B.Tech. MECHANICAL ENGINEERING (BTMEVI)

Term-End Examination 00610

December, 2013

BIMEE-008 : MECHANICAL VIBRATION

Time : 3 hours *Maximum Marks : 70*

Note : *(i) Attempt **any five** questions. Each question carries **equal** marks.*

*(ii) Standard **symbols** have usual meaning.*

*(iii) Assume **missing** data if any.*

1. (a) Determine the natural frequency of oscillations for the system given below in Fig. 1 (a). Assume lever to be massless. 7

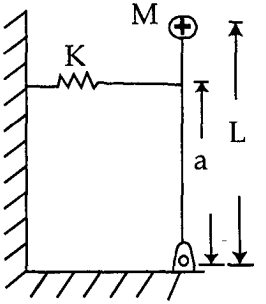

Fig 1(a)

(b) Represent the periodic motion by harmonic series, for the system given below in Fig.1 (b) 7

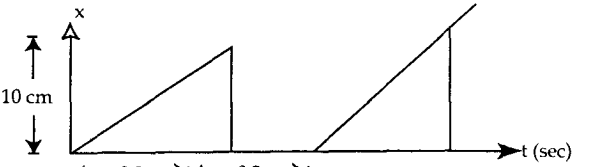

Fig 1(b)

2. (a) Determine the natural frequency of the spring - pulley system shown in Fig - 2 (a) below. 7

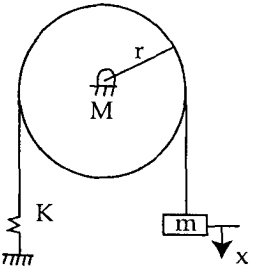

Fig - 2 (a)

(b) For the system shown in Fig - 2 (b), the characteristics of the dashpot are such that when a constant force of 49 N is applied to piston its velocity is found to be constant at 0.12 m/s. 7

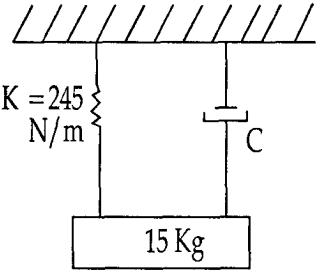

Fig - 2 (b)

(i) Find value of 'C'

(ii) Is complete system periodic ?

3. (a) A gun barrel of mass 600 kg has a recoil spring of stiffness 294,000 N/m. If barrel recoils 1.3m on firing. Determine : 7

(i) Initial recoil velocity of barrel

(ii) Critical damping coefficient of dashpot which is engagged at end of recoil stroke.

(b) The disc of torsional pendulam has a Moment of Inertia of 600 kg-m^2 and is immersed in viscous fluid. The brass shaft attached to it is of 10 cm dia. and 40 cm long. When pendulum is vibrating, the observed amplitudes on same side of rest position for successive cycles are 9°, 6° and 4°. Determine : 7

(i) logarithmic decrement

(ii) damping torque at unit velocity

(iii) The periodic time of vibration

4. (a) A radio set of 20 kg mass must be isolated from a machine vibrating with an amplitude of 0.05 mm at 500 rpm. The set is mounted on four isolators each having spring scale of 31400 N/m and damping factor of 392 N−S/m. 7

(i) What is amplitude of radio vibration ?

(ii) What is dynamic load on each isolator due to vibration ?

(b) A commercial type vibration pick-up has a natural frequency 5.75 Hz and damping factor of 0.65. What is lowest frequency beyond which amplitude can be measured within - 7

(i) One percent error,

(ii) Two percent error ?

5. (a) For the double pendulam shown in fig 5 (a) derive the following relation. 7

$$\frac{X_1}{X_2} = \frac{\frac{m_2}{l_2}.g - m_2w^2}{\left(m_2/l_2\right)g}$$

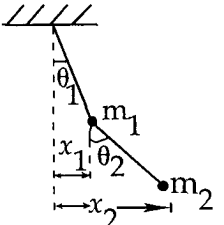

Fig - 5 (a)

(b) Two uniform rods AB and CD are pivoted at upper ends as shown in fig - 5 (b). Their lower ends are at the same level and are connected by a spring. Each rod weights 5 kg/m and is vertical in equilibrium stifness is 2940 N/m and the spring is compressed and released. Find the Frequency of vibrations, neglecting the gravity effect. 7

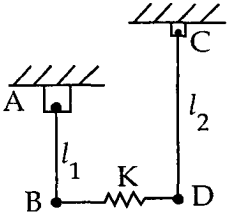

Fig - 5 (b)

6. (a) Obtain the frequency equation for the lateral vibrations of cantilever of uniform cross - section having length '*l*'. 7

(b) For the system shown in Fig - 6 (b), determine the steady state response of both the masses when, $m_1 = m_2 = 0.12kg$ $K_1 = K_2 = 60$ N/m; $\omega = 30$ rad/Sec. 7

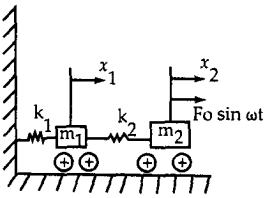

Fig - 6 (b)

7. (a) Using Dunkerley's method find the fundamental natural frequency of transverse vibration of the beam as shown in fig - 7 (a) below. 7

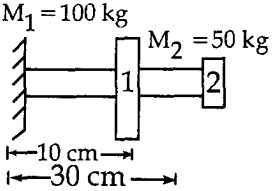

Fig - 7 (a)

(b) For the three degree of freedom system shown in Fig. 7 (b) below. Find the lowest natural frequency by stodola's method. 7

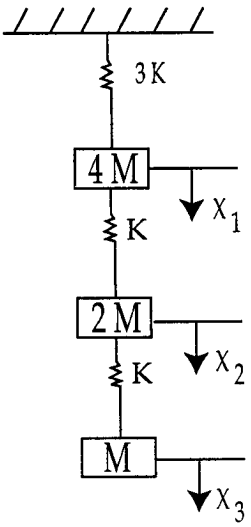

Fig 7 (b)

8. Write short notes on ***any four*** of the following : **14**

(a) Vibration absorber
(b) CO - ordinate coupling
(c) Semi - definite system
(d) Influence numbers
(e) Viscous and Coloumb damping
(f) Frahm's reed techometer