Printed Pages: 6 **NME-013**

(Following Paper ID and Roll No. to be filled in your Answer Books)	
Paper ID : 140663	**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. (2×10=20)

(a) What is resonance?

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

(c) In a single degree, damped, forced vibrating system, what is value of magnification factor when the frequency ratio is very low?

(d) On what value of the frequency ratio, vibration isolation is really effective?

(e) Define mode shape of any vibratory system.

(f) Define degree of freedom of any system?

(g) What is damping ratio?

(h) What is value of amplitude at any node section?

(i) What are the basic elements of any vibrating system?

(j) Define secondary critical speed of shaft.

Section-B

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

(a) A body is subjected to two harmonic motions: $x_1 = 15 \text{ Sin } (\omega t + 30^0)$, $x_2 = 8 \text{ Cos } (\omega t + 60^0)$. What harmonic motion should be given to body to bring it to equilibrium?

(b) Determine the natural frequency of the spring-mass-pulley system as shown in fig. 1.

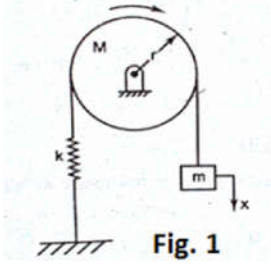

Fig. 1

(c) Derive the equation of motion of a spring-mass-damper single degree of freedom system considering an externally applied force $F = F_0 \sin\omega t$ and viscous damping. Also explain the steady state behavior of this system in detail.

(d) A system having rotating unbalance has total mass of 25 Kg. The unbalanced mass of 1 Kg rotates with a radius 0.04 m. It has been observed that at a speed of 1000 rpm, the system and eccentric mass have a phase difference of 90 degrees and the corresponding amplitude is 0.015 m. Find out:

i. Natural frequency of the system

ii. Damping factor

iii. Amplitude at 1500 rpm

iv. Phase angle at 1500 rpm.

(e) Set up the differential equations of motion for the double pendulum shown in Fig. 2, using the coordinates x_1 and x_2 and assuming small amplitudes. Find the natural frequencies, ratios of amplitude and draw mode shapes if $m_1 = m_2 = m$ and $L_1 = L_2 = L$.

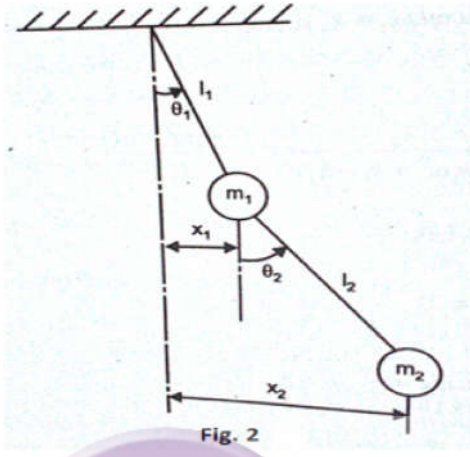

Fig. 2

(f) What is the importance of influence coefficients and set up the stiffness influence coefficients matrix and flexibility influence coefficients matrix for the system shown in fig. 3.

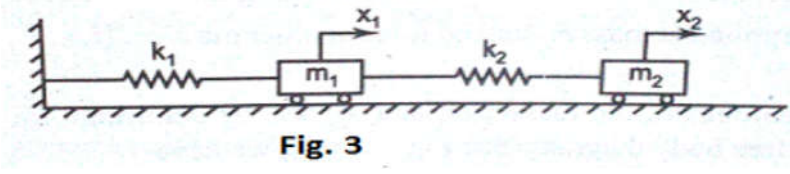

Fig. 3

(g) Derive the frequency equation for longitudinal vibration of a bar with one end fixed and a mass, M attached at the other end.

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

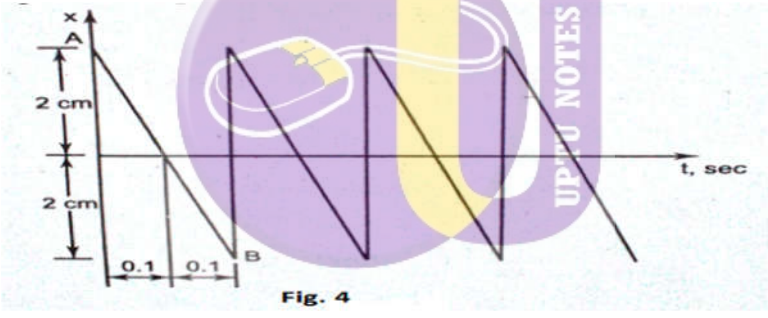

Fig. 4

4. Using Holzer method, determine the natural frequencies of the system shown in Fig. 5.

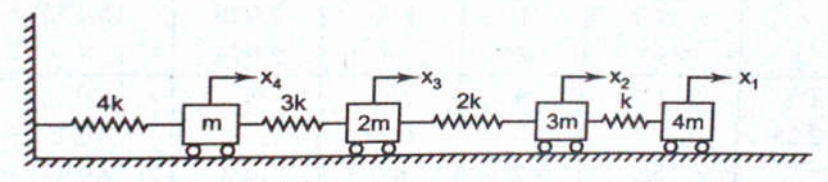

Fig. 5

5. Attempt all :

(a) What is damping and its types? Explain viscous damping in detail.

(b) What is vibration isolation? Explain in detail.

(c) Write a short note on torsional vibrational absorber.

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