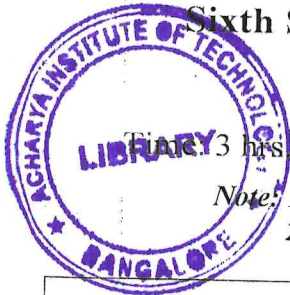


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Sixth Semester B.E./B.Tech. Degree Examination, June/July 2026

Vibration and Aeroelasticity

Time: 3 hrs

Max. Marks: 100

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.
 2. M : Marks , L: Bloom's level , C: Course outcomes.

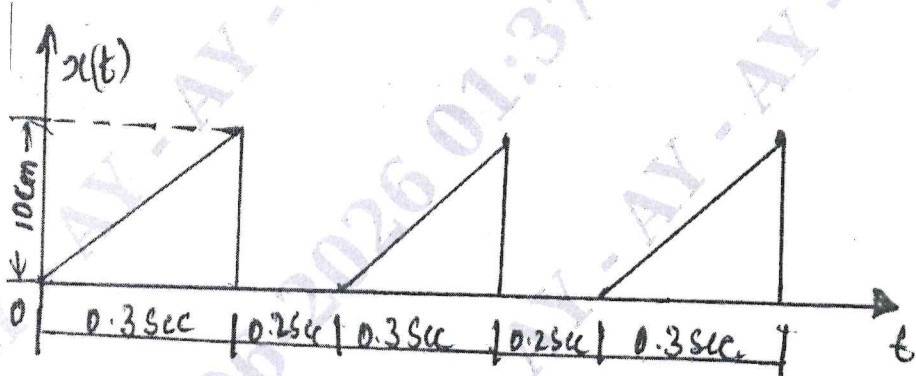
Module – 1				M	L	C
Q.1	a.	Add the following harmonic motions and check the solution graphically $x_1 = 2 \cos (\omega t + 0.5)$ $x_2 = 5 \sin (\omega t + 1.0)$		10	L2	CO1
	b.	Derive differential Equation for a displacement of spring mass system suspended vertically with single degree of freedom using Newton's Method.		10	L2	CO1
OR						
Q.2	a.	Define the following terminologies. i) Natural frequency ii) Degree of freedom iii) Damping iv) Resonance v) Phase difference		10	L1	CO1
	b.	Represent the periodic motion given in fig. Q 2 (b) by harmonic series. 		10	L3	CO1

Fig. Q. 2 (b)

Module – 2

Q.3 a. Find the natural frequency of the system shown in fig. Q. 3(a). 08 L3 CO2

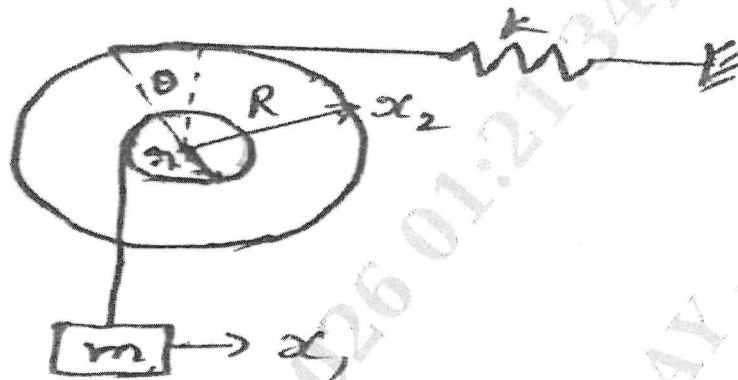


Fig. Q. 3 (a)

- b. An overdamped system shown in fig.Q.3(b) has a spring constant $k = 15 \text{ N/mm}$, mass 10 kg and damping factor $c = 1.5 \text{ N-sec/mm}$. It is at rest in its static equilibrium position when it receives an impulse force acting to the right that create an initial instantaneous velocity $V_0 = 25 \text{ m/s}$ determine :
- An expression for the displacement x of the mass in terms of t .
 - Maximum displacement of the mass from initial position.
 - Time required for the mass to attain the position of maximum displacement

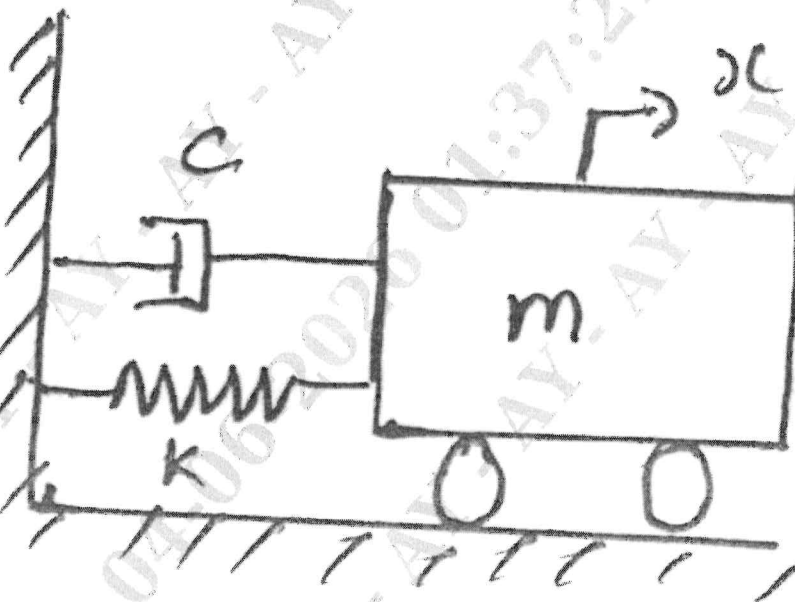
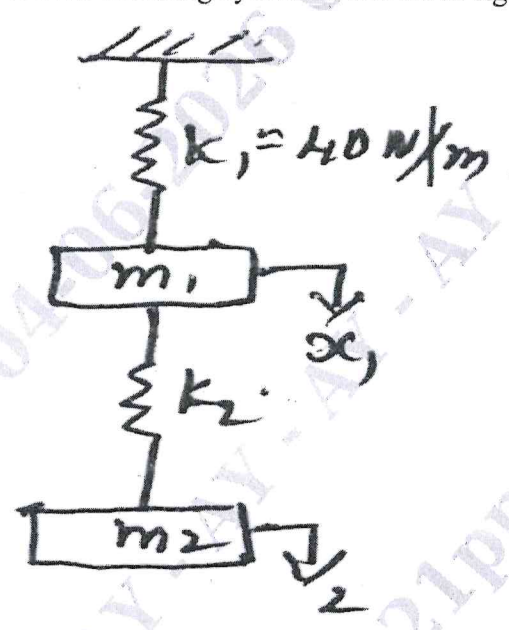


Fig. Q. 3 (b)

OR

Q.4	a.	A mass of 10 kg suspended from one end of helical spring, the other end is fixed. The stiffness of spring is 10 N/mm. The viscous damping causes the amplitude to decrease $1/10^{\text{th}}$ of initial value in 4 complete oscillations. If a periodic force of $150 \cos 50t$ N is applied at the mass with vertical direction. Find the amplitude of forced vibration. What is its value at resonance?	10	L3	CO2
	b.	Sketch and explain vibrometer and Fullerton tachometer.	10	L2	CO2

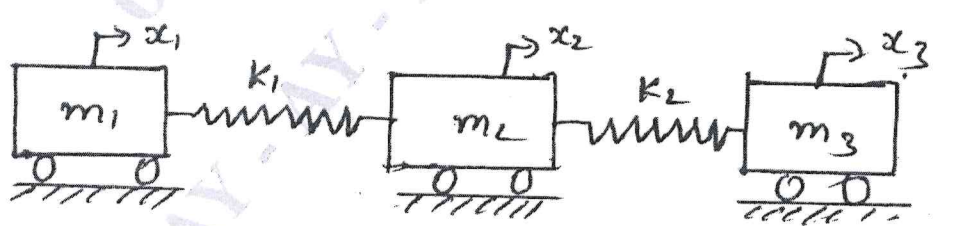
Module – 3

Q.5		A two degrees of freedom vibrating system is shown in fig. Q. 5 (a).  Fig. Q. 3(b) Determine: - The two natural frequencies of vibration - Ratio of amplitude of motion of m_1 and m_2 for two modes of vibration - Modal vector and modal shapes - Locate the nodes for each mode of vibration. Take : $m_1 = 2$ kg, $m_2 = 1$ kg, $k_1 = 40$ N/m, $k_2 = 20$ N/m	20	L3	CO3
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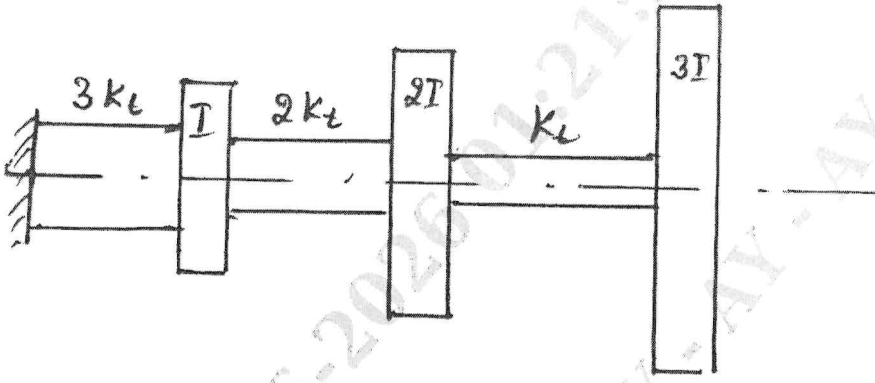
OR

Q.6		Derive 1 – D wave equation for lateral vibration of string and obtain the solution assuming the boundary condition as the string is fixed at both ends.	20	L3	CO3
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Module – 4

Q.7		Determine the natural frequency of the system shown in fig.Q.7 using Holzer's method.  Fig.Q.7 Given : $m_1 = 2$ kg, $m_2 = 4$ kg, $m_3 = 2$ kg, $k_1 = 5$ N/m, $k_2 = 10$ N/m	20	L3	CO4
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OR

Q.8	a.	Using Stodola's method, determine the lowest natural frequency of a torsional system shown in fig. Q. 8 (a).	12	L3	CO4
 Fig. Q. 8 (a)					
	b.	Explain step by step procedure to find natural frequency using Matrix Iteration method.	08	L3	CO4
Module – 5					
Q.9	a.	Explain the concept of aeroelastic coupling and discuss the different types of coupling in aircraft structures.	10	L2	CO5
	b.	Explain wind divergence and discuss the methods used to prevent divergence.	10	L2	CO5
OR					
Q.10	a.	What is flutter? Explain the mechanism of flutter and discuss various flutter prevention techniques.	10	L2	CO5
	b.	Explain loss and reversal of aileron control and discuss its prevention measure.	10	L2	CO5

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