Exam.Code:0942
Sub. Code: 6732

2014
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 Part. Assume suitable data wherever necessary. All questions carry equal marks.***

x-x-x

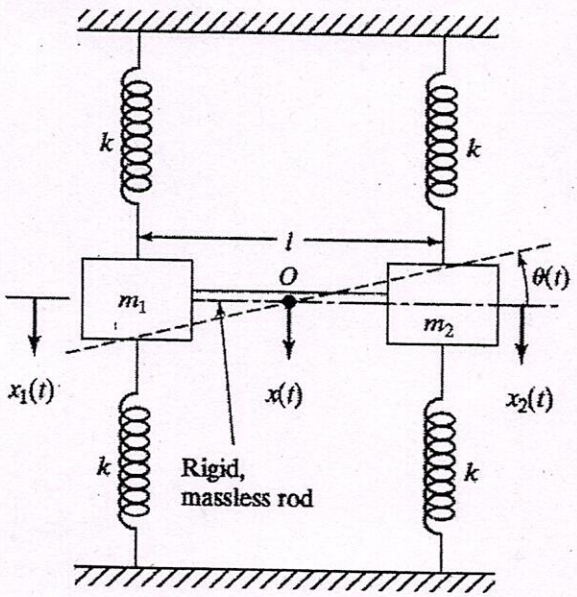
Question 1: Answer the following

(a) How are the amplitude, frequency, and phase of a steady-state vibration related to those of the applied harmonic force for an undamped system ?
(b) Explain why a constant force on the vibrating mass has no effect on the steady-state vibration
(c) Define these terms: mass coupling, velocity coupling, elastic coupling.
(d) How can we find the response of a multidegree-of-freedom system using the first few modes only
(e) Why is the mass matrix [M] for a multi degree of freedom system always positive definite ?

Part A

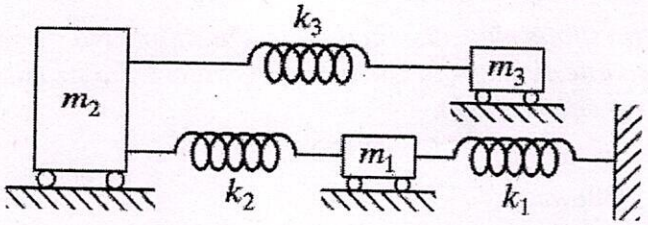
Question 2: A mass m is suspended from a spring of stiffness 4000 N/m and is subjected to a harmonic force having an amplitude of 100 N and a frequency of 5 Hz. The amplitude of the forced motion of the mass is observed to be 20 mm. Find the value of m.

Question 3: 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 Fig below. (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.



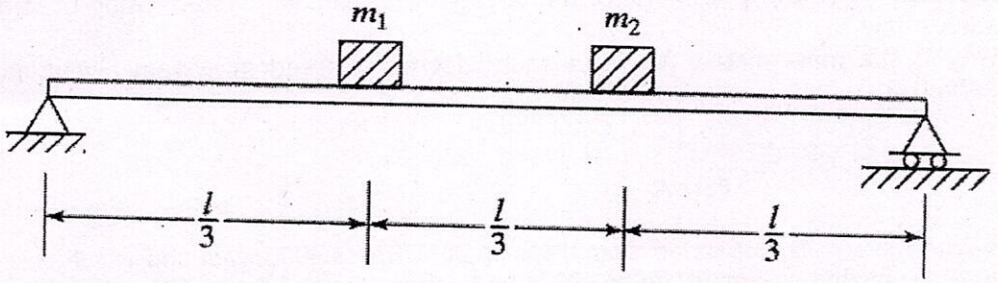
P.T.O.

Question 4: Derive the flexibility and stiffness matrices of the spring-mass system shown in Fig. below assuming that all the contacting surfaces are frictionless.



Part B

Question 5: A uniform simply supported beam carries two masses as shown in Fig. below. Find the fundamental natural frequency of the beam using Dunkerley's method.



Question 6: A steel wire of 2 mm diameter is fixed between two points located 2 m apart. The tensile force in the wire is 250 N. Determine (a) the fundamental frequency of vibration and (b) the velocity of wave propagation in the wire.

Question 7: Write short notes on: (a) Orthogonality & Principal Coordinates (b) Quotient Semi-definite Systems (c) Principal Vibration Modes.