6E3052

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6E3052

B.Tech. VIth Semester (Main/Back) Examination, June - 2010

Mechanical Engineering

Noise, Vibration and Harshness

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five questions** selecting **one question from each unit**. All questions carry **equal marks**. (Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

Unit - I

1. a) Write a detailed note on subjective response of humans to sound, explaining frequency dependent and sound pressure dependent human response. **(8)**

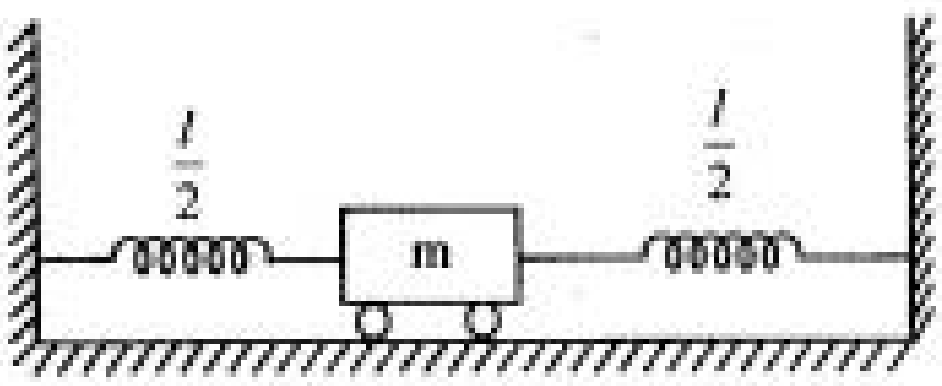
   b) What is inverse square law? Deduce a relationship between sound power level and sound intensity level. **(8)**

OR

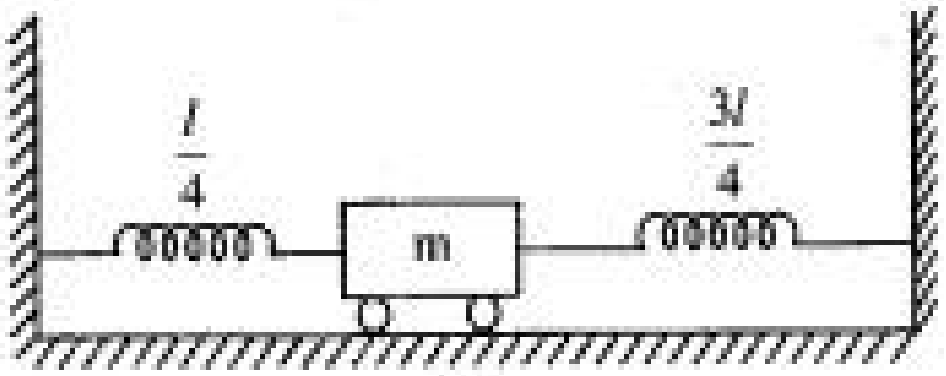
2. What are the major industrial noise sources? Explain various strategies used to control the industrial noise. **(16)**

Unit - II

3. a) A helical spring of stiffness k is cut into two halves and a man *m* is connected to the two halves as shown in figure (i) The natural time period of this system is found to be 0.5 Sec. If an identical spring is cut so that one part is one-fourth and the other part three-fourth of the original length, and the man *m* is connected to the two parts as shown in figure (ii) What would be the natural period of the system? **(8)**



(i)



(ii)

b) Describe the principle of conservation of energy and *D'* Alembert's principle. Derive the equation of motion of spring-man system using both of these principles. **(8)**

OR

4. a) Explain the salient characteristics of a coulamb damped system. **(8)**

b) A vibrating system is defined by the following parameters.

M = 3kg, k = 100 N/m, C = 3N - sec/m

Determine :

i) the damping factor / ratio.

ii) the natural frequency of damped vibrations.

iii) logarithmic decrement.

iv) the number of cycles after which the original amplitude is reduced to 20%
(8)

Unit - III

5. a) Derive the expression of displacement transmissibility for a single degree of freedom spring-man-dashpot system. Subjected to a harmonic excitation of the base. Plot the displacement transmissibility ratio for different amounts of damping against the frequency ratio. **(8)**

b) A spring - man- damper system is subjected to a harmonic force. The amplitude is found to be 20 mm at resonance and 10 mm at a frequency 0.75 times the resonant frequency. Find the damping ratio of the system. **(8)**

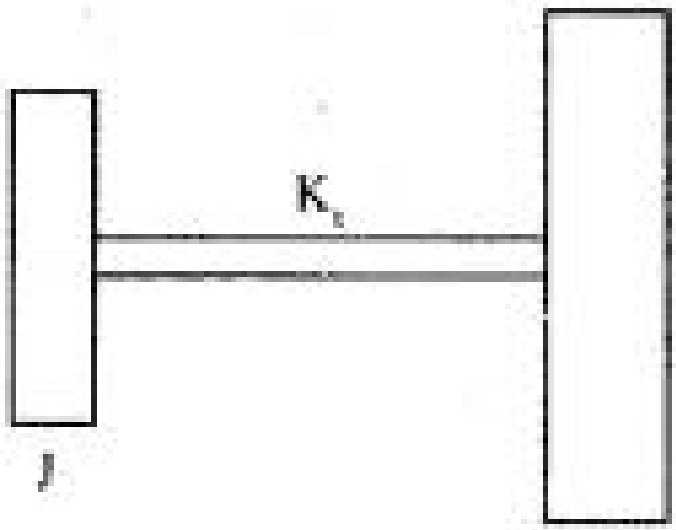
OR

6. a) Write a short note on various materials used in vibration isolation. **(8)**

b) Consider a spring-man-damper system with k = 4000 N/m, m = 10 kg, and c = 40N-Sec/m. Find the steady state and total response of the system under the harmonic force $F(t) = 200 \cos 20t$ and the initial conditions $x_0 = 0.1$ m and $dx_0/dt = 0$. **(8)**

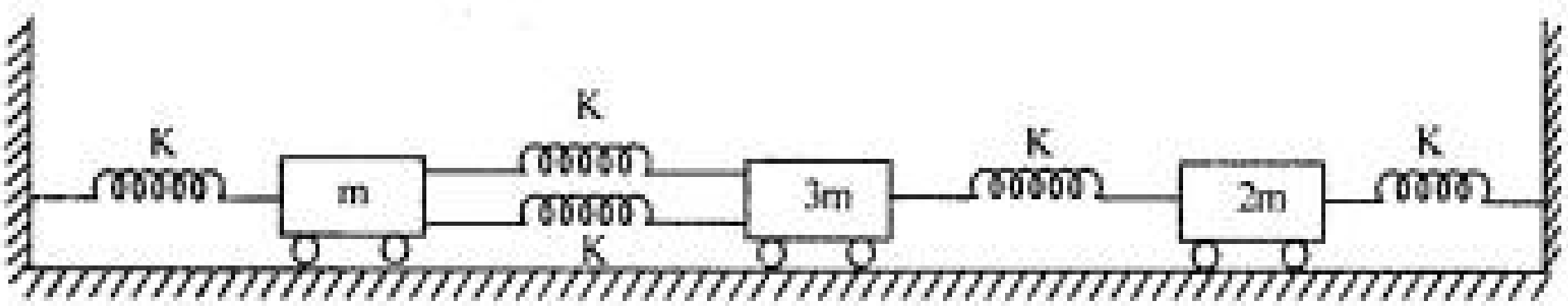
7. a) Explain the principle and working of centrifugal pendulum absorber. **(8)**

b) For the following system derive and determine the equation of motion, natural frequencies of vibration and mode shapes. **(8)**

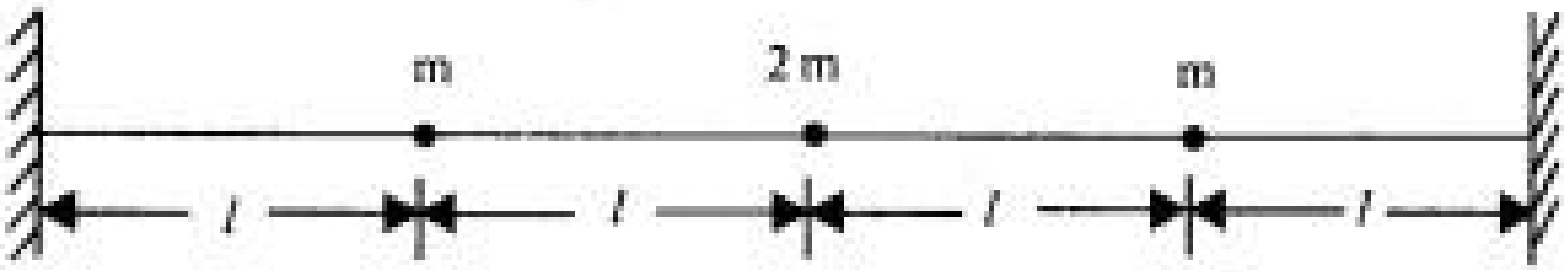


OR

8. a) Draw the free-body diagram of the following many degrees of freedom system and derive the differential equation governing the motion of the system using Newton's law of motion. Also arrange these equation in matrix form. **(8)**



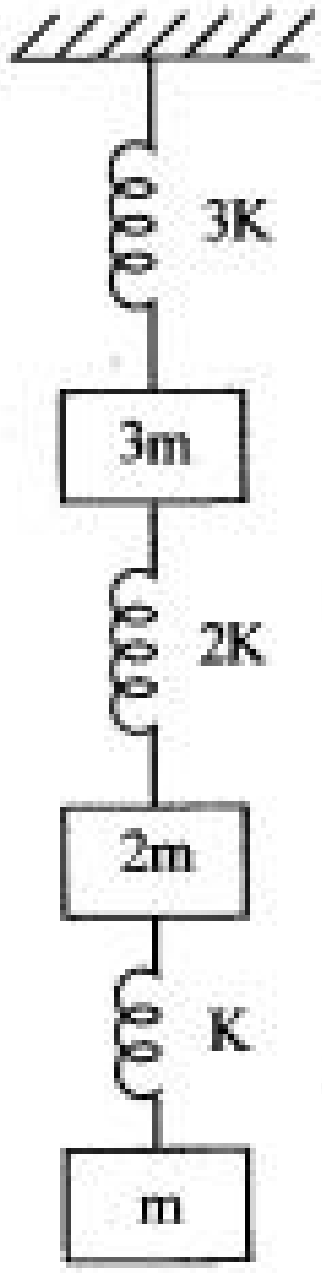
b) A mass less string is stretched with tension T has three mass points attached at equal intervals as shown in figure. Find the natural frequency and mode shapes of the system. **(8)**



Unit - V

9. a) Write a short note on Holzer's method and point out advantage and limitations of this method. **(8)**

b) Find the lowest natural frequency of the following system using Stodola's method. **(8)**



OR

10. Derive the equation governing the transverse vibrations of a tightly stretched string. Also find the first four natural frequencies and corresponding mode-shapes for the fixed - fixed end conditions. **(16)**