

B. Tech-3rd (CE)
Geotechnical Engg.-1

Full Marks : 50

Time : $2\frac{1}{2}$ hours

Answer **all** questions

The figures in the right-hand margin indicate marks

Symbols carry usual meaning

Graph Sheet is to be provided

1. Answer *all* questions : 2 × 5

✓ (a) Distinguish between Residual soil and Transported Soil with examples.

✓ (b) Establish the relation between seepage and discharge velocity through a saturated soil mass.

✓ (c) Differentiate between the normally consolidated clay and over consolidated clay.

(Turn Over)

(2)

(d) The stresses at failure on the failure plane in a cohesionless soil mass were : Shear stress = 5 kN/m^2 ; normal stress = 12 kN/m^2 . Determine the resultant stress on the failure plane, the angle of internal friction of the soil and the angle of inclination of the failure plane to the major principal plane.

(e) What is soil stabilization ? What are its Uses ?

2. (a) The Atterberg limits of a clay soil are : Liquid limit = 75%; Plastic limit = 45%; and Shrinkage limit = 25%. If a sample of this soil has a volume of 30 cm^3 at the liquid limit and a volume 16.6 cm^3 at the shrinkage limit, determine the specific gravity of solids, Shrinkage ratio and volumetric Shrinkage.

(b) Describe the use of particle size distribution curve.

(3)

Or

(a) Describe briefly about Unified classification system of soil.

(b) Determine the total stress and effective stress at a depth of 16 m below the ground level for the following conditions : Water table is 3 m below ground level; $G = 2.68$; $e = 0.72$; average water content of the soil above water table is 8%.

3. (a) Determine the coefficient of permeability from the following data :

Length of sand sample = 25 cm

Area of cross section of the sample = 30 cm^2

Head of water = 40 cm

Discharge = 200 ml in 110 s.

(b) What are the various parameters/factors that affect the permeability of soil in the field ?

(4)

Or

(a) Write short notes on : Quicksand conditions. 4

(b) An earth dam is built on an impervious foundation with a horizontal filter at the base near the toe. The permeability of the soil in the horizontal and vertical directions are 3×10^{-2} mm/s and 1×10^{-2} mm/s respectively. The full reservoir level is 30 m above the filter. A flow net constructed for the transformed section of the dam, consists of 4 flow channels and 16 head drops. Estimate the seepage loss per metre length of the dam. 4

4. (a) Write a brief note on Proctor's needle. 3

(b) A moist soil sample compacted into a mould of 1000 cm^3 capacity and weight 35 N, weighs 53.5 N with the mould. A representative sample of soil taken from

(5)

it has an initial weight of 0.187 N and even dry weight of 0.1691 N. Determine (i) water content, (ii) wet density, (iii) dry density, (iv) void ratio and (v) degree of saturation of sample. Take specific gravity of soil is 2.65. 5

Or

(a) Explain Log fitting method for evaluation of coefficient of consolidation from laboratory consolidation test. 4

(b) A layer of soft clay is 6 m thick and lies under a newly constructed building. The weight of sand overlying the clayey layer produces a pressure of 260 kN/m^2 and the new construction increases the pressure by 100 kN/m^2 . If the compression index is 0.5, compute the settlement. Water content is 40% and specific gravity of grains is 2.65. 4

(6)

5. (a) A sample of dry sand is subjected to a triaxial test. The angle of internal friction is 37 degrees. If the minor principal stress is 200 kN/m^2 , at what value of major principal stress will the soil fail ? 4

- (b) What is Mohr's circle ? Discuss its important characteristics. 4

Or

- (a) The following data were obtained in a direct shear test. Normal pressure = 20 kN/m^2 , tangential pressure = 16 kN/m^2 . Angle of internal friction = 20° , cohesion = 8 kN/m^2 . Represent the data by Mohr's Circle and compute the principal stresses and the direction of the principal planes. 4

- (b) What are the advantages and disadvantages of a triaxial compression test ? 4

(7)

6. (a) What is Mechanical stabilization ? What are the factors that affect the mechanical stability of a mixed soil ? 4

- (b) Describe in brief cement Stabilization and lime stabilization. 4

Or

- (a) What are the different types of chemicals used in stabilization of soil ? 4

- (b) Write short notes on thermal and electrical stabilization. 4

$$\frac{\sigma_1 + \sigma_3}{2}$$

Principal stress

$$\sigma_1 = \frac{\sigma_1 + \sigma_3}{2} + \sqrt{\left(\frac{\sigma_1 - \sigma_3}{2}\right)^2 + \tau^2}$$