[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2125)

15241

B. Tech 7th Semester Examination

Mechanical Vibration (ME) (OS)

ME-7001

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : (i) The candidate are required to attempt 5 questions in all selecting one question from each of the sections A, B, C, and D of the question paper and all the subparts of the questions in section E.

(ii) Use of only non-programmable calculators is allowed.

SECTION - A

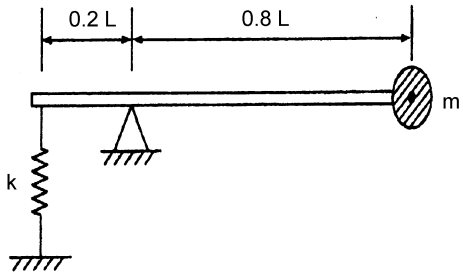
1. (a) Distinguish between longitudinal, transverse and torsional vibrations. (6)

(b) Define the terms: damping factor, co-efficient of damping and critical damping co-efficient. (6)

(c) Determine the power required to vibrate a spring-mass-dashpot system with an amplitude of 1.5 cm at a frequency of 100 Hz. The system has a damping factor of 0.05 and damped natural frequency of 22 Hz. The mass of system is 0.5 kg. (8)

[P.T.O.]

2. (a) In Fig. below, find the natural frequency of the system, if m = 10 kg is attached at one end of weightless rod and k = 1000 N/m. (10)



(b) During a free vibration test, the damped natural frequency was found as 9.8 Hz. During forced vibration test with constant exciting force on the same system, the maximum amplitude of vibration was found as 9.6 Hz. Find the damping factor for the system and its natural frequency. (10)

SECTION - B

3. (a) Define the term: Logarithmic decrement & Magnification factor. Find an expression for logarithmic decrement in terms of damping factor. (10)

(b) A mass of 2 kg is supported on an isolator having a spring scale of 2940 N/m and viscous damping. If the amplitude of free vibration of the mass falls to one-half its original value in 1.5 seconds, determine the damping coefficient of the isolator. (10)

4. A body of mass 1500 kg is suspended on a leaf spring. The system was set into vibration and the frequency of vibration was measured as 0.982 Hz. The successive amplitudes were measured to be 4.8 cm. 4.1 cm. 3.4 cm and 2.7 cm. Determine the spring stiffness and the amount of damping. (20)

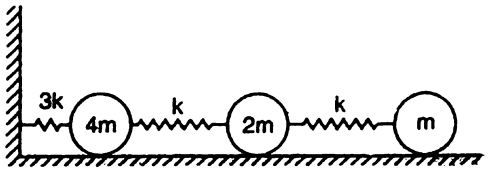
SECTION - C

5. An automobile weighs 2000 N and has a wheel base of 3.0 m. The c.g. is located 1.4 m behind front wheel axle and has a radius of gyration of 1.1 m about c.g. The front spring have a combined stiffness of 6 x 10^6 N/m and rear spring 6.5 x 10^6 N/m. Find the principal mode of vibration of the automobile and locate the nodal points for each mode. (20)

6. Explain with a neat sketch, the basic working principle of a dynamic vibration absorber. What is the main disadvantage of a dynamic vibration absorber? Show that for such an absorber, its natural frequency should be equal to the applied frequency. (20)

SECTION - D

7. (a) A 3-degree of freedom system is shown in fig. below. Calculate its natural frequencies. (10)



   (b) Derive an expression for natural frequency of a shaft carrying several loads using Dunkerley's method. (10)

8. What is a continuous system? How does a continuous system differ from a discrete system in the nature of its equations of motion? How many natural frequencies does a continuous system have? (20)

SECTION - E

9. (a) Explain causes of vibration.

   (b) Explain good effects of vibration.

   (c) Discuss 'forced vibration' and its response.

   (d) Explain sharpness of resonance.

   (e) Explain different types of damping.

   (f) Describe the materials used in vibration isolation.

   (g) Discuss 'Whirling of a shaft'.

   (h) Differentiate between vibrometer and accelerometer.

   (i) Explain mode shapes of a system.

   (j) Explain the Rayleigh's equation for determining the fundamental natural frequency of a multimass system. (2×10=20)