Total No. of Questions : 09] [Total No. of Pages : 03

# B.Tech. (Sem. - 7th/8th)

## MECHANICAL VIBRATIONS

**SUBJECT CODE : ME - 408**

**Paper ID : [A0841]**

[Note : Please fill subject code and paper ID on OMR]

**Time : 03 Hours** **Maximum Marks : 60**

**Instruction to Candidates:**

1) Section - A is **Compulsory**.
2) Attempt any **Four** questions from Section - B.
3) Attempt any **Two** questions from Section - C.

### Section - A

*Q1)* *(10 × 2 = 20)*

a) Define longitudinal vibrations.

b) Write two uses of vibrations.

c) Define resonance.

d) If the mass of the vibrating body increases 9 times, what will be its effect on frequency.

e) Define logarithmic decrement.

f) What is the angle between inertia and spring force?

g) What is the number of nodes if the shaft is having three rotors?

h) What is a continuous system?

i) Define principal mode of vibration.

j) What is a semi definite system?

## Section - B

*(4 × 5 = 20)*

***Q2)*** A body is subjected to two harmonic motions as given below :

$$x_1 = 15 \sin(wt + \frac{\pi}{6}) \text{ and } x_2 = 8 \cos (wt + \pi/3)$$

What harmonic motion should be given to the body to bring it to equilibrium?

***Q3)*** Determine the natural frequency of the mass m = 15kg as shown in Fig-1, assuming that the cords do not stretch and slide over the pulley rim. Assume that the pulley has no mass.

Given $k_1 = 8 \times 10^3$ N/m

$k_2 = 6 \times 10^3$ N/m

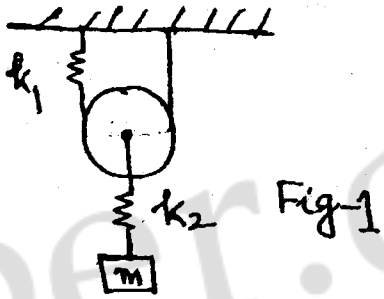

Fig-1

***Q4)*** A door 200cm high, 75cm wide and 4cm thick and weighing 35kg is fitted with an automobile door closer. The door opens against a spring with a modulus of 1kg cm/rad. If the door is opened 90° and released, how long will it take the door to be within 1° of closing? Assume the return spring of the door to be critically damped. Refer fig. - 2.

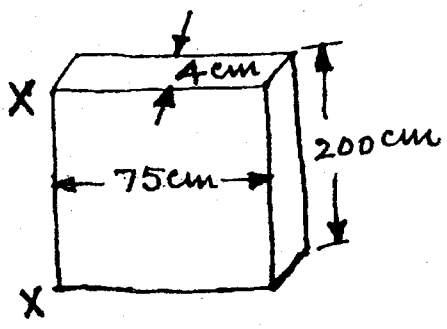

Fig-2

***Q5)*** The springs of an automobile trailer are compressed 0.1m under its own weight. Find the critical speed when the trailer is passing over a road with a profile of sine wave whose amplitude is 80mm and the wavelength is 14m. Find the amplitude of vibration at a speed of 60 km/hr.

*Q6)* Find the lowest natural frequency of vibration for the system shown in Fig. -3 by Rayleigh's method.

$E = 1.96 \times 10^{11}$ N/m$^2$, $I = 4 \times 10^{-7}$ m$^4$

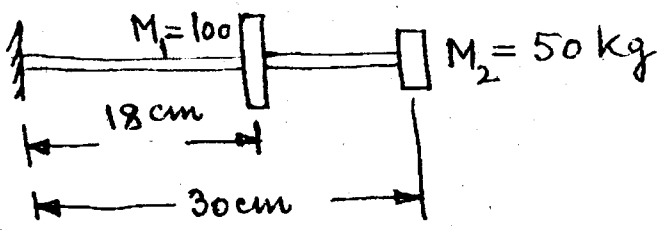


Fig-3.

## Section - C

*(2 × 10 = 20)*

*Q7)* Write short note on any two of the following :

(a) Holzer's method.

(b) Vibrometer.

(c) Centrifugal pendulum vibration absorber.

*Q8)* Find the natural frequencies of a bar shown in Fig - 4.

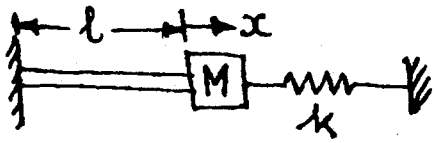


Fig-4

*Q9)* Derive the frequency equation of torsional vibrations for a free-free shaft of length l.

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