

Dec.-23-0395

CE-402 (Geotechnical Engineering-I)

B.Tech. 4th (CBCS)

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five question in all. One question each from section A,B,C,D. Question No. 9 is compulsory, which is of 20 marks.

SECTION - A

1. (a) Differentiate between 'residual' and 'transported' soils. Also briefly describe the processes of soil formation. (5)

(b) From consistency limit test on a fine grained soil the following data has been obtained.

Weight of crumbled threads of 3 mm diameter = 20.11 gm

Weight of oven dried soil threads = 14.82 gm

Liquid limit of soil sample = 64.2%

Classify the soil according to Indian Standard Soil Classification System. (5)

OR

2. (a) What is Diffused Double Layer (DDL) and adsorbed water? What are the factors that affect the DDL? (5)

(b) The mass of a moist soil sample collected from the field is 465 grams, and its oven dry mass is 405.76 grams. The specific gravity of the soil solids was determined in the laboratory to be 2.68. If the void ratio of the soil in the natural state is 0.83, find the following:

i. The moist density of the soil in the field (kg/m^3)

ii. The dry density of the soil in the field (kg/m^3)

iii. The mass of water, in kilograms, to be added per cubic meter of soil in the field for saturation. (5)

SECTION - B

3. (a) Determine total stress, pore water pressure and effective stress of soil profile as shown in Fig. 1 at level AA', BB', CC', and DD' also draw the stress distribution. If due to rain water table rises up to level BB' then determine total stress, pore water pressure and effective stress at level AA', BB', CC' and DD'. Also draw stress distribution. (Load is applied gradually at the ground surface, unit weight of water = 10 kN/m^3). (6)

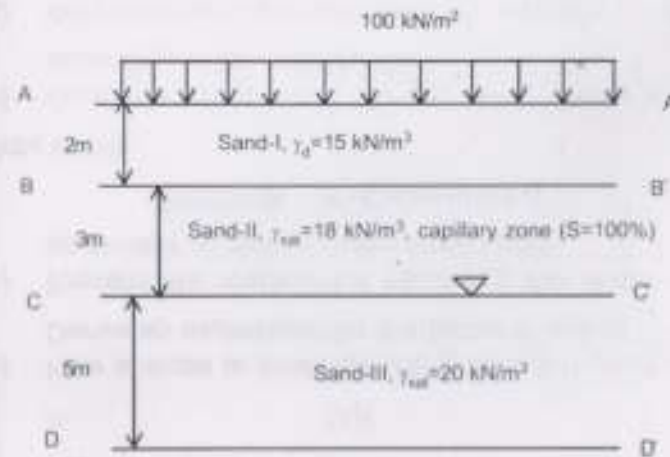


Fig. 1

(b) Explain the effect of capillarity on soil. Write the methods for determining capillary rise in soils. (4)

OR

4. (a) What is effective stress principle? Does effective stress is equal to intergranular stress for all type of soil? Justify the answer. (5)

[P.T.O.]

- (b) Write the procedure for drawing flow net i) in isotropic soil, ii) in anisotropic soil. (5)

SECTION - C

5. (a) A clay layer 6 m thick, having double drainage, settles by 30 mm in 3 years after it has been subject to a certain load. Its final consolidation settlement is calculated equal to 120 mm. If a layer of sand of negligible thickness were to be present at a depth of 1.5 m from the top of the clay layer, what will be the final consolidation settlement of the clay layer? What will be its settlement after 3 years? (5)
- (b) Explain the phenomenon of secondary consolidation. Differentiate between the secondary consolidation index and the primary compression index. (5)

OR

6. (a) In normally consolidated clay stratum of 3m thickness has two permeable layers at its top and bottom. The liquid limit and initial void ratio of the clay are 3.6% and 0.82% respectively while the initial overburden pressure at the middle of the clay layer is 2kg/cm^2 . Due to construction of new building this pressure increases by 1.5kg/cm^2 . Compute the Probable consolidation settlement of the building. (5)
- (b) Differentiate between normally consolidation and over consolidated soils. How would you determine the over consolidation pressure? (5)

SECTION - D

7. (a) The results obtained from a series of \overline{CU} tests 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 in a \overline{CU} test under a cell pressure of 150 kN/m^2 . Determine (i) deviator stress at failure, (ii) pore water pressure at failure, (iii) minor principal effective stress at failure, (iv) major principal effective stress at failure, (v) the magnitude of A_r . (5)

- (b) Discuss the friction circle method for the stability analysis of slopes. Can this method be used for purely cohesive soil? (5)

OR

8. (a) How a slope is analysed using Swedish circle method? Derive an expression for the factor of safety. (5)
- (b) Explain the method for obtaining the shear strength parameter (c and ϕ) using stress path.

SECTION - E (Compulsory)

9. Write briefly:
- (a) Give the grain sizes ranges of different soil types according to IS: 1498(1970).
- (b) Why engineering significance of void ratio is more than the porosity?
- (c) Does the increase in vertical stress at a certain soil depth from an applied surface load a total stress increase or an effective stress increase? Explain your answer.
- (d) Differentiate between water pressure and effective stress.
- (e) What are the factors that influence the height of capillary rise in soil?
- (f) How does flow through a soil change the effective stress?
- (g) What do you understand by secondary consolidation?
- (h) Differentiate between pore water pressure and excess pore water pressure.
- (i) Classify the triaxial test based on drainage.
- (j) What is stress path? (10×2=20)