

Bachelor of Civil Engg. (Evening) 5th Year Exam. 2017**Subject: Advanced Soil Mechanics****Answer Question no. 5 and any THREE from the rest**

Full Marks : 100

Times : Three hours

1. (a) State and explain Skempton's pore pressure parameters. Deduce the expression for excess pore pressure in terms of those parameters.
 (b) The results obtained from a series of CU tests with pore pressure measurements on a soil gave the following results: $c_{CU} = c'_{CU} = 0$, $\phi_{CU} = 15^\circ$, $\phi'_{CU} = 30^\circ$
 A sample of this soil was tested under a cell pressure of 100 kN/m^2 .
 Determine: (a) deviator stress at failure
 (b) pore water pressure at failure
 (c) minor principal effective stress at failure
 (d) major principal effective stress at failure
 (e) the magnitude of A_f . 10 + 15

2. (a) Write down Terzaghi's three dimensional consolidation equation clearly explaining the meaning of the various terms. Explain how this equation can be modified to obtain the equation for radial drainage.
 (b) Explain the basic theory behind the working principles of sand drains.
 (c) What do you mean by smear?
 (d) A 5m thick clay layer drained at top and bottom has some sand drains. A uniform surcharge is applied at the top of the clay layer. Calculate the average degree of consolidation for combined vertical and radial drainage after 150 days of load application. Given $C_{vr} = C_v = 4 \text{ mm}^2/\text{min}$, $d_e = 2\text{m}$, and $r_w = 0.2\text{m}$. Assume no smear. 5+3+2+15

3. (a) State and explain stress path giving a neat sketch. Draw the stress paths for K_0 line, $K > 1$ line and $K = 1$ line.
 (b) Express the shear strength parameters (c , ϕ) in terms of the intercept (a) and slope (α) of K_f - line in the p - q diagram. Deduce the necessary relationship.

(e) CU triaxial tests conducted on specimens of a saturated clay soil gave the following results:

Cell Pressure σ_3 (kN/m ²)	Additional axial stress ($\sigma_1 - \sigma_3$) or deviator stress at failure (kN/m ²)	Pore water pressure u at failure (kN/m ²)
150	102	80
300	200	164
450	304	264
600	405	325

Determine the effective stress strength parameters c' and ϕ' by the Mohr circle method and the stress point method.

5 + 7 + 13

4. (a) Derive the equations of static equilibrium for stresses acting on an elemental soil mass in terms of effective stresses giving a neat sketch.

(b) Deduce the expressions of shear strain. What do you mean by plain strain problems? Explain the mathematical interpretations.

10 + 10 + 5

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

5 x 5

- Free earth and fixed earth support anchored sheet pile walls
- Bishop & Morgenstern method
- Skempton's pore pressure parameters
- p - q diagram
- Effective stress analysis and total stress analysis
- UU and CU test.