

## Mechanical Vibrations

University of Mumbai

Examinations Summer 2022

Time: 2 hour 30 minutes

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	When there is a reduction in the amplitude of vibrations over every cycle of vibration, then the body is said to have
Option A:	Free vibration
Option B:	Forced vibration
Option C:	Damped vibration
Option D:	Torsional vibrations
2.	Torsional vibrational frequency of a shaft with n oscillating masses will be
Option A:	n-1
Option B:	n
Option C:	2n
Option D:	n+1
3.	For steady forced vibration, the phase lag at resonance is.....
Option A:	0°
Option B:	45°
Option C:	90°
Option D:	180°
4.	Two rotors supported by a shaft has a natural frequency $\omega_n$ . If one of the rotors is fixed, the natural frequency.....
Option A:	Increases
Option B:	Decreases
Option C:	Remains constant
Option D:	Becomes zero
5.	In under damped vibrating system, if $x_1$ and $x_2$ are the successive values of the amplitude on the same side of the mean position, then the logarithmic decrement is equal to.....
Option A:	$x_1/x_2$
Option B:	$\log (x_1/x_2)$
Option C:	$\log_e (x_1/x_2)$
Option D:	$\log (x_1.x_2)$
6.	Which of the following instruments measure amplitude of a vibrating body?
Option A:	Vibrometers
Option B:	Velometer
Option C:	Accelerometer
Option D:	Barometer
7.	Damping capacity of the material is the ability to
Option A:	Absorb shock

Option B:	Absorb impact
Option C:	Withstand creep failures
Option D:	Absorb vibrations
8.	Calculate logarithmic decrement if damping factor is 0.33.
Option A:	1.36
Option B:	3.23
Option C:	5.16
Option D:	2.19
9.	A seismometer is a device used to measure the _____ of a vibrating body.
Option A:	Displacement
Option B:	Velocity
Option C:	Acceleration
Option D:	Amplitude
10.	In a multi-rotor system of torsional vibration maximum number of nodes that can occur is.....
Option A:	Two
Option B:	Equal to the number of rotors plus one
Option C:	Equal to the number of rotors
Option D:	Equal to the number of rotors minus one

<b>Q2.</b> (20 Marks)	<b>Solve any Two Questions out of Three</b>	<b>10 marks each</b>
A	A seismic instrument with a natural frequency of 6 Hz is used to measure the vibration of a machine operating at 120 rpm. The relative displacement of the seismic mass is 0.5 mm. Determine the amplitude of vibration of the machine. Neglect damping.	
B	In a single degree damped vibration system, a suspended mass of 8 kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value after 5 oscillations. Determine: a) spring stiffness b) logarithmic decrement c) damping factor d) damping coefficient	
C	Explain Perturbation method to obtain solutions of non – linear systems.	

<b>Q3.</b> (20 Marks)	<b>Solve any Two Questions out of Three</b>	<b>10 marks each</b>
A	Explain Vibration Isolation, Transmissibility and Magnification Factor. Also explain any two types of vibration absorbers.	

B	Calculate the natural frequency of torsional vibration of a shaft of 10 cm diameter 300 cm long carrying two circular discs of uniform thickness at the ends. The discs have the mass of 500 Kg and 1000 kg and diameter of 125 cm and 190 cm respectively. Take $G = 0.83 \times 10^{11} \text{ N/m}^2$ .
C	Compare Vibrometer and Accelerometer on the basis of the following: parameters of measurement, mass of device, natural frequency of device, practical applicability and error estimation.

<b>Q4. (20 Marks)</b>	<b>Solve any Two Questions out of Three</b>	<b>10 marks each</b>
A	Explain in viscous dampers with examples. Also explain any one in detail.	
B	A machine mass of 100 kg is supported on springs of total stiffness $7.84 \times 10^5 \text{ N/m}$ . It has an unbalanced rotating element which results in a disturbing force of 392 N at 3000 rpm. Assuming a damping factor $\zeta = 0.20$ , determine: a) amplitude of motion due to unbalance b) transmissibility c) force transmitted	
C	Explain Dunkerley's method and Rayleigh's method to calculate the frequency of transverse vibration of shaft carrying number of point loads.	