B. Tech. 5th Semester (Civil Engg.) Examination,

December–2012

SOIL MECHANICS

Paper–CE-307-F

Time allowed : 3 hours]   *[Maximum marks : 100*

Note : *Attempt five questions in all. Question No. 1 is compulsory and hence attempt* **one** *question from each Section. All questions carry equal marks. Neat and lucid answers will merit more. Assume missing data wheresoever necessary.*

1. Complete the statements given below by filling the blanks/short answers.

    (i) Water transported soils are called _____ .

    (ii) The term 'Soil Mechanics' was first used by _____ .

    (iii) What is the relationship between bulk density and unit weight ?

    (iv) Density of water is given by _____ .

    (v) Air content is the ratio of _____ .

    (vi) State Darcy's Law.

    (vii) Pore water pressure is known as _____ .

    (viii) Define quicksand conditions.

    (ix) Till is an example of _____ .

    (x) Define shear strength of soil.   10×2=20

Section–A

2. (a) Establish the following relationship

$$e = \frac{G.\gamma w}{\gamma d} - 1$$

where e = Void ratio

G = Specific Gravity

γw = Unit weight of water

γd = dry unit weight of soil.

(b) If void ratio of earth fill is 0.7, how many cubic metre of soil will be excavated from borrow-pit having void-ratio as 0.95 to construct 10,000 m³ of earth fill. 14+6=20

3. (a) What do you understand by Grain Size Distribution ? Elucidate.

(b) A pumping-out test was carried out at a level site where 9 metre of clay overlies a stratum of 1.5 metre thick sand. The sand stratum is underlain by an impermeable rock stratum. At steady-state, the rate of flow was found to be 15 litres/second. The water level in two observation wells located at radial distances of

6 metre and 15 metre from axis of main well were 5 metre and 4.5 metre below ground surface. Compute the Coefficient of Permeability of the Sand Stratum.   4+16=20

Section–B

4. (a)   Define soil water. What are its main types ?

(b)   Write a note on capillary siphoning.

(c)   A deposit of sand has a porosity of 40% and specific gravity of sand particle is 2.7. The ground water table is 2 metre below the ground surface. Compute effective stress at a depth of 6 metre below ground surface if capillary rise above water table is 1 metre.   3+3+14=20

5. (a)   Define critical hydraulic gradient, properties of Flow-net, Piping and Protective filter.

(b)   A masonary dam has pervious sand as foundation. Determine the maximum upward gradient if the factor of safety of 4 is required against boiling? Sand has : η = 45% and Specific Gravity as 2.65.   6+14=20

Section–C

6. (a) Define Iso-bar and Pressure-bulb.

   (b) A concentrated load 10 kN acts on the surface of a soil mass. Using Boussinesq Analysis, find the Vertical Stress at Points

      (i) 3m below the surface on the axis of loading, and

      (ii) at radial distance of 2m from the axis of loading but at same depth of 3m.

                                                4+16=20

7. (a) In a consolidation test, void ratio decreased from 0.70 to 0.65 when the load was changed from 50 kN/m² to 100 kN/m². Compute Compression Index and Co-efficient of volume change.

   (b) A soil sample 20 mm thick takes 20 minutes to reach 20 percent consolidation. Find the time taken for a clay layer 6 metre thick to reach 40% consolidation. Assume double drainage in both cases.   10+10=20

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Section–D

8. (a) Enumerate factors contributing to Shear Strength of soil.

(b) Determine the Shear Strength in terms of effective stress on a plane with a saturated mass at a point where the total normal stress is 180 kN/m² and Pore-water-pressure is 70 kN/m². The effective Shear Strength Parameters for the soil are apparant cohesion, $c = 15$ kN/m² and angle of friction, $\phi = 25°$.   4+16=20

9. A retaining wall is 6m high and retains soil with following properties :

angle of internal friction of soil $\phi = 34°$

unit weight of soil $\gamma = 19$ kN/m³

angle of friction between soil and retaining wall. $\delta = 20°$

The backfill surface is sloping at an angle of 10° to the horizontal.

(i) Determine the total active thrust by Rebhann's Graphical Construction;

(ii) Plane of sliding.   20