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Total Number of Pages: 2

M.TECH
MDPC103

1st Sem. M Tech Regular/ Back Examination – 2015-16
SUBJECT NAME: MECHANICAL VIBRATIONS
BRANCH(S): Mechanical System Design
Time: 3 Hours
Max marks: 70
Q.CODE:T1039

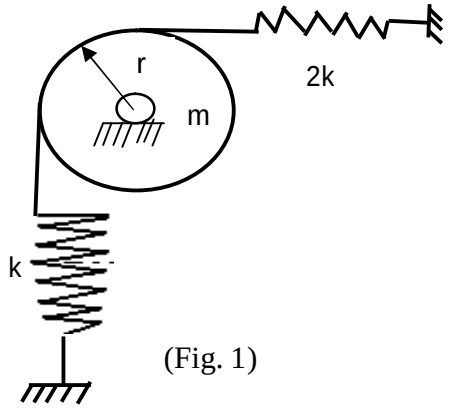
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: (2 x 10)

a) What is the difference between a discrete and a continuous system? Is it possible to solve any vibration problem as a discrete one?
b) A 453-kg mass attached to a light spring elongates it 7.87 mm. Determine the natural frequency of the system?
c) What is logarithmic decrement and its use in vibration system?
d) Define the critically damped system.
e) What do mean by forced vibrations?
f) How does the force transmitted to the base change as the speed of the machine increase?
g) What is amplitude ratio?
h) What is normal mode of vibration?
i) Plot graph between transmissibility again frequency ration for various values of damping factors.
j) What is vibration isolations?

Q2 a) A shaft of length 0.75 m, supported freely at the ends, is carrying a body of mass 90 kg at 0.25 m from one end. Find he natural frequency of transverse vibration, Assume E = 200 x 10^9 N/ m^2 and shaft diameter is 50 mm (5)

b) Determine the natural frequency of the system shown in fig.-1. (5)



(Fig. 1)

Q3 a) A suspension system is to be designed for a 2000 kg vehicle (empty weight). The maximum added mass from passengers and cargo is estimated to be 1000 kg. when the vehicle is empty, its static deflection is to be 3.5 mm. what is the minimum value of the damping coefficient such that the vehicle is subjected to not more than 5% overshoot, empty of full ? (10)

Q4 A machine of 100 kg mass is supported on spring of total stiffness 700 k N-m and has an unbalanced rotating element, which results in a disturbing force of 350 N at a speed of 3000 rev/min. Assume a damping factor of ξ = 0.20, determine (10)

(a) Its amplitude of motion due to the unbalance.
(b)The transmissibility,
And (c) the transmitted force.

Q5 Find the total response of a single degree freedom system with m=10kg, c= 50 N.s/m. and k=2000 N/m under the action of harmonic force $F=F_0 \sin wt$ with $F_0=200$ N and w= 31.416 rad /s. The initial condition are initial displacement is 0.01 and initial displacement=5 m/s at t=0 (10)

Q6 The damped frequency of a system as obtained from a free vibration test is 10.5 Hz. During the forced vibration test with constant excitation force on the same system, the peak amplitude of vibration is found to be 9.5 Hz. Find the damping factor pf the system and its natural frequency. (10)

Q7 Determine the natural frequencies and amplitude rations for the systems shown in the figure-2. It is given that m_1=20 kg, m_2=35 kg and k=300N/m (10)

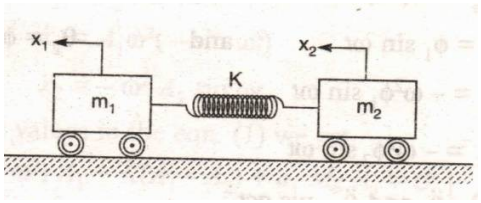


Fig. 2

Q8 (Answer any two) (5 x 2)

a) Derive natural frequency and the amplitude ration of forced vibration of undamped two degree of freedom system
b) Write down a brief notes on Vibration measuring instruments
c) Derive the fundamental equation for the lateral vibration of Beams and determine the natural frequency of a simply supported beam.
d) Determine the normal functions for free longitudinal vibration of a bar of length L and uniform cross-section. One end of the bar is fixed and the other free.