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10ME72

Seventh Semester B.E. Degree Examination, June/July 2023

Mechanical Vibration

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Add the following harmonic motions analytically and check the solution graphically :
i) $x_1 = 4\cos(\omega t + 10°)$
ii) $x_2 = 6\sin(\omega t + 60°)$. **(10 Marks)**

b. Saw tooth periodic motion of a follower operated by a cam is shown in Fig.Q1(b). Represent the motion by a Harmonic series. The cam rotates uniformly at 60 rpm and the lift of follower is 25mm.

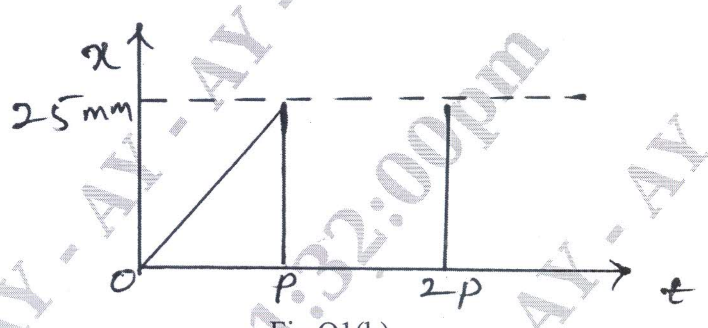

Fig.Q1(b) **(10 Marks)**

2 a. Determine the effect of the mass of the spring on the natural frequency of the system. **(10 Marks)**

b. Determine the natural frequency of the system shown in Fig.Q2(b).

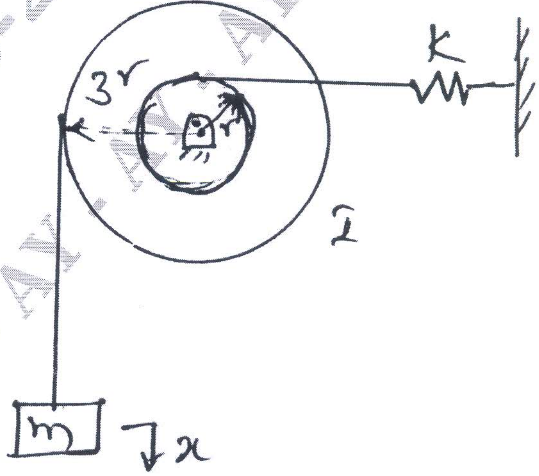

Fig.Q2(b) **(10 Marks)**

3 a. For an underdamped system, derive an expression of response. **(10 Marks)**

b. Free vibration records of 1 tonne machine mounted on an oscillater is shown in Fig.Q3(b). Identify the type of oscillater and its characteristics.

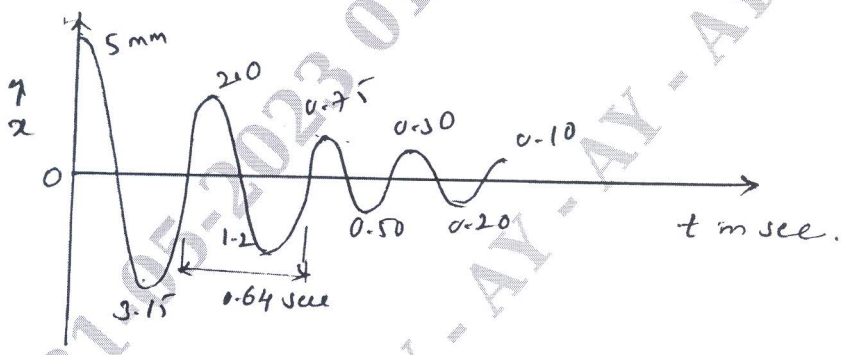

Fig.Q3(b) **(10 Marks)**

4 a. Analyse the underdamped system subjected to constant harmonic excitation and show the complete solution. **(12 Marks)**

b. A vibratory body of mass 150 kg supported on springs of total stiffness 1050 kN/m has a rotating unbalance force of 525 N at a speed of 6000 rpm. If the damping factor is 0.3, determine :

i) the amplitude caused by the unbalance and its phase angle

ii) the transmissibility

ii) the actual force transmitted and its phase angle. **(08 Marks)**

PART – B

5 a. Explain the working principle of

i) Fullation tachometer

ii) Frahm tachometer. **(10 Marks)**

b. Derive an expression for amplitude of a whirling shafts with air damping. **(10 Marks)**

6 a. Explain the principle of dynamic vibration absorber. Derive the necessary equations. **(10 Marks)**

b. For the system shown in Fig.Q6(b). Find the natural frequencies and amplitude ratio. Given $m_1 = 10$ kg, $m_2 = 15$ kg and $K = 320$N/m.

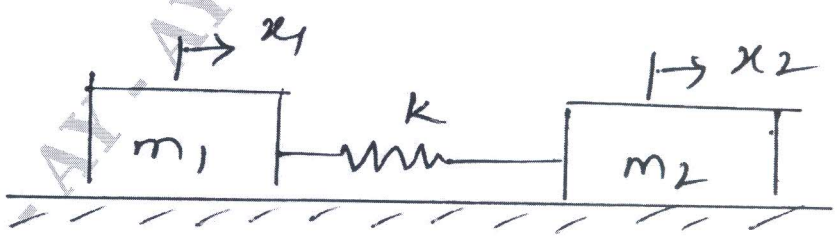

Fig.Q6(b) **(10 Marks)**

7 a. Determine the influence coefficients for the system shown in Fig.Q7(a).

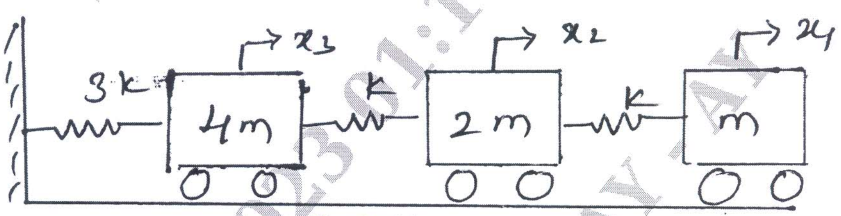

Fig.Q7(a) **(10 Marks)**

b. Using Stodola's method, determine the lowest natural frequency of the system show in Fig.Q7(b).

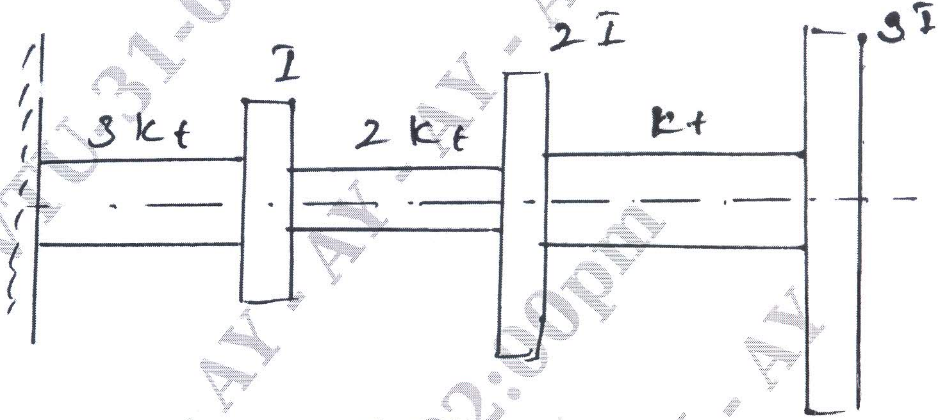

Fig.Q7(b) **(10 Marks)**

8 a. Briefly explain the hardware of an equipment necessary for experimental model analysis. **(10 Marks)**

b. Explain machine condition monitoring techniques. **(10 Marks)**

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