TE - sem. VI - Old - Mechanical

MV

21/12/15

(OLD COURSE) **QP Code : 1953**

(4 Hours) **[Total Marks : 100**

Instructions: 1) Question *No. 1* is compulsory.
2) Answer any ***four*** from the remaining six questions.
3) Use your judgment for unspecified data, if any.

Q.1 Answer any ***four*** of the following: (4 x 5 =20)

i) Explain dry friction or coulomb damping, Damping factor, damping coefficient and critical damping coefficient.
ii) What is logarithmic decrement and derive an expression for it ?.
iii) Define following terms:
a) Coupled and uncoupled differential equations.
b) Mode shapes.
iv)Explain the following terms:
a) Vibration isolation
b) Force transmissibility
v) What do you mean by critical speed of shaft ?. State its significance.
vi) What do you mean by balancing ?. Why it is necessary for high speed engines?.

Q 2 a) Find the natural frequency of oscillation for the roller rolling on horizontal surface without slipping, as shown in figure 1. The mass of roller is 5 kg, radius of roller is 50 mm and stiffness of ring is 2000 N/m. What would be the frequency of oscillation, if radius of roller is made 100 mm without changing the mass?. (10)

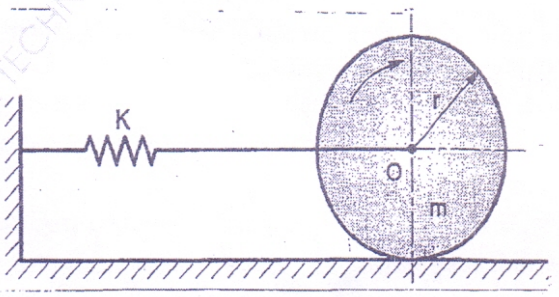

Figure 1.

b)Determine the natural frequency of vibration of a system shown in figure 2. (10)

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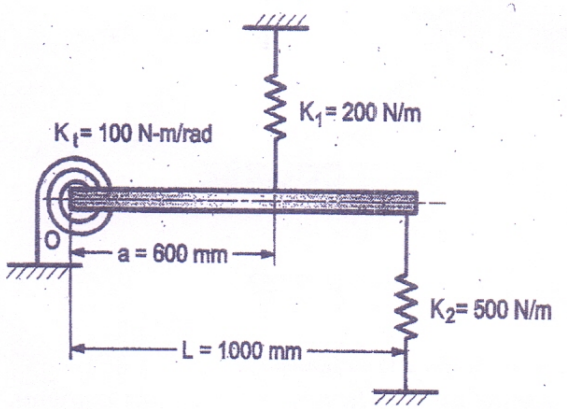

Figure 2

Q.3 a) A door along with door-closing system shown in figure 3, has a moment of inertia of 25 kg-m^2 about the hinge axis. If the stiffness of torsional spring is 20 N-m/rad, find the most suitable value of the damping coefficient. (10)

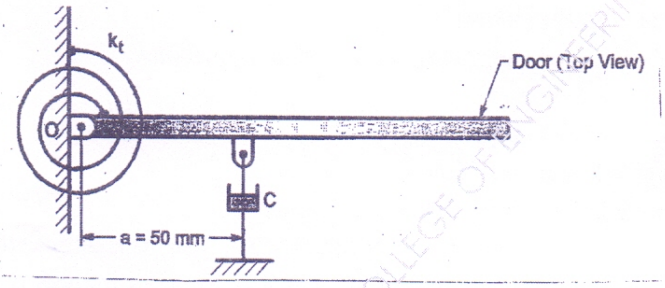

Figure 3

b) A mass placed on rough surface is attached to a spring and is given an initial displacement of 95 mm from its equilibrium position. After completing five cycles of oscillations in 2 sec, the final position of the mass is found to be 8 mm from its equilibrium position. Find the coefficient of friction between the surface and the mass. (10)

Q.4 a) Derive the equation of motion for the system shown in figure 4 by using Lagrange's equation if $K_1 = K_2 = K_3 = 1$ and $m_1 = m_2 = 1$ (10)

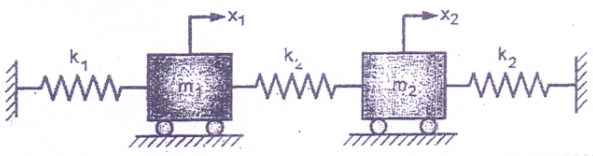

Figure 4

b) Find the lowest natural frequency of transverse vibration for the system shown in figure 5 by Rayleigh's method. Take E= 2.01 x 10^{11} N/m^2, I=10^{-6} m^4. (10)

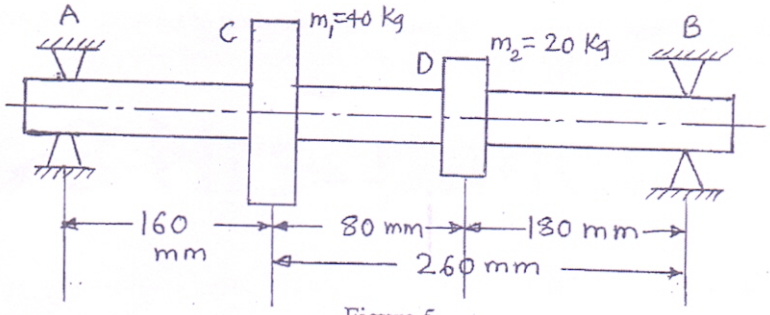

Figure 5.

Q.5 a) A machine part weighing 20 N vibrates in a viscous medium. Determine the damping coefficient when a harmonic exciting force of 25 N results in a resonant amplitude of 0.01 m with a period of 0.2 sec. if the same system is excited by a harmonic force of frequency 4 Hz. What will be the percentage increase in the amplitude of forced vibration when the dash pot is removed. (10)

b) A seismic instrument is mounted on machine at 1200 rpm. The natural frequency of seismic instrument is 18 rad/s. The instrument records relative amplitude of 0.5 mm. Compute displacement, velocity and acceleration of machine. Damping of seismic instrument is neglected. (10)

Q.6 a) An instrument panel of an aircraft is mounted on isolators. The isolator has a negligible damping and it deflects 5 mm under the weight of28 kg. Find the percentage of motion transmitted to the instrument board, if the vibration of the aircraft is at 2500 rpm. (10)

b) A rotor has a mass of 15 kg and is mounted on a 25 mm diameter horizontal shaft supported at its ends by two ball bearings. The bearings are 1 m apart. The shaft rotates at 2400 rpm. If the center of mass of rotor is 0.11 mm away from the geometric axis of the rotor, due to manufacturing defects, find the amplitude of the steady state vibrations and the dynamic force transmitted to the bearings. Assume E=200 GN/m^2. (10)

Q.7 a) Four masses A,B,C and Dare completely balanced. Masses C and D makes angles of 90^0 and 195^0 respectively with B in the same sense. The masses have following properties:

m_A = magnitude of mass A
m_B = 25 kg
m_C = 40 kg
m_D = 35 kg

r_A = 150 mm 0.15 m
r_B = 200 mm =0.2 m
r_C = 100 mm = 0.1 m
r_D = 180 mm =0.18 m

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Planes B and C are 250 apart. Determine a) the mass A and its angular position b) the position of planes A and D. (12)

b)What do you understand by primary and secondary balancing of reciprocating masses ?. Explain partial balancing of reciprocating engine. (8)

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Correction:

It is 3 Hrs. paper

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