**MECHANICAL VIBRATIONS**
**(ME-408, Dec-07)**

**Note:** Section A is compulsory. Attempt any four questions from Section B and any two from Section C.

## Section-A

1. a) Define spring stiffness and damping constant.
   b) Why is it important to find the natural frequency of a vibrating system?
   c) What happens to the response of an undamped system at resonance?
   d) What are principal coordinates?
   e) Define the flexibility and stiffness influence coefficients.
   f) What is Reyleigh's Principle?
   g) How many natural frequencies does a continuous system have?
   h) What is the difference between a vibration absorber and vibration isolator?
   i) What is an accelerometer?
   j) How do you harmonic motions having different frequencies?

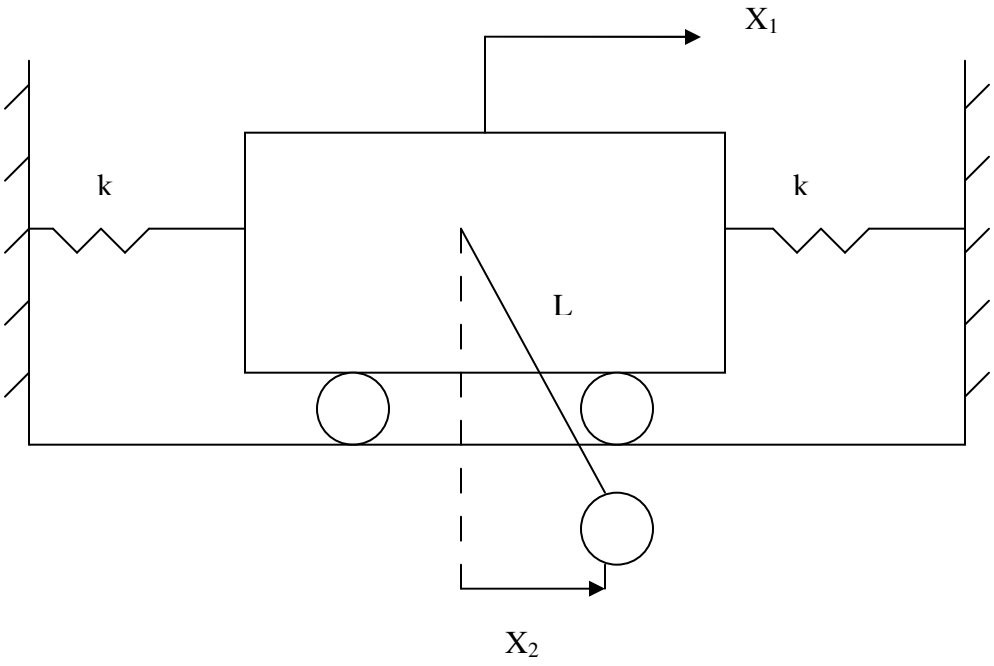
## Section-B

2. A U-tube open to atmosphere at both ends contains a column length L of certain liquid. Find the natural period of oscillation of the liquid column.
3. Assuming that the phase angle is zero, show that the response x(t) of an under damped single degree of freedom system reaches a maximum value when

   $\text{Sin}\omega_d t = \sqrt{1-\zeta^2}$

4. A vibratory body of mass 150 kg supported on springs of total stiffness 1050 KN/m has a rotating unbalanced force of 525 N at a speed of 6000rpm. If the damping factor is 0.3, determine (a) The amplitude caused by the unbalance and its angle, (b) The transmissibility, (c) The actual force transmitted and its phase angle.
5. Derive the equation of motion of the system shown in figure below and find its frequencies.

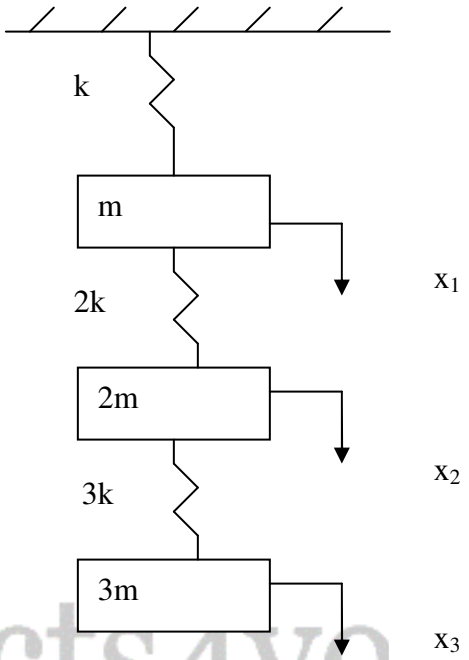





6. Draw a neat sketch of dry friction damper and explain its working.

**Section-C**

7. What are forced vibrations? Derive an expression for amplitude and phase difference for a system subjected to harmonic excitation ($F_0 Sin\omega t$). Draw appropriate vector diagrams for
   (a) $\omega << \omega_n$ (b) $\omega >> \omega_n$ (c) $\omega = \omega_n$
8. Calculate the fundamental frequency of the system shown in figure below by Stodia method.






9. Explain following:
   (a) Vibration pick ups
   (b) Holzer's method with suitable example.