(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 100854 Roll No. | | | | | | | | | | |

B.Tech.

(SEM. VIII) THEORY EXAMINATION 2013-14

MACHINE FOUNDATION DESIGN

Time : 3 Hours *Total Marks : 100*

Note :– Attempt **all** questions. All questions carry equal marks.

1. Attempt any **two** parts of the following : **(10×2=20)**

(a) Derive general equation of motion for an undamped force vibration of a single degree of freedom system.

(b) Explain the response of an SDOF system subjected to Harmonic excitation in the form of a Sine wave.

A weight of 13.8 N is vertically suspended on a steel wire of length 125 cm and cross sectional area 6.5×10^{-3} cm^2. Determine the frequency of free vibrations of the weight. If modulus of elasticity of steel is 2.12×10^5 N/mm^2. Determine the amplitude of this vibration if the initial displacement is 0.025 cm and initial velocity is 2.50 cm/sec.

(c) A system is modelled by two freely vibrating masses m_1 and m_2 interconnected by a spring and a damper element as shown in Fig. 1(a). Determine for this system, the

differential equation of motion in terms of the relative motion of the masses, $\mu = y_2 - y_1$.

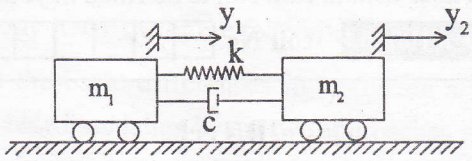

Fig. 1(a)

2. Attempt any **two** parts of the following : **(10×2=20)**

   (a) Classify different types of machine foundations according to the permissible value of their amplitudes suggested by Indian Standard code method.

   (b) How will you determine the machine foundation natural frequencies by Ford and Haddow's method ?

   (c) Outline the Barken method for finding natural frequency.

   A Foundation block of weight 30 kN rest on a soil for which the stiffness may be assumed as 25000 kN/m. The machine is vibrated vertically by an exciting force of 3.0 sin (30t) kN. Find the natural frequency, natural period, natural circular frequency and the amplitude of vertical displacement. The damping factor is 0.50.

3. Attempt any **two** parts of the following : **(10×2=20)**

   (a) Write the name of the various geophysical methods to determine the various dynamic soil properties. Explain cyclic plate load test as per IS : 5249–1992. Explain the procedure to determine the coefficient of uniform elastic compression.

(b) Explain the cross–bore wave propagation method of estimating dynamic properties of soil. For a torsional elastic wave in a rod of infinite length, derive the torsional wave propagation velocity given by $V^2_s = (G/\rho)^{1/2}$.

(c) The following data refers to a block vibration test. Obtain the value of coefficient of uniform elastic compression of the soil. Estimate the spring constant of the system.

Weight of machine = 22.50 kN, weight of oscillator = 300 N and size of foundation block is 2.50 m × 3.00 m × 2.00 m height.

Frequency of Vibration (Hz)	30	36	40	46	49	53	55	58
Amplitude (mm)	0.065	0.095	0.150	0.380	0.430	0.375	0.320	0.270

Determine the value of damping ratio and maximum amplitude. What is the prospect of resonance, if the operating frequency of the oscillator is 600 rpm ?

4. Attempt any two parts of the following : (10×2=20)

(a) Explain the methods of vibration isolation with respect to the following :

(i) Counter balancing the exciting loads

(ii) Stabilisation of soils

(iii) Use of structural measures

(iv) Isolation by trench barriers.

(b) Describe criteria for a satisfactory machine foundation. Also explain the methods of decreasing vibrations of exciting foundations.

(c) What do you understand by active isolation and passive isolation ? Discuss the different properties of material and media used for vibration isolation.

5. Attempt any **two** parts of the following : **(10×2=20)**

(a) List the basic differences in analyzing a reciprocating machine foundation by the two approaches namely; linear weightless spring–mass system and elastic half- space theory.

(b) Draw the models for analysis of rotary type machines according to I.S. code. What are their limitations ?

(c) Write the reinforcement and construction details of different types of machine foundations. Explain the suitability of various machine foundations for the different types of machines.