PVP 17

Code: **17MEMD1T3**

I M.Tech - I Semester – Regular / Supplementary Examinations
February 2020

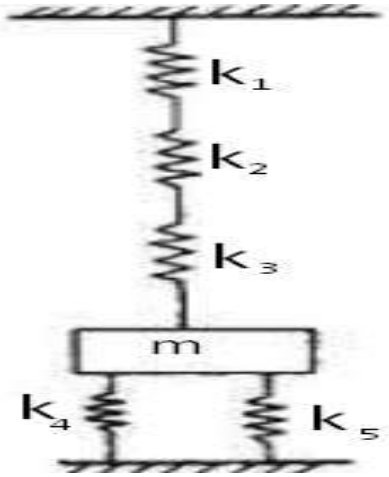
MECHANICAL VIBRATIONS
(MACHINE DESIGN)

Duration: 3 hours Max. Marks: 60

Answer the following questions.

1. a) Add the following two simple harmonic motions:
$X_1 = 10 \cos(\omega t + \pi/4)$ and $X_2 = 8 \sin(\omega t + \pi/6)$ 7 M

b) Determine the mass of the system, if $K_1 = 2000$ N/m, $K_2 = 1500$ N/m, $K_3 = 3000$ N/m, $K_4 = K_5 = 500$ N/m and natural frequency is 10 Hz. 8 M



(OR)

2. a) Discuss the response of
(i) Under – damped system; (ii) Critically – damped system 7 M

b) In a single degree damped vibration system, a suspended mass of 8 kg makes 30 oscillations in 18 seconds. The amplitude decreases to 0.25 of the initial value in 5 oscillations. Determine

i. Stiffness of the spring.
ii. The logarithmic decrement.
iii. The damping factor.
iv. The damping co efficient. 8 M

3. a) A body of mass 20 kg is suspended from a spring which deflects 15 mm under the weight of the body. The damper provides 28% of the critical damping. If a harmonic force of 200 N at a frequency of 10 Hz is made to act on the body, find the amplitude of motion and phase of the body with respect to the impressed force. 7 M

b) A refrigerator unit having a mass of 35 kg is to be supported in three springs, each having spring stiffness 'K', the unit operates at 480 rpm. Find the value of stiffness 'K' if only 10% of the shaking force is allowed to be transmitted to the support structure. 8 M

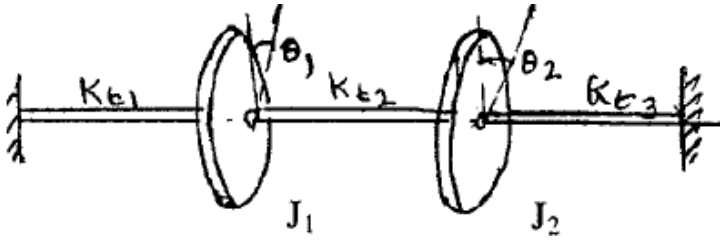
(OR)

4. A machine of mass 75 kg is mounted on springs of stiffness 1200 KN/m and a damping factor of 0.2. A piston within the machine of mass 2 kg with a stroke of 80mm and a speed of 3000 cpm. Find

i. The amplitude of mass

ii. The phase angle of mass with respect to exciting force
iii. The force transmitted to the foundation
iv. The phase angle of transmitted force with respect to exciting force. 15 M

5. Find the natural frequency and mode shapes for the torsional system shown in fig.
Given $J_1 = J_0$ $J_2 = 2J_1$; $K_{t1} = K_{t2} = K_{t3} = K_t$

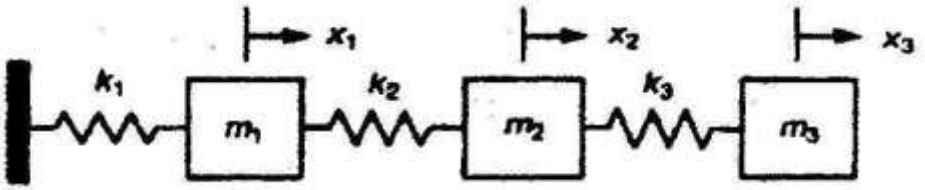


15 M

(OR)

6. Obtain the response equation for an undamped single degree freedom system subjected to
(i) an impulse input (ii) a rectangular pulse. 15 M

7. For the three-degrees of –freedom system shown in fig, Write the differential equations of motion in matrix form and Obtain the natural frequencies for
$k_1 = k$, $3k_2 = 2k_3 = 6k$, $m_1 = m$, $3m_2 = 2m_3 = 6m$. 15 M



(OR)

8. Derive an expression for the natural frequencies for the lateral vibration of a uniform simply supported beam.

15 M