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10AE65

Sixth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Theory of Vibrations

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain longitudinal, transverse and torsional vibrations with the help of neat sketches. **(06 Marks)**

b. Represent the periodic motions given in Fig. Q1 (b) by harmonic series. **(14 Marks)**

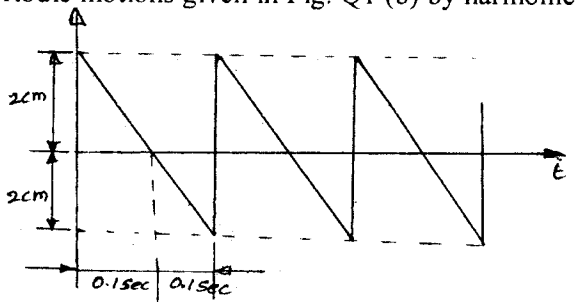

Fig. Q1(b)

2 a. Derive the differential equation of one dof spring mass system. Also obtain its solution applying suitable boundary conditions. **(08 Marks)**

b. Find the natural frequency of vibration of the system shown in Fig.Q2(b) for small amplitudes. If K1, K2, a and b are fixed, determine the value of b for which the system will not vibrate. Find maximum acceleration of the mass. **(12 Marks)**

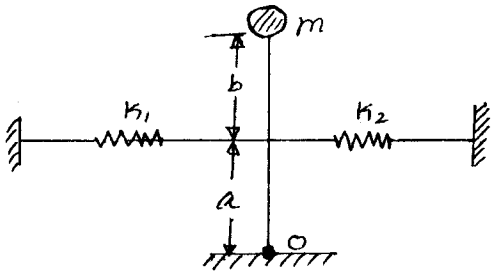

Fig. Q2 (b)

3 a. Explain the following: (i) Viscous damping (ii) Coulomb damping (iii) Structural damping. **(06 Marks)**

b. The single pendulum is pivoted at point O as shown in Fig. Q3 (b). If the mass of the rod is negligible for small oscillation, find the damped natural frequency of the pendulum. **(14 Marks)**

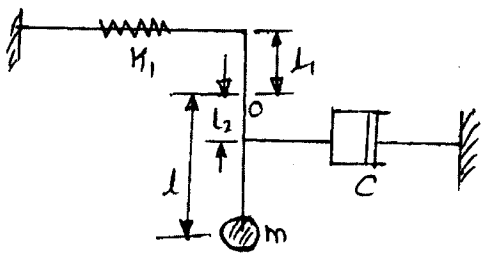

Fig. Q3 (b)

4 a. Explain the following:
(i) Vibration isolation (ii) Transmissibility **(06 Marks)**

b. A vibratory body of mass 150 kg supported on springs of total stiffness 1050 kN/m has a rotating unbalance force of 525 N at a speed of 6000 rpm. If the damping factor is 0.3, determine
(i) the amplitude caused by the unbalance and its phase angle.
(ii) the transmissibility and
(iii) the actual force transmitted and its phase angle. **(14 Marks)**

PART – B

5 a. With the help of neat sketch, explain working of vibrometer. Derive the necessary conditions for the same. **(08 Marks)**

b. The rotor of a turbo super charger weighing 9 kg is keyed to the centre of a 25 mm diameter steel shaft 40 cm between bearings. Determine :
(i) the critical speed of shaft
(ii) the amplitude of vibration of the rotor at a speed of 3200 rpm, if the eccentricity is 0.015 mm and
(iii) the vibratory force transmitted to the bearings at this speed.
Assume the shaft material to be simply supported and that the shaft material has a density of 8 gm/cm^3. Take $E = 2.1 \times 10^6$ kg/cm^2. **(12 Marks)**

6 a. Explain the following:
(i) Modes of vibration (ii) Co-ordinate coupling (iii) Vibration absorber. **(06 Marks)**

b. Solve the problem shown in Fig. Q6 (b). $m_1 = 10\,kg$, $m_2 = 15\,kg$ and $K = 320$ N/m. **(14 Marks)**

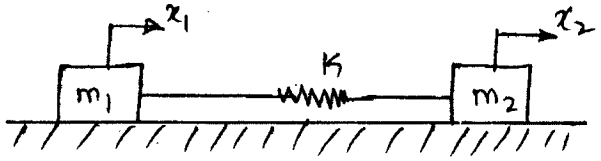

Fig. Q6 (b)

7 a. Obtain the general equation for transverse vibration of beam (Euler's equation for beams). Also obtain its solution. **(14 Marks)**

b. Derive suitable expression for longitudinal vibrations for a rectangular uniform cross-section bar of length *l* fixed at one end and free at the other end. **(06 Marks)**

8 Use Holzer's method, to find the natural frequencies of the system shown in Fig. Q8. **(20 Marks)**

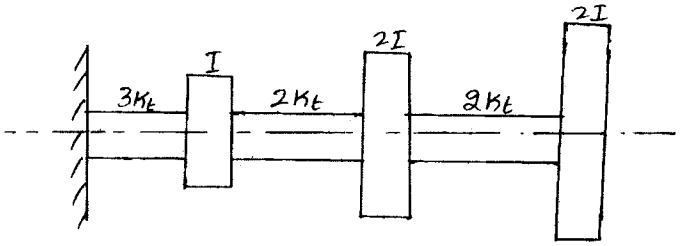

Fig. Q8

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