ONE TIME EXIT SCHEME

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10ME72

Seventh Semester B.E. Degree Examination, April 2018
Mechanical Vibrations

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Assumption if made should be stated explicitly.***

PART – A

1 a. Add the following harmonic analytically and check the solution graphically $x_1 = 3 \sin(wt + 30°)$, $x_2 = 4 \cos(wt + 10°)$ **(10 Marks)**

b. Represent the periodic motions given by the following Fig. Q1 (b) by harmonic series.

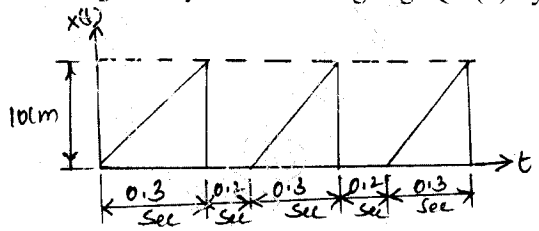

Fig Q1(b) **(10 Marks)**

2 a. Determine the natural frequency of spring – mass system taking the mass of the spring into account. **(10 Marks)**

b. Find the time period of small vibrations of an inverted pendulum and spring mass system shown in Fig Q2(b). The pendulum is vertical in the equilibrium position. **(10 Marks)**

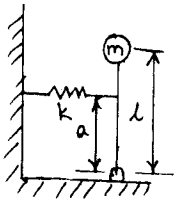

Fig Q2(b)

3 a. A spring mass dashpot system is over damped. It is subjected to a free vibrations. Obtain expression for response. **(10 Marks)**

b. A machine of mass 20kg is mounted with spring and dashpot as shown in Fig Q3(b). The total spring stiffness is 10N/mm and the total damping is 0.15N-s/mm. If the system is initially at rest and a velocity of 100mm/sec is imported to the mass, then determine :

i) Displacement and velocity of mass as a function of time

ii) Displacement and velocity at time equal to one sound.

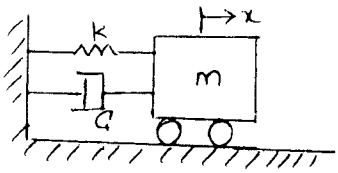

Fig Q3(b) **(10 Marks)**

4 a. Derive an expression for total response of an under damped spring mass dashpot system subjected to harmonic excitation mass. **(10 Marks)**

b. A mass of 100kg been mounted on a spring mass dashpot system having spring stiffness of 19600N/m and damping co-efficient of 100N-S/m. The mass is acted upon by a harmonic force of 39N at the undamped natural frequency of the system. Determine :

i) Amplitude of the vibration of the mass
ii) Phase difference between force and displacement
iii) Force transmissibility ratio. **(10 Marks**

PART – B

5 a. Explain and discuss vibrometer and accelerometer devices with the help of relative amplitude ratio versus frequency ratio plot. **(10 Marks)**

b. Obtain an expression for amplitude whirling shaft with air damping. **(10 Marks)**

6 a. Set up the differential equation of motion for the system shown in Fig. Q6(a) and hence derive the frequency equation and obtain two natural frequencies of the system. Sketch the mode shapes. **(10 Marks)**

b. With respect to Fig Q6 (b) assume $\ell_1 = \ell$ and $\ell_2 = 2\ell$, $m_1 = m_2 = m$. obtain the natura frequencies of the double pendulum and also sketch its mode shape. **(10 Marks)**

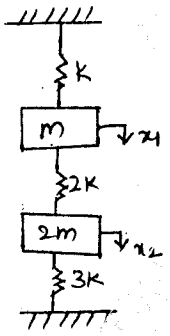

Fig Q6(a)

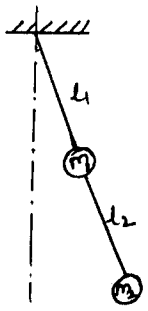

Fig Q6(b)

7 a. Determine the influence co-efficients of the triple pendulum shown in Fig Q7(a). **(10 Marks**

b. Using Stodola's method determines the fundamental mode of vibration and its natura frequency of the spring mass system shown in Fig Q7 (b). Given m = 2, k = 20N/m.

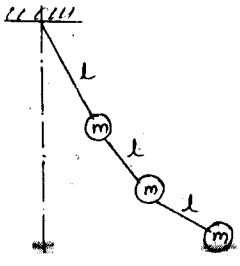

Fig Q7(a)

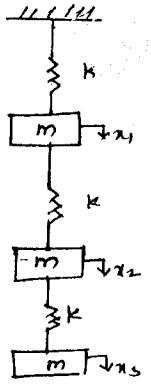

Fig Q7(b) **(10 Marks**

8 a. Explain hardware of equipment used for experimental modal analysis. **(10 Marks**

b. Explain various types' m/c maintenance techniques. **(10 Marks**