CBCS SCHEME

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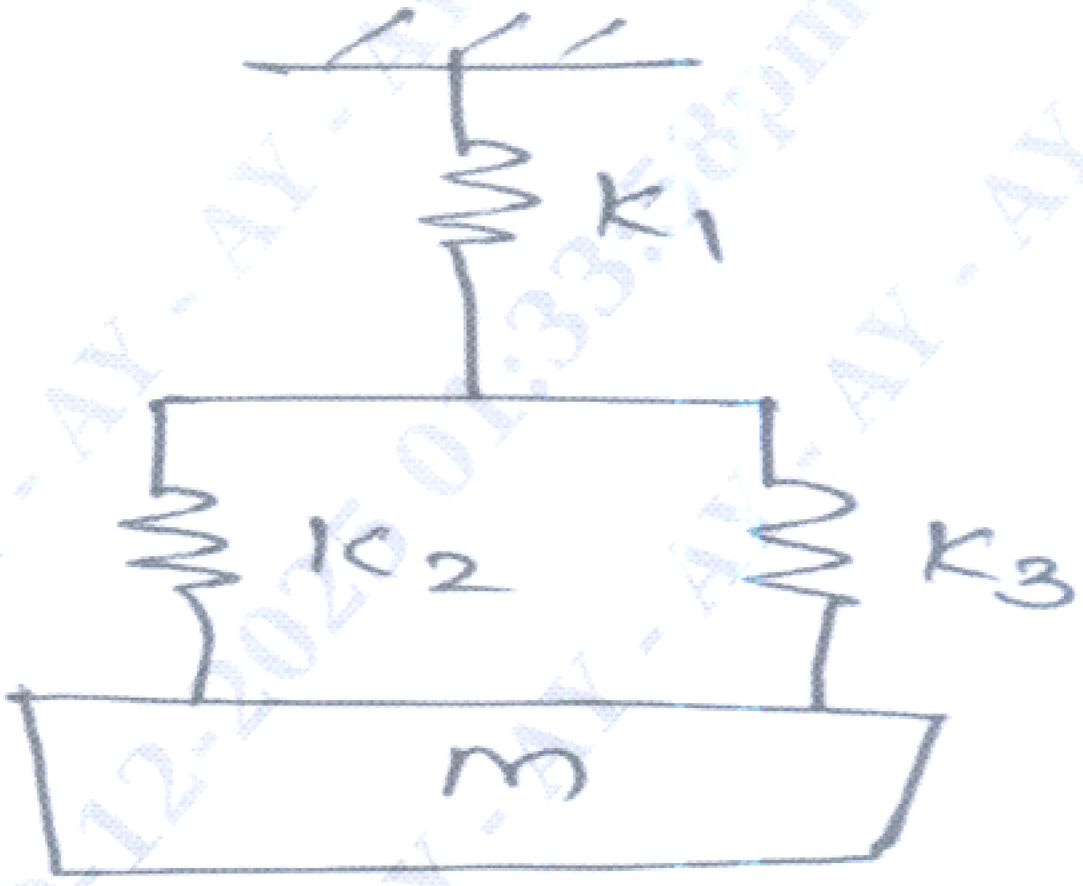
BAE613D

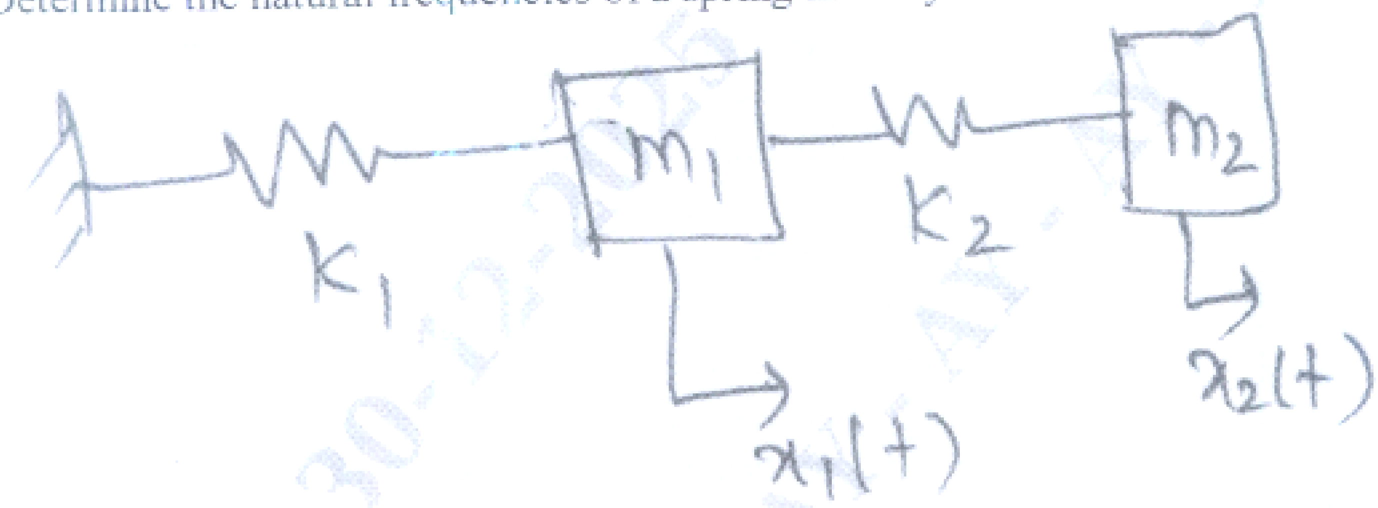
Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

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.	Explain simple harmonic motion with an example.	10	L2	CO1
	b.	Define : i) Cycle ii) Amplitude iii) Phase angle iv) Time period v) Degree of freedom	10	L2	CO1
		OR			
Q.2	a.	Explain D'Alembert's Principle	10	L2	CO1
	b.	Explain the energy method with an example.	10	L2	CO1
		Module – 2			
Q.3	a.	A mass is suspended from a linear spring. Determine the natural frequency of the system. $K_1 = 5000$ N/M , $K_2 = K_3 = 8000$ N/M $m = 25$ kg.  Fig. Q. 3 (a)	10	L3	CO2
	b.	Determine the resultant displacement and phase difference of two single degree of freedom system harmonic motions are $x_1 = A_1 \sin \omega t$ and $x_2 = A_2 \sin(\omega t + \phi)$	10	L3	CO2

		OR			
Q.4	a.	Determine the displacement response of a spring mass damper system subjected to constant force. Take m = 25 kg K = 5000 N/M C = 250 NS/m F (t) = F_o = 50 N.	10	L3	CO2
	b.	Explain the working principle of a accelerometer with neat sketch.	05	L3	CO2
	c.	Derive the equation of motion of a spring, mass, damper system under free vibration.	05	L3	CO2
		Module – 3			
Q.5	a.	Find the displacement response of a free-vibration of a string fixed at both ends.	10	L2	CO3
	b.	Determine the natural frequencies of a spring mass system.  Fig. Q. 5(b)	10	L2	CO3
		OR			
Q.6	a.	Explain the following : i) Co – ordinate coupling ii) Orthogonality principle.	10	L2	CO3
	b.	Derive the displacement response of a longitudinal vibration of a rod.	10	L3	CO3
		Module – 4			
Q.7	a.	Explain Holzer's method to find natural frequencies of a undamped semi-definite system.  Fig. Q. 7(a)	10	L2	CO4
	b.	Determine the fundamental natural frequencies and corresponding mode shape for the system shown in fig. 7 (b).  $m_1 = m_2 = m_3 = m$ and $k_1 = k_2 = k_3 = k$. Fig. Q.7(b)	10	L2	CO4

		OR			
Q.8	a.	Explain : i) Matrix – Iteration Method ii) Stodola Method	10	L2	CO4
	b.	Find natural frequencies of mass stiffness matrices of the system. $[m] = m\begin{bmatrix}1 & 0 & 0\\ 0 & 1 & 0\\ 0 & 0 & 2\end{bmatrix}$ and $[k] = k\begin{bmatrix}2 & -1 & 0\\ -1 & 3 & -2\\ 0 & -2 & 2\end{bmatrix}$	10	L2	CO4
		Module – 5			
Q.9	a.	Explain the basic methods used to prevent the aeroelastic instabilities.	10	L2	CO5
	b.	Discuss the coupling effects in aero elasticity with respect to bending and torsion of a wing.	10	L2	CO5
		OR			
Q.10	a.	Determine the critical flutter speed of a 2-D wing section.	10	L2	CO5
	b.	Describe different types of aeroelastic instabilities. How do these instabilities affect aircraft structures.	10	L2	CO5

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