

[5461]-523

B.E. (Mechanical)

Dynamics of Machinery (402043)
(2015 Course) (Semester-I) (End Sem.)

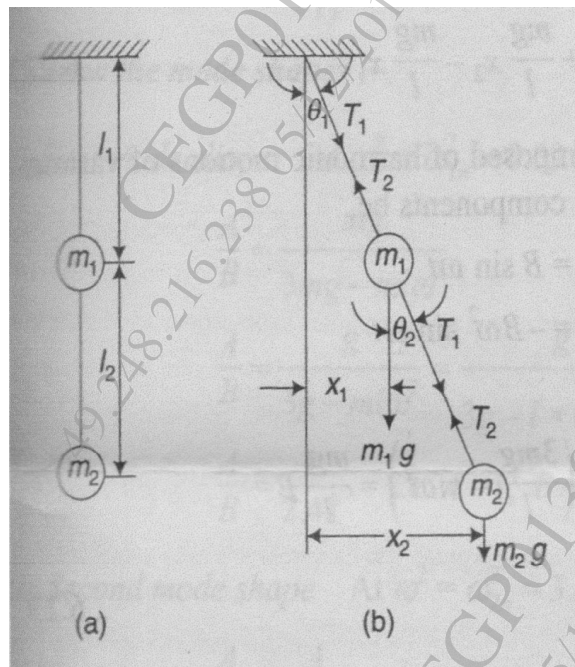
Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Solve 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 where ever necessary.
- 5) Figures to the right indicate full marks.

Q1) Find the natural frequency of oscillations of the double pendulum as shown in following fig. where $m_1 = m_2 = m$ and $l_1 = l_2 = l$. Draw mode shapes and locate the nodes for each mode of vibration. [10]



OR

Q2) a) Explain frequency response curve with neat labeled diagram.

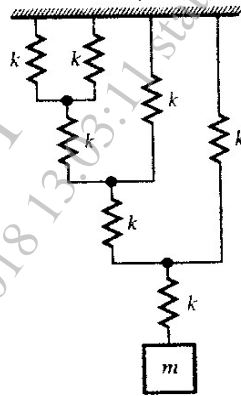
[5]

P.T.O.

- b) Find the natural frequency of the system shown in following fig.

Take $K = 2 \times 10^5 \text{ N/m}$ and $m = 20 \text{ kg}$.

[5]



- Q3)** The static deflection of an automobile on its springs is 100 mm. Find the critical speed when the automobile is travelling on a road, which can be approximated by a sine wave of amplitude 80 mm and a wavelength of 16 m. Assume the damping to be given by (damping ratio : 0.05) also determine the amplitude of vibration at 75 km/hr.

[10]

OR

- Q4) a)** Explain following terms: [4]
 i) Zero frequency deflection
 ii) Node point
 b) A body of mass 5 kg is supported on a spring of stiffness 1960 N/m and has a dashpot connected to it which produces a resistance of 1.96 N at a velocity of 1 m/sec. In what ratio will the amplitude of vibration be reduced after 5 cycles. [6]

- 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) Explain direct and reverse crank method with neat diagram. [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, 80mm 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)** Why single cylinder engine cannot be completely balanced? [4]

- Q7) a)** Explain condition monitoring of machines. Explain different techniques for it. [6]
- b)** A seismic instrument is used to find the displacement, velocity and acceleration of a machine running at 250 rpm. If the natural frequency of instrument is 5 Hz and it records the displacement 5 mm, find the displacement, velocity and acceleration of vibrating machine assuming no damping. [6]
- c)** Explain the working of FFT Analyzer. [4]

OR

- Q8) a)** Explain working of Magneto - Rheological dampers with neat sketch and application. [6]
- b)** A vibrometer with a natural frequency of 2 Hz and with negligible damping is attached to a vibrating system which performs a harmonic excitation. Assuming the difference between the maximum and minimum recorded values are 0.6 mm determine the amplitude of motion of the vibrating system when its frequency is 20 Hz and 4 Hz. [6]
- c)** Explain ISO standards used in vibration. [4]
- Q9) a)** Show that if the sound pressure is doubled, then the sound pressure level increases by almost 6 dB. [6]
- b)** State and explain various types of sound fields? [6]
- c)** Noise at the construction site is contributed by a few construction activities such as Piling work: 104 dB, Scraper : 93 dB, Bulldozer : 94 dB, Mobile compressor: 73 dB and Machanical Shovel: 76 dB on A weighing network. What is the overall sound pressure level? [4]

OR

- Q10) a)** Explain acoustic material & its characteristics. [6]
- b)** Explain in brief various sources of noise and how to control the same. [6]
- c)** Determine the sound pressure level of a source that generate a following rms sound pressure. [4]
- i) 1.7 N/m^2
- ii) 0.7 Pa

