編號： 125　系所：土木工程學系乙組　　科目：基礎工程

本試題是否可以使用計算機：☑可使用，☐不可使用　（請命題老師勾選）

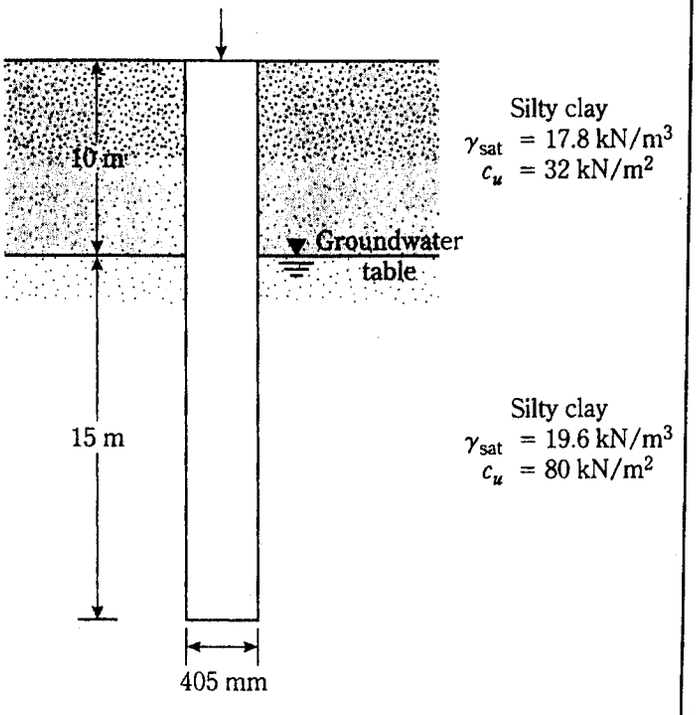
1. Translate following terminologies to Chinese and explain its meanings: (24%)
   (1) angular distortion (2) group efficiency (3) piping (4) friction ratio
   (5) tieback (6) standard penetration test

2. Present Schmertmann's method for estimating the settlements of footings on sand. (12%)

3. Compute the net ultimate bearing capacity of a 2 m square footing founded at a depth of 1 m below the ground surface for the following three situations: (a) the ground water level (GWL) is located at the ground surface. (b) the GWL is at a depth of 1 m below the ground surface. (c) the GWL is at a depth of 4 m below the ground surface. Assume the soil is a clayey sand with cohesion, c = 10 kPa, internal friction angle, ϕ = 30 degree, moist unit weight, γ_m = 17.81 kN/m^3, saturated unit weight, γ_{sat} = 18.81 kN/m^3. (15%)

4. A cantilevered sheet pile wall is to support the side of an excavation 3 m deep in the sandy soil deposits. The soil properties are: cohesion, c' = 0, specific gravity, G_s = 2.65, degree of saturation, S_r = 80%, internal friction angle, ϕ' = 30 degree, void ratio, e = 0.65. The ground water level is located at 7.5 m under ground surface. Determine: (a) the safe driving depth required for the factor of safety of 1.3. (b) the maximum bending moment induced in the piling. (c) the factor of safety against piping if the ground water level outside the wall is located at ground surface while the ground water level inside the wall is located at excavation level during the raining day. (24%)

5. a concrete pile 405 mm X 405 mm in cross section is shown right. (25%)
   (a) Calculate the net point bearing capacity.
   (b) Calculate skin resistance (1) by using α method, (2) by using β method, and (3) by using λ method. Let ϕ'_R = 30 degree for all clay layers, which are normally consolidated.
   (c) Estimate the net allowable pile capacity. Use FS (factor of safety) = 3.



（背面仍有題目，請繼續作答）

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Reference equations and figures:

As ϕ = 30 degree，$N_c = 30.14$、$N_q = 18.4$、$N_\gamma = 22.4$；

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

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

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

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

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

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