Code : 011509

B.Tech 5th Semester Examination, 2016

Soil Mechanics-I

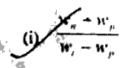Time : 3 hours   Full Marks : 70

Instructions :

(i) There are Nine Questions in this paper.

(ii) Attempt Five questions in all.

(iii) Question No. 1 is compulsory.

(iv) The marks are indicated in the right-hand margin.

---

1. Answer any seven questions from the following:

$2 \times 7 = 14$

(a) A soil has a bulk density of 1.80 g/cm³ at a water content of 5%. If the void ratio remain constant. then its bulk density for a water content of 10% will be:

 (i) 1.98 g/cm³

 (ii) 1.88 g/cm³

 (iii) 1.80 g/cm³

 (iv) 1.70 g/cm³

(b) Liquidity index of a soil is given by:

 (i) $\dfrac{w_n - w_p}{w_l - w_p}$

 (b) $\dfrac{w_l - w_n}{w_l - w_p}$

 (c) $\dfrac{w_l - w_p}{w_n - w_p}$

 (d) $\dfrac{w_l - w_n}{w_n - w_p}$

(c) In a falling head permeability test, equal time interval was noted for drops of heads from H_1 to H_2 and again from H_2 to H_3, then H_2 is equal to:

 (i) $\dfrac{H_1 - H_3}{2}$

 (ii) $\sqrt{\dfrac{H_1^2 + H_3^2}{2}}$

 (iii) $\sqrt{H_1 \times H_3}$

 (iv) $\dfrac{1}{2}\sqrt{H_1^2 + H_3^2}$

(d) Clayey soil are best compacted by:

 (i) Sheep foot rollers

 (ii) Vibratory rollers

 (iii) Heavy drum rollers

 (iv) Pneumatic tamping

(e) Pycnometer is used for the determination of:

P.T.O.

(i) Water content and void ratio

(ii) Void ratio and specific gravity

(iii) Specific gravity and water content

(iv) Water content, void ratio and specific gravity

(f) The Westergard equation are used in the analysis of:

(i) Cohesive soil

(ii) Sandy soil

(iii) Stratified soil

(iv) Clayey soil

(g) The pheratic line in an earth dam may be

(i) circular

(ii) elliptical

(iii) parabolic

(iv) a straight line

(h) The relation between coefficient of consolidation C_v, time factor T_v, drainage path d and time t is given by

(i) $C_v = \dfrac{d^2 \times T_v}{t}$

(ii) $C_v = \dfrac{d^2 \times T}{T_v}$

(iii) $C_v = \dfrac{t \times T_v}{d^2}$

(iv) $C_v = \dfrac{T_v}{d^2 \times t}$

(i) As per Indian Standards (IS). weight of hammer in standard proctor test and modified proctor test are respectively:

(i) 2.60 kg and 4.90 kg

(ii) 2.65 kg and 4.95 kg

(iii) 2.65 kg and 4.90 kg

(iv) 2.60 kg and 4.95 kg

(j) Boussinesq's influence factor (K_B) for soil pressure at depth z, is given by:

(i) $K_B = \dfrac{3}{2\pi}\left[\dfrac{1}{1+(r/z)^2}\right]^{\frac{3}{2}}$

(ii) $K_B = \dfrac{3}{2\pi}\left[\dfrac{1}{1+(r/z)^2}\right]^{\frac{5}{2}}$

(iii) $K_B = \dfrac{3}{2\pi}\left[\dfrac{1}{1+(r/z)}\right]^{\frac{3}{2}}$

(iv) $K_B = \dfrac{3}{2\pi}\left[\dfrac{1}{1+(r/z)}\right]^{\frac{5}{2}}$

Here. r is the radial distance.

2. (a) Derive from fundamentals the relationship between dry unit weight of soil, specific gravity of solids, water content and percentage air voids.

(b) A sampling tube of 38 mm internal diameter was used to extract a sample of cohesive soil from a test pit. The length of the extracted sample was 102 mm and it had a mass of 220 gm and water content of 18%. Compute void ratio, saturated unit weight, submerged unit weight and bulk unit weight.

3. (a) State Darcy's law and define coefficient or permeability. What are the different methods to determine coefficient of permeability (k) in laboratory? Also derive and expression to determine 'k'.

(b) A pumping out test was carried out at a level site, where 9 m of clay overlies a stratum of sand 1.5 m thick. The sand stratum is underlain by an impermeable rock stratum. When steady state was reached the rate of flow was found to be 15 liters/second. The water level in two observation wells located at radial distance of 6 m and 15 m from axis of main well were 5 m and 4.5 m below ground surface. Compute the coefficient of permeability of sand stratum.

4. (a) What is flow net? What are the properties of flow net? Also explain the uses of flow net.

(b) An earth dam is built on an impervious foundation with a horizontal filter at the base near the toe. The coefficient of permeability in the horizontal and the vertical directions are 3×10^{-2} and 1×10^{-2} mm/s respectively. The full reservoir level is 25 m above the filter. A flow net constructed from the transformed section of the dam consists of 4 flow channels and 12 equipotential drops. Estimate the seepage loss per meter length of the dam.

5. (a) Explain the plasticity chart with neat sketches as per IS:1498 (1970) and give the group symbols of the various regions in the chart.

(b) What is a silica tetrahedron and an aluminium octahedron? How are the silica sheet and alumina sheet formed? Show their schematic representation.

6. (a) How is consolidation different from compaction? Explain different stages of consolidation.

(b) A soil sample 20 mm thick takes 20 minutes to reach 20% consolidation. Find the time taken for a clay layer 6 m thick to reach 40% consolidation. Assume double drainage in both cases.

(a) Derive an expression of vertical stress in a homogeneous soil under uniformly loaded circular area by Boussinesq analysis.

(b) What is the basis of the construction of the Newmark's chart? How it is used?

8. (a) What is compaction of soil? List and explain the factors affecting compaction.

(b) In a laboratory compaction test a soil attains a maximum dry density of 1.86 g/cc at a water content of 15%. The specific gravity of soil is 2.70. Determine the degree of saturation, air content and percentage air voids at the maximum dry density. What would be the theoretical maximum dry density corresponding zero air voids at the optimum water content?

9. (a) What is mechanical stabilization ? What are the factors that effect mechanical stabilization of a soil?

(b) Write short notes on any four:

   a. Geotextiles
   b. Soil cement stabilisation
   c. Electrical stabilisation
   d. Soil stabilisation
   e. Lime stabilisation
   f. Chemical stabilisation

***