ELIZADE UNIVERSITY, ILARA-MOKIN,
ONDO STATE, NIGERIA

DEPARTMENT OF MECHANICAL ENGINEERING

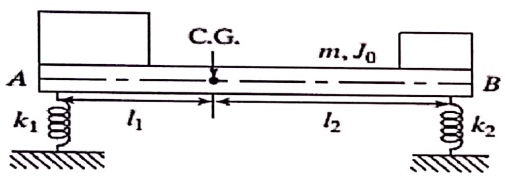
FIRST SEMESTER EXAMINATIONS
2019/2020 ACADEMIC SESSION

COURSE: MEE 403 – Mechanical Vibration (3 Units)
CLASS: 400 Level Mechanical & Automotive Engineering
TIME ALLOWED: 3 Hours
INSTRUCTIONS: Answer Any Five (5) Questions. Date: February, 2020

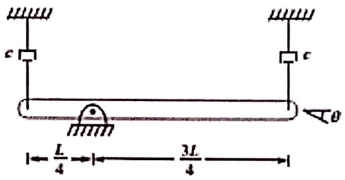
HOD'S SIGNATURE

Question 1

a) What is vibration? Give three practical examples
b) Identify the number of degrees of freedom (DoF) for the following systems



(i)



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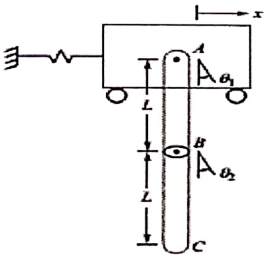

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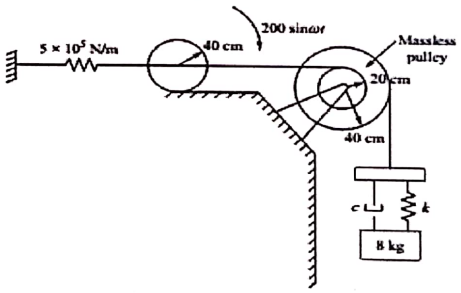

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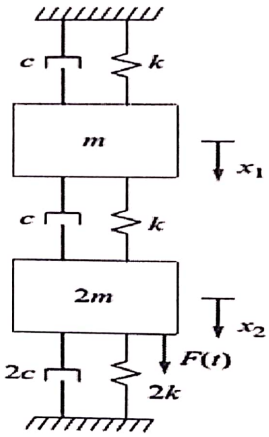

(v)

Question 2

If the system shown in Fig Q2 is critically damped, write out the governing equation and determine the damping coefficient c.

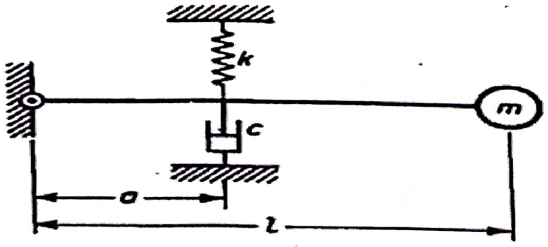

Fig. Q2

Question 3

A 20 kg cart rolls on a flat, horizontal surface as shown in Fig. Q3. The cart is pulled 10 m to the right and released with a velocity of 15 m/s to the left at t = 0. If the spring constant k = 800N/m and the damping coefficient c is 400N.s/m, determine the response of the system and the displacement after 4s.

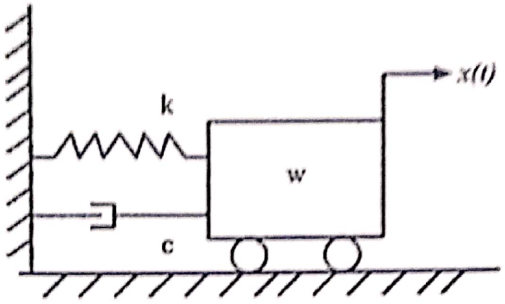

Fig. Q3

Question 4

The parameters of a single-degree-of-freedom system shown in Fig. Q4 are given by m = 4 kg, c = 15 N.s/m, and k = 64 N/m. Find the response of the system for the following initial conditions, x(0) = 0.1 and v(0) = 2m/s

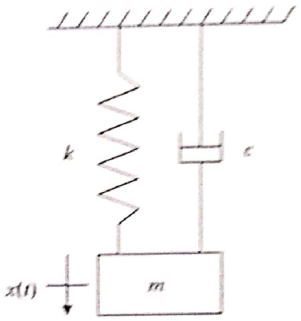

Fig. Q4

Question 5

A suspension system is modelled by the equation $200\ddot{x} + 400\dot{x} + 16000 = 0$, find the natural frequency ω_n and the damping ratio ζ .Comment on the system behaviour.

Question 6

Consider the forced response of an internal combustion engine modeled according to the diagram shown in Fig. Q6. The stiffness k = 7000 N/m and the damping coefficient c = 320N.s/m. If the 20 kg eccentric mass m is located from the centerline by 1.5 m and the entire engine structure weighs 2500 kg, find the magnification of the system if the frequency of vibration is to be limited to 0.95 Hz.

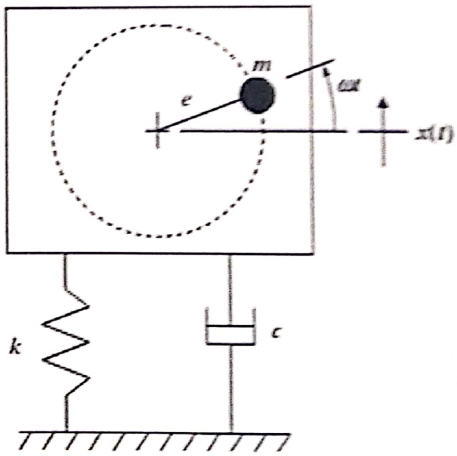

Fig. Q6

Question 7

Determine the displacement, velocity, and acceleration of the mass of a spring-mass system with k = 500 N/m, m = 2 kg, x_0 = 0.1 m, and v_0 = 5m/s