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06ME62

Sixth Semester B.E. Degree Examination, June/July 2015
Mechanical Vibrations

Time: 3 hrs. Max. Marks:100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. The motion of a particle is represented by the equation X = 10 sin wt. Show the relative positions and magnitudes of the displacement, velocity and acceleration vector at time t = 0 for the case when i) w = 2 rad/s ii) w = 0.5 rad/s. **(10 Marks)**

b. A harmonic motion is described as $X(t) = X\cos(100t + \psi)$mm, the initial conditions are $X(0) = 4$mm and $\dot{X}(0) = 1\,m/s$. Find the constants X and ψ. **(10 Marks)**

2 a. Find the natural frequency of the single degree freedom system shown in Fig.Q.2(a). The rod AOB of the system is light, straight and stiff. Also find the natural frequency when a = b and $k_1 = k_2 = k = 10$N/m. Take m = 25kg. **(10 Marks)**

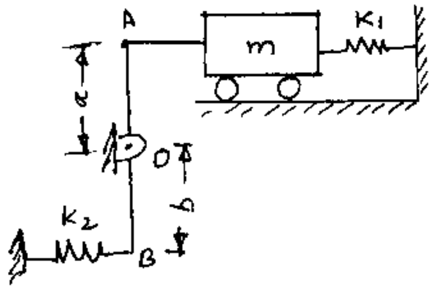

Fig.Q.2(a)

b. Show that for finding the natural frequency of a spring-mass system, the mass of the spring can be taken into account by adding 1/3rd of its mass to the main mass. **(10 Marks)**

3 a. Define Logarithmic decrement and hence obtain an expression for logarithmic decrement in terms of damping factor. **(10 Marks)**

b. A mass of 10kg is kept on two slabs of isolators placed one over the other, one of the isolator is of rubber having a stiffness of 3kN/m and a damping co-efficient of 100 N-s/m while the other isolator is of felt with stiffness of 12kN/m and damping coefficient of 300 N-s/m. If the system is set in motion in vertical direction, determine the damped and undamped natural frequency of the system. **(10 Marks)**

4 a. A flywheel of mass moment of inertia 0.5 kg-m^2 is suspended from a thin wire of stiffness 10N-m/rad. A periodic torque having a maximum value of 3N-m at a frequency of 5 rad/s is impressed upon the flywheel. A viscous dash pot applies damping couple of 0.5N-m at an angular velocity of 2 rad/s. Determine:

i) Maximum angular displacement
ii) Maximum couple applied to the dash pot
iii) Critical damping coefficient
iv) Angle by which the angular displacement lags the torque. **(10 Marks)**

b. A vibrating body is supported by six isolators each having stiffness 30 kN/m and six dash pots having damping factor as 400 N-s/m. The vibrating body is to be isolated by a rotating device having an amplitude of 0.06mm at 600 rpm, take m = 30 kg. Determine: i) Amplitude of vibration of the body; ii) Dynamic load on each isolator due to vibration. **(10 Marks)**

PART – B

5 a. Explain briefly Seismometer and accelerometer used for the measurement of natural frequency. **(10 Marks)**

b. A disc of mass 10kg is mounted midway on a simply supported shaft. The bearing span is 0.5m and the diameter of shaft is 10mm. The Centre of gravity of disc is displaced 3mm from the geometric centre. The equivalent viscous damping at the centre of disc-shaft may be taken as 50 N-s/m. If the shaft rotates at 720 rpm, find the power required to drive the shaft. Assume $E = 2 \times 10^{11}$ N/m^2. **(10 Marks)**

6 a. Explain the principle of working of a dynamic vibration absorber. **(10 Marks)**

b. Determine the natural frequency of the system shown in Fig.Q.6(b). Given $k_1 = k_2 = 40$ N/m, $k = 60$ N/m, $m_1 = m_2 = 10$kg. **(10 Marks)**

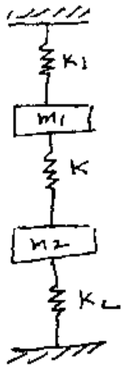

Fig.Q.6(b)

7 a. Obtain the one dimensional wave equation for lateral vibration of string. **(10 Marks)**

b. Fin the frequency equation of a bar fixed at one end and carries a mass 'm' at its free end. The length of bar is 'L'. **(10 Marks)**

8 Find the fundamental frequency of the system shown in Fig.Q.8, using:

i) Matrix iteration method

ii) Holzer's method. **(20 Marks)**

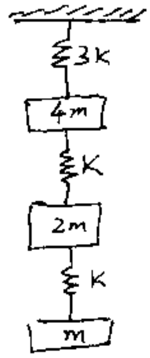

Fig.Q.8

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