Roll No .....

MMPD - 104

M.E./M.Tech. I Semester

Examination, December 2014

Theory of Vibration

Time : Three Hours

Maximum Marks : 70

Note : Attempt any five questions. All questions carry equal marks.

1. A load W is vertically suspended on two springs of constants S_1 and S_2 as shown in fig 1 below, Determine the resultant spring constant and the frequency of the load.

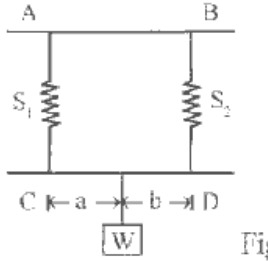

Figure 1

2. Determine the natural frequencies of spring mass system shown in fig 2 below by matrix method.

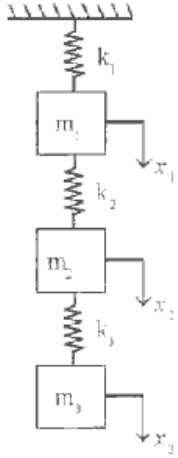

Figure 2

3. Consider two pendulums of length L as shown in fig 3 below. Determine the natural frequency of each pendulum. If k = 100 N/m, m_1 = 2kg, m_2 = 5kg, L = 20 cm a = 10 m.

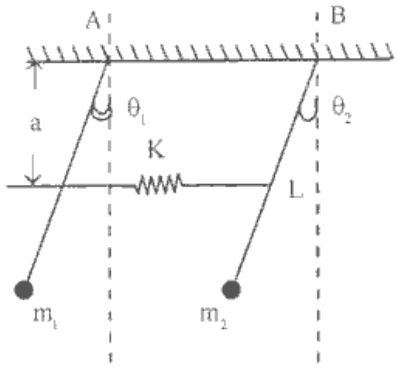

Figure 3

4. A non linear spring for a single degree of freedom system is given by k (x) = 10 x + 2000 x^3. C for viscous damping is 1.5 kg/sec/cm. A harmonic force 5 kg amplitude acts on the mass = 1 kg. Find the steady state response using the direct integration method.

5. Use Stodola's method to find the natural frequency of the system shown in fig 4 below.

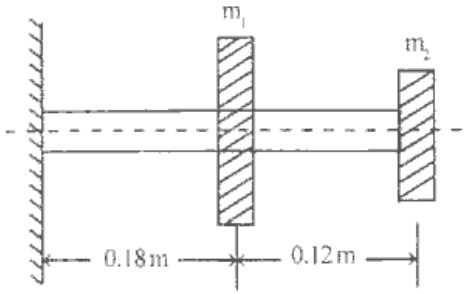

Figure 4

6. Find the singular points for the following differential equation and say whether they are stable or unstable:

$$m\ddot{x} + \alpha x + \beta x^3 = 0\,,\ \alpha < 0, \beta < 0$$

7. a) Prove that the principle of super position does not hold good for non linear differential equations. Take a specific differential equation.

   b) Using the first two terms of the expression of sinθ determine by the method of perturbation the time period of simple pendulum as a function of amplitude.

8. Write short notes on followings: (any four)

   a) Hierarchical FEM method and inclusion principle

   b) Auto correction function

   c) Narrow band and wide band random process

   d) Probability density function

   e) Self exited vibration caused by dry friction

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