Total No. of Questions : 10]

SEAT No. :

P3045

[Total No. of Pages : 4

[5354]-533

B.E. (Mechanical)

DYNAMICS OF MACHINERY

(2012 Pattern)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

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

Q1) a) The length of each connecting rod of a 60° V- engine is 220 mm and the stroke is 100 mm, The mass of reciprocating parts is 1.2 Kg per cylinder and the crank speed is 2400 rpm. Find the values of the primary forces and comment on the balancing of the engine. **[6]**

b) Obtain an expression for stiffness and natural frequency of a cantilever beam with cross section 'B x D' and length L' subjected to a transverse force of'F' Newton's at free end. **[4]**

OR

Q2) a) In a single degree freedom viscously damped vibrating system, the suspended mass of 20 Kg makes 50 oscillations in 20 seconds. The amplitude of natural vibrations decreases to one fourth of the initial value after 4 oscillations. **[6]**

Determine -.

i) The logarithmic decrement.

ii) Damping factor

iii) Damping coefficient.

b) Explain concept of Primary and Secondary forces in Reciprocating Engines. **[4]**

P.T.O.

Q3) a) A machine having a mass of 100 kg is mounted on the springs and damper. The total stiffness of the springs is 7.84×10^5 N/m while the damping ratio of the damper is 0.2. A vertical harmonic force F = 392 sin (314.15t) N acts on the machine, for the steady state vibrations of the system. **[6]**

Determine:

i) The amplitude of vibration of the machine.

ii) The transmissibility

iii) The transmitted force.

b) Plot vibration response of a single degree freedom system for following damped vibration conditions- **[4]**

i) Critically damped system

ii) Under-damped system.

OR

Q4) a) Explain with neat sketch, effect of damping on magnification factor for different forcing frequencies & hence justify that dynamic systems are to be operated at high speed as is possible. **[4]**

b) Explain what do you mean by whirling of shaft ? And Obtain expression for excessive transverse vibrations of a simply supported shaft rotating at N rpm with a rotor of mass m' having eccentricity 'e'. **[6]**

Q5) a) Find the natural frequencies and mode shapes of a spring-mass system, shown in Fig. 1, which is constrained to move in the vertical direction only. Take $n = 1$ **[12]**

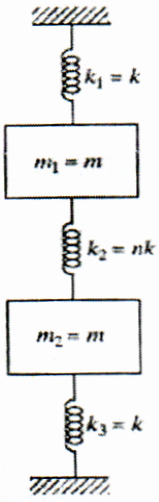

Fig. 1. Q 5) a)

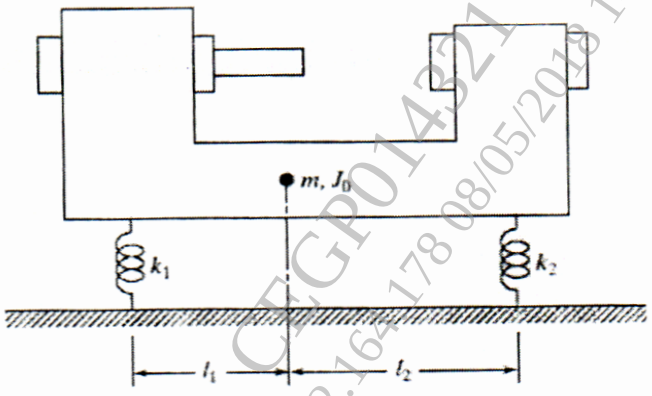

Fig. 2. Q 6) a)

b) For a semi definite two rotor system, draw the mode shapes for zero frequency and second mode frequency. **[4]**

OR

Q6) a) A machine tool, having a mass of m = 1000 kg and a mass moment of inertia of J_o = 300 Kg m^2, is supported on elastic supports, as shown in Fig. 2, if the stiffness of the supports are given by k_1 = 3000 N/mm and k_2 = 2000 N/mm, and the supports are located at l_1 = 0.5 m and l_2 = 0.8m. find the natural frequencies and mode shapes of the machine tool. **[12]**

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

Q7) a) A vibration measuring instrument is used to find the displacement, velocity and acceleration of a machine running at 120 rpm. If the natural frequency of the instrument is 5 Hz and it records the displacement 0.004 cm, What are the three readings? Assume no damping. **[8]**

b) Explain vibration Isolation, sketch Transmissibility curve and discuss Isolation region on curve. **[8]**

OR

Q8) a) An exhaust fan, rotating at 1000 rpm, is to be supported by four springs, each having a stiffness of K. If only 10 percent of the unbalanced force of the fan is to be transmitted to the base, what should be the value of K? Assume the mass of the exhaust fan to be 40 kg. **[8]**

b) Explain in details: **[8]**

i) Active vibration control

ii) FFT analyzer

Q9) a) If two machines are producing 80 dB each what will be the overall sound pressure level? Derive the equation you use. **[6]**

b) Determine different levels **[6]**

i) sound pressure level, if rms sound pressure is 1 Pa,

ii) Sound intensity level, if sound intensity is 1 W / m^2 and

iii) Sound Power level of a source generating 1 W of Sound Power.

c) Explain the following terms:- **[6]**

i) Reflection coefficient

ii) Absorption coefficient

iii) Transmission coefficient

OR

Q10)a) Explain different sound fields for sound measurements? **[6]**

b) Prove that 'Doubling the distance from point of source reduces sound intensity level by 6 dB' **[6]**

c) Write Short notes on: - **[6]**

i) Octave Bands

ii) Pass-by-noise