Printed Pages: 6 **EME-024**

(Following Paper ID and Roll No. to be filled in your Answer Books)	
Paper ID : 140658	**Roll No.**

B.TECH.

Theory Examination (Semester-VI) 2015-16

MECHANICAL VIBRATIONS

Time : 3 Hours ***Max. Marks : 100***

Section-A

1. Attempt all parts. All parts carry equal marks. Write answer of each part in short. (10×2=20)

(a) What is logarithmic decrement?

(b) Explain newton's method for writing the equation of motion for any vibratory system

(c) Write down types of damping (only name)

(d) What is free vibration and forced vibration?

(e) Dynamic vibration absorber is suitable for which type of machines?

(f) Define force transmissibility.

(g) What is the whirling speed of shaft?

(h) What are the reasons for vibration?

(i) What is equivalent stiffness when two springs are connected in parallel?

(j) A harmonic motion has an amplitude of 0.06 m and a frequency of 20 Hz. Find the time period.

Section-B

2. Attempt any five question from this section. (10×5=50)

(a) Split the harmonic motion $x = 10 \text{ Sin } (\omega t+30^0)$ into two harmonic motions one having a phase angle of zero and other of 45^0.

(b) A pendulum consists of a stiff weightless rod of length (L) carrying a mass (m) onits end as shown in fig. 1. Two springs each of stiffness (k) are attached to the rod at a distance (a) from the upper end. Determine the frequency of small oscillations.

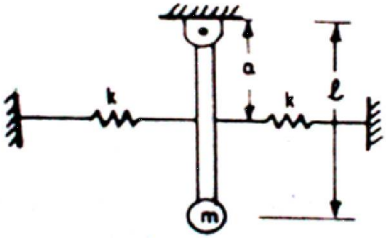

Fig. 1

(c) Derive the expression for the steady state amplitude of a spring-mass-damper single degree of freedom system considering harmonic motion of support (relative motion). Also explain how this amplitude vary with frequency ratio with graph.

(d) A machine 100 kg mass has a 20 kg rotor with 0.5 mm eccentricity. The mounting springs have K = 85 x 10^3 N/m, ε = 0.02. The operating speed of machine is 600 rpm and the unit is constrained to move vertically. Find:

i. The dynamic amplitude of machine

ii. The force transmitted to the supports

(e) Derive the expression for the natural frequencies and mode shape for the system shown in fig.2 for small displacement in the plane of paper. The pendulum rod is stiff and is pivoted at O.

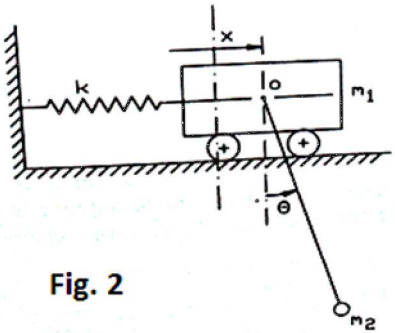

Fig. 2

(f). A sprig-mass-damper single degree of freedom system system is defined by following parameters: m = 3 Kg. k = 100 N/m, c = 3 Ns/m. **Determine:**

i. critical damping constant,

ii. damping ratio,

iii. frequency of damped oscillation,

iv. Logarithmic decrement,

v. No. of cycles after which the initial amplitude is reduced to 20%

(g) Determine the equation for the natural frequencies of a uniform rod in torsional oscillation with one end fixed and the other end free.

(h) Derive the expression for the deflection of a light uniform shaft in case of whirling with a single disc with damping.

SECTION-C

Note:-Attempt any TWO question from this section.

(2×15=30)

3. Using Holzer Method, determine the natural frequencies of the system shown in fig. 3. Take $I_1 = I_2 = I_3 = 1$ and $K_{t1} = K_{t2} = 1$.

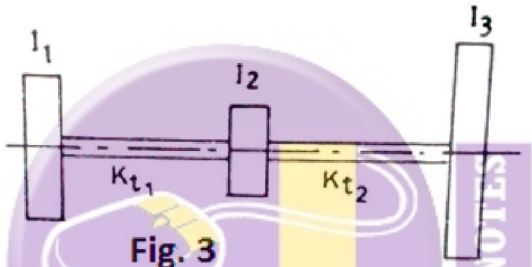

Fig. 3

4. Represent the periodic motion given in Fig. 4 by harmonic series.

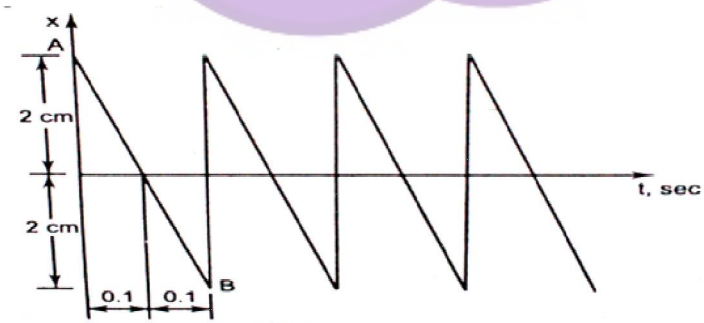

Fig. 4

5. **Write a short note on:**

(a) Stiffness influence coefficients.

(b) Vibrometer.

(c) Vector method of representation of harmonic motion.