	ADAMAS UNIVERSITY **END-SEMESTER EXAMINATION : MAY 2021** (Academic Session: 2020 – 21)		
Name of the Program: (Example: B. Sc./BBA/MA/B.Tech.)	**B.Tech.**	**Semester:** (I/III/ V/ VII/IX)	**VIII**
Paper Title :	**Vibration & Noise Control**	**Paper Code:**	**EME44102**
Maximum Marks :	**40**	**Time duration:**	**3 hours**
Total No of questions:	**08**	**Total No of Pages:**	**02**
Answer all the groups			

Answer all the Groups

Group A

*(Answer **all** the questions)*

$5 \times 1 = 5$

1. a) Piezoelectric accelerometers are preferred over seismic accelerometers. Justify.

b) Differentiate between vibration isolator and vibration absorber.

c) Sensitivity of an accelerometer for the entire operating range of frequency is highest when damping factor of the instrument is equal to _____.

d) In case of a tuned undamped vibration absorber application, stiffness of the primary and the absorber systems are 100 N/m and 10 N/m, respectively. The desired ratio of absorber mass to mass of the primary system is _____.

e) Identify the object shown in the figure and mention its function.

Group B

*(Answer any **three** questions)*

$3 \times 5 = 15$

2. A spring-mass-damper system, having an undamped natural frequency of 100 Hz and a damping constant of 20 N-s/m, is used as an accelerometer to measure the vibration of a machine operating at a speed of 3000 rpm. If the actual acceleration is $1g$ and the recorded acceleration is 9 m/s^2, find the mass and the spring constant of the accelerometer.

3. A variable-length cantilever beam of rectangular cross section 1/16 inch x 1 inch made of spring steel (Young's Modulus = 2 GPa), is used to measure the frequency of vibration. The length of the cantilever can be varied between 2 inches and 10 inches. Find the range of frequencies that can be measured with this device.

4. A torsional pendulum has natural frequency of 200 cycles/min when vibrating in a vacuum. The mass moment of inertia of the disc is 0.2 kg-m^2. It is then immersed in oil and its natural frequency is found to be 180 cycles/min. Determine the damping constant.

5. a) A steel chimney (natural frequency 2 Hz) has a height 2 m, an inner diameter 0.75 m, and an outer diameter 0.80 m. Find the velocity of the wind flowing around the chimney which will induce transverse vibration of the chimney in the direction of airflow.

b) A 50-kg mass is subjected to the harmonic force given by F(t) =1000 Cos (120t) N. Design an undamped isolator so that the force transmitted to the base does not exceed 5% of the applied force.

Group C

*(Answer any **two** questions)*

$2 \times 10 = 20$

6. A gun barrel of mass 500 kg has a recoil spring of stiffness 40 MN/m. If the barrel recoils a distance of 1.5 m on firing, determine:

i. The initial recoil velocity of the gun barrel.
ii. The critical damping coefficient of the dashpot which is engaged during both the recoil and return strokes.

7. A spring-mass-damper system is defined by following parameters M=10 kg, K=150 N/m, C=30 Ns/m. Determine the free damped vibration response of the above system for the initial displacement of 5 cm, and zero initial velocity.

8. The seat of a helicopter as shown in the figure, with the pilot, weighs 1000 N and is found to have a static deflection of 10 mm under self-weight. The vibration of the helicopter rotor is transmitted to the base of the seat as harmonic motion with frequency 4 Hz and amplitude 0.2 mm. The acceptable levels of displacement, velocity and acceleration are 1 mm, 15 mm/s and 300 mm/s^2, respectively.

i. What is the level of vibration felt by the pilot?
ii. How the seat can be redesigned to reduce the effect of vibration?

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