Total No. of Questions : 6]

SEAT No. :

P62

[Total No. of Pages : 3

OCT. -16/BE/Insem. - 116
B.E. (Mechanical)
DYNAMICS OF MACHINERY
(2012 Course) (402043) (Semester - I)

Time : 1Hour] ***[Max. Marks :30***

Instructions to the candidates:

1) ***Answer Q. 1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of Nonprogrammable Calculator is allowed.***
5) ***Assume Suitable data if necessary.***

Q1) A shaft carries four masses in parallel planes A, B, C and D. The masses at B and C are 18kg and 12.5kg respectively and each has an eccentricity of 60 mm. The masses at A and D have an eccentricity of 80mm. The angle between B and C is 100° and that between the masses B and A is 90° measured in the same direction. The axial distance between the planes A and B is 100 mm and that between B and C is 200 mm. If the shaft is in complete dynamic balance, Determine: **[10]**

a) Masses at planes A and D.

b) Distance between the planes A and D.

c) Angular position of the mass at D.

OR

Q2) The cranks of a four cylinder marine oil engine are arranged at angular intervals of 90°. The engine speed is 70 rpm and the reciprocating mass per cylinder is 800 kg. The inner cranks are 1m apart and are symmetrically arranged between the outer cranks which are 2.6 m apart. Each crank is 400 mm long. Draw the primary force and couple polygon for the firing order 1-4-2-3 and comment on balancing. **[10]**

Q3) a) A circular cylinder of mass m and radius r is connected by a spring of stiffness k on an inclined plane as shown in Fig. Q.3(a). If it is free to roll on the rough surface which is horizontal without slipping, determine its natural frequency. **[4]**

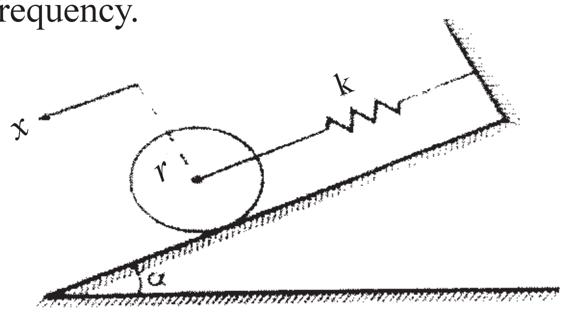

Fig. Q.3(a)

b) An under damped shock absorber is to be designed for a motor cycle of mass 200 kg such that during a road bump, the damped period of vibration is limited to 2 sec. and the amplitude of vibration should reduce to one-sixteenth in one cycle. Find the necessary stiffness and damping coefficient of the shock absorber. **[6]**

OR

Q4) a) Derive equation of motion for the system shown in Fig. Q.4(a). If m = 1.5kg, k = 4900N/m, a=6 cm and b = 14 cm, determine the value of C for which the system is critically damped. **[5]**

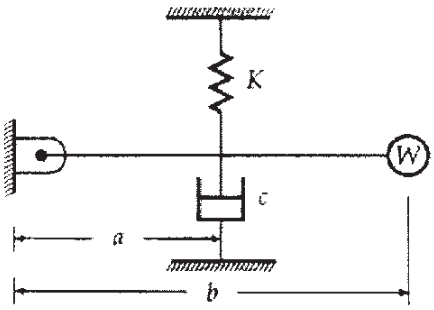

Fig.Q.4(a)

b) A vibrating system is defined by the following parameters: m = 3 kg, k = 100 N/m, C = 3 N-sec/m. Determine: **[5]**

i) Damping factor,

ii) Natural frequency of damped vibration,

iii) Logarithmic decrement,

iv) Ratio of two consecutive amplitudes and

v) Number of cycles after which the original amplitude is reduced to 20 percent.

Q5) a) A system having rotating unbalance has total mass of 25 kg. The unbalanced mass of 1 kg rotates with a radius 0.04 m. It has been observed that at a speed of 1000 rpm, the system and eccentric mass have a phase difference of 90 degrees and the corresponding amplitude is 0.015 m. Find out: **[4]**

i) Natural frequency of the system.

ii) Damping factor.

iii) Amplitude at 1500 rpm.

iv) Phase angle at 1500 rpm.

b) An automobile, weighing 9.8 kN when fully loaded and 2.45 kN when empty, vibrates in a vertical direction while travelling at 96 km/hr on a rough road having a sinusoidal wave form with an amplitude Y and wavelength 4.88 m. Assuming that the automobile can be modeled as a single degree-of-freedom system with stiffness 350 kN/m and the damping factor 0.5. Determine the amplitude ratio of the vehicle when fully loaded and when empty. **[6]**

OR

Q6) a) A spring-mass-damper system is subjected to a harmonic force. The amplitude is found to be 0.02 m at resonance and 0.01 m at a frequency 0.75 times the resonant frequency. Find the damping ratio of the system. **[4]**

b) A machine part of mass 4 kg vibrates in a viscous fluid. Find the damping coefficient when a harmonic exciting force of 50 N results in resonant amplitude of 250 mm with a period of 0.4 sec. If the excitation frequency is 2 Hz, find the percentage increase in the amplitude of forced vibration when the damper is removed. **[6]**

☛ ☛ ☛