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10AE65

Sixth Semester B.E. Degree Examination, Dec.2018/Jan.2019
Theory of Vibrations

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find the sum of the two harmonic motions $x_1(t) = 8 \text{ Cos } (wt + 1)$ and $x_2(t) = 12 \text{ Cos } (wt + 2)$ and check your solutions graphically. **(10 Marks)**

b. Represent the periodic motions given in Fig Q1(b) by harmonic analysis

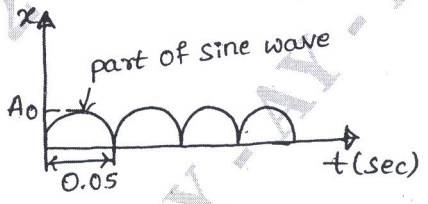

Fig Q1(b) **(10 Marks)**

2 a. Determine the natural frequency of a simple spring mass system by energy method. Also obtain its solution. **(10 Marks)**

b. Determine the differential equation of motion of the system shown in Fig Q2(b). Moment of inertia of the mass m and the bar about the pivot point is I_0.

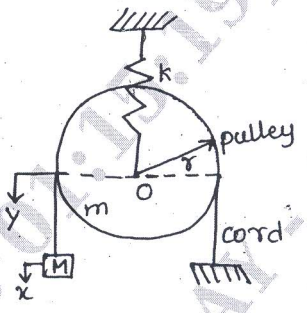

Fig Q2(b) **(10 Marks)**

3 a. Explain the following :
i) Viscous damping
ii) Coulomb damping
iii) Structural damping **(10 Marks)**

b. Determine suitable expression for equation of motion of the damped vibratory system shown in Fig Q3(b). Find the critical damping coefficient when a = 12cm, b = 14cm, k = 5N/mm and M = 1.5kg.

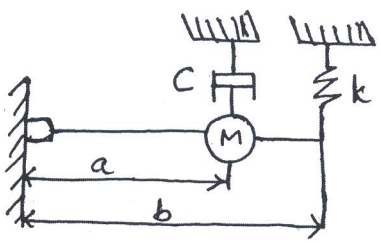

Fig Q3(b) **(10 Marks)**

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

b. A vibration body of mass 150kg supported on springs of total stiffness 1050 kN/m has a rotating unbalance force of 525N at a speed of 6000rpm. 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. Explain the working of a seismic instrument with a neat sketch. State the conditions for which the instrument functions as : i) Vibrometer ii) Accelerometer. **(08 Marks)**

b. A rotor has a mass of 15kg and is mounted at a distance 300 from right hand support on a 20mm diameter horizontal shaft supported at the ends by two bearings. The bearings are 80cm apart. The shaft routes at 2400 rpm. If the centre of mass of the rotor is 0.11mm away from the geometric centre of the rotor due to a certain manufacturing inaccuracies, find the amplitude of the steady state vibration and the dynamic force transmitted to each bearing. Take E = 200GPa. **(12 Marks)**

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

b. Find the natural frequency and amplitude ratio for the system shown in Fig Q6(b). Take $m_1 = 10kg$, $m_2 = 15kg$ and $k = 320$ N/m.

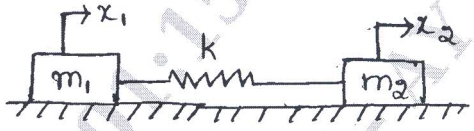

Fig Q6(b) **(14 Marks)**

7 a. A bar fixed at one end is pulled at the other end with force P. The force is suddenly released. Investigate the vibration of the bar. **(10 Marks)**

b. Obtain an expression for Euler's equation for beams. **(10 Marks)**

8 Use Holzer's method to find the natural frequencies of the system shown in Fig Q8.

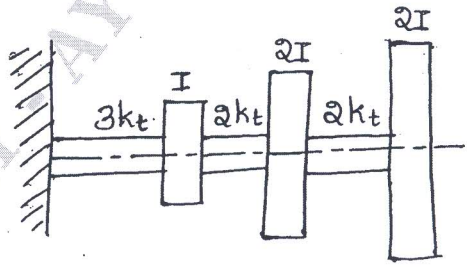

Fig Q8 **(20 Marks)**

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