

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2535 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. VI) THEORY EXAMINATION 2011–12

MECHANICAL VIBRATIONS

Time : 2 Hours *Total Marks : 50*

Note :– (i) Attempt **all** questions.

(ii) Assume any missing data suitably.

(iii) Be precise in your answer.

1. Attempt any **two** parts of the following :– **(7×2=14)**

(a) Discuss the various sources of vibration excitations in a machine.

(b) Explain the exponential representation of harmonic motion. Add the following harmonic motions :

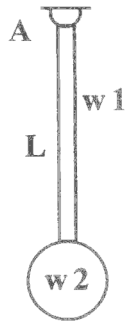
$x_1 = 4 \cos (wt + 10°)$

$x_2 = 6 \sin(wt + 60°)$

(c) Develop the Fourier series for the following periodic function : $x(t) = \begin{cases} -\frac{1}{2} \text{ for } -\pi < x < 0 \\ \frac{1}{2} \text{ for } 0 < x < \pi \end{cases}$

2. Attempt any two parts of the following : (6×2=12)

(a) Figure shows a pendulum where the weight of connecting rod is w1 and weight of pendulum is w2. Determine natural frequency and period of small oscillation.



(b) Discuss the following with respect to a forced vibration with damping :

(i) Magnification factor

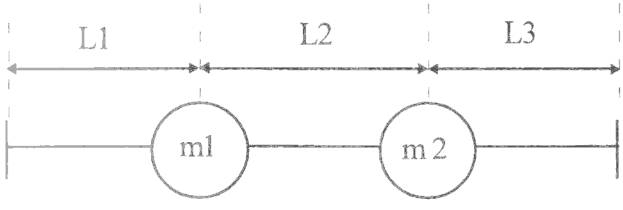
(ii) Phase angle v/s frequency ratio

(iii) Maximum amplitude

(c) Explain the forced vibration due to support action. Differentiate between absolute and relative amplitude. Also find the energy dissipated by damping in forced vibration.

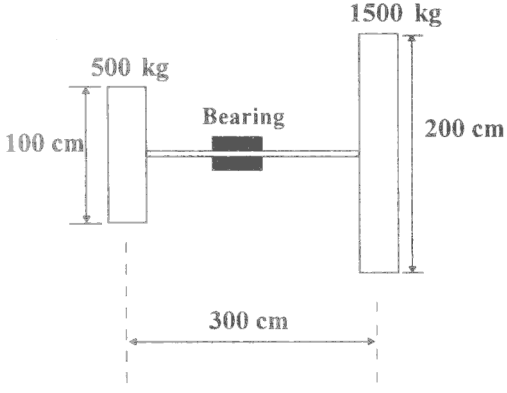
3. Attempt any **two** parts of the following : **(6×2=12)**

(a) Determine the natural frequencies and mode shapes of the given transverse vibration system consisting of two masses fixed on a tightly stretched string as shown in figure. Given $m1 = m2 = m$ *and* $L1 = L2 = L3 = L$.



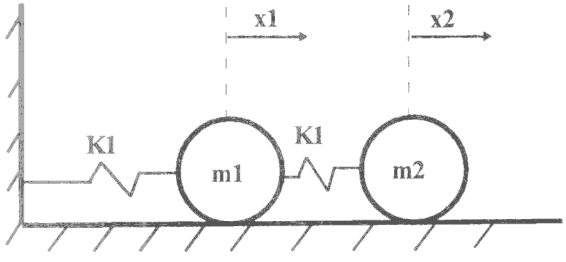
(b) Define principal coordinates. Explain the [illegible] for selection of principal coordinates.

(c) Calculate the natural frequency of torsional vibration of a shaft of diameter 75 mm and 300 cm long carrying two circular discs of uniform thickness at the ends. The discs have masses of 500 kg and 1500 kg and their diameters are 100 cm and 200 cm respectively. Given G = 0.84 GPa.

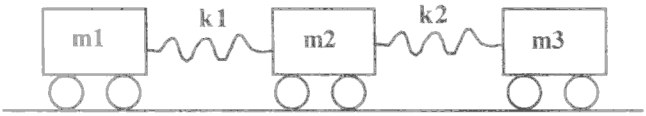


4. Attempt any **two** parts of the following : **(6×2=12)**

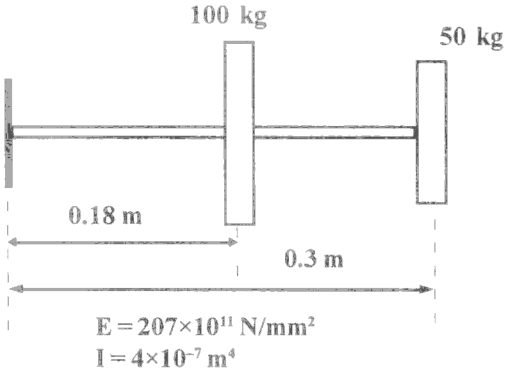
(a) Define stiffness coefficients for a multi degree of freedom system. Determine the stiffness coefficients for a rectilinear system shown in figure.



(b) Find the natural frequencies and mode shapes of the system shown in figure for m1 = m2 = m3 = m and k1 = k2 = k.



(c) Find the natural frequency of the following system by using Stodola method.



(d) A rotor of mass 10 kg is mounted midway on a shaft of 500 mm span and 20 mm diameter in short bearings. The center of gravity of the rotor is 0.02 mm away from geometric center of rotor. If the rotor runs at 1500 rpm find the amplitude and steady state vibration and dynamic load transmitted to the bearing. Take E = 210 GPa.