Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 714302N **Date: 02-12-2014**

Subject Name: Soil Dynamics

Time: 10:30 am - 01:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Enlist the various soil dynamic properties, state the various methods to determine these properties and explain resonant column test in detail using spring-base model. **07**

(b) Derive expression for the vibration response of free damped SDOF structural system. **07**

Q.2 **(a)** Attempt following **07**

1. Enlist the various parameters to be verified in design of Machine Foundation
2. Consider the natural period T and acceleration 'a' of a SDOF system. When mass M of the system increases, how 'T' and 'a' affected?
3. 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 = 70 kg, k = 160 N/m, c = 15 N – sec / 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 65%.

OR

(b) A simply supported beam of negligible mass spanning 15 m supports a machine of 60 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 57000 kN-m^2. Determine (i) maximum amplitude of vibration (ii) amplitude of vibration at resonance **07**

Q.3 **(a)** What do you mean by Active & Passive isolation? Why they are determined? Enlist the various methods to determine it. **07**

(b) 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**

OR

Q.3 **(a)** Differentiate between Cohesionless and cohesive soils in relation to resistance to horizontal dynamic load. **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: Cu, Cτ, Cφ, C_Ψ, E and G for foundation block of size 4m x 3m.

Q.4 A vertical vibration test was conducted on a 1.5m x 0.75m x 0.75m high concrete block in an open pit having depth 2.5m which is equal to the anticipated depth of actual foundation. The test was repeated at different settings (θ) of eccentric masses. The data obtained from the tests are given below: **14**

Sr.No	θ (degree)	f_{nz}	Amplitude at resonance (microns)
1	37	41	14
2	74	39	25
3	110	33	32
4	150	31	41

The soil is sandy in nature having angle of internal friction Ø = 34° and saturated density γ_{sat} = 20.6kN/m^3. The water table lies at a depth of 3.5 below ground surface. Probable size of actual foundation 4.0 x 3.0 x 3.5m high. Determine the values of C_u, E and G to be adopted for the design of actual foundation. Limiting vertical amplitude of the machine is 160μ.

OR

Q.4 **(a)** Critically discuss the stability of retaining wall for earthquake conditions. **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**

Q.5 A standard penetration tests was carried out at given site for depth upto 15m and following results were recorded: **14**

Depth (m)	Soil Classification	D_{50} (mm)	N-value	D_R (%)	Remarks
1.5	SP	0.18	2	18	Position of water table lies 1.5m below ground surface. Take γ_{moist} = 19.2kN/m^3, γ_{sub} = 10kN/m^3
4.5	SM	0.12	7	36	
7.5	SM	0.13	11	47	
10.5	SW	0.20	19	53	
13	SW	0.22	25	62	
15	SW	0.24	30	65	

The given site belongs to seismically active region and is likely to be subjected by an earthquake of magnitude 7.5. Determine the zone of liquefaction using (i) Seed and Idriss method (ii) Iwasaki method.

OR

Q.5 A retaining wall 8m high is inclined 10° to vertical and retains horizontal backfill with following properties. γ_b=18 KN/m^3, Φ=30° and c=8 KN/m^2.A surcharge load of 20 KN/m^2 is placed on the backfill. The wall is in seismic zone having α_h=0.1. Compute dynamic active earth pressure and the percentage increase in pressure over static earth pressure. Show the point of application of these pressures with reason. Would you recommend the inclination of wall towards or away from fill? Justify your answer. **14**

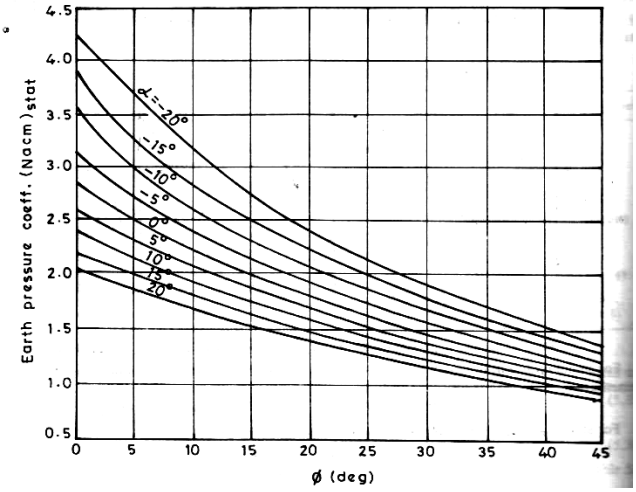

Chart-1

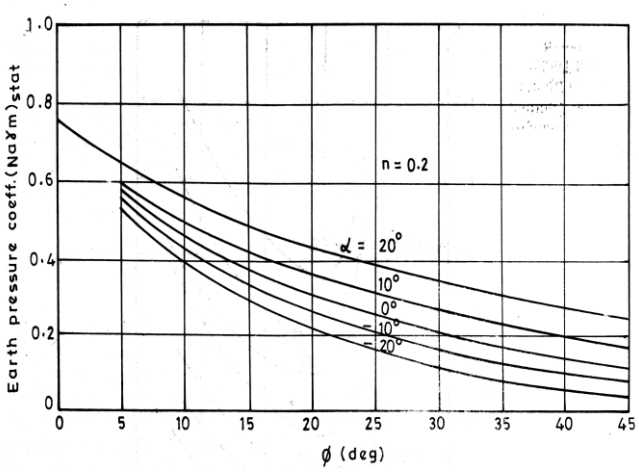

Chart-2

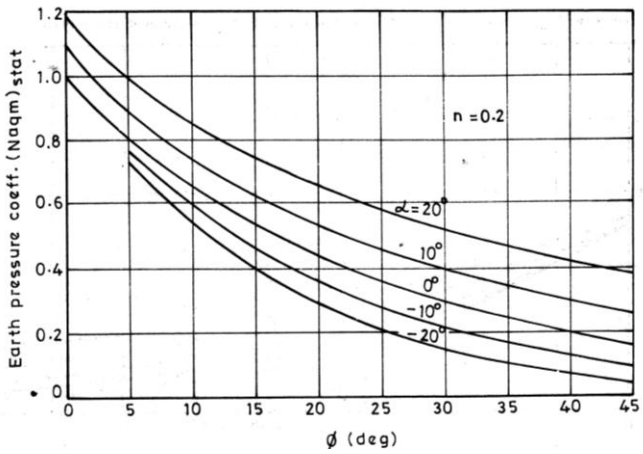

Chart- 3

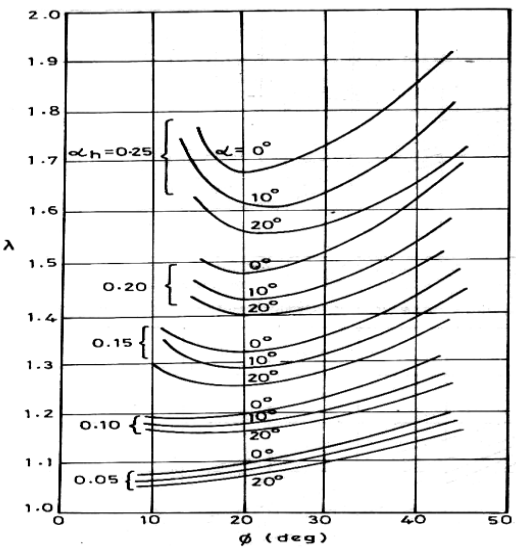

Chart-4

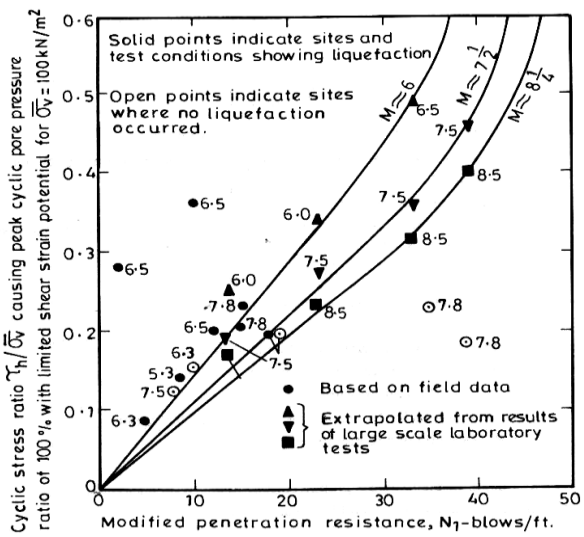

Chart- 5

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