CBCS SCHEME

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15AE553

Fifth Semester B.E. Degree Examination, July/August 2022
Theory of Vibrations

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define i) Periodic Motion ii) Time period iii) Amplitude iv) Natural Frequency v) Resonance vi) Degree of Freedom vii) Phase difference viii) Cycle. **(08 Marks)**

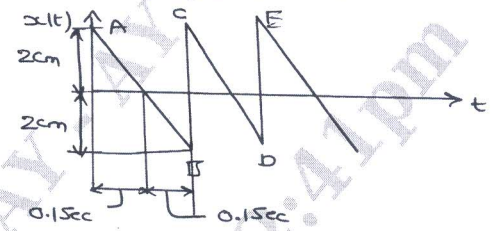
b. Add the following harmonies analytically and check the solution graphically : $x_1 = 3 \sin(\omega t + 30°)$; $x_2 = 4\cos(\omega t + 10°)$. **(08 Marks)**

OR

2 a. Show that the motion of the piston of a reciprocating engine is periodic with terms containing the fundamental and even harmonics. **(08 Marks)**

b. Represent the periodic motion shown in Fig. Q2(b) by Harmonic series.

Fig. Q2(b)



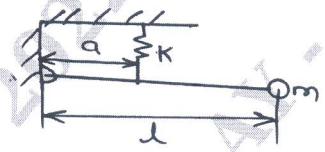
(08 Marks)

Module-2

3 a. Determine the Natural Frequency of a spring mass system where the mass and the spring is also to be taken into account. **(08 Marks)**

b. Determine the Natural Frequencies and the system shown in Fig. Q3(b) by i) Newtonian method ii) Energy method. **(08 Marks)**

Fig. Q3(b)

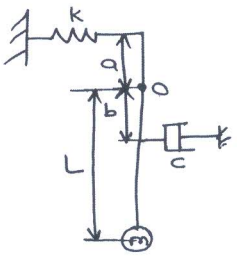


OR

4 a. Define Logarithmic decrement and obtain an expression for Logarithmic decrement. **(08 Marks)**

b. A pendulum in pivoted at point O as in Fig. Q4(b). If the mass of the rod is negligible and for small oscillation. Find i) Critical damping coefficient ii) Damped natural frequency. **(08 Marks)**

Fig. Q4(b)



Module-3

5 a. Derive an expression for steady state amplitude and vibration of mass in a spring mass damper system when the mass is subjected to harmonic excitation. **(08 Marks)**

b. A machine of total mass 68kg mounted on spring and stiffness K = 11000 N/m. With an assumed damping factor $\xi = 0.2$. A piston within the machine has a mass of 2kg has a reciprocating motion with stroke 7.5cm and a speed of 3000 rpm. Assuming the motion of piston to be SHM. Determine i) Amplitude of machine ii) Phase angle with respect to exiting force iii) Transmissibility and force transmitted to foundation iv) Phase angle and transmitted force with respect to exiting force. **(08 Marks)**

OR

6 a. Explain Fullerton tachometer and Frahm tachometer. **(08 Marks)**

b. Derive an expression for Amplitude of Whirling of shaft with air damping. **(08 Marks)**

Module-4

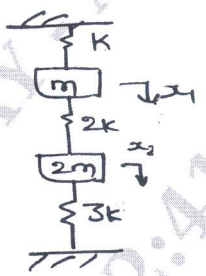
7 Fig, Q7, show a spring mass system. Determine

a. Equation of motion.

b. Frequency equation and Natural frequency of the system.

c. Model vectors of mode shape. **(16 Marks)**

Fig. Q7



OR

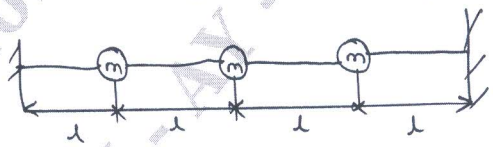
8 a. Derive an expression for general solution of longitudinal vibration of rods or bars. **(08 Marks)**

b. Derive an expression for the free longitudinal vibration of a uniform bar of length 'L' which is free. **(08 Marks)**

Module-5

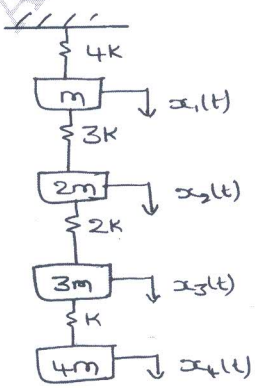
9 a. Determine the influence co-efficient of the system shown in Fig. Q9(a). **(08 Marks)**

Fig. Q9(a)



b. Determine the Fundamental natural frequencies of the system shown in Fig. Q9(b) by Dunkerley's equation. **(08 Marks)**

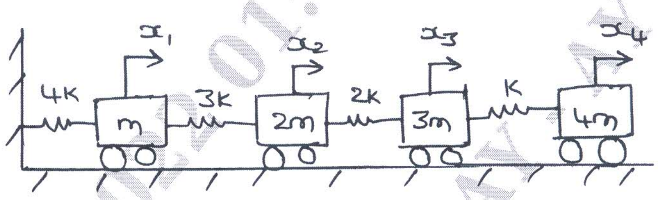
Fig. Q9(b)



OR

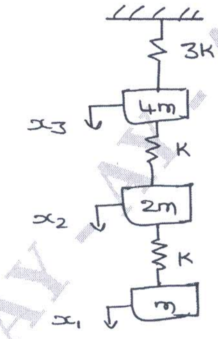
10 a. Using Stodola's method, determine the lowest natural frequency and the system shown in Fig. Q10(a). **(08 Marks)**

Fig. Q10(a)



b. Find the Natural frequencies and the system shown in Fig. Q10(b) by Holzer's method. Assume K = 1N/m , m = 1kg. **(08 Marks)**

Fig. Q10(b)



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