CBCS SCHEME

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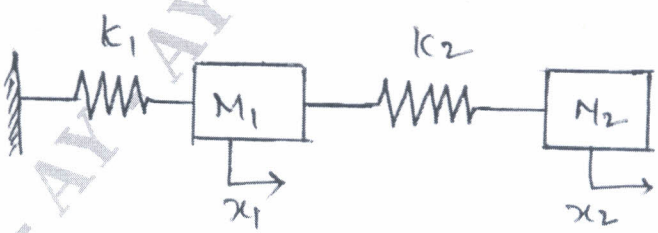
BAE613D

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025
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.	Define vibration? Write some of reasons of vibrations.	05	L1	CO1
	b.	How to reduce the vibration from the systems mention any three of them.	03	L1	CO1
	c.	Define the following : i) Frequency ii) Amplitude iii) Natural Frequency iv) Degree of freedom v) Simple harmonic motion vi) Phase difference	12	L1	CO1
		OR			
Q.2	a.	Write the various methods of vibration Analysis and derive the equation of motion of Energy method.	10	L1	CO1
	b.	Explain about the types of vibration.	10	L1	CO1
		Module – 2			
Q.3	a.	What are the four types of damping used in mechanical system. Explain about the viscous damping.	10	L2	CO2
	b.	A damping force having magnitude $2\cos\left(2\pi t - \frac{\pi}{4}\right)$ N gives $5\cos 2\pi t$ m displacement. Calculate : i) The energy dissipated during first 5 seconds and ii) The energy dissipated during the first $\frac{3}{4}$ seconds	10	L3	CO2
		OR			
Q.4	a.	Describe the sources of Excitation of forced vibration?	10	L2	CO1
	b.	Write the types of vibration measuring instrument? Explain about the vibrometer.	10	L2	CO1
		Module – 3			
Q.5	a.	The given figure shows a vibrating system having two degrees of freedom. Determine the two natural frequencies of vibrations and the ratio of amplitudes of the motion of m_1 and m_2 for the two modes of vibration.  Fig. Q5(a)	10	L3	CO2
	b.	Derive the mass matrix, damping matrix and stiffness matrix for Forced vibration of 2DoF.	10	L3	CO2

OR

Q. No.		Question	Marks	Level	CO
Q.6	**a.**	Use Lagrange's equation. Find the equation of motion for a system as shown in fig.Q.6 (a) where $M_1 = 10$kg, $M_2 = 15$kg and K = 320 N/M	10	L3	CO2

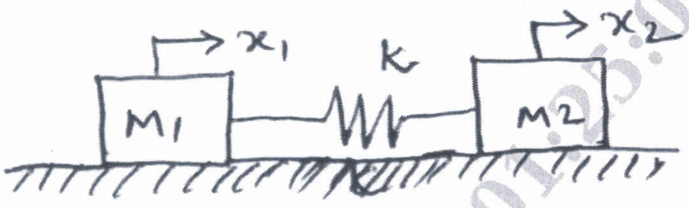


Fig.Q. 6 (a)

Q. No.		Question	Marks	Level	CO
	b.	Two bodies having equal masses as 60 kg each and radius of gyration 0.3m are keyed to bolt ends of a shaft 0.8m long. The shaft is 0.08m is diameter for 0.30m length, 0.10m diameter for 0.20m length and 0.09m diameter for rest of the length. Find the frequency of torsional vibrations. Take $G = 9 \times 10^{11}$ N/m^2.	10	L3	CO2

Module – 4

Q. No.		Question	Marks	Level	CO
Q.7	**a.**	Describe about the orthogonality principle with Relevant equations.	10	L1	CO1
	b.	Determine the flexibility influence co-efficient for the system shown in fig. Q.7 (b)	10	L3	CO2

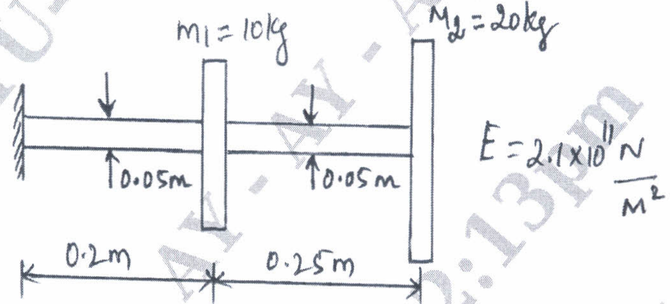


Fig. Q.7 (b)

OR

Q. No.		Question	Marks	Level	CO
Q.8	**a.**	Using matrix method determine the Natural frequency of the given system.	10	L4	CO2

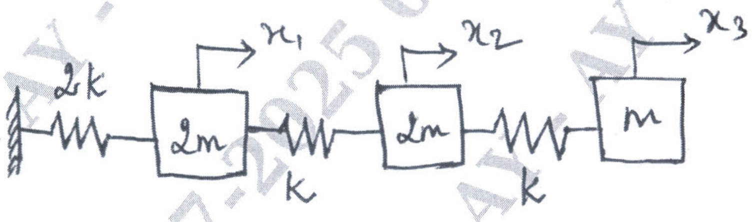


Fig. Q. 8(a)

Q. No.		Question	Marks	Level	CO
	b.	Determine the Natural frequency of the spring mass system as shown in fig. Q.8 (b). Take $M_1 = M_2 = M_3 = M$ and $K_1 = K_2 = K_3 = K$ use Stodola's method.	10	L3	CO2

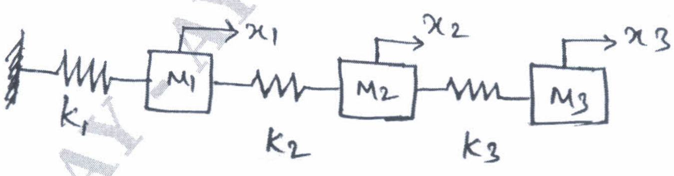


Fig. Q. 8(b)

		Module – 5			
Q.9	a.	Write the types of Aeroelastic Instabilities and describe about the static Instabilities with their preventions.	10	L2	CO2
	b.	What is wing divergence? Explain the key factors Influencing the divergence.	10	L2	CO2
		OR			
Q.10	a.	Describe the Analysis and testing to ensure that Aircraft remain aeroelastically stable and safe throughout their operational flight Envelope?	12	L2	CO2
	b.	Explain about the flutter and its prevention.	08	L1	CO1

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