Roll No. .....

8641

Printed Pages : 4

BT–6 / M–15

MECHANICAL VIBRATION

Paper–ME–306E, Opt. II

Time allowed : 3 hours] *[Maximum marks : 100*

Note : Attempt any five questions. Taking at least one question from each unit.

Unit–I

1. (a) A body is subjected to two harmonic motions given below :

$X_1 = 15 \sin(\omega t + \pi/6)$, $X_2 = 8 \cos(\omega t + \pi/3)$

What harmonic motion must be given to body to bring it to the equilibrium ? 10

(b) A force $P_0 \sin \omega t$ acts on a displacement $X_0 \sin(\omega t - \pi/6)$ if $P_0 = 30$ N, $X_0 = 0.05$ M, $\omega = 10\pi$ rad/sec. Find (a) Work done during first cycle, (b) First second, (c) 1/40th of second ? 10

2. (a) Find the natural frequency of the system shown in figure : 1 10

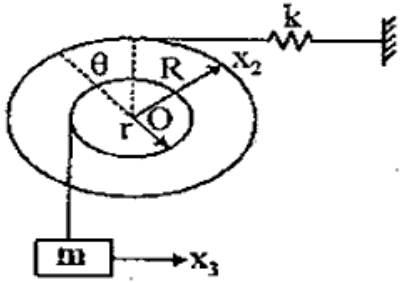

Figure : 1

[Turn over

(b) A cylinder of diameter D and mass m floats vertically in a liquid of mass density ρ as shown in figure : 2. It is Depressed slightly and released. Find the period of oscillation. What will be the frequency of salty liquid of specific gravity 1.2 ? 10

Figure : 2

Unit–II

3. (a) In a spring mass system, the mass block (m = 0.9072 Kg) is displaced from the instructed position of the spring by an amount of 254 mm and released from the rest. How long the body will oscillate ? Assume tensile force developed in the spring corresponding to the initial stretch is 44.5 N and cofficient of friction is 0.25. 10

(b) The torsional pendulum with a disc of moment of inertia $J = 0.05$ Kg-m^2 immersed in a viscous medium as shown in figure : 3. During vibration of pendulum the observed amplitude on the same side of the neutral axis for successive cycles are found to decay 50% of the original value. Determine : (a) Logerithmic Decrement, (b) Damping Torque per unit velocity, (c) Periodic time of vibration, (d) The frequency when disc is removed from the fluid. 10

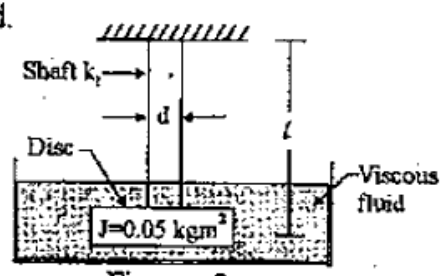

Figure : 3

4. (a) For a viscously damped spring-mass system excited by harmonic force $F = F_0 \sin \omega t$, the resonating amplitude is found to be 5.8 mm. At 80% of the resonating frequency, the amplitude is observed as 4.6 mm. Calculate the damping factor for the system. 10

(b) Calcualte the steady state amplitude of angular oscillation of the rod. Given mass of Rod : 1.8 Kg and $J = 0.33\ ml^2$. 10

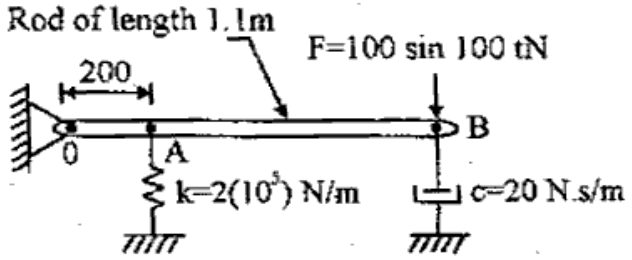

Figure : 4

Unit–III

5. Using matrix iteration technique, calculate all the natural frequencies of the system shown in figure : 6. 20

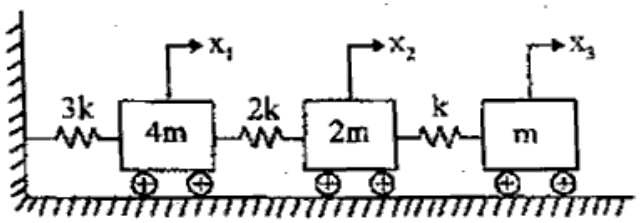

Figure : 6

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6. Consider the pendulum of length L as shown in figure : 7. Determine the natural frequency of each pendulum. If $k = 100$ N/m, $m_1 = 2$ Kg, $m_2 = 5$ Kg, and length $L = 0.2$ m, $a = 0.10$ m 20

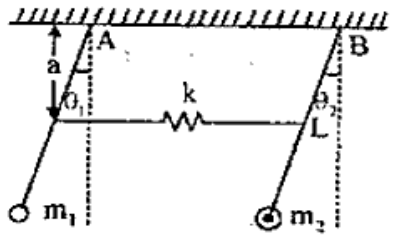

Figure : 7

Unit–IV

7. Derive suitable expression for longitudinal vibration for a rectangular uniform cross-section bar of length L fixed at one end and free at other eud. 20

8. A disc of mass 4 Kg is mounted midway between the bearings which may be assumed to be simple supports. The bearings spans is 48 cm. The steel shaft which is horizontal, is 9 mm in diameter. The CG of the disc displaced 3 mm from the geomatric centre. The equivalent viscous damping at the centre of the disc may be taken as 49 N-sec/m. if the shaft rotates at 760 RPM, find the maximum stress in the shaft and compare it with the dead load stress in the shaft. Also find the power required driving the shaft at this speed. 20