QUESTION BANK

DEPARTMENT: CIVIL **SEMESTER: V**

SUBJECT CODE / Name: 19CEB301 / SOIL MECHANICS

UNIT 2- SOIL WATER AND WATER FLOW

PART - A (2 marks)

1. What are the different types of soil water?
2. List out the methods of drawing flow net.
3. What is meant by total stress, neutral stress and effective stress?
4. What is meant by capillary rise in soil and how it affects the stress level in soils?
5. Prove that effective stress in soil mass is independent of variation in water table above the ground surface.
6. State and explain Darcy's law.
7. What is quick sand? How would you calculate the hydraulic gradient required to create quick sand conditions in a sample of sand?
8. For a homogeneous earth dam 52 m high and 2 m free board, a flow net was constructed and following results were obtained:
   Number of potential drops = 25; Number of flow channels = 4
   Calculate the discharge per metre length of the dam if the co-efficient of permeability of the dam material is 3×10^{-5} m/sec.
9. What is capillary rise?
10. What is surface tension?
11. What are the different forms of soil water?
12. Write down the uses of Flow net.
13. Define Neutral stress.
14. What is seepage velocity?
15. Define soil water and classify the types of soil water.
16. Define Capillarity and permeability.
17. What is surface tension?
18. Illustrate the applications of flow net
19. Give the relationship between total, neutral and effective stress.
20. What are the factors affecting permeability?
21. What are the methods available for determination of permeability in the laboratory?

22. Define discharge and seepage velocity.
23. What are methods of determination of permeability in the field?
24. Define seepage pressure and flow net.
25. What is quick sand condition?

PART - B (16 marks)

1. The water table in a deposit of sand 8 m thick is at a depth of 3 m below the ground surface. Above the water table, the sand is saturated with capillary water. The bulk density of sand is 19.62 kN/m^3. Calculate the effective pressure at 1m, 3m and 8m below the ground surface. Hence plot the variation of total pressure, neutral pressure and effective pressure over the depthof 8m.

2. Write down the procedure for determination of permeability by constant head test in the laboratory.

3. Compute the total, effective and pore pressure at a depth of 20 m below the bottom of a lake 6 m deep. The bottom of lake consists of soft clay with a thickness of more than 20 m. the average water content of the clay is 35% and specific gravity of the soil may be assumed to be 2.65.

4. What will be the ratio of average permeability in horizontal direction to that in the vertical direction for a soil deposit consisting of three horizontal layers, if the thickness and permeability of second layer are twice of those of the first and those of the third layer twice those of second?

5. The subsoil strata at a site consist of fine sand 1.8 m thick overlying a stratum of clay 1.6 m thick. Under the clay stratum lies a deposit of coarse sand extending to a considerable depth. The water table is 1.5 m below the ground surface. Assuming the top fine sand to be saturated by capillary water, calculate the effective pressures at ground surface and at depths of 1.8 m, 3.4 m and 5.0 m below the ground surface. Assume for fine sand G = 2.65, e = 0.8 and for coarse sand G = 2.66, e = 0.5. What will be the change in effective pressure at depth 3.4 m, ifno capillary water is assumed to be present in the fine sand and its bulk unit weight is assumed to be 16.68 kN/m^3. The unit weight of clay may be assumed as 19.32 kN/m^3.

6. In a constant head permeameter test, the following observations were taken. Distance between piezometer tappings = 15 cm, difference of water levels in piezometers = 40 cm, diameter of the test sample = 5 cm, quantity of water collected = 500 ml, duration of the test = 900 sec.

determine the coefficient of permeability of the soil. If the dry mass of the 15 cm long sample is 486 g and specific gravity of the solids is 2.65. Calculate seepage velocity of water during the test.

7. A foundation trench is to be excavated in a stratum of stiff clay, 10m thick, underlain by a bed of coarse sand (fig.1.). In a trial borehole the ground water was observed to rise to an elevation of 3.5m below ground surface. Determine the depth upto which an excavation can be safely carried out without the danger of the bottom becoming unstable under the artesian pressure in the sand stratum. The specific gravity of clay particles is 2.75 and the void ratio is 0.8. if excavation is to be carried out safely to a depth of 8m, how much should the water table be lowered in the vicinity of the trench?

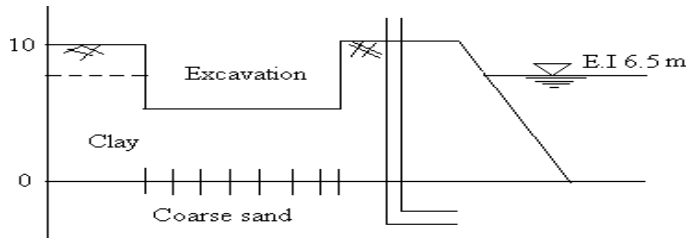

Fig.1

8. The following data were recorded in a constant head permeability test.
   Internal diameter of permeameter = 7.5cm
   Head lost over a sample length of 18cm = 24.7cm
   Quantity of water collected in 60 Sec = 626 ml
   Porosity of soil sample was 44%
   Calculate the coefficient of permeability of the soil. Also determine the discharge velocity and seepage velocity during the test.

9. Explain the falling head permeability test.

10. Discuss in detail quick sand condition and derive the expression for Critical Hydraulic gradient

11. Determine the effective stress at 2m, 4m, 6m, 8m and 10m is a soil mass having γ_s =21 KN/m^3. Water table is 2m below ground surface. Above water table there is capillary rise upto ground surface. Also draw total stress diagram up to 10m.

12. Evaluate the co-efficient of permeability of a soil sample, 6 cm in height and 50 cm^2 in cross-sectional area, if a quantity of water equal to 430 ml passed down in 10 min. Under an effective constant head of 40 cm. On oven-drying, the test specimen has mass of 498 g. Taking the specific gravity of soil solids as 2.65, calculate the seepage velocity of water during the test.
13. The discharge of water collected from a constant head permeameter in a period of 15 minutes is500 ml. the internal diameter of the permeameter is 5 cm and the measured difference in head between two gauging points 15 cm vertically apart is 40 cm. calculate the coefficient of permeability. If the dry weight of the 15 cm long sample is 486 gm and the specific gravity of the solids is 2.65, calculate the seepage velocity.
14. Explain in detail the laboratory determination of permeability using constant head method and falling head method.
15. Explain in detail the procedure for drawing the phreatic line for an earthen dam.