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10ME72

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Mechanical Vibrations

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Derive the expression for workdone by Harmonic force. **(08 Marks)**

b. Determine the Fourier series representation for the periodic excitation shown in Fig.Q.1(b).

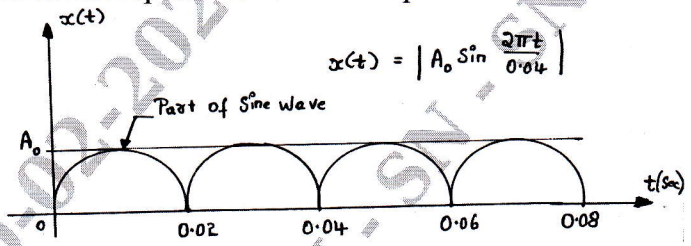

Fig.Q.1(b)

(12 Marks)

2 a. Derive the natural frequency of a spring mass system considering the effect of the mass of spring. **(08 Marks)**

b. Determine the natural frequency of the system shown in Fig.Q.2(b). **(12 Marks)**

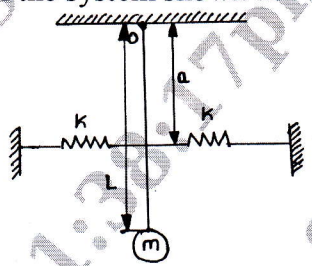

Fig.Q.2(b)

3 a. Define logarithmic decrement and also derive the expression for the same, when the system executes 'n' cycles. **(10 Marks)**

b. A shock absorber is to be designed so that its overshoot is 10% of the initial displacement when released. Determine the damping factor. If the damping factor is reduced to one half of this value, what will be the overshoot? **(10 Marks)**

4 a. The spring of an automobile trailer is compressed 0.1m under its own weight. Find the critical speed when the trailer is travelling over a road with a profile approximated by a sine wave of amplitude 80mm and wave length 14m. What will be the amplitude of vibration at 60km/hr? **(08 Marks)**

b. A machine of mass one tonne is acted 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. **(12 Marks)**

PART – B

5 a. A vibrometer having the amplitude of vibrations of the machine part as 4mm and $\xi = 0.2$ performs harmonic motion. If the difference between maximum and minimum recorded value is 10mm, determine the natural frequency of vibrometer if the frequency if the vibrating part is 12rad/sec. **(10 Marks)**

b. Derive the expression for critical speed of shaft when the damping is present in the form of air resistance. **(10 Marks)**

6 a. Derive the expression for natural frequencies and hence determine the two natural frequencies for the system shown in Fig.Q.6(a), when $m_1 = m$, $m_2 = 2m$ and $L_1 = L$ and $L_2 = 3L$ **(10 Marks)**

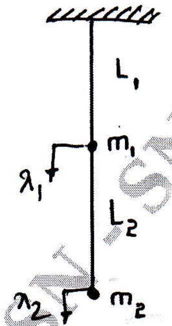

Fig.Q.6(a)

b. Find the natural frequency of vibration for the system shown in Fig.Q.6(b) and show that this is a semi-definite system. **(10 Marks)**

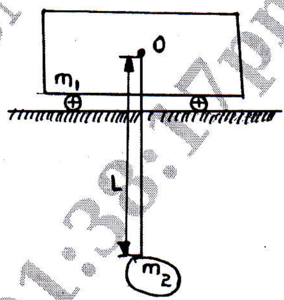

Fig.Q.6(b)

7 Find the lowest natural frequency for the system shown in Fig.Q.7 by stadola method. Assume K = m = 1 unit. **(20 Marks)**

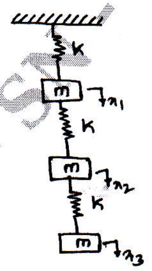

Fig.Q.7

8 a. Define condition monitoring of a machine and also explain the monitoring techniques considered in achieving the most effective, safe and efficient operations. **(10 Marks)**

b. Explain dynamic testing of machines and also explain the different methods used for dynamic testing of a structure. **(10 Marks)**

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