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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Sixth Semester, B.E. - Automobile Engineering

Semester End Examination; May/June - 2019

Mechanical Vibration

Time: 3 hrs *Max. Marks: 100*

***Note**: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Determine the natural frequency of spring mass system; 12

i) By neglecting mass of the spring ii) By considering mass of the spring

b. Determine the natural frequency of oscillations of the system shown in Fig. 1(b). 8

2 a. What is logarithmic decrement? Show that logarithmic decrement $\delta = \frac{1}{n}\log_e \frac{x_0}{x_n}$ where x_0 = initial amplitude, x_n = amplitude of vibration after 'n' cycles. 8

b. Obtain the differential equation of motion for the system shown in Fig. 2(b) and hence find; 12

i) Critical dumping coefficient ii) Natural frequency of the damped oscillations.

UNIT - II

3 a. What is magnifications factor? Discuss its variation with frequency ratio for different amount of damping. 8

b. A machine of total mass 17 kg is mounted on spring having stiffness K = 11000 N/cm. A piston within the machine has a mass of 2 kg has a reciprocating with stroke 7.5 cm and speed 6000 rpm. Assuming the motion to be SHM determine; i) Amplitude of machine 12

ii) Transmissibility iii) Force transmitted to the ground. Take; $\xi = 0.2$.

4 a. Define force transmissibility and obtain an expression for the same. 8

b. Determine the critical speed when an automobile trailer is travelling over a road with the road surface varies sinusoidally with a wave length of 15 meters and amplitude of 0.075 m. The springs of the Automobile are compressed 0.125 m under its own weight. Also determine the amplitude of vibration at 50 km/hr. 12

UNIT - III

5 a. What is seismic Instrument? Explain the principle of Vibrometer and Accelerometer. 10

b. A vibrometer gives a reading of relative displacement of 0.5 mm. The natural frequency of vibration is 600 rpm and the machine runs at 200 rpm. Determine the magnitude of displacement, velocity and acceleration of the vibrating machine part. 10

6 a. Explain Whirling of shaft. 4

b. A disc of mass 4 kg is mounted midway between bearings which may be assumed to be simply supports. The bearing span is 48 cm. The steel shaft which is horizontal is 9 mm in diameter. The C.G. of the disk is displaced by 0.3 cm from Geometric centre. The equivalent viscous damping at the centre of disk shaft may be taken as 49 N-s/m. If the shaft rotates at 760 rpm, find the maximum and minimum stress in the shaft. Also find the power required to drive the shaft at this speed. Assume E = 2.1×10^{11} N/m^2. 16

Contd…2

UNIT - IV

7. Fig. 7 shows the spring mass system. Determine; 20
   i) Equation of motion ii) Natural frequencies iii) Mode shape
8. With respect to Fig. 8, assume $l_1 = l$ *and* $l_2 = 2l$, $m_1 = m_2 = m$, obtain natural frequencies and sketch its mode shape. 20

UNIT - V

9. Using Holzer's method, determine the natural frequencies of the system shown in Fig. 9. 20
10 a. Find the lowest natural frequency of the system shown in Fig. 10(a) by Stodala method. 10
   b. For the system shown in Fig. 10(b) determine the influence coefficients. 10

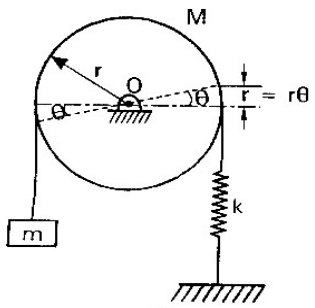

Fig- 1(b)

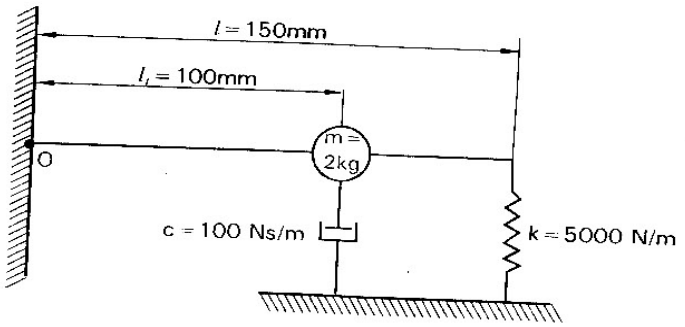

Fig - 2 (b)

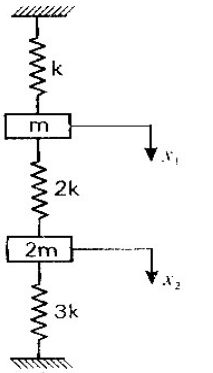

Fig - 7

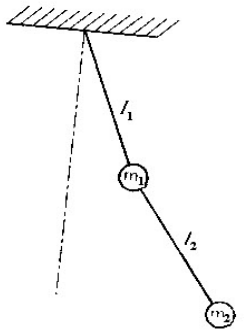

Fig - 8

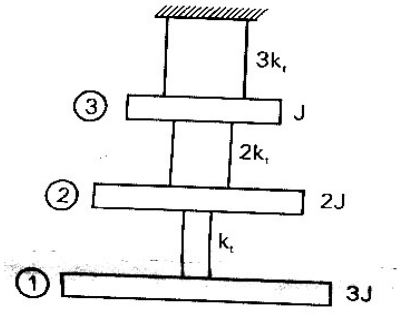

Fig- 9

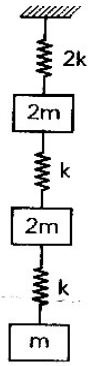

Fig - 10(a)

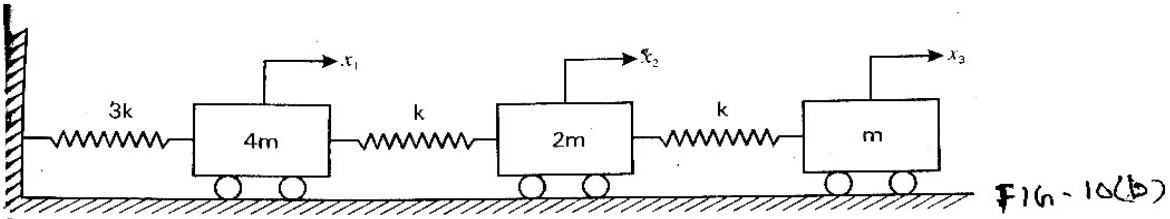

Fig - 10(b)

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