

8. (a) Describe the falling head method for determination of permeability  $K$  of a soil mass. If during permeability test on soil sample with a falling head permeameter equal time intervals are noted for drops of head from  $h_1$  to  $h_2$  and again from  $h_2$  to  $h_3$ , find the relationship between  $h_1$ ,  $h_2$  and  $h_3$ .
- (b) Explain the process of consolidation with the help of spring and piston analogy.
9. (a) What is quick sand phenomenon and in which type of soil, and under what condition may this occur? Explain critical hydraulic gradient. Derive an expression for it.
- (b) Describe, with neat sketch, Terzaghi's theory of one-dimensional consolidation.

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## B.Tech 5th Semester Exam., 2015

## SOIL MECHANICS

Time : 3 hours

Full Marks : 70

Instructions :

- (i) All questions carry equal marks.  
 (ii) There are **NINE** questions in this paper.  
 (iii) Attempt **FIVE** questions in all.  
 (iv) Question No. 1 is compulsory.

1. Choose the most suitable option (any seven) :

- (a) Toughness index is defined as the ratio of  
 (i) plasticity index to consistency index  
 (ii) plasticity index to flow index  
 (iii) liquidity index to flow index  
 (iv) consistency index to liquidity index
- (b) Which of the following statements is correct?  
 (i) A uniform soil has more strength and stability than a non-uniform soil  
 (ii) A uniform soil has less strength and stability than a non-uniform soil  
 (iii) Uniformity coefficient does not effect strength and stability  
 (iv) Uniformity coefficient of a poorly-graded soil is more than that of a well-graded soil

( Turn Over )

(c) Which of the following is a measure of particle size range?

- (i) Effective size
- (ii) Uniformity coefficient
- (iii) Coefficient of curvature
- (iv) None of the above

(d) The average coefficient of permeability of natural deposits

- (i) parallel to stratification is always greater than perpendicular stratification
- (ii) parallel to stratification is always less than that perpendicular to stratification
- (iii) is always same in both directions
- (iv) parallel to stratification may or may not be greater than that perpendicular direction

(e) Boussinesq's influence factor for soil pressure at depth  $z$  and at the centre of circular area of diameter  $a$  of uniformly distributed load is

$$(i) \left[ 1 - \frac{1}{1 - \left(\frac{a}{z}\right)^2} \right]^{3/2}$$

$$(ii) \frac{3}{2\pi} \left[ \frac{1}{1 + \left(\frac{a}{z}\right)^2} \right]^{3/2}$$

$$(iii) 1 - \left[ \frac{1}{1 + \left(\frac{a}{z}\right)^2} \right]^{3/2}$$

$$(iv) 1 - \left[ \frac{1}{1 + \left(\frac{a}{2z}\right)^2} \right]^{3/2}$$

- (f) Stokes' law is valid only if the size of particle is
- less than 0.0002 mm
  - greater than 0.2 mm
  - between 0.2 mm and 0.0002 mm
  - All of the above
- (g) For proper field control, which of the following methods is best suited for the determination of water content of a soil mass?
- Oven drying method
  - Sand bath method
  - Alcohol method
  - Calcium carbide method
- (h) If the degree of saturation of a partially saturated soil is 60%, then the air content of the soil is
- 40%
  - 60%
  - 80%
  - 100%

- (i) Which of the following types of soil is transported by gravitational forces?
- Loess
  - Talus
  - Drift
  - Dune sand
- (j) The value of compression index for a remoulded sample whose liquid limit is 50% is
- 0.028
  - 0.28
  - 0.36
  - 0.036
2. State and explain the factors affecting permeability. Also state the properties of flow net.
- (a) At a subsoil consisting of 8 m thick layer of dry sand ( $G = 2.65$ ,  $e = 0.85$ ,  $D_{10} = 0.14$  mm) which is underlain by a 6-m thick clay layer ( $G = 2.75$ ,  $w = 22\%$ ), below which there exists a thick layer of hard strata. Ground water table is located at depth of 6 m below the ground level. Calculate and plot the distribution of total, neutral and effective stresses up to 14 m depth. Assume  $c = 0.5 \text{ cm}^2$ .

3. (a) Differentiate between standard proctor test and modified proctor test. Explain the factor affecting compaction.
- (b) Draw and explain the plasticity chart used as per the IS soil classification system.
4. (a) What is the difference between rock and soil? How are soils formed and what are their types?
- (b) Define compression index and coefficient of volume change, and derive an expression for estimating settlement using them. Write down the basic difference equation of consolidation (no derivation required). What does it relate?
5. (a) Define liquid limit, liquidity index and consistency index.
- (b) A fully saturated clay sample has a mass of 130 gm and has a volume of  $64 \text{ cm}^3$ . The clay mass is found to be 105 gm after oven drying. Assuming that the volume does not change during drying, determine the following :
- Specific gravity of soil solids
  - Void ratio
  - Porosity
  - Dry density

6. (a) Explain the importance of Boussinesq's equation in determining ultimate settlement of clay layers due to construction of building.
- (b) A clay layer 8.5 m thick underlain by impervious rock covered by pervious overburden. A structure, wide enough to be considered infinite in any horizontal direction, has been constructed close to the top and imparts a uniform load of  $211 \text{ kN/m}^2$ . In a test, the initial void ratio was found to be 0.876 and final as 0.863. Determine the value of (i) final settlement and (ii) settlement at 50% consolidation.
7. (a) Write short notes on any four of the following :
- Soil stabilization
  - Dewatering of ground soils
  - Grouting technique for foundation improvement
  - Sand drains
  - Vibro floatation and stone columns
  - Sand compaction piles
- (b) What do you mean by soil structure? Briefly describe about single grained, honeycomb, flocculent and dispersed structure in soil.