Mid Semester Examination, Autumn Semester, 2011-12

Sub. No: - CE 40003 **Subject: - Foundation Engineering**

Time: - 2 hrs **Max. Marks: 30**

Answer all the questions (assume any suitable value if required)

Q1. The following observations relate to vertical static pile load test on a 300 mm diameter pile:

load (kN)	50	100	200	300	400	500	600
Settlement (mm)	2.5	4.0	9.5	16.5	27.0	40.5	61.0

Plot the load-settlement curve and determine the allowable load as per IS code. **[5]**

Q2. Design a raft foundation for the building frame shown in Fig. 1(b). The soil data are given in Fig. 1(a). Each column is carrying 400 kN load. The factor of safety is taken as 2.5 against shear failure. Take pore water correction factor as 0.75. Use Skempton's bearing capacity equation for clay soil. Take E = 600 c_u and $\mu = 0.5$. The foundation is located at a depth of 1.5 m below ground surface. Dimension of each column is 250 mm x 250 mm. **[10]**

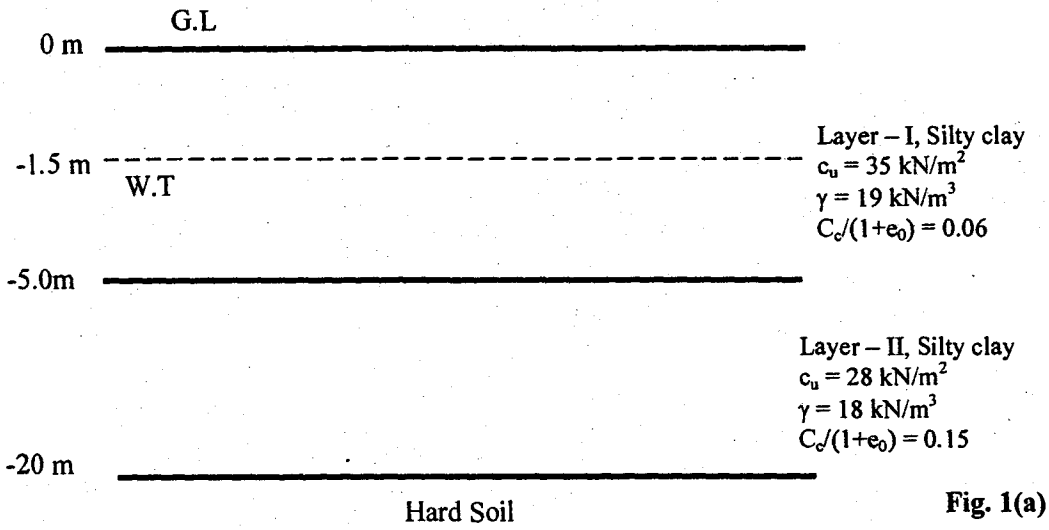

Fig. 1(a)

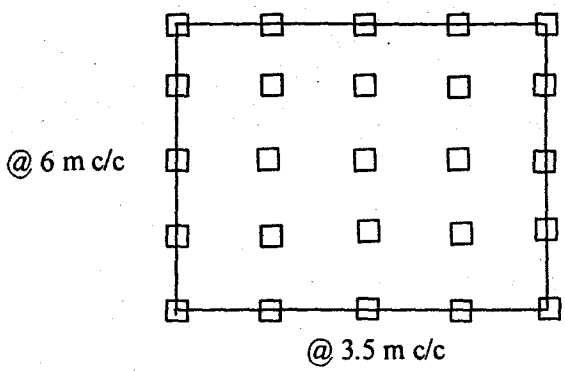

Fig. 1(b)

Q3. (a) Design a friction pile group to carry a total load of 3000 kN including the weight of pile cap at a site where the soil is uniform clay to a depth of 20m, underlain by rock. Average unconfined compressive strength of clay is 70 kN/m^2. A factor of safety of 3 is required against shear failure. Neglect the bearing and assume adhesion factor of 0.8. **[5]**

(b) Calculate the ultimate bearing capacity of a rectangular footing 2 m x 4 m founded at a depth of 1.0m below ground surface. The load on the footing acts vertically and is eccentric in the direction of width (B) by 15 cm. The unit weight of the soil is 18kN/m^3. c′ = 15 kN/m^2 and ϕ' = 35°. Neglect the effect of water table location. Use Meyerhof recommendations. [3]

Q4. (a) What are the corrections required for SPT values obtained from the field and why? [3]

(b) Name the three laboratory tests where use of undisturbed soil sample is must. [2]

(c) Describe the minimum depth of boring determination as recommended by ASCE (1972) [2]

Use the following Tables and Chart

Table1: Meyerhof's Bearing Capacity Factors

ϕ°	N_c	N_q	N_γ	ϕ°	N_c	N_q	N_γ
25	20.7	10.7	6.8	30	30.1	18.4	16.7
34	42.2	29.4	31.1	36	50.6	37.8	44.5
38	61.4	48.9	64.0	40	75.3	64.2	93.7

Table 3: Influence Factor, I_f for Vertical Displacement

Shape	I_f Flexible Foundation
	Centre
Square	1.12
Rectangle	
L/B = 1.5	1.36
L/B = 2.0	1.52
L/B = 5.0	2.10
L/B = 10	2.52
L/B = 100	3.38

Table 4: Meyerhof's Correction Factors

Factors	Expressions
s_c	$1+0.2\frac{B}{L}\tan^2\left(45°+\frac{\phi}{2}\right)$
s_q, s_γ	$1+0.1\frac{B}{L}\tan^2\left(45°+\frac{\phi}{2}\right)$ for $\phi > 10°$
d_c	$1+0.2\frac{D_f}{B}\tan\left(45°+\frac{\phi}{2}\right)$
d_q, d_γ	$1+0.1\frac{D_f}{B}\tan\left(45°+\frac{\phi}{2}\right)$ for $\phi > 10°$
i_c, i_q	$\left(1-\frac{\alpha}{90}\right)^2$ α inclination of load with vertical (in degree)
i_γ	$\left(1-\frac{\alpha}{\phi}\right)^2$

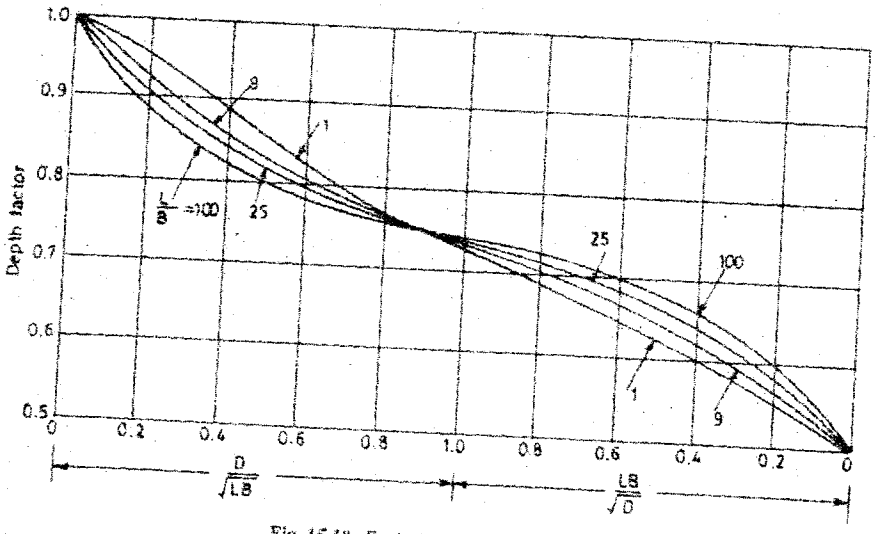

Fig. 15.18 Fox's depth correction factor

at of Settlement