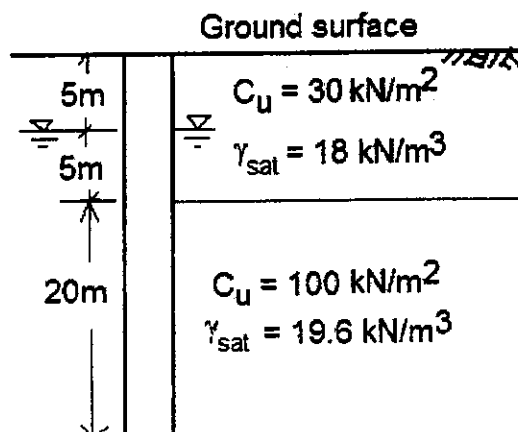系所組別： 土木工程學系乙組

考試科目： 基礎工程　　　　　　　　　　　　　　　　考試日期：0307，節次：1

※ 考生請注意：本試題 ☑可 □不可 使用計算機

1. Translate following terminologies to Chinese and explain its meanings: (6 x 5% = 30%)
   (1) fully compensated foundation　(2) counterfort wall　(3) soldier beam
   (4) undisturbed sample (5) cone penetration test　(6) heave

2. A square column foundation is 2 m x 2 m in plan. Let D_f = 1.5 m, γ = 16.5 kN/m^3, ϕ' = 30 degree and c' = 0. Assuming general shear failure in soil and a factor of safety of 4, use Terzaghi's equation (Terzaghi's bearing capacity factor, N_c = 37.16、N_q = 22.46、N_γ = 19.13 for ϕ = 30 degree) and reference equations (Vesic, De Beer, etc.) given in reference data sheet (bearing capacity factor, N_c = 30.14、N_q = 18.4、N_γ = 22.4 for ϕ = 30 degree) to determine the gross allowable vertical load (kN) the column could carry. (20%)

3. Braced vertical sheeting is used to brace a deep open trench excavation made for the purpose of installing a large-diameter water main pipe for a municipal supply system. The excavation will be 6.5 m deep, extending through sandy soils (unit weight of 18 kN/m^3). The sheeting will be supported by three rows of struts. The top strut will be level with the ground surface, the second strut 3 m down, and the third strut 4.5 m down from the ground surface. In plan view, the struts are positioned 4 m apart. Calculate the force in each strut. (10%)

4. A driven closed-end pipe pile in clay is shown in figure below. The pipe has outside diameter of 40 cm, and wall thickness is 0.64 cm. The clay layer given ϕ'_R = 30 degree for all clay layers. The top 10 m of clay is normally consolidated. The bottom clay layer has an OCR of 2. (a) Calculate the net point bearing capacity. Calculate the skin resistance (kN) by (b) α method, (c) β method, (d) λ method. (e) Estimate the net allowable pile capacity (kN) with using FS = 3. (5 x 5% = 25%)

Ground surface

5m

5m

20m

C_u = 30 kN/m^2

γ_{sat} = 18 kN/m^3

C_u = 100 kN/m^2

γ_{sat} = 19.6 kN/m^3

5. (a) What modes of bearing capacity failure were defined by Vesic? (9%) (b) How did they depend on relative density and depth of burial? (6%)

※ 考生請注意：本試題 ☑可　□不可 使用計算機

Reference data sheet

Reference equations (Vesic, De Beer, etc.):

As $\phi = 30$ degree, $N_c = 30.14 \cdot N_q = 18.4 \cdot N_\gamma = 22.4$;

$q_u = c\, N_c\, F_{cs}\, F_{cd}\, F_{ci} + q\, N_q\, F_{qs} F_{qd}\, F_{qi} + 0.5\gamma\, B\, N_\gamma F_{\gamma s} F_{\gamma d}\, F_{\gamma i}$;

$F_{cs} = 1 + (B/L)(N_q / N_c)$, $F_{cd} = 1 + 0.4(D/B)$, $F_{ci} = F_{qi} = (1 - \beta/90)^2$,

$F_{qs} = 1 + (B/L)\tan\phi$, $F_{qd} = 1 + 2\tan\phi\,(1 - \sin\phi)^2\,(D/B)$,

$F_{\gamma s} = 1 - 0.4(B/L)$, $F_{\gamma d} = 1$, $F_{\gamma i} = (1 - \beta/\phi)^2$;

$f = \alpha c_u$, $f = \beta\sigma_o'$, $f_{av} = \lambda(\sigma_m' + 2c_u)$, $\beta = K \tan\phi_R'$,

$K = (1 - \sin\phi_R')(OCR)^{0.5}$