

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) The string length of simple pendulum is increased nine times, how the natural frequency of the system will be changed?
- b) What do you mean by resonance?
- c) What is beat?
- d) Explain energy method / Rayleigh's method for finding the frequency of the system.
- e) What are the main components of a vibrating system?
- f) What is the advantage (write one only) of critical damping?
- g) What do you mean by continuous system?
- h) What is the difference between transverse and longitudinal vibrations?
- i) Is it correct that the linear systems tend to become non-linear with large vibration amplitudes?
- j) Explain the term vibration isolation.

J-680

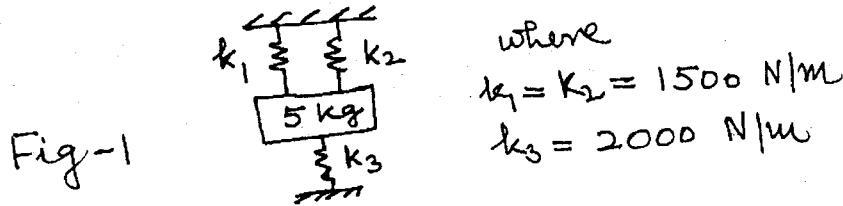
P.T.O.

Section - B

(4 × 5 = 20)

Q2) A body describes simultaneously two motions, $x_1 = 3 \sin 40 t$, $x_2 = 4 \sin 41 t$. What is the maximum and minimum amplitude of combined motion and beat frequency?

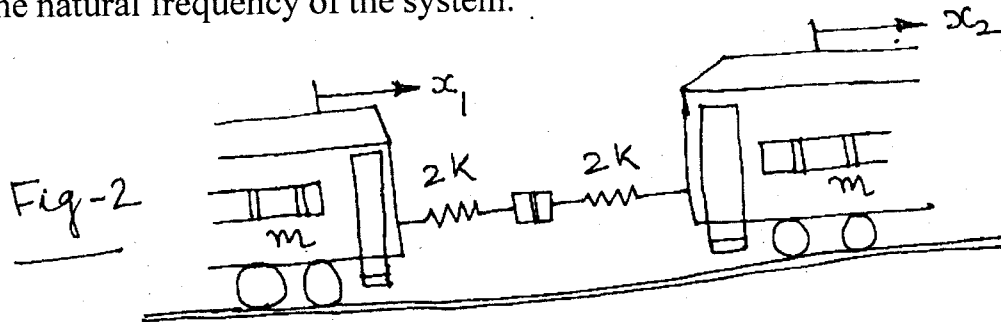
Q3) Find the natural frequency of the system shown in Fig - 1.



Q4) A vibratory system in a vehicle is to be designed with the following parameters :
 $k = 100 \text{ N/m}$, $C = 2 \text{ N. sec / m}$, $m = 1 \text{ kg}$.

Calculate the decrease of amplitude from its starting value after 3 complete oscillations and (b) the frequency of oscillation.

Q5) An electric train made of two cars each of mass 2000 is connected by couplings of stiffness equal to $40 \times 10^6 \text{ N/m}$, as shown in Fig - 2. Determine the natural frequency of the system.



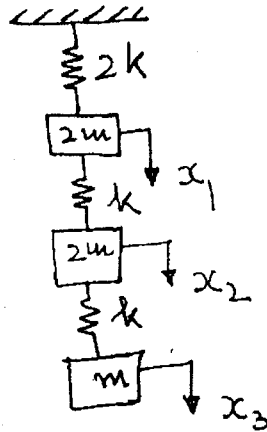
Q6) A vibrometer indicates 2 percent error in measurement and its natural frequency is 5 Hz. If the lowest frequency that can be measured is 40 Hz, find the value of damping factor (ζ).

Section - C

(2 × 10 = 20)

Q7) Derive the frequency equation of longitudinal vibrations for a free beam with zero initial displacement.

Q8) Determine the natural frequencies and mode shapes of the system shown in Fig - 3.



Q9) (a) Write the demerits of dynamic vibration absorber.

OR

Explain the working of centrifugal pendulum vibration absorber.

- (b) A machine of mass one tonne is acted upon by an external force of 2450 N at a frequency of 1500 r.p.m. To reduce the effects of vibration, isolator of rubber having a static deflection of 2mm under the machine load and an estimated damping $\zeta = 0.2$ are used. Determine the force transmitted to the foundation.

