

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）

考試日期：0301，節次：1

1. Translate following terminologies to Chinese and explain its meanings: (30%)  
 (1) coefficient of earth pressure at rest (2) strain influence factor (3) neutral plane  
 (4) negative skin friction (5) plate loading test (6) general shear failure
2. A strip footing will be constructed on a silty sand deposit that has the shear strength properties of  $c' = 0$ ,  $\phi' = 30$  degree, a moist unit weight of  $18.0 \text{ kN/m}^3$ , and a saturated unit weight of  $19.7 \text{ kN/m}^3$ . The proposed strip footing will be 1.2m wide and embedded 0.6 m below the ground surface. Assume the groundwater table is located 1.2 m below the ground surface. Determine the net ultimate bearing capacity, the allowable bearing pressure  $q_{all}$  and the maximum vertical concentric load the strip footing can support for the silty sand. (Use a factor of safety of 3) (18%)
3. A 6 meters high retaining wall is to support a soil with moist unit weight  $\gamma_m = 17.4 \text{ kN/m}^3$ , soil friction angle  $\phi = 26$  degree, and cohesion  $c = 14.36 \text{ kN/m}^2$ . (a) Determine the Rankine active force per unit length of wall both before and after the tension crack occurs, and determine the line of action of the resultant in both cases. (20%) (b) If the water table is located at the top of the retaining wall at the backfill side while the other side is at the toe of the retaining wall during the raining day, calculate the Rankine active force per unit length of wall before the tension crack occurs, and determine the line of action of the resultant. Assume the saturated unit weight  $\gamma_{sat} = 19.7 \text{ kN/m}^3$ ,  $c'$  and  $\phi'$  are the same as  $c$  and  $\phi$ , respectively. (10%)
4. Estimate the group capacity of a  $3 \times 3$  group of 300 mm diameter precast piles that penetrate 10 meters into a clay that has adhesion  $c_a = 38 \text{ kPa}$ , undrained strength  $c_u = 62 \text{ kPa}$ , specific gravity  $G_s = 2.7$ , void ratio  $e = 0.75$ , effective cohesion  $c' = 0$ , effective friction angle  $\phi' = 30$  degree. The center-to-center spacings of individual piles are 1 meter. The water table is located at the ground surface. (16%)
5. What assumptions are made regarding soil properties for the Terzaghi's bearing capacity theory? (6%)

Reference equations:

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

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

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

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

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