CBCS SCHEME

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18MR71

# Seventh Semester B.E. Degree Examination, July/August 2022
## Mechanical Vibrations

Time: 3 hrs. Max. Marks: 100

***Note: Answer any FIVE full questions, choosing ONE full question from each module.***



### Module-1

1 a. What is vibration? Explain the various types of vibration and its causes. **(08 Marks)**

b. Add the following harmonic motions and check the solution graphically:

$x_1 = 2\cos(\omega t + 0.5)$; $x_2 = 5\sin(\omega t + 1.0)$ **(12 Marks)**

**OR**

2 a. Define the following:

(i) Periodic motion (ii) Degrees of freedom

(iii) Resonance (iv) Simple harmonic motion **(08 Marks)**

b. Represent the periodic motion given in Fig.Q2(b).

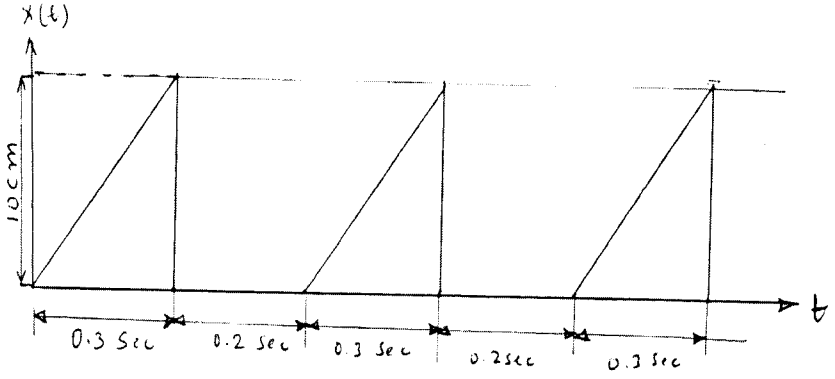


Fig.Q2(b) **(12 Marks)**

### Module-2

3 a. Determine the natural frequency of a spring mass system where the mass of the spring is also to be taken into account. **(10 Marks)**

b. A circular disc of 5 kg mass, 100 mm radius is held by a spring of constant 200 N/m at the distance of 50 mm from the centre and rolls on a smooth horizontal plane. Find the natural frequency of the system by energy method. [Refer Fig.Q3(b)]

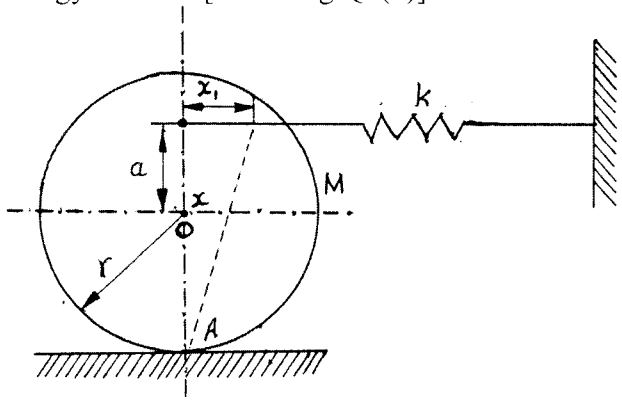


Fig.Q3(b) **(10 Marks)**

**OR**

4 a. Define Logarithmic Decrement. Show that logarithmic decrement $\delta = \frac{1}{n} \ell n \left( \frac{x_o}{x_n} \right)$. **(08 Marks)**

b. For the system shown in Fig.Q4(b), determine:
(i) Undamped natural frequency
(ii) Damped natural frequency
(iii) Logarithmic decrement
(iv) If the mass is initially at rest and given a velocity of 10 cm/sec, then calculate the amplitude of vibration after 5 oscillation.

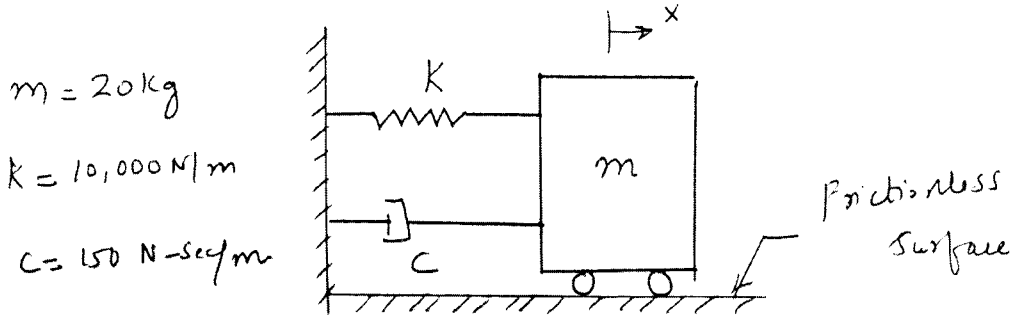


Fig.Q4(b) **(12 Marks)**

## Module-3

5 a. Define transmissibility. Derive an expression for displacement transmissibility and show the plots of 'X/Y' against frequency ratio '$\omega/\omega_n$'. **(10 Marks)**

b. A machine of total mass 17 kg is mounted on springs have stiffness K = 11,000 N/cm. A piston within the machine has a mass of 2 kg has a reciprocating motion with stroke 7.5 cm and speed 6,000 rpm. Assuming the motion to be S.H.M. Determine:
(i) Amplitude of machine
(ii) Transmissibility
(iii) Force transmitted to be ground or foundation.
Take $\xi = 0.2$. **(10 Marks)**

**OR**

6 a. What is a seismic instrument? Explain any two types of seismic transducers with neat sketches. **(10 Marks)**

b. Calculate the first and second whirling speed in case of steel tube supported in short bearing two metre centre to centre. The external and internal diameter of tube are 3.5 cm and 2.5 cm respectively. Density of steel may be taken as 7800 kg/m$^3$ and E for steel 200 GPa. **(10 Marks)**

## Module-4

7 a. A shaft 100 mm diameter is supported in short bearings 3m apart and carries 3 discs weighing 900 N, 1400N, 700N situated in 1m, 2m and 2.5 m from one of the bearings respectively. Assuming E = 200 GPa and density of shaft material = 7800 kg/m$^3$, calculate the frequency of transverse vibration by Dunkerley's method. **(08 Marks)**

b. Using Stodola's method, determine the fundamental mode of vibration of the spring mass system shown in Fig.Q7(b).

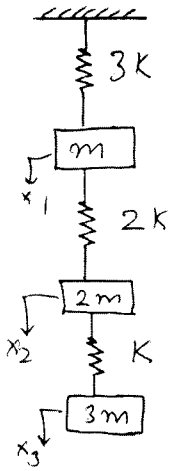


Fig.Q7(b) **(12 Marks)**

**OR**

8 Find all the natural frequencies of the four degree-of-freedom system shown in Fig.Q8 by Holzer's method.

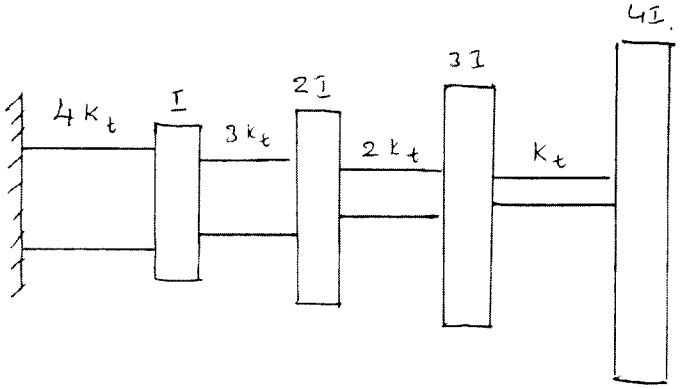


Fig.Q8 **(20 Marks)**

## Module-5

9 a. What is experimental modal analysis? With a schematic arrangement, explain experimental modal analysis of mechanical system. **(10 Marks)**

b. Write short notes on the following:

(i) FFT Analyzers

(ii) Sound level meters **(10 Marks)**

**OR**

10 a. What is Machine Condition Monitoring? Explain briefly machine condition monitoring techniques. **(10 Marks)**

b. Explain Microphones and Spectrum Analyzers with neat sketches. **(10 Marks)**

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