

Total No. of Questions : 10]

SEAT No. :

P3878

[5561]-534

[Total No. of Pages : 3

B.E. (Mechanical)

DYNAMICS OF MACHINERY

(2015 Course) (402043) (Semester - I)

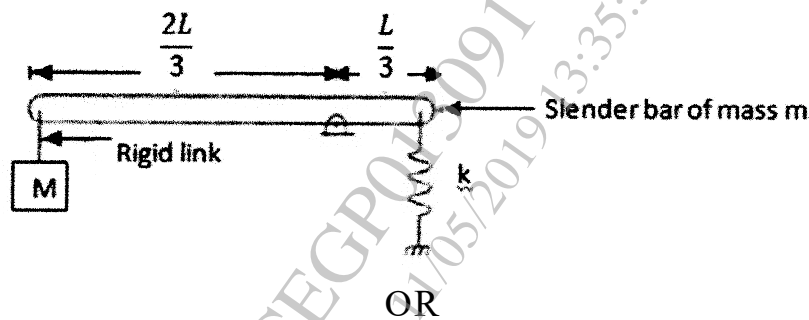
Time : 2½ Hours]

[Max. Marks : 70

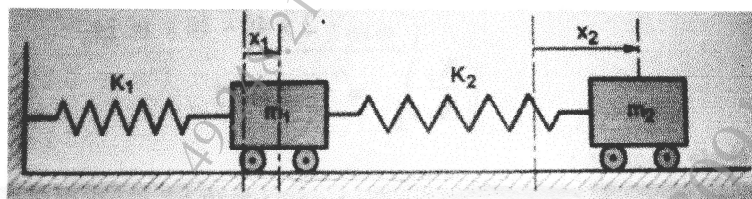
Instructions to the candidates:

- 1) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.
- 2) Draw neat diagrams wherever necessary.
- 3) Use of scientific calculator is allowed.
- 4) Assume suitable data, wherever necessary.
- 5) Figures to the right indicate full marks.

Q1) What is natural frequency? Determine natural frequency of the system shown in following fig. **[10]**



Q2) a) What is 2 DOF systems? Write governing differential equations for system given below **[5]**



b) What is damping factor? Draw and explain displacement-time curves for over damped system, critically damped and under damped vibratory system. **[5]**

Q3) a) Explain Torsionally equivalent shaft with respect to 2 DOF free vibration. **[5]**

P.T.O.

- b) A 45 kg machine is mounted on four parallel springs each of stiffness 2×10^5 N/m. When the machine operates at 32 Hz, the machine's steady-state amplitude is measured as 1.5 mm. What is the magnitude of the excitation force provided to the machine at this speed? [5]

OR

- Q4)** a) What is Coulomb Damping? Show that the loss of amplitude per cycle is given by $4F/k$. [5]
b) Explain with neat diagram mathematical model of a motorbike. [5]

- Q5)** a) A rotating shaft carries three unbalanced masses of 4 kg, 3 kg and 2.5 kg at radial distances of 75 mm, 85 mm and 50 mm and at the angular positions of 45° , 135° and 240° respectively. The second and the third masses are in the planes at 200 mm and 375 mm from the plane of the 1st mass. The angular positions are measured counter clockwise from the reference line along x axis and viewing the shaft from the first mass end. The shaft length is 800 mm between bearings and the distance between the plane of 1st mass and the bearing at that end is 225 mm. Determine the amount of counter masses in plane at 75 mm from the bearings for the complete balance of the shaft. The first counter mass is to be in a plane between the first mass and the bearing at a radius 75 mm. The second mass is in a plane between the third mass and the bearing at that end at a radius 40 mm. [14]
b) State and explain condition for static and dynamic balancing. [4]

OR

- Q6)** a) Each crank and the connecting rod of a six cylinder four stroke in line engine are 60 mm and 240 mm respectively. The pitch distances between the cylinder centre lines are 80 mm, 80 mm, 100 mm, 80 mm and 80 mm respectively. The reciprocating mass of each cylinder is 1.4 kg. The engine speed is 1000 rpm. Determine the out of balance primary and secondary forces and couples on the engine, if the firing order be 1-4-2-6-3-5. Take a plane midway between the cylinders 3 and 4 as the reference plane. [14]
b) Explain the need of balancing. [4]

- Q7)** a) Explain the working principle of seismic instrument. Discuss the response curve and variation of phase angle with frequency ratio. [6]
b) In a seismic instrument if mass $m = 0.1$ kg, stiffness of spring, $K = 1$ N/mm and damping ratio as 0.5, determine the amplitude of recorded motion if the motion of the vibrating body is $3\sin 200t$ (mm). [6]
c) What are vibration exciters? Explain any one exciter. [4]

OR

- Q8)** a) Explain working of Magneto-Rheological dampers with neat sketch and application. [6]
- b) A device used to measure torsional acceleration consists of a ring having a moment of inertia of 0.049 kg-m^2 connected to a shaft by a spiral spring having a scale of 0.98 N-s/rad and a viscous damper having a constant of 0.11 N-m-s/rad . When the shaft vibrates with a frequency of 15 cpm , the relative amplitude between the ring and the shaft is found to be 2° , what is the maximum acceleration of the shaft? [6]
- c) Explain the working principle of accelerometer. [4]
- Q9)** a) Explain the working of sound level meter with neat diagram. [6]
- b) An operator in textile mill is operating six machines. The sound pressure levels of the machines at his position are 60 dB , 56 dB , 62 dB , 53 dB , 51 dB and 54 dB respectively. What is the total noise level when [6]
- i) All machine are working.
- ii) First and second are not working.
- c) Define following term and write expression for it. [4]
- i) Sound power level.
- ii) Sound pressure level.
- OR
- Q10)** a) Explain acoustic material & its characteristics. [6]
- b) Explain following terms [6]
- i) Sound reflection coefficient.
- ii) Sound absorption coefficient.
- iii) Sound transmission coefficient.
- c) Determine the sound power level of a source that generate a sound power of [4]
- i) 1.0 W .
- ii) 3.0 W .

