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10ME72

Seventh Semester B.E. Degree Examination, Dec. 2013/Jan. 2014
Mechanical Vibrations

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With a sketch, explain the beats phenomenon and obtain its resultant motion. **(10 Marks)**

b. If $x(t) = a_0 + \sum_{n=1}^{\infty} a_n \cos nwt + \sum_{n=1}^{\infty} b_n \cos nwt$, where x(t) us a periodic, nonharmonic, obtain expressions for a_0, a_n and b_n. **(10 Marks)**

2 a. What is the effect of mass of a spring on its natural frequency? Derive. **(10 Marks)**

b. Find the natural frequencies of Fig. Q2(b). **(10 Marks)**

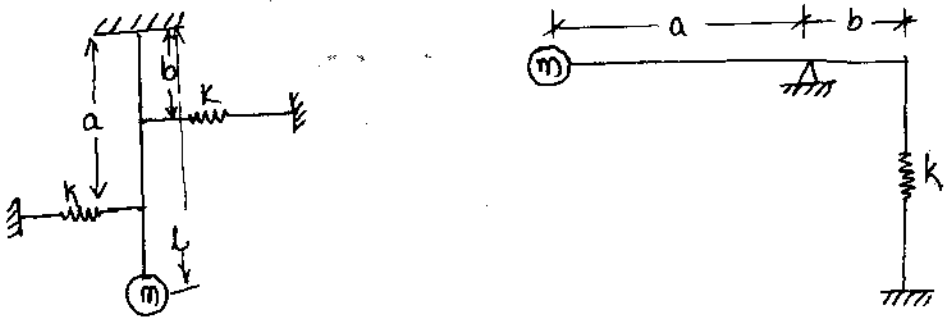

Fig. Q2(b)

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

b. A vibrating system having a mass 3 kg, spring stiffness of 100 N/m and damping coefficient of 3 N – sec/m. Determine damping ratio, damped natural frequency, logarithmic decrement, ratio of two consecutive amplitudes and number of cycles after which the original amplitude is reduced to 20%. **(10 Marks)**

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

b. A vibrating system having mass 100 kg is suspended by a spring of stiffness 19600 N/m and is acted upon by a harmonic force of 39.2 N at the undamped natural frequency. Assuming visious damping with a coefficient of 98 N – sec/m. Determine resonant frequency, phase angle at resonance, amplitude at resonance, the frequency corresponding to the peak amplitude and damped frequency. **(08 Marks)**

PART – B

5 a. Mention the instruments used to measure displacement and acceleration. Discuss the relevant frequency response curves. **(10 Marks)**

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

6 a. Discuss the effect f mass ratio on frequency ratio of an undamped dynamic vibration absorber with derivation. **(12 Marks)**

b. Two equal masses are attached to a string having high tension as shown in the Fig. 6(b). Determine the natural frequencies of the system. **(08 Marks)**

Fig. Q6(b)

7 a. Determine the influence coefficients of the triple pendulum system as shown in Fig. 7(a).

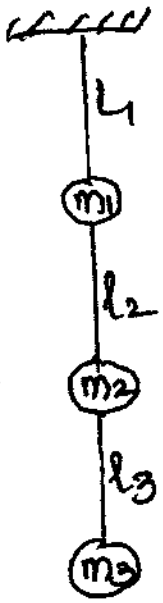

Fig. Q7(a)

(10 Marks)

b. Use the Stodola method to determine the lowest natural frequency of four degrees of freedom spring mass system as shown in Fig. 7(b).

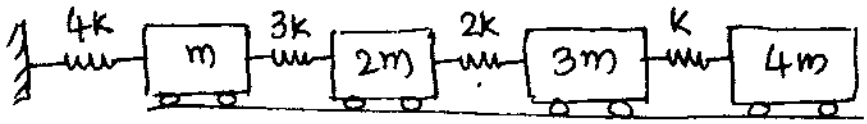

Fig. Q7(b)

(10 Marks)

8 Write a short notes on any FOUR :

a. Signal analysis
b. Dynamic testing of machines
c. Experimental modal analysis
d. Machine condition monitoring
e. Orthogonality of principal modes. **(20 Marks)**

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