

GUJARAT TECHNOLOGICAL UNIVERSITY
M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 2714302**Date: 12-01-2015****Subject Name: Soil Dynamics & Machine Foundations****Time: 02:30 pm - 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use chart 1-5 whenever necessary

- Q.1** (a) Enlist the important terms related to machine foundation as per IS 1893. Define each and discuss in detail their role in design of machine foundation. **07**
- (b) Explain the general requirements of machine foundations. Support your answer with necessary plots and equations. **07**

- Q.2** (a) Attempt following **07**
1. Consider the natural period T and acceleration $\ddot{a}_0$ of a SDOF system. When mass M of the system increases, how δT and $\ddot{a}_0$ affected?
 2. A vertical spring mass system has a mass of 5kg and initial deflection of 0.6cm. Find the spring stiffness and natural frequency of the system.

- (b) A SDOF vibrating system is having following parameters. **07**
 $m = 75 \text{ kg}$, $k = 160 \text{ N/m}$, $c = 16 \text{ N } \cdot \text{sec} / \text{m}$. Determine (i) the damping factor (ii) the natural frequency of damped vibration (iii) logarithmic decrement (iv) the ratio of two successive amplitudes & (v) the number of cycles after which the original amplitude is reduced to 64%.

OR

- (b) A simply supported beam of negligible mass spanning 12 m supports a machine of 62 kN at center with an unbalanced rotor applying a vertical force of $150 \sin 20t$ kN. The damping force is 0.6 kN-s/m & Flexural rigidity of beam is 58000 kN-m^2 . Determine (i) maximum amplitude of vibration (ii) amplitude of vibration at resonance **07**
- Q.3** (a) Explain with neat sketch the modes of vibration of rigid foundation block. **07**
- (b) Define flow liquefaction and cyclic mobility of soils. Explaining mechanism of liquefaction & discuss factors affecting liquefaction potential of a soil. Can cohesive soil liquefy? Give reason for your answer. **07**

OR

- Q.3** (a) Define the following: coefficient of elastic uniform compression, coefficient of elastic uniform shear, coefficient of elastic non-uniform compression, coefficient of elastic non-uniform shear. Also state their equations. **07**
- (b) A cyclic plate load test was performed on 60cm x 60cm size plate. The elastic rebound observed are as under: **07**

Load intensity(t/m^2)	10	20	40	60	80
Rebound in (mm)	0.3	0.53	0.74	1.1	2.0

Using this data obtain following: C_u , C_{ψ} , C_v , C_s , E and G for foundation block of size 4m x 3m.

- Q.4** Discuss in detail the dynamic response of embedded block foundations for conditions of vertical vibrations, pure sliding vibrations, pure rocking vibrations and coupled sliding & rocking vibrations. Support your answer with necessary equations and plots. **14**

OR

- Q.4** A reciprocating machine is symmetrically mounted on a block of size 4.0m x 3.0m x 3.5m high. The soil at the site is sandy in nature having $\phi = 36^\circ$ and $\gamma_{sat} = 19 \text{ KN/m}^3$. The water table lies at a depth of 3.0m below the ground surface. The block is embedded in the ground by 2.0m depth. The machine vibrating at a speed of 250rpm generates, **14**
- Maximum vertical unbalanced force = 2.6KN
 Torque about Z-axis = 4.0 KN = 2.0KN at a height of 0.2m above the top of the block. The machine weight is small in comparison to the weight of foundation. Limiting amplitude of the machine is 150 microns. Determine the natural frequencies and amplitudes by linear weightless spring method. Take, $C_u = 3.62 \times 10^4 \text{ KN/m}^3$, $G = 1.1 \times 10^4 \text{ KN/m}^2$, $E = 2.98 \times 10^4 \text{ KN/m}^2$, $\mu = 0.36$, $C_v = 1.82 \times 10^4 \text{ KN/m}^3$, $C_\phi = 6.28 \times 10^4 \text{ KN/m}^3$, $C_\ell = 2.73 \times 10^4 \text{ KN/m}^3$. Assume any other data if required.

- Q.5 (a)** Giving steps discuss in detail the pseudo-static analysis of designing footing for dynamic loading. In what way this method differs from dynamic analysis, also give critical comment on dynamic bearing capacity of footing. **07**
- (b)** At a given industrial site a compressor is installed having operating speed of 1100rpm at a distance of 50m from a precision machine. Suggest a suitable open trench barrier to provide effective vibration isolation. The velocity of shear waves at the site was found as 150m/s. **07**

OR

- Q.5 (a)** Discuss with neat sketches the various possible arrangements of a hammer foundation to minimize the vibrations. **07**
- (b)** What do you mean by Active & Passive isolation? Why they are determined? Enlist the various methods to determine it. **07**

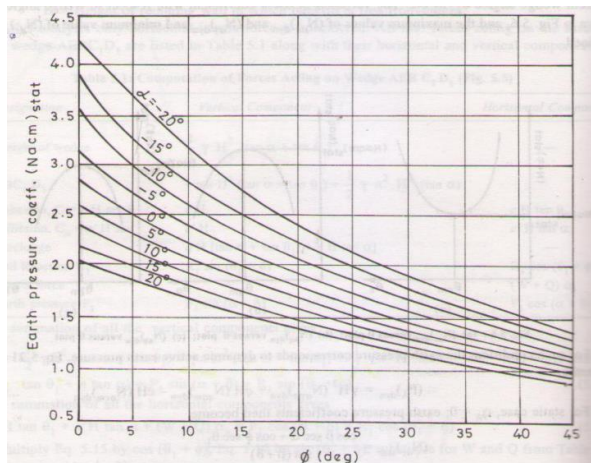


Chart 1

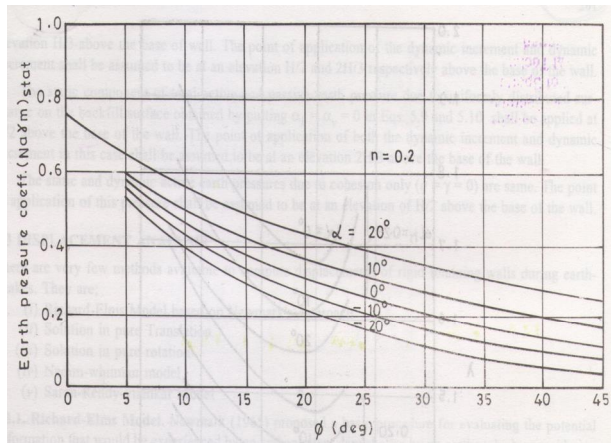


Chart-2

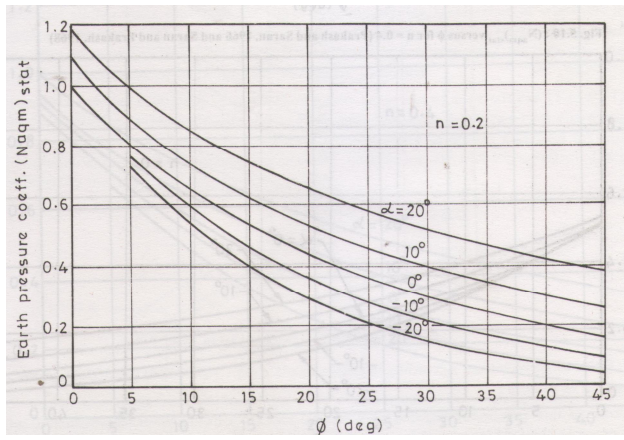


Chart-3

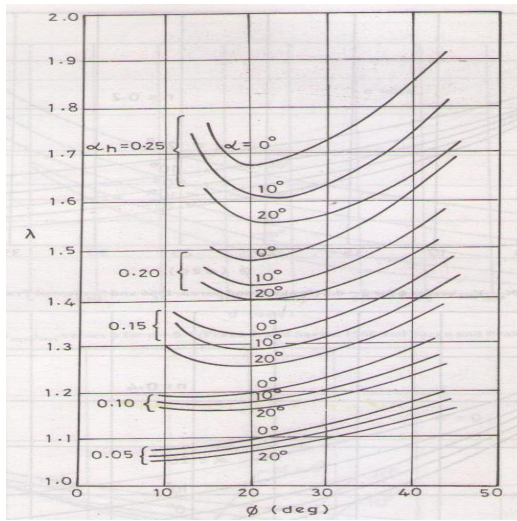


Chart-4

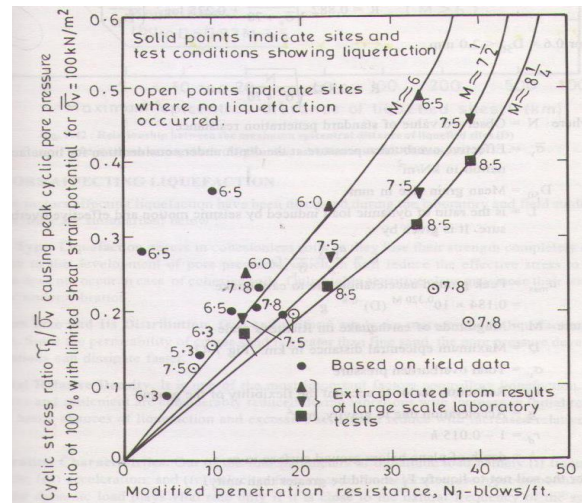


Chart-5