Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

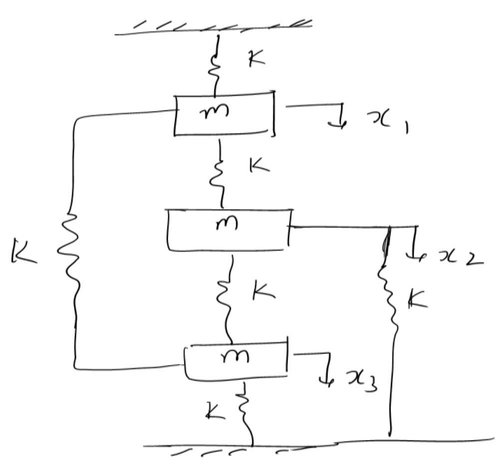
End Semester Examination, Dec 2021

Course: Vibrations and Aero elasticity **Semester: VII**

Program: B.Tech. ASE **Time 03 hrs.**

Course Code: ASEG 4013 **Max. Marks: 100**

SECTION A (5*4)

S. No.		Marks	CO
Q 1	State Rayleigh's energy method and find out natural frequency of a simple pendulum using it.	**4**	**CO1**
Q 2	Define Logarithmic decrement. Explain it using the expression.	**4**	**CO1**
Q 3	What would be the mode shape of a semidefinite system? Discuss using suitable figure.	**4**	**CO1**
Q 4	Write its mass matrix and stiffness matrix for the system shown in the figure. 	**4**	**CO3**
Q 5	What is flutter? Discuss the causes of fluttering and buffeting in airplane's control surfaces	**4**	**CO3**
SECTION B (4*10)			
Q 6	Derive the equation of motion of the vibratory system shown in figure below and determine the natural frequency and amplitude ratio for corresponding frequency Use data given below, K_1= 98000 N/m, M_1 =196 kg, K_2= 19600 N/m, M_2= 49 kg	**10**	**CO2**

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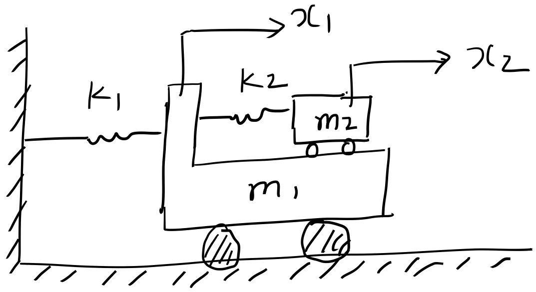
<tr><td></td><td>
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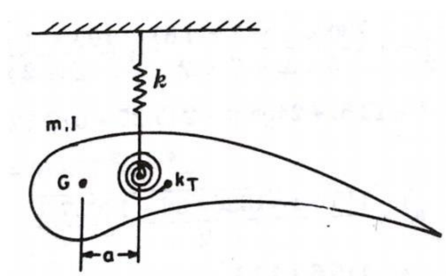
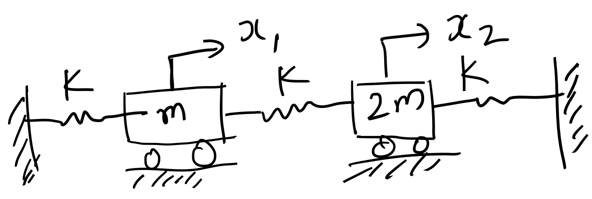
<tr><td>Q 7</td><td>A gun barrel of mas 600kg has a recoil spring of stiffness 294000 N/m. If the barrel recoils 1.3 m on firing, determine
a) the initial recoil velocity of the barrel
b) critical damping coefficient of the dashpot which is engaged at the end of the recoil stroke
c) The time required for the barrel to return to a position 5cm from the initial position.</td><td>10</td><td>CO2</td></tr>
<tr><td>Q 8</td><td>An infinite wing in its first bending and torsional modes can be represented schematically as shown in fig below connected through a translation spring of stiffness K and a torsional stiffness Kt. Write the equation of motion for the system and obtain the two natural frequency assume the following data.
M= 5 kg, I= 0.12 Kg m_2 , K= $5x10^3$ N/m , k_T= $0.4x10^3$ Nm/rad, a= 0.1 m


Or
Derive the equation of motion of the system shown in figure using Lagrange's equation. In addition, find the natural frequencies.

</td><td>10</td><td>CO3</td></tr>
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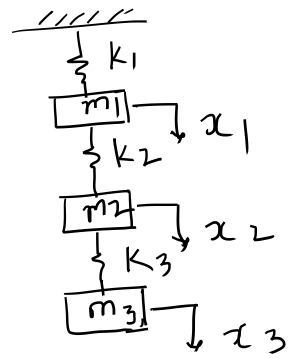
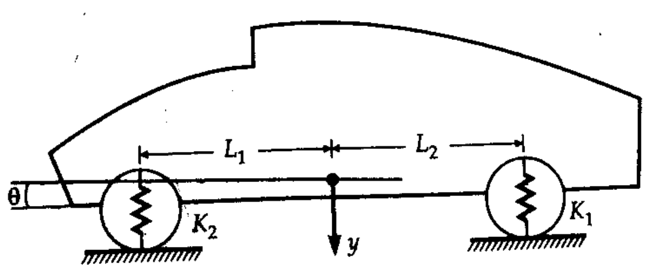
Q 9	Estimate the fundamental frequency of vibration of the system as shown in figure. Assume the m1=m2=m3=m, k1=k2=k3=k , and the mode shape is $\vec{X} = \begin{Bmatrix} 1 \\ 2 \\ 3 \end{Bmatrix}$ Use Rayleigh quotient to solve the problem.  Or Discuss the effect of reversal speed and divergence speed on aileron effectiveness of an infinite wing. Derive the required expression.	**10**	**CO4**
SECTION-C(2*20)			
Q 10	A car model as shown in figure simplified by considering its rigid body supported on rear and front springs, is considered to study vertical linear vibration and angular oscillations. Derive the equation of motion of the car and expression for natural frequencies.  	**20**	**CO3**
Q 11	Find the flexibility influence coefficient matrix of the system shown in the figure.	**20**	**CO4**

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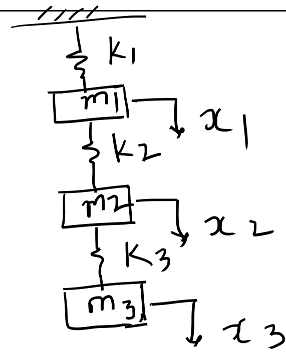
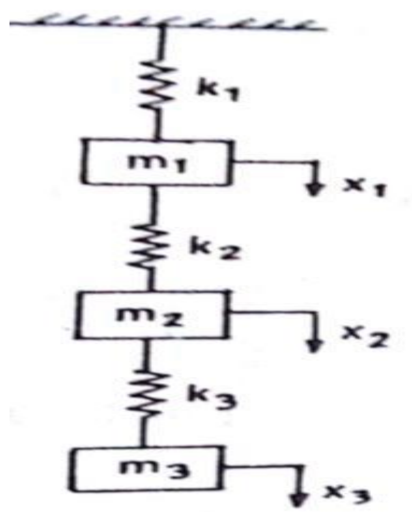


Or

Find the first natural frequency using matrix iteration method for the system shown in figure where K1=K2=K3 and m1=m2=m3.



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