KATHMANDU UNIVERSITY
End Semester Examination
March/April 2017

APR 20 2017

Level : B.E.
Year : III
Time : 2 hrs. 30 mins.

Course : CIEG 303
Semester: I
F.M. : 40

SECTION "B"

1.a. Starting from the relation of $\gamma_{sat}, G \text{ and } e$, for a given saturated soil, show that, [2]

$$w_{sat} = \frac{n.\gamma_w}{\gamma_{sat} - n.\gamma_w}$$

b The unit weight of a soil is 95 lb/ft^3. The moisture content of the soil is 19.2 % and the degree of saturation is 60%. Determine:

i. Void ratio
ii. Specific gravity of soil solids
iii. Saturated unit weight
iv. Weight of water to be added to increase DOS of 10 ft^3 of the soil to 95 %. [4]

2.a. Draw a typical particle size distribution curve and describe various parameters that could be determined from it. Also, describe the types of soil based upon grain size distribution with the help of curves and criteria of parameters. [3]

b. A 100 cm^3 clay sample has a natural water content of 30 %. It's shrinkage limit is 18 %.If the specific gravity of solids is 2.72, what will be the volume of soil sample at a water content of 15%? [3]

3. Define Compaction curve and Zero air voids line. Draw a compaction curve for a soil showing maximum dry density, optimum water content, zero air voids line, dry side and wet side of optimum. Compare the compaction curve for sand and clay. [2+2]

4. The soil profile at a site for a proposed office building is shown in the figure (Fig. 1). The groundwater table was observed at $3m$ below ground level. The void ratio of the sand is 0.8 and the water content of the clay is 40%. The building will impose a vertical stress increase of 100 kPa at the middle of the clay layer. Calculate the primary consolidation settlement of the clay: (a) If the clay is normally consolidated with $C_c = 0.3$. (b) If the clay is over consolidated with an $OCR = 2.5, w = 38\%, and\ C_r = 0.05$. Assume the soil above the water table to be saturated, and $G = 2.65$ for both sand and clay.

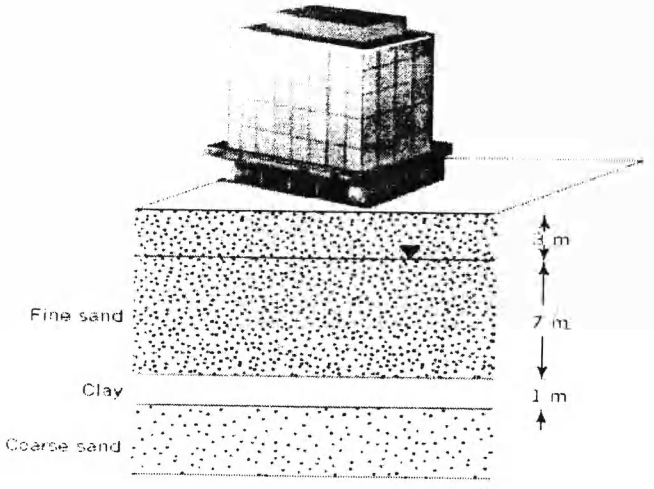

Fig.1

OR

Derive the general equation for calculation of settlement from one dimensional primary consolidation. Also, write the particular equations for normally consolidated and over-consolidated clays. How can you determine coefficient of consolidation using Root time method? [5]

5. A cylindrical water tank of diameter $5m$ and height $10\ m$ is filled with water. Self weight of tank is $300\ kN$ and unit weight of water is $9.81\ kN/m^3$. Assuming the base of water tank foundation to be at surface, calculate the increase in vertical total stress at a depth of $4m$ under center of water tank if tank rests on
   i. Circular foundation of $5m$ diameter.
   ii. Ring foundation of $5m$ external diameter and $3m$ internal diameter. [4]

6.a. Discuss the effect of seepage flow on the magnitude of effective stress in a soil. A sketch of a flow net under a dam is shown in Figure (Fig.2). (i) Determine the flow rate under the dam, if $k_{eq} = 2 \times 10^{-7} cm/s$. (ii) Determine the porewater pressures at A and B. [2+2]

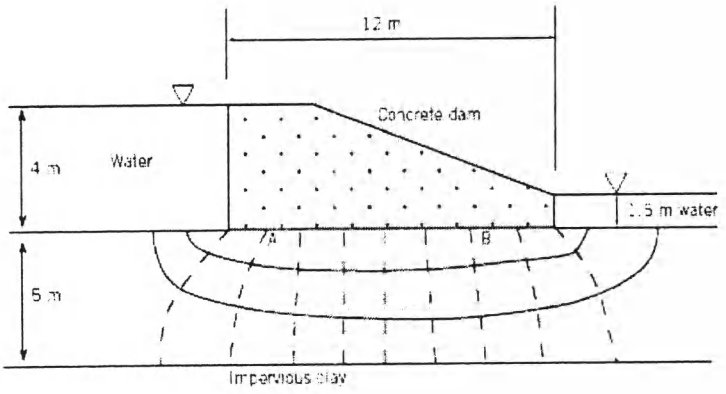

Fig.2

b. Figure (Fig.3) shows a $5\ m$ high retaining wall supporting sandy backfill ($G = 2.7$) carrying a surcharge of $30\ kN/m^2$. The wall is restrained from yielding. Calculate the lateral force P_o per unit length of the wall. Also, determine the location of the resultant force. [4]

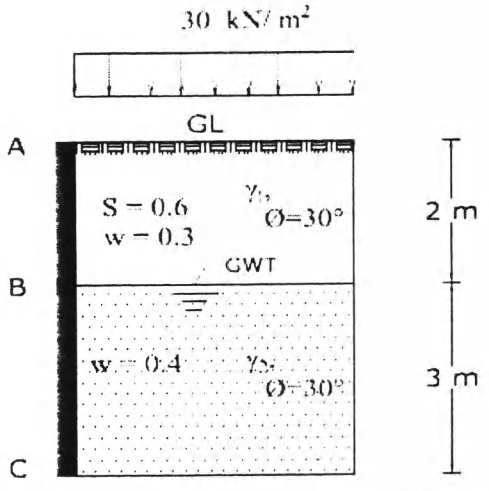

Fig.3

7. State Mohr-Coulomb failure criterion. Write down the three basic equations defining the criteria and also write the combined form that relates principle stresses at failure. How are the results in direct shear test interpreted and values of $c - \emptyset$ calculated? [2+2]

8. What types of slope failure are common in soils? Define various types of factor of safety. What methods of analysis are used to estimate the stability of slope? [3]