Ministry of Higher Education
& Scientific Research
Tikrit University
College of Engineering
Mechanical Engineering Dept.

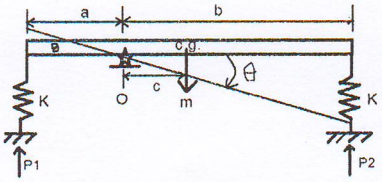
جامعة تكريت

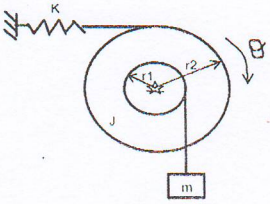
Final Exam
2015-2016

Class : 4th Class
Subject: Vibration.
Time: Three Hours
Date : 25 / 5 / 2016
Form: (3)

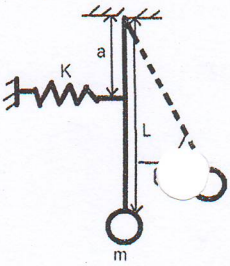
Q.1: Select the right answer and solution causes (choose 2 branches only) (25Mark)

A- 1. $\omega n = \sqrt{\frac{k(a^2+c^2)}{Jo}}$ 2. $\omega n = \sqrt{\frac{Jo}{k(a^2+c^2)}}$ 3. $\omega n = \sqrt{\frac{k(a^2+b^2)}{Jo}}$





B- 1. $\omega n = \sqrt{\frac{kr^2{}_2}{J+mr^2{}_1}}$ 2. $\omega n = \sqrt{\frac{kr^2{}_1}{J+mr^2{}_2}}$ 3. $\omega n = \sqrt{\frac{k(r^2{}_1+r^2{}_2)}{J+mr^2{}_2}}$



C- 1. $\omega n = \sqrt{\frac{mga+mL^2}{ka^2}}$ 2. $\omega n = \sqrt{\frac{mgL+ka^2}{mL^2}}$ 3. $\omega n = \sqrt{\frac{mL^2}{mgL+ka^2}}$

Q.2: Drive the system equation of motion, its natural frequency and find the time response of system shown in fig. (2), if d=1 Cm, L=25 Cm, R=7 Cm, K=500 N/m, C=5*103 N.s/m, the shaft material has modulus of rigidity G=0.8x1011 N/m^2 and polar mass moment of inertia of the disk I=0.04 Kg. m^2 , (initial velocity $\dot{\theta}_0$=5 rad/Sec, initial rotation θ_0 =0)

(25 Mark)

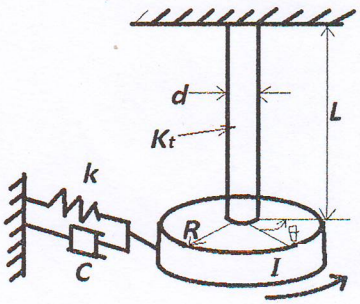


Fig. 2

Q.3: An electric motor of mass M, mounted on an elastic foundation, is found to vibrate with a deflection of 0.15 m at resonance (Fig. 3). It is known that the unbalanced mas s of the motor is 8% of the mass of the rotor due to manufacturing tolerances used, and the damping ratio of the foundation is ζ=0.025. Determine the following:

a. the eccentricity or radial location of the unbalanced mass (e),

b. the peak deflection of the motor when the frequency ratio varies from resonance , $r_{max} = (\omega/\omega_n)_{max} = 1/(1-2\zeta^2)^{1/2}$

c. the additional mass to be added uniformly to the motor if the deflection of the motor at resonance is to be reduced to 0.1 m.

(Assume that the eccentric mass remains unaltered when the additional mass added to the motor.) (25 Mark)

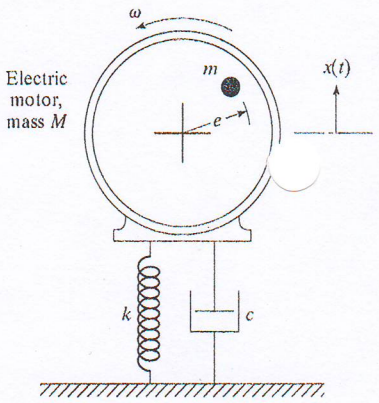


Fig. 3

Q.4.Find the steady state response, natural frequencies and mode shapes of the system shown in fig.(4), when m2 excited by a force(F=200 $e^{i\omega t}$) and $m_1=m_2=m$ =10kg, k_1 =250 N/m, k_2=200 N/m, C_1=120 N.s/m ,C_2=100 N.s/m . Assume harmonic solution. (25 Marks)

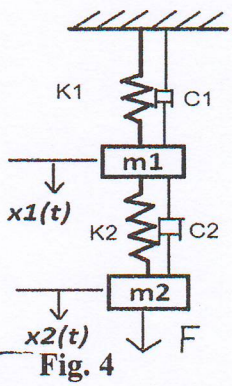


Fig. 4

Good Luck

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