Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2023

Course: Noise vibration and harshness **Semester: VII**
Programme: B. Tech ADE **Time: 3 hrs.**
Course code: MECH4039 **Max. Marks: 100**

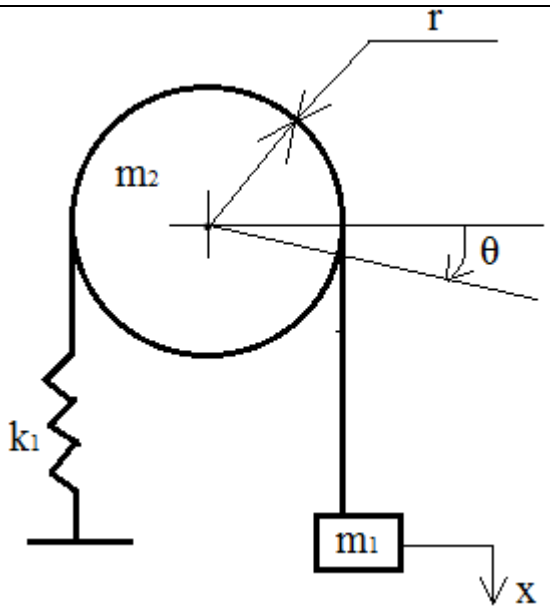
Instructions: All the questions are compulsory. Assume suitable data if missing.

SECTION A
(5Qx4M=20Marks)

Q.1	Briefly explain the various causes of vibration in automobile.	**4**	**CO1**
Q.2	Establish the relationship between sound power level and sound intensity level.	**4**	**CO1**
Q.3	Briefly explain the different types of dampers used in automobile and explain the concept of passive and active suspensions system.	**4**	**CO1**
Q.4	Discuss the sound measurement techniques for vehicular noise.	**4**	**CO1**
Q.5	Briefly explain the Brake Squeal noise and Pass-by Noise.	**4**	**CO1**

SECTION B
(4Qx10M= 40 Marks)

Q.6	Explain the need for the study for NVH in concern to automobiles. Also, discuss the legislations applicable for vehicles in India	**10**	**CO1**
Q.7	Explain in brief the octave band analysis. An octave band analysis was done on an automobile. It was found that the octave band sound pressure levels were 90 dB at 300 Hz, 93 dB at 1000 Hz, 95 dB at 3000 Hz, 92 dB at 6000 Hz. Determine the total mean square pressure	**10**	**CO2**
Q.8	Discuss the concept of seismic instruments. A device used to measure torsional acceleration consists of a ring having a moment of inertia of 0.045 kg-m^2 , is connected to a shaft by a spiral spring having a scale of 0.90 N-m/rad, and a viscous damper having a constant of 0.11 N-m-s/rad. When the shaft vibrates at a frequency of 15 cpm, the relative amplitude between the ring and the shaft is found to be 2 degrees. Calculate the maximum acceleration of the shaft.	**10**	**CO2**
Q.9	In a spring-mass-dashpot system k = 40 kN/m, m = 120 kg, and the damping provided is only 15% of the critical value. Determine (i) the damping ratio (ii) the critical damping coefficient (iii) the natural frequency of damped vibration (iv) the logarithmic decrement OR Find the time period of small vibrations of the system shown in figure considering no-slip condition. Treat the system as a single degree of freedom system.	**10**	**CO2**

			
SECTION-C (2Qx20M=40 Marks)			
Q.10	Explain the characteristic and source of vibration for the following power train components. (a)Differential (b) Drive shaft (c) Trans axle (d) Power train mounts	**20**	**CO3**
Q.11	A 1200 kg machine is mounted on four identical springs of total spring constant k=1.96 x 10^6 N/m and having negligible damping. The machine is subjected to a harmonic external force of amplitude F_o = 490 N and frequency 180 rpm. Determine the amplitude of motion of the machine and the maximum force transmitted to the foundation because of unbalanced force. OR A four wheeler vehicle is a complex with many degrees of freedom. As a first approximation let it be assumed that the vehicle is constrained to move in vertical direction and that tires do not provide any spring effect. A vehicle of this type weighs 9.8 kN when fully loaded and 2.45 when empty. The effective spring constant is 3.5 kN/cm and the damping factor is 0.5 when vehicle is fully loaded. The speed of vehicle is 96 km/hr and the road surface may be assumed sinusoidal with a period of 4.88 minutes and an amplitude X_1 cm, determine the amplitude ratio of vehicle when fully loaded and empty.	**20**	**CO3**