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53 (CE 403) GTEN

2016

GEOTECHNICAL ENGINEERING

Paper : CE 403

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer **any five** questions.

1. (a) Describe the *two* basic fundamental crystal sheets of clay minerals. 6

(b) Discuss with suitable diagram the structure of montmorillonite clay. 4

(c) A soil sample has a porosity of 40%, the specific gravity of solids is 2.7. Calculate, 10

(i) Void ratio

(ii) Dry density

(iii) Unit weight of the soil at 50% saturation.

(iv) Unit weight if the soil is completely saturated.

Contd.

2. (a) Discuss the various factors affecting compaction. 10

(b) For a homogenous earth dam 52m high and 2m free board, a flow net was constructed and following results were obtained. 5

Number of potential drops = 25

Number of flow channels = 4

The dam has a horizontal filter of 40m length at its downstream end. Calculate the discharge per metre length of the dam if the coefficient of permeability of the dam material is 3×10^{-3} cm/s.

(c) A soil has a bulk unit weight of 20.11 kN/m³ and water content of 15%. Calculate the water content if the soil partially dries to a unit weight of 19.42 kN/m³ and the void ratio remains unchanged. 5

3. (a) Derive the relationship for permeability of stratified soil for horizontal flow (flow parallel to bedding planes). 10

(b) Define plasticity index and liquidity index. 2

- (c) Determine the value of liquid limit of a soil from the following test data. 8

Number of blows	38	34	20	12
Water content	16	17	20	22

4. (a) What is the difference between settlement and compressibility? Discuss all the components of total settlement. 10

- (b) Calculate the coefficient of permeability of a soil sample, 6cm in height and 50cm² in cross sectional area, if a quantity of water equal to 430ml passes down in 10 min under an effective constant head of 40cm.

On oven drying the test specimen has mass of 498g. Taking the specific gravity of soil solids as 2.65, calculate the seepage velocity of water during the test. 10

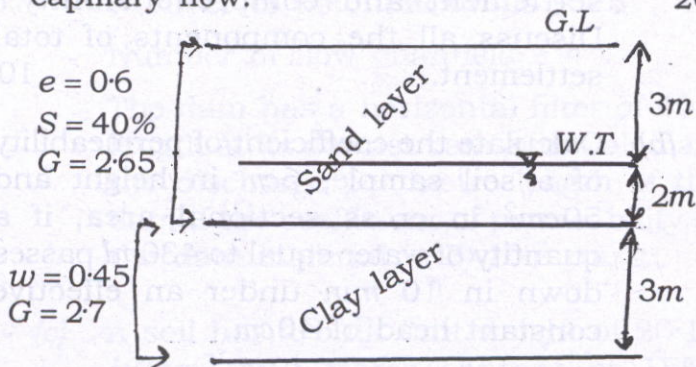
5. Discuss briefly : 20

- (i) Liquid limit, plastic limit and shrinkage limit.
(ii) Coefficient of uniformity, coefficient of curvature and D₃₀.

(iii) Virgin compression, expansion and recompression.

(iv) Quick sand condition.

6. For the subsoil condition shown in Fig. draw the total, neutral and effective stress diagram upto a depth of 8m. Neglect capillary flow. 20



7. A retaining wall with smooth vertical back retains sand backfill for a depth of 6m. The backfill has a horizontal surface and has the following properties, $C' = 0$, $\phi' = 28^\circ$, $Y = 16 \text{ kN/m}^3$, $Y_{\text{sat}} = 20 \text{ kN/m}^3$. Calculate the magnitude of the total thrust against the wall when it is free to yield, water table at 3m depth and there is no drainage. Also determine the point of application of the resultant thrust. 20