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18MR71

Seventh Semester B.E. Degree Examination, June/July 2023

Mechanical Vibration

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 Explain the following basic definitions of terms of vibrations:
- (i) Vibration
 - (ii) Periodic motion
 - (iii) Time period.
 - (iv) SHM
 - (v) Amplitude
 - (vi) Frequency
 - (vii) Free vibration
 - (viii) Natural frequency
 - (ix) Resonance
 - (x) Degree of freedom
- (20 Marks)

OR

- 2 a. Show that the resultant motion of three harmonic motions given below is zero.
- $$x_1 = a \sin \omega t, \quad x_2 = a \sin \left(\omega t + \frac{2\pi}{3} \right), \quad x_3 = a \sin \left(\omega t + \frac{4\pi}{3} \right)$$
- (10 Marks)
- b. A body describes simultaneously two motions, $x_1 = 3 \sin 40t$, $x_2 = 4 \sin 41t$.
What is the maximum and minimum amplitude of combined motion and what is the beat frequency?
- (10 Marks)

Module-2

- 3 a. Find the natural frequency of the system shown in Fig. Q3 (a).

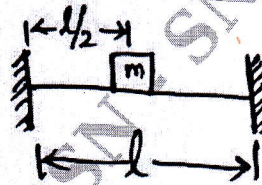
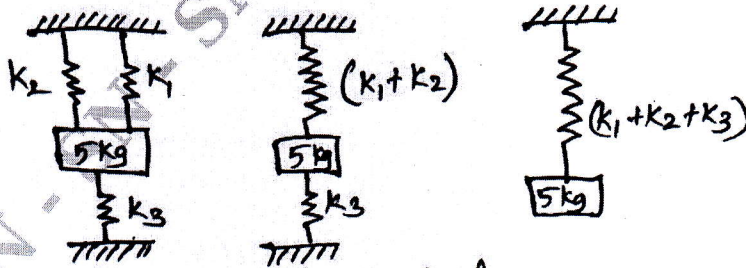


Fig. Q3 (a)

(10 Marks)

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



Free body diagram

Fig. Q3 (b)

(10 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 4 Explain in detail about over damped system and critically damped system. (20 Marks)

Module-3

- 5 a. What are the sources of Excitation? Explain any 2 in brief. (10 Marks)
 b. A single cylinder vertical Petrol Engine of total mass 320 kg is mounted upon a steel chassis of causes a vertical static deflection of 2 mm. The reciprocating parts of the engine have a mass of 24 kg and move through a vertical stroke of 150 mm with Simple Harmonic Motion. A dashpot attached to the system offers a resistance of 490 N at a velocity of 0.3 m/sec. Determine : (i) The speed of the driving shaft at resonance ; and
 (ii) The amplitude of steady state vibration, when the driving shaft of the engine rotates at 480 rpm. (10 Marks)

OR

- 6 a. Explain in detail about Basic Vibration Measurement scheme. (10 Marks)
 b. A vibrometer having a natural frequency of 4 rad/s and $\zeta = 0.2$ is attached to a structure that performs a harmonic motion. If the difference between the maximum and the minimum recorded values is 8 mm, find the amplitude of motion of the vibrating structure when its frequency is 40 rad/s. (10 Marks)

Module-4

- 7 Find the lowest natural frequency of vibration for the system shown in Fig. Q7 by Rayleigh's method. $E = 1.96 \times 10^{11} \text{ N/m}^2$, $I = 4 \times 10^{-7} \text{ m}^4$

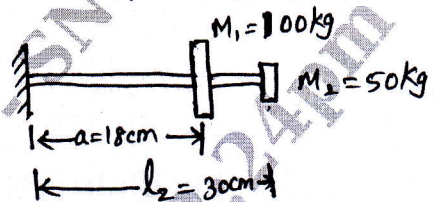


Fig. Q7

(20 Marks)

OR

- 8 Determine the influence coefficient of the spring-mass system shown in Fig. Q8.

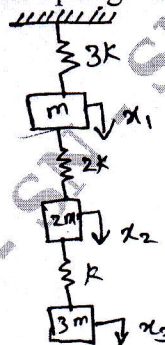


Fig. Q8

(20 Marks)

Module-5

- 9 Explain in detail about machine vibration monitoring techniques. (20 Marks)

OR

- 10 a. Explain in detail about factors which influence maintenance strategy. (10 Marks)
 b. Explain maintenance system in detail. (10 Marks)
