Seat No. | | | | | | |

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मळभ - 008

Mechanical Vibration

P. Pages : 2

Time : Three Hours **Max. Marks : 100**

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Solve **any five** questions.
5. Figures to right indicate full marks and assume suitable data if necessary.

1. Obtain the three natural frequencies and the corresponding mode shapes for the system shown in fig. 1. Assume the tension T in the string to be large. Use matrix method with flexibility influence coefficient : **20**

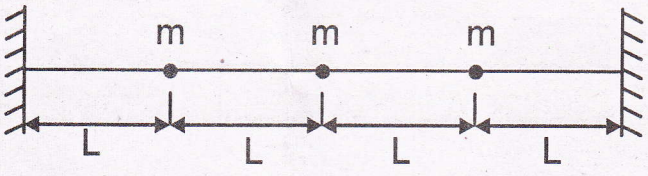

Fig. 1

2. Determine the lowest natural frequency and corresponding principal mode of vibration of the system shown in fig. 2 using method of matrix iteration. Also obtain the higher modes by applying the principle of orthogonality : **20**

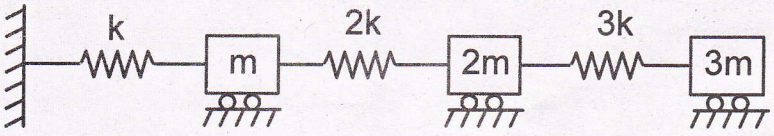

Fig. 2

3. a) A bar of cross sectional area A and length L is fixed at one end and free at the other end. It is pulled by an axial force P at its free end. Investigate the resulting vibrations if force P is suddenly removed : **12**

b) Explain the fundamentals of noise measurements : **8**

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4. a) A mass m1 is dropped on to a vibratory system from a height h as shown in fig. 4. Assuming that the two masses adhere together after impact, obtain the response of the combined system after impact. Plot it against time : 13

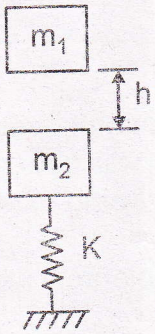

Fig. 4

b) Write note on : Phase plane method. 7

5. a) The mass shown in fig. 5 is given an initial velocity v. Find the time period T per cycle of oscillation as a function of v. Plot T verses v. When k = 1, m = 1, plot the phase plane trajectory for the motion of the system. 14

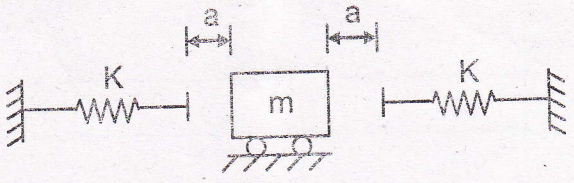

Fig. 5

b) Explain Jump Phenomenon. 6

6. a) Explain Stodola method : 6

b) Explain the different parameters which affect the selection of sensors for a vibratory system : 6

c) Write note on : i. FFT analyser ii. microphones. 8

7. a) Compute the autocorrelation function of a periodic square wave with zero mean value and compare this result with that of a sinusoidal wave of the same period. Assume amplitudes to be same for both waves. 10

b) Derive an expression for the spectral density of response of a system when it is acted upon by two forces $P_1(t)$ and $P_2(t)$ which are random and uncorrelated. What would be expression for response when the two forces have a constant ratio ? 10

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