PVP 12

Code: **MEMD2T2**

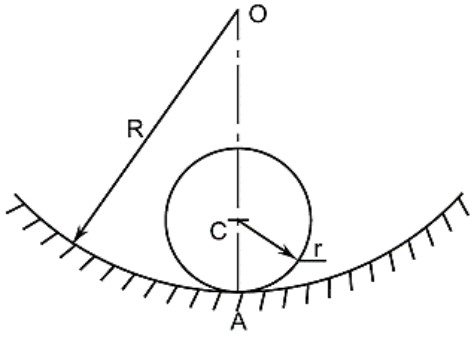
I M.Tech - II Semester – Regular/Supplementary Examinations
JULY - 2017

MECHANICAL VIBRATIONS
(MACHINE DESIGN)

Duration: 3 hours Max. Marks: 70

Answer any FIVE questions. All questions carry equal marks

1. a) A cylinder of mass ‘m’ and radius ‘r’ rolls without slipping on a circular surface of radius ‘R’. Find out the natural frequency of cylinder for small oscillations about the equilibrium point ‘A’. Use Energy Method. 7 M

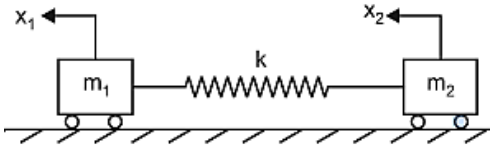


b) The mass of a spring-mass-dashpot is displaced by a distance of 0.05 m from the equilibrium position and released. Find the equation of motion for the system for the case, when the damping ratio is 1.5. 7 M

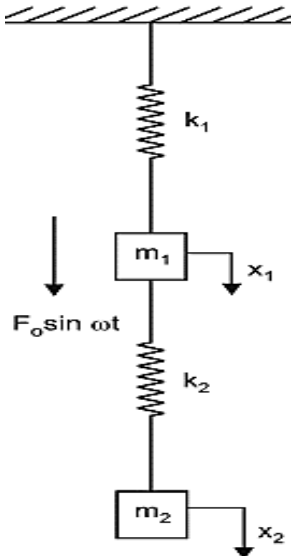
2. a) Explain how to deal with rotating unbalanced masses in vibrating mechanical systems? Give the mathematical treatment with neat supporting sketches. 9 M

b) Explain the working principle of accelerometer in detail with supporting figures. 5 M

3. a) Determine the natural frequencies and amplitude ratios for the system shown in figure. It is given that m_1 = 20 kg, m_2 = 35 kg and k = 300 N/m. 7 M

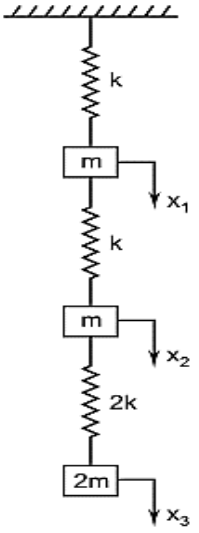


b) In the system shown in figure, the mass m_1 is excited by a harmonic force having a maximum value of 50 N and frequency of 2 Hz. Find the forced amplitude of each mass for m_1 = 10 kg, m_2 = 5 kg, k_1 = 8000 N/m, k_2 = 2000 N/m.



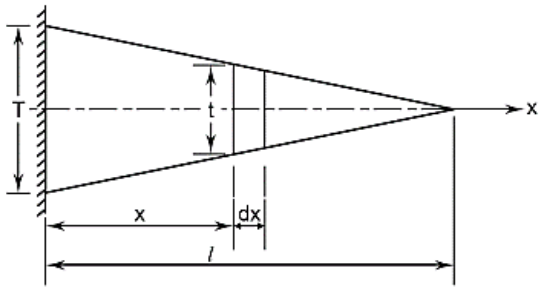
7 M

4. Apply matrix method to the system shown in the following figure and find first three natural frequencies. 14 M



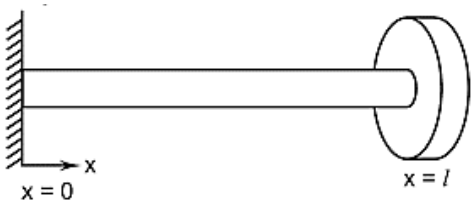
5. a) Using Rayleigh method, find out the first natural frequency of transverse vibration of a uniform simply supported beam. 7 M

b) Determine the fundamental frequency of longitudinal vibration of a tapered bar fixed at its base as shown in figure. Take width of the bar as unity (b = 1) 7 M



6. a) Derive the frequency equation for longitudinal vibration of a rectangular bar of length *'l'* having both ends free. 7 M

b) Determine the response of a torsional system which consist of a shaft having one end fixed and disc attached to other end. Assume the torsional rigidity of the shaft as GJ and mass moment of inertia of the disc as I_0. 7 M



7. A simply supported shaft having a disc of mass 5 kg is mounted midway between bearings. Following are the given parameters for this set up:

   Diameter of the shaft = 10 mm; Bearing span = 500 mm; Eccentricity = 2 mm; Viscous damping at the centre of the disc shaft = 50 N-sec/m; Speed of shaft = 750 rpm; $E = 2 \times 10^{11}$ N/m^2. Find the maximum stress in the shaft and power required to drive the shaft. 14 M

8. Determine the response of a spring – mass system subjected to the following input excitations: 14 M

   a) Impulsive input.

   b) Step input.