USN

06ME62

Sixth Semester B.E. Degree Examination, June/July 2018

Mechanical Vibrations

Time: 3 hrs. Max. Marks:100

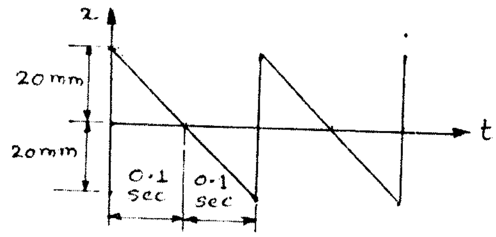
Note: 1. ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. ***Assumptions if made should be stated explicitly.***

PART – A

1 a. Add the following motions analytically and check the solution graphically.
$x_1 = 4.\cos(wt + 10^0)$; $x_2 = 6.\sin(wt + 60^0)$. **(10 Marks)**

b. A periodic motion observed on the oscilloscope is shown in fig.Q1(b). Represent this motion by harmonic series. **(10 Marks)**

Fig.Q1(b)



2 a. Show that for finding the natural frequency of a spring mass system, the mass of the spring can be taken into account by adding one – third of its mass to the main mass. **(08 Marks)**

b. A cylinder of mass 'm' and radius 'r' rolls without slipping on a cylindrical surface of radius 'R'. Find the natural frequency for small oscillations about the lowest point. Use Energy method. **(12 Marks)**

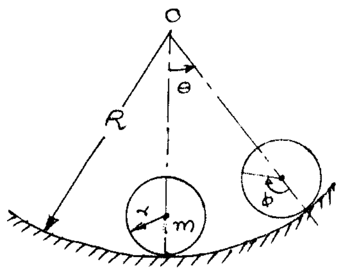


Fig.Q2(b)

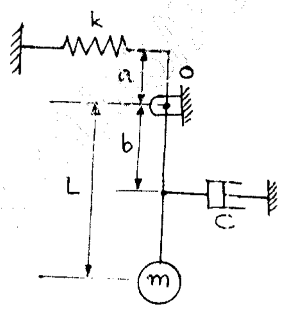


Fig.Q3(a)

3 a. A pendulum is pivoted at point 'O' as shown in fig. Q3(a). If the mass of the rod is negligible and for small oscillations find damped natural frequency. **(10 Marks)**

b. In a single degree damped vibrating system, a suspended mass of 18 kg makes 10 oscillations in 8 seconds. The amplitude decreases to 25% of the initial value after 5 cycles. Determine : i) Damped natural frequency ii) Spring constant iii) Logarithmic decrement iv) Undamped natural frequency v) Damping coefficient. **(10 Marks)**

4 a. A single degree of freedom damped system is composed of a mass of 10kg, a spring, having a spring constant of 2000 N/m and a dash pot having a damping constant of 50 N-sec/m. The mass of the system is acted upon by a harmonic force, F = Fo Sin wt having a maximum value of 250N and a frequency of 5Hz. Determine the complete solution for the motion of the mass. **(10 Marks)**

b. The springs of an automobile are compressed 0.1m under its own weight. Find the critic speed, when the automobile is travelling over a road, with a profile approximated by a si wave of amplitude 0.08m and wave length of 14m. What will be the amplitude of vibrati at 60km/hour? (10 Mark

PART - B

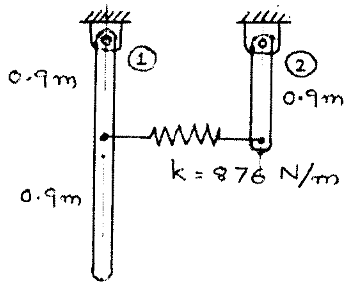
5 a. Explain the principle of "Seismic" instrument and indicate how it can be used to measu displacement and acceleration of a vibrating body. (08 Mark

b. A rotor having a mass of 5kg is mounted midway on a 10mm diameter shaft supported the ends by two bearings. The bearing span is 400mm. Because of some manufacturi inaccuracies, the c.g. of the disc is 0.02mm away from the geometric centre of the rotor. the system rotates at 3000 rpm, find the amplitude of steady state vibrations and dynan force transmitted to the bearings. Neglect damping and take $E = 1.96 \times 10^{11}$ N/m^2. Assur the shaft to be simply supported. (12 Mark

6 a. Explain the working principle of dynamic vibration absorber. (08 Mark

b. Two uniform slender rods weighing w1 = 131.4N and w2 = 65.7N are suspended at th upper ends and are connected by a spring of stiffness 876 N/m as shown in fig.Q6(Compute the natural frequencies of the system. (12 Mark

Fig.Q6(b)



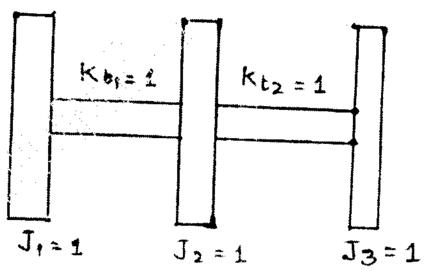
7 a. A uniform bar fixed at one end, is pulled at the other end with a force 'P', and is sudde released. Investigate the vibration of the bar. (10 Mark

b. Derive the differential equation of motion for the free torsional vibration of a circular sha (10 Mark

8 a. Prove Maxwell's reciprocal theorem for the simply supported beam with two concentrat loads acting on the beam. (05 Mark

b. For the system shown in fig. Q8(b), determine the natural frequencies by using Holze method. (15 Mark

Fig.Q8(b)



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