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06ME62

Sixth Semester B.E. Degree Examination, December 2012

Mechanical Vibration

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. Missing data may be suitably assumed.

PART – A

1 a. Add the following motions analytically:
$x_1 = 4\cos(\omega t + 10°)$, $x_2 = 6\sin(\omega t + 60°)$ **(10 Marks)**

b. Develop a periodic function in terms of sines and cosines of a Fourier series and determine a_o, a_n and b_n. **(10 Marks)**

2 a. Determine the effect of the mass of the spring on the natural frequency of the spring-mass-system. **(10 Marks)**

b. A bifiliar suspension consists of thin cylindrical rod of mass m suspended symmetrically by two equal strings as shown in Fig.Q2(b). Find the frequency of oscillation of the rod about vertical axis Y-Y. **(10 Marks)**

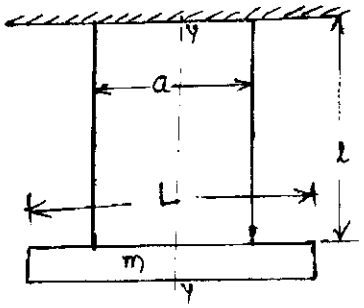

Fig.Q2(b)

3 a. Obtain the response of viscous damped system for underdamped case. **(10 Marks)**

b. Find the equation of motion for the system shown in Fig.Q3(b) when ξ = 1, 0.3 and 2. If the mass m is displaced by a distance of 30 mm and released. **(10 Marks)**

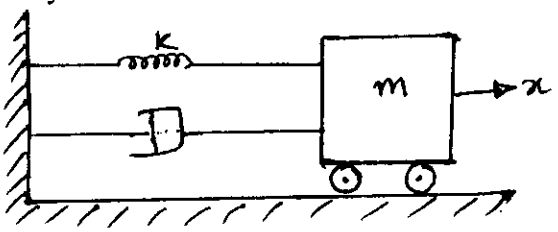

Fig.Q3(b)

4 a. Derive an expression for a steady state solution with viscous damping due to harmonic force. **(10 Marks)**

b. A vibrating body is supported by six isolators each having stiffness 32000 N/m and 6 dashpots each have 400 N-s/m. The vibrating body is to be isolated by a rotating device having an amplitude of 0.06 mm at 600 rpm. Take m = 30 kg. Determine the amplitude of vibration of the body and dynamic load on each isolator. **(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 whirling of 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 the two natural frequencies of the system. Sketch the mode shapes for $m_1 = m_2 = m$, $k_1 = k_2 = k_3 = k$. **(10 Marks)**

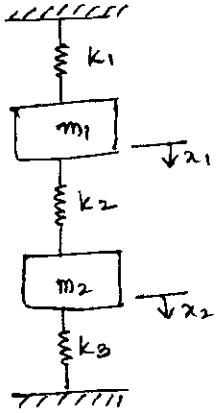

Fig.Q6(a)

b. Explain the principle of undamped dynamic vibration absorbers. Obtain an expression for $\frac{X_1}{X_{st}}$ for main mass and $\frac{X_2}{X_{st}}$ for absorber mass. **(10 Marks)**

7 a. Derive the general solution of a torsional vibration of rods. **(10 Marks)**

b. Derive suitable mathematical expression for longitudinal vibration of a rod of uniform c/s. **(10 Marks)**

8 a. Calculate the influence coefficients of 3-DOF spring mass system shown in Fig.Q8(a). Take $m_1 = m_2 = m_3 = m$ and $k_1 = k_2 = k_3 = k_4 = k_5 = k_6 = k$. **(10 Marks)**

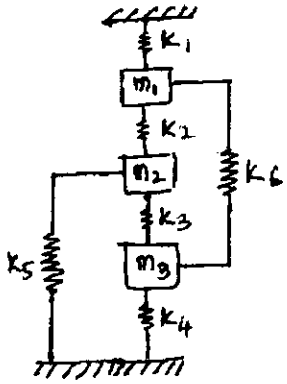

Fig.Q8(a)

b. Use the Stodola method to determine the lowest natural frequency of a 4-DOF spring mass system shown in Fig.Q8(b). **(10 Marks)**

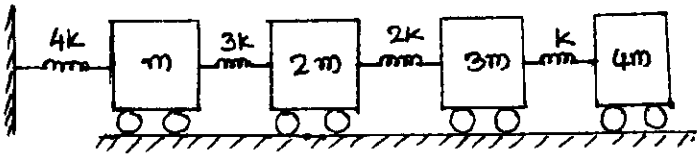

Fig.Q8(b)

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