Code: 9D15203

M.Tech I Semester Supplementary Examinations August 2016

MECHANICAL VIBRATIONS

(Production Engineering & Engineering Design)

(For students admitted in 2012, 2013, 2014 & 2015 only)

Time: 3 hours Max. Marks: 60

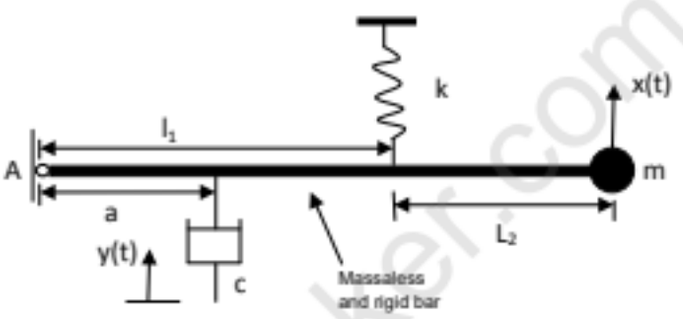
Answer any FIVE questions

All questions carry equal marks

*****

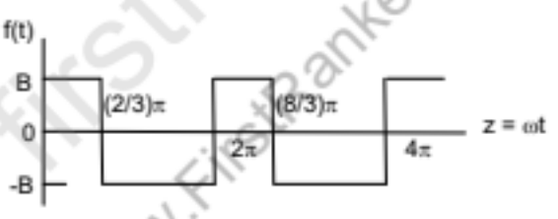
1 (a) What is vibration isolation and transmissibility?

(b) Consider the system shown in figure below. Where a = 25 cm, l_1 = 50 cm and l_2 = 50 cm, k = 1100 N/m, m = 2 kg and damping ratio is 0.1.



2 (a) What is unit impulse and unit step functions?

(b) Determine the Fourier coefficients for the forcing function shown in figure below.

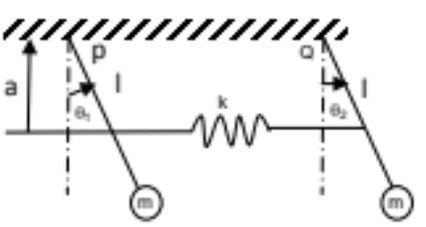


3 (a) Write short notes on velocity meters and accelerometers.

(b) Explain about design of vibrometer with examples.

4 (a) What are principle modes? Explain.

(b) Figure shows two simple pendulums connected by a spring. Find the natural frequency of each pendulum.

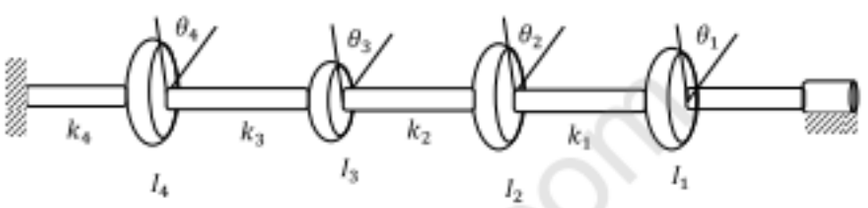


Contd. in page 2

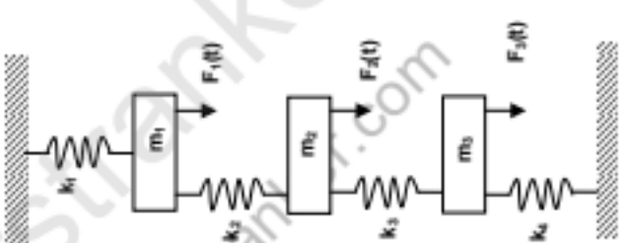
Code: 9D15203

5 (a) Explain the coupling of coordinates in a multi degree freedom system.
(b) Determine the natural frequency of the three mass three spring vibrating system by matrix method. Assume $m_1 = 4m$ kg, $m_2 = 2m$ kg, $m_3 = 1$ m kg, $k_1 = 3k$, $k_2 = k_3 = k$.

6 Figure below shows four degree of freedom torsional system with generalized coordinates θ_1, θ_2, θ_3 and θ_4. (a) Determine the kinetic and potential energy functions for the system. (b) Obtain the equations of motion governing the motion of the system using Lagrange's equation. (c) Obtain he solution to the equations of the motion of the system found in (b), (d) determine the principal modes and natural frequencies for $k_1 = k_2 = k_3 = k_4 = k$, and $I_1 = I_2 = I_3 = I_4 = I$.



7 For the system shown in figure below: (a) write the differential equation of motion. (b) Determine the forced response of the system for $k_1 = k_2 = k_3 = k$, k4 = 2k, $m_1 = m_2 = m_3 = m$, $F_1(t) = F_1 \sin\omega t$, $F_2(k) = F_2 e^{-t}$, and $F_3(t) = 0$.



8 (a) What do you mean by whirling of shaft? Derive an expression for amplitude of vibration of shaft supporting a disc at the mid-span.
(b) A vertical shaft of 5 mm diameter is 200 mm long and is supported in long bearings at its ends. A disc of mass 50 kg is attached to the centre of the shaft. Neglecting any increase in stiffness due to the attachment of the disc to the shaft, find the critical speed of rotation and the maximum bending stress when the shaft is rotating at 75% of the critical speed. The centre of the disc is 0.25 mm from the geometric axis of the shaft. $E = 200$ GN/m^2.

*****