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Code No: 117AB **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech IV Year I Semester Examinations, November/December - 2017

ADVANCED FOUNDATION ENGINEERING

(Civil Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

(25 Marks)

1.a) Give examples for footing subjected to eccentric loading. Also discuss about modified width of footing due to load eccentricity. [2]

b) Write the assumptions of Mayerhof's theory of bearing capacity. [3]

c) Define pile group and draw a pile group which is possible with minimum number of piles. [2]

d) A 6m long and 0.3m diameter pile is fully embedded in soft clay where complete adhesion is possible. If the UCS of clay is 100 kPa, estimate the shaft friction load. [3]

e) List assumptions of Rankine's theory of eath pressure. [2]

f) Why shear key is provided beneath the base of the retaining wall? Discuss how its depth is estimated. [3]

g) Draw the typical pattern of deformation of vertical walls: i) anchored bulk head, ii) Braced - cut and iii) Tieback – cut. [2]

h) Define Strut and Wale. [3]

i) Define swelling pressure. Comment whether a building can be lifted up or not when bearing capacity of soil is higher than the swelling pressure. [2]

j) Write a note on sand cushion technique in swelling soils. [3]

PART-B

(50 Marks)

2.a) Define and discuss the importance of Safe bearing capacity and Allowable bearing capacity in the design of foundation.

b) A square footing is to be designed for a safe load of 350 kN. If the load is inclined at an angle of 15^0 to the vertical, determine the width of the foundation. Take a factor of safety of 3.0 and use Vesic's equation. The following are the soil properties: unit weight of soil = 19 kN/m^3, angle of internal friction of soil is 35^0 and cohesion is 5 kPa. The depth of foundation is 1.25m. Assume no water table effect. The bearing capacity factors are: N_c= 46.12, N_q = 33.3, N_γ = 48.03. For square footing:
Shape factors are: $s_c = 1+ (N_q/N_c)$, $s_q = 1 + \tan\phi$ and $s_\gamma = 0.6$.
Depth factors are: $d_c = 1+ 0.4(D_f/B)$, $d_q = 1 +2 \tan\phi(1-\sin\phi)^2 (D_f/B)$, $d_\gamma = 1.0$; and
Inclination factors are: $i_c = i_q =[1- (\alpha/90)]^2$, $i_\gamma = [1- (\alpha/\phi)]^2$ [3+7]

OR

3.a) Write a note on bearing caapcity of layerd clay soil.

b) Square footing of size 5 x 5 m is founded at a depth of 1.5m below the ground surface in loose to medium dense sand with net load intensity of 135 kPa. Standard Cone Penetration tests conducted at the site gave the following data.

Depth below GL (m)	2	4	6	8	10	12	14	16	18
Cone Resistance, q_c *(kPa)*	800	800	800	800	1000	1000	1000	1200	1200

The water table is at the base of the foundation. Above and below the water table the unit weights of soil are 16.5kN/m^3, and 19kN/m^3. Compute the elastic settlement that can take place over a period of 4 years. Use the equation, $E_s = 4q_c$ kN/m^2, for computing the modulus of elasticity of the sand. Assume $\mu = 0.3$ and the depth of the compressible layer = $2B = 10$m (= H). [3+7]

4.a) Discuss how settlement of pile group is controlled in clay soil.

b) A raft footing is founded at a depth of 3.5 m below the ground level in a deep stratum of normally consolidated clay having the following properties: saturated unit weight of soil = 20 kN/m^3, compression index of clay = 0.34, initial void ratio = 0.85. The raft carries a uniformly distributed load of 125 kPa. It is supported by a group of 81 piles arranged in a square formation such as 9x9 pile group. The length, diameter and spacing of the piles are 15m, 0.45m and 2.5 m respectively. The projection of the raft beyond the edges of the piles is 0.6 m. The water table is located at the ground level. Estimate the consolidation settlement of the piled raft exactly 5m below the pile group tip level. Assume that the load dispersion starts from a height of 1/3 of pile length from the pile tip. Assume also 2:1 distribution for vertical stress calculation. [3+7]

OR

5.a) Distinguish short and long pile. Explain with neat sketches the defelection and bending behaviour of laterally loaded free headed and fixed headed short and long pile.

b) Discuss with charts and formulae the procedure of estimation of lateral capacity of piles in clay as per the Broms theory. [5+5]

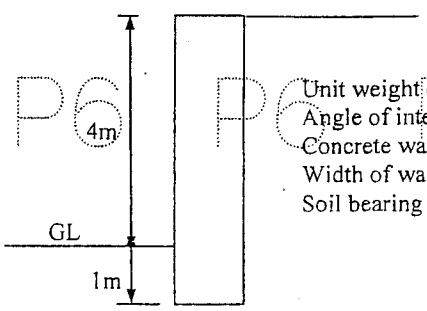
6.a) Discuss how the surcharge or line load is accounted in Culman's method while estimating active earth pressure.

b) A retaining wall 5m high with a vertical back supports a horizontal fill weighing 18 kN/m^3. The backfill has angle of internal friction 30°, wall friction 18°, and cohesion is zero kPa. Determine the total active thrust on the wall by Culmann's graphical method. [4+6]

OR

7.a) What are the modes of faulires in retaining walls explain them with neat sketches.

b) Check the stability against overturning and bearing pressure of the retaining wall shown below. Consider the passive resistance also. [4+6]



Unit weight of soil for both the sides = 18 kN/m^3
Angle of internal friction of soil = 30°
Concrete wall unit weight = 24 kN/m^3
Width of wall = 1m and length is extended
Soil bearing capacity = 200 kPa.

8.a) Differentiate the cantilever sheet pile walls with anchored sheet pile walls and discuss the practical relevance of both.

b) Discuss the formulations for depth of embedment of anchored sheet pile wall in granular soils using free earth support method. [4+6]

OR

9.a) Differentiate sheet pile walls with braced cuts and discuss the practical relevance of both.

b) Discuss the Bjerrum and Eide method of stability analysis of braced-cuts. [4+6]

10.a) Discuss the effects of swelling soils on building foundations.

b) Explain the importance of Sand Cushion and CNS techniques in controlling the damages of building foundations in swelling soils. [4+6]

OR

11.a) Define 'lime fixation point' for a soil. Discuss how it can be achieved?

b) What are the recommended percentages of lime for different soils? Enunciate the effect of lime content and curing time on the properties of soil-lime mixes. [4+6]

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