

EX/CE/5/T/506B/2019

Bachelor of Civil Engg. (Evening) 5<sup>th</sup> Year Exam. 2019

Subject: Advanced Soil Mechanics

Time : Three hours

Answer any FOUR questions

Full Marks : 100

1. (a) State and explain the different triaxial tests giving neat sketches of Mohr's circles and failure envelopes.  
(b) An embankment is being built of a soil whose effective stress shear strength parameters are:  $c' = 100 \text{ kN/m}^2$  and  $\phi' = 20^\circ$ ; unit weight is equal to  $17 \text{ kN/m}^3$ . The pore pressure parameters A and B as determined by the triaxial shear tests are 0.6 and 0.8 respectively. The height of the embankment has just been raised from 4m to 9m. Determine the shear strength of the soil at the base of the embankment. It can be assumed that the dissipation of pore pressure during this stage of the construction is negligible and the lateral pressure at any point is one-half of the vertical pressure.  
15+10
2. (a) Deduce an expression for three dimensional consolidation for sand drains in terms of polar coordinates. What is 'smear'?  
(b) A 6 m thick clay layer is drained at the top and bottom and has some sand drains. The given data are  $C_v$  (for vertical drainage) =  $49.51 \times 10^{-4} \text{ m}^2/\text{day}$ ;  $k_v = k_h$ ;  $r_w = 0.225 \text{ m}$ ;  $r_e = 1.5 \text{ m}$ ;  $r_w = r_s$  (no smear at the periphery of drain wells). It has been estimated that a given uniform surcharge would cause a total consolidation settlement of 250 mm without the sand drains. Calculate the consolidation settlement of the clay layer with the same surcharge and sand drains at time  $t = 6$  months and 1 year.  
15 + 10.
3. (a) What do you mean by stress point and stress path? Explain  $K=1$ ,  $K>1$ ,  $K<1$  and  $K_0$  lines giving neat sketches wherever necessary.  
(b) Draw the stress paths for axial compression and extension in triaxial tests showing comparisons with laboratory tests vis-à-vis at field.  
(c) Draw the stress paths for CU test and UU test on normally consolidated clay.  
10 +10+5
4. (a) Explain with a neat sketch showing the various forces acting on a cantilever sheet pile wall. What do you mean by free earth and fixed earth support anchored sheet pile walls?  
(b) An anchored sheet pile wall of total height 15 m is penetrated 4.5m into a sandy stratum. It retains a similar sandy soil on its back upto its top with a horizontal ground surface. The tie bars are horizontal and are provided at a depth of 2m below the top. The free water level stands at a height of 8m above the dredge line in front of

the wall and that of 9m in the backfill. The bulk density of sand above the free water level is  $1.68 \text{ t/m}^3$  and the submerged density below the water level is  $0.99 \text{ t/m}^3$ . The angle of internal friction of sand is  $35^\circ$ . Determine the factor of safety with respect to passive resistance of soil for the given depth of penetration. What is the anchor pull per metre length of the wall? 10+15

5. Write short notes on any FIVE of the following:

5 x 5

- a) Taylor's stability no.
- b) Simplified Bishop's method
- c) Skempton's pore pressure parameters
- d) p - q diagram
- e) Total stress analysis
- f) One dimensional consolidation vs. three dimensional consolidation