

Paper Id: 

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**B. TECH**  
**(SEM V) THEORY EXAMINATION 2022-23**  
**GEOTECHNICAL ENGINEERING**

*Time: 3 Hours**Total Marks: 70***Note:** Attempt all Sections. If require any missing data; then choose suitably.**SECTION A****1. Attempt all questions in brief.****2x7 = 14**

- (a) What are the building blocks of clay minerals?
- (b) Draw the figure of element separated soil into three phases.
- (c) What do you mean by hydraulic conductivity?"
- (d) Write the factor on which permeability depends.
- (e) Define coefficient of compressibility.
- (f) Write limitation of Consolidation Theory.
- (g) Draw the figure of element separated soil into three phases.

**SECTION B****2. Attempt any three of the following:****7x3 = 21**

- (a) A borrow material with an in situ dry unit weight of 16 kN/m<sup>3</sup> is to be used in the construction of a highway embankment. The wet unit weight of the compacted soil in the embankment is 19.6 kN/m<sup>3</sup> with a water content of 11%. The volume of embankment is 50000m<sup>3</sup>. Calculate the volume of the borrow material required.
- (b) A layer of sand 8m thick lies above a layer of clay. The water table is at a depth of 1m below the ground surface. Above the water table, the sand is saturated with the capillary moisture. The saturated unit weight of sand is 20kN/m<sup>3</sup> and its dry unit weight is 17 kN/m<sup>3</sup>. Plot the total stress, neutral stress and effective stress with depth up to of 8m.
- (c) A saturated specimen of clay had undergone consolidation under a pressure of 200kN/m<sup>2</sup> in an oedometer test. The thickness of the specimen was then found to be 21.18mm and its water content 12%. Subsequently, with a further increase in pressure of 100kN/m<sup>2</sup>, the thickness of the specimen at end of 24 hours was reduced by 1.18mm. From these data, compute the coefficient of volume compressibility and compression index of soil? Take  $G=2.7$ .
- (d) A long natural slope in an over consolidated clay ( $c' = 10\text{kN/m}^2$ ,  $\phi' = 25^\circ$ ,  $\gamma_{\text{sat}} = 20\text{kN/m}^3$ ) is inclined at  $10^\circ$  to the horizontal. The water table is at the surface and the seepage is parallel to the slope. If a plane slip had developed at depth of 5m below the surface, determine the factor of safety. Take  $\gamma_w = 10\text{kN/m}^3$ .
- (e) A square footing is to be constructed at a depth of 4m below the ground surface on a sandy clay soil for which the cohesion is 50kN/m<sup>2</sup> and the bulk density is 16.8 kN/m<sup>3</sup>. The total load applied to the soil is 4250 kN and it is uniformly distributed. Find out the size of the footing using Terzaghi's formula. Use a factor of safety of 3.  $N_c = 10$ ,  $N_q = 4$  and  $N_\gamma = 2$ .

## SECTION C

3. **Attempt any one part of the following:** 7x1 = 7
- (a) Explain the Indian classification system in details?  
A fine-grained soil has liquid limit of 54% and plastic limit of 30%. Classify the soil as per Indian Standard Classification"
  - (b) Discuss Atterberg's limits of soil? Explain the methods to determine the each limits.
4. **Attempt any one part of the following:** 7x1 = 7
- (a) Explain variable head permeability test. Derive the formula for the coefficient of permeability corresponding to this test?
  - (b) Discuss the permeability in case of stratified soil deposits. The horizontal and vertical permeabilities for each layer are given in the following figure. Find the equivalent coefficients of permeability in the horizontal and vertical direction?
5. **Attempt any one part of the following:** 7x1 = 7
- (a) Explain oedometer test. The average effective pressure in a normally consolidated clay layer 3m thick is doubled due to the construction of a structure. The initial void ratio of the clay is 1.0m and its liquid limit is 54%. Calculate the consolidation settlement of clay layer"
  - (b) Explain field compaction control?
6. **Attempt any one part of the following:** 7x1 = 7
- (a) Explain Rehmann's Construction for active pressure?
  - (b) Explain methods of slices.
7. **Attempt any one part of the following:** 7x1 = 7
- (a) Explain Plate Load Test.
  - (b) Explain Standard Penetration Test in details with diagram.