Name:

Enrolment No:

UPES

End Semester Examination, December 2024

Course: Vibration and Aeroelasticity **Semester : VII**

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

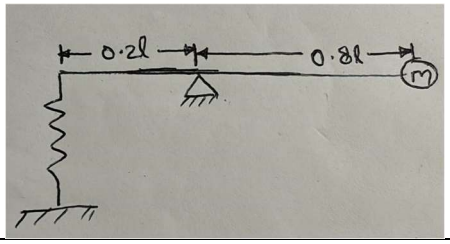
Course Code: ASEG 4018 **Max. Marks: 100**

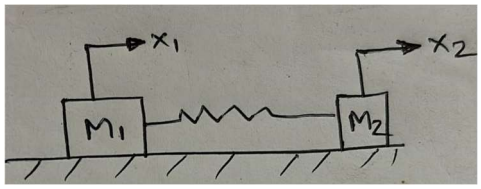
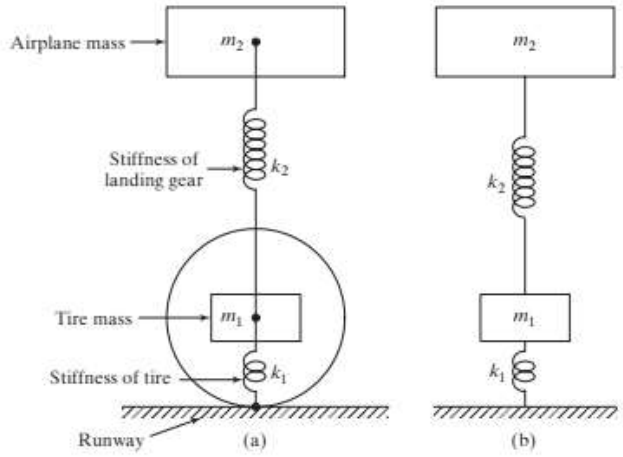
Instructions: Brief and to-the-point, answers are expected. Assume suitable data if needed.

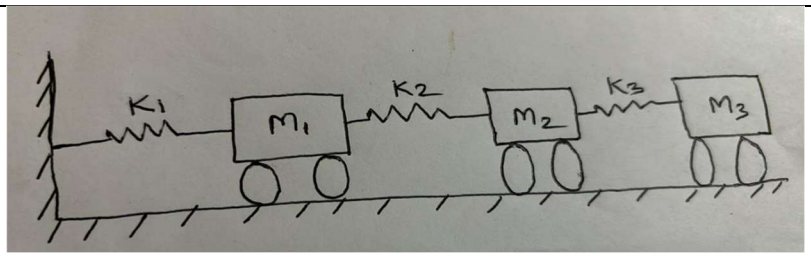
SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Explain the principle of dynamic vibration absorber? What is the main disadvantage of such an absorber?	**4**	**CO1**
2	A barrel of an artillery gun weight 50 kg upon firing, it recoils by 5 cm against a recoil spring having stiffness of 10 kN/m. determine the critical damping coefficient for the system.	**4**	**C02**
3	The undamped natural frequency of 1 DOF spring mass system is 100Hz. What should be the damping factor so that the frequency of damped free vibrations of this system drops to 80 Hz.	**4**	**C01**
4	Define flutter in the context of aeroelasticity.	**4**	**C03**
5	Differentiate between a vibration absorber and a vibration isolator.	**4**	**C01**

SECTION B
(4Qx10M= 40 Marks)

Q 6	A machine of mass 75 kg is mounted on springs of stiffness 12 kN/cm with an assumed damping factor 0.2. a piston within the machine of mass 2 kg has a reciprocating motion with a stroke of 7.5 cm and a speed 50 Hz. Assuming the motion of the piston to be harmonic determine. a) amplitude of the machine b) transmissibility c) force transmitted to the foundation	**10**	**CO2**
7	Find the natural frequency of the system if m= 15 kg attached at one end of a weightless rod and k= 1200 N/m. 	**10**	**C01**

8	Explain the control reversal, derive an expression of control reversal speed for 2 D wing.	**10**	**C03**
9	Discuss the whirling of the speed and its importance, and derive the expression for the same. **OR** Solve the following system and calculate the natural frequency. Consider spring stiffness = 1000 N/m and m1= 5 kg and m2 = 8 kg 	**10**	**C02**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	A simplified model of the main landing gear system of a small airplane is shown in Fig. below with m_1 = 100 kg , m_2 5000 kg and k_1 = 10^4 N/m and k_2 = 10^6 N/m a. Find the equations of motion of the system. b. Find the natural frequencies and the mode shapes of the system. 	**20**	**CO4**
11	Three masses are connected in series by springs. The stiffness of each spring is $K_1 = K_2 = 40 \times 10^5$ N/m and $K_3 = 50 \times 10^5$ N/ and masses are $m_1 = 20 \times 10^3$ kg $m_2 = 40 \times 10^3$ kg and $m_3 = 16 \times 10^3$kg . Determine the natural frequency of vibration. Neglect the friction.	**20**	**C04**



OR

Determine the natural frequency of multi degree of freedom spring mass system shown in figure.