Total No. of Questions : 10] SEAT No. :

P1956 [Total No. of Pages : 5

[5059]-533
B.E. (Mechanical)
DYNAMICS OF MACHINERY
(2012 Pattern) (End Semester)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:-

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Use of electronic calculator is allowed.***
4) ***Assume suitable data, if necessary.***

Q1) a) A four cylinder vertical engine has cranks 150 mm long. The cylinders are spaced 200 mm apart. Mass of reciprocating parts of 1st, 2nd and 4th cylinders are 50 kg, 60 kg and 50 kg respectively. Find the reciprocating mass of the 3rd cylinder and relative angular positions of the cranks to achieve complete primary balance. **[6]**

b) Determine the expression for natural frequency of the system shown in Fig.1 **[4]**

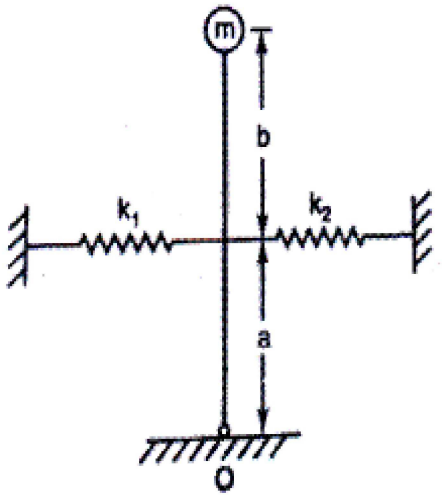

Fig. 1 (Q. 1b)

OR

P.T.O.

Q2) a) A shock absorber is to be designed so that its overshoot is 10% of the initial displacement when released. Determine the damping factor. Also find the overshoot if the damping factor is reduced to 50%. **[6]**

b) Explain the terms Static Balancing and Dynamic Balancing. **[4]**

Q3) a) A single cylinder vertical petrol engine of total mass 320 kg is mounted on a steel chassis and causes a vertical static deflection of 2 mm. The reciprocating parts of the engine have a mass of 24 kg and move through a vertical stroke of 150 mm with SHM. A dashpot attached to the system offers a resistance of 490 N at a velocity of 0.3 m/s. Determine :

i) the speed of driving shaft at resonance

ii) the amplitude of steady state vibrations when the driving shaft of the engine rotates at 480 rpm. **[6]**

b) Define the following terms : **[4]**

i) Damping coefficient

ii) Critical damping coefficient

iii) Damping factor

iv) Logarithmic decrement

OR

Q4) a) A horizontal spring mass system with coulomb damping has a mass of 5 kg attached to a spring of stiffness 980 N/m. If the coefficient of friction is 0.25, calculate : **[6]**

i) The frequency of free oscillations

ii) The number of cycles corresponding to 50% reduction in amplitude if the initial amplitude is 5 cm

iii) Time taken to achieve this 50% reduction

b) Write a short note on Forced vibrations due to reciprocating unbalance. **[4]**

Q5) a) Find the natural frequencies of the system shown in Fig. 2. **[12]**

m_1 =10 kg, m_2 = 12 kg

r_1 = 0.10 m, r_2= 0.11 m

k_1= 40 × 10^3 N/m

k_2 = 50 × 10^3N/m

k_3 = 60 × 10^3 N/m.

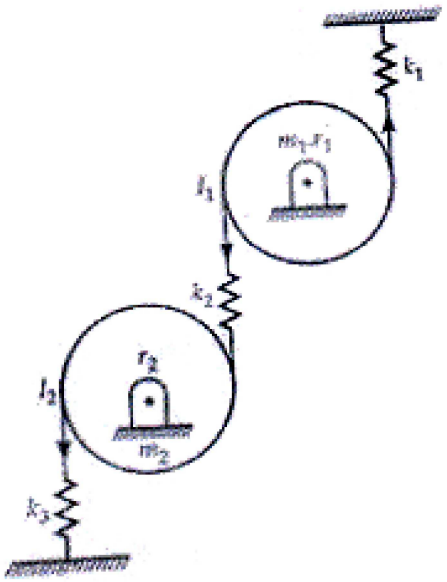

Fig. 2 (Q. 5 a)

b) Define the following terms : **[4]**

i) Zero frequency

ii) Node point

OR

Q6) a) Find the natural frequencies and mode shapes for the torsional system shown in Fig. 3. Assume $J_1 = J_0$, $J_2 = 2J_0$ and stiffness for each spring as k_t. **[12]**

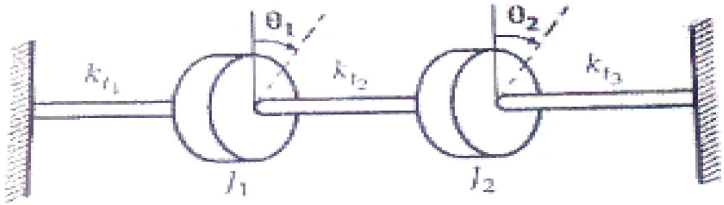

Fig. 3 (Q. 6a)

b) Explain the concept of torsionally equivalent shaft. **[4]**

Q7) a) An accelerometer has a suspended mass of 0.01 kg with a damped natural frequency of vibration of 150 Hz. It is mounted on an engine running at 6000 rpm and undergoes an acceleration of 1 g. The instrument records an acceleration of 9.5 m/s^2. Find the damping constant and the spring stiffness of the accelerometer. **[8]**

b) Write a short note on prediction of vibration failure using time and frequency domain analysis of vibration signals. **[8]**

OR

Q8) a) For finding vibration parameters of a machine running at 260 rpm, a seismic instrument is used. The natural frequency of the instrument is 7 Hz and the recorded displacement is 6 mm. Determine the displacement, velocity and acceleration of the vibrating machine assuming no damping. **[8]**

b) Write a short note on : **[8]**

i) FFT analyzer

ii) Condition monitoring of machines

Q9) a) Determine the sound power level of a source generating **[8]**

i) 0.5 W

ii) 1.5 W

iii) 2.2 W

iv) 3 W of sound power

b) Explain the following terms : **[10]**

i) Wavelength

ii) Velocity of sound

iii) Decibel scale

iv) Sound power level

v) Sound pressure level

OR

Q10) a) Define the following terms : **[6]**

i) Reflection coefficient

ii) Absorption coefficient

iii) Transmission coefficient

b) Draw and explain the main components of human hearing mechanism. **[6]**

c) Show that if the sound pressure is doubled, the sound pressure level increases by six decibels. **[6]**