Exam.Code:0942
Sub. Code: 7060

2010

B.E. (Mechanical Engineering) Sixth Semester

MEC-603: Mechanical Vibrations

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit. Make suitable assumptions wherever found necessary.*

x-x-x

I. Answers the following:-

a) Explain why mechanical vibration is an important "area of study for engineers?

b) Define the term *magnification factor.* How is the magnification factor related to the frequency ratio?

c) Why is viscous damping used in most cases rather than other types of damping?

d) What is meant by orthogonality of modal vectors? What is difference between orthogonal and orthonormal vectors?

e) What is significance of wave velocity? (5x2)

UNIT – I

II. A 10 kg instrument is to be mounted at the end of a cantilever arm of annular cross-section. The arm has a Young's modulus of elasticity, $E = 72 \times 10^9\ N/m^2$ and a mass density $\rho = 2800\ kg/m^3$. If this arm is 500 *mm* long, determine the cross-section dimensions of the arm so that the first natural frequency of the system is above 50 *Hz.* (10)

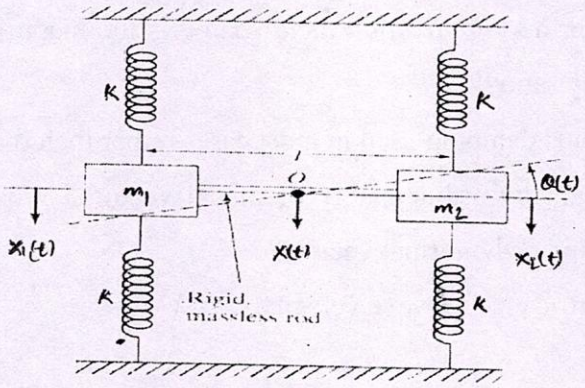
III. The damped single degree-of-freedom mass-spring system has a mass m = 20 kg and a spring stiffness coefficient k = 2400 N/m. Determine the damping coefficient of the system, if it is given that the mass exhibits a response with an amplitude of 0.02 m when the support is harmonically excited at the natural frequency of the system with an amplitude Y_0 = 7mm. In addition, determine the amplitude of the dynamic force transmitted to the support. (10)

IV. An automobile is modeled as a single-degree-of-freedom system vibrating in the vertical direction. It is driven along a road whose elevation varies sinusoidally. The distance from peak to trough is 0.2 m and the distance along the road between the peaks is 35 m. If the natural frequency of the automobile is 2 Hz and the damping ratio of the shock absorbers is 0.15, determine the amplitude of vibration of the automobile at a speed of 60 km/hour. If the speed of the automobile is varied, find the most unfavorable speed for the passengers. (10)

P.T.O.

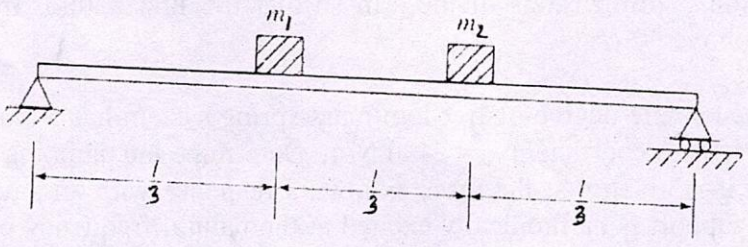
UNIT – II

V. Two masses and each connected by two springs of stiffness, k, are connected by a rigid massless horizontal rod of length l as shown in figure, (a) Derive the equations of motion of the system in terms of the vertical displacement of the C.G. of the system, $x(t)$. and the rotation about the C.G. of the system, (b) Find the natural frequencies of vibration of the system for $m_1 = 50$ kg, $m_2 = 200$ kg, and $k = 1000$ N/m.



(10)

VI. A uniform simply supported beam carries two masses m_1 and m_2 with $m_1 = 3m_2$. Find the fundamental natural frequency of the beam using Dunkerley's method.



(10)

VII. Derive and solve the governing equations of motion of free vibrations of a cantilevered beam. (10)

x-x-x