO1	PO2	**10**
		UNIT - II			
3	a)	Derive general solution for a spring-mass-dashpot system and obtain complete solution, when the system subjected to critical damping.	CO2	PO2	**10**
	b)	Find the response of the system shown in fig 3b i) if block of mass m pulled down by 0.15m and then released from rest. Take	CO2	PO2	**10**

			m=2kg, k_1=0.5 N/m, k_2=0.25 N/m, c=0.5 N-s/m.  fig 3b			
			OR			
	4	a)	A mass of 7.5 kg hangs from a spring and makes damped oscillations. The time for 60 oscillations is 35 secs and the ratio of first to seventh displacement is found to be 2.5. Find (i) stiffness of spring (ii) damping resistance (iii) if the oscillations were critically damped what is the damping resistance	*CO2*	*PO2*	**10**
		b)	Derive equation of motion for the system shown in figure. also determine the critical damping constant. 	*CO2*	*PO2*	**10**
			UNIT - III			
	5	a)	Derive an expression for absolute motion displacement transmissibility (X/Y) for a SDOF spring mass damper system.	*CO3*	*PO2*	**10**
		b)	The weight of an electric motor is 125 N and it runs at 1500 rpm. The armature weighs 35 N and its center of gravity lies 0.05 cm from the axis of rotation. The motor is mounted on five springs of negligible damping so that the force transmitted is one-eleventh of the impressed force. Assuming that the weight of motor is equally distributed among the five springs. Determine a) stiffness of each spring b) dynamic force transmitted to the base at the operating speed c) natural frequency of the system	*CO3*	*PO2*	**10**
			OR			
	6	a)	Derive an expression for the ratio of displacement versus eccentricity for a rotating disc subjected to air damping	*CO3*	*PO2*	**10**

		b)	A disc of mass 4kg is mounted midway between bearings which may be assumed to be simple supports. The bearing span is 48cm. The steel shaft which is horizontal is 9mm in diameter. The CG of the disc is displaced 3mm from the geometric centre. The equivalent viscous damping at the centre of the disc-shaft may be taken as 49 N-sec/m. If the shaft rotates at 760rpm, find the maximum stress in the shaft and compare it with dead load stress in the shaft. Also find the power required to drive the shaft at this speed.	*CO3*	*PO2*	**10**
			UNIT - IV			
	7		Figure shows a system of two masses attached to a tightly stretched string, fixed at both ends. Determine the natural frequencies and mode shapes of the system for m1=m2=m 	*CO4*	*PO2*	**20**
			OR			
	8	a)	Derive an expression for vibration absorber and show that the force excreted by the auxiliary spring on the main mass is opposite to impressed force.	*CO4*	*PO2*	**15**
		b)	Explain principal mode of vibration with example	*CO4*	*PO1*	**5**
			UNIT - V			
	9		Find the natural frequencies and mode shapes of the three degrees of freedom system shown in figure 9.1 using matrix method  fig 9.1	*5*	*2*	**20**
			OR			

	10		Using Holzer method determine the natural frequencies of the system shown in figure 10.1  fig 10.1	*5*	*2*	**20**

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