

M.E. DEGREE EXAMINATIONS: NOVEMBER 2009

Second Semester

CAD / CAM

P07CC201: Mechanical Vibrations

Time: Three Hours

Maximum Marks: 100

Answer ALL the Questions:-

PART A (10 x 2 = 20 Marks)

1. A body having 5 kg mass is hung on two helical springs in parallel. One spring elongates 10 mm by a force of 3 N; the other spring requires a force of 2 N for 10 mm elongation. Find the natural frequency of vibration of the system.
2. A free vibration has a frequency of 10 Hz and its maximum velocity is 4.57 m/s. Find its amplitude, period and maximum acceleration.
3. Sketch the two degree of freedom torsional system and write its governing equations.
4. What is meant by semi definite system?
5. Define eigen value and eigen vector.
6. What is the importance of influence coefficients in multi DOF systems?
7. What is the effect of considering rotary inertia in solving beam problems?
8. Differentiate natural boundary condition from the geometric boundary condition.
9. Distinguish between the time domain signal and frequency domain signals
10. What are the main specifications of the electro dynamic exciters?

PART B (5 x 16 = 80 Marks)

- 11 (a) A mass m is resting on a heavy spring of stiffness K . The spring mass is m_s and in the mean equilibrium position, It occupies a length l . Determine the Natural frequency considering the mass of the spring also. Assume vibration to be in SHM.

(OR)

- (b) Determine (i) the Critical damping coefficient (ii) the damping factor (iii) the natural frequency of damped vibration and (iv) the logarithmic decrement of a vibrating system which consists of mass of 30 kg a spring of stiffness of 15 kN/m and a damper. The damping provided is only 15 % of the critical Damping

12 (a) Find the frequencies of the system shown in figure-1.

$$k = 90 \text{ N/m}, L = 0.25 \text{ m} \quad m_1 = 2 \text{ kg}, m_2 = 0.5 \text{ kg}$$

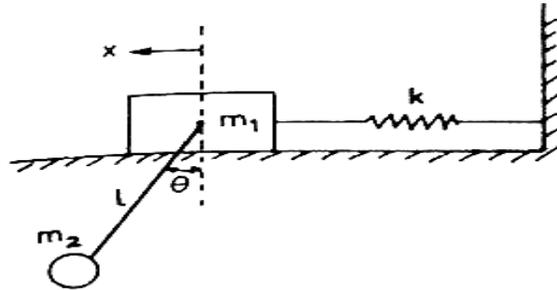


Figure-1

(OR)

(b) The spring of an automobile trailer are compressed 101.6 mm under its weight. When the trailer is travelling over a road with a profile approximated by a sine wave of amplitude 76.2 mm and wave length of 14.63 m, determine its critical speed. Find also the amplitude of vibration,

13 (a) A tension T in the string with three masses attached to it can be assumed to remain constant for all small angles of oscillation. If the masses are placed at equal distances apart as shown in figure-2. Determine the natural frequencies and the principle modes of vibration of the system.

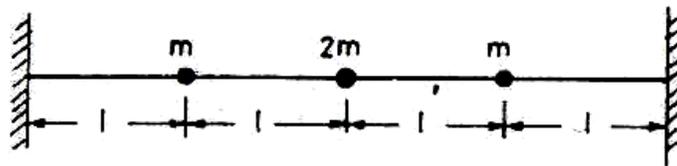


Figure-2

(OR)

- (b) Determine the natural frequency of the four mass system. Use Holzer method
Assume $m_1=m$; $m_2=2m$; $m_3=3m$; $m_4=4m$, $k_1=4k$; $k_2=3k$; $k_3=2k$; $k_4=k$

- 14 (a) Derive the one dimensional wave equation for torsional vibration of a uniform shaft.
Also obtain the general solution of the equation

(OR)

- (b) A bar of uniform cross sectional area A , density ρ , modulus of Elasticity E and length l is fixed at one end and mass M is attached at the other end. Find the natural frequency of the system.

- 15 (a) (i) Explain the principles of working of vibrometers and accelerometers. (8)

- (ii) An undamped vibration pick-up having a natural frequency of 5.1 cps is used to measure a harmonic vibration of 1.7 cps. If the amplitude indicated by the pickup is 0.005 cm, what is the correct amplitude? (8)

(OR)

- (b) (i) Explain the different types of vibration exciters and their working principles (8)

- (ii) Give the schematic for instrumentation for determining natural frequencies of turbine blade model and explain its working. (8)
