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10ME72

Seventh Semester B.E. Degree Examination, Dec.2014/Jan.2015
Mechanical Vibrations

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain phenomena beats. **(05 Marks)**

b. Derive an equation for work done by harmonic force. **(05 Marks)**

c. Represent the periodic motion given in the Fig.Q.1(c) by harmonic series. **(10 Marks)**

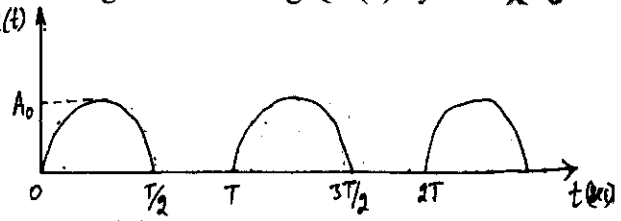

Fig.Q.1(c)

2 a. Determine the natural frequency of the system shown in the Fig.Q.2(a) by Newton's method and energy method. **(10 Marks)**

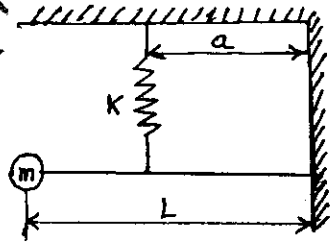

Fig.Q.2(a)

b. Determine the natural frequency of the system shown in the Fig.Q.2(b) by Newton's method and Energy method. **(10 Marks)**

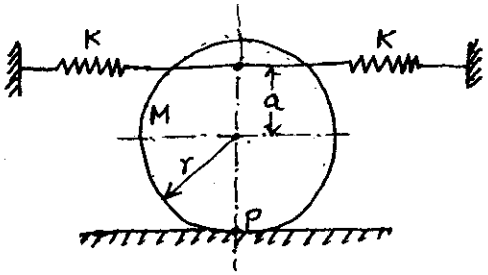

Fig.Q.2(b)

3 a. Set up the differential equation for a spring mass damper system and obtain complete solution for the critically damped condition. **(10 Marks)**

b. Determine: i) Critical damping coefficient; ii) Damping factor; iii) Natural frequency of damped vibrations; iv) Logarithmic decrement; v) Ratio of two consecutive amplitudes of vibrating system which consists of mass of 25kg, a spring of stiffness 15kN/m and a damper. The damping provided is only 15% of the critical value. **(10 Marks)**

4 a. Define transmissibility and derive an expression for the transmissibility ratio and the phase angle for transmitted force. **(10 Marks)**

b. A machine of mass one ton is acted upon by an external force 2450N at a frequency of 1500rpm. To reduce the effects of vibration, isolator of rubber having a static deflection of 2mm under the machine load and an estimated damping factor of 0.2 are used. Determine: i) Force transmitted to the foundation; ii) Amplitude of vibration of the machine; iii) Phase lag of the transmitted force with respect to the external force. **(10 Marks)**

PART – B

5 a. Explain Frahm's reed tachometer. **(05 Marks)**

b. Explain vibrometer. **(05 Marks)**

c. The rotor of a turbo-super charger weighing 88.3N is keyed to the centre of a 25mm diameter shaft 40cm between the bearings. Determine: i) the critical speed of shaft; ii) The amplitude of vibration of the rotor at a speed of 3200 rpm of the eccentricity is 0.015mm and iii) Vibratory force transmitted to the bearings at this speed. Assume the shaft to be simply supported and the shaft material has a density of $8gm/cm^3$. Take $E = 2.06 \times 10^5$ MPa. **(10 Marks)**

6 a. Explain the working principle of dynamic absorber. **(08 Marks)**

b. Determine the natural frequencies of the spring mass pulley system as shown in the Fig.Q.6(b). The cord is inextensible and there is no slippage between the cord and the pulley. Take $K_1 = 40N/m$, $K_2 = 60N/m$, $m = 2kg$ and $M = 10kg$. **(12 Marks)**

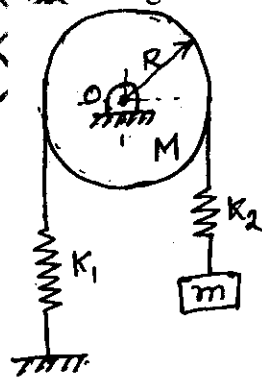

Fig.Q.6(b)

7 Determine the natural frequency of the system shown in the Fig.Q.7 by Holzer's method. **(20 Marks)**

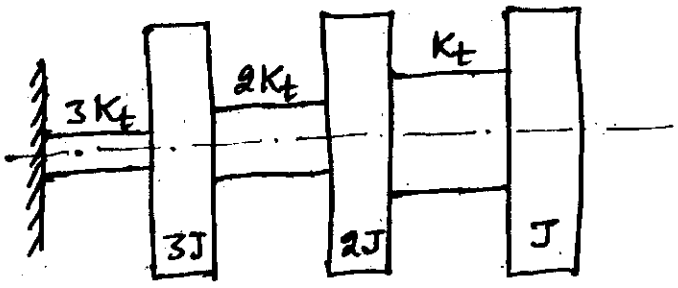

Fig.Q.7

8 a. Explain the experimental modal analysis and the necessary basic equipments. **(10 Marks)**

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

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