B.E. (CE) Part-III 5th Semester Examination, 2007

Soil Mechanics-I

(CE-504)

Time : 3 hours **Full Marks : 100**

Use separate answerscript for each half.

FIRST HALF

(Answer Q.No.4 and any TWO from the rest.)

1. i) Explain the terms effective stress, neutral stress and total stress.

   ii) The water table in a certain area is at a depth of 2.0 m below the ground surface. The densities of soil above and below the ground water level are 18 kN/m^3 and 20 kN/m^3 respectively. Calculate the effective pressure at a depth of 8.0 m below the ground surface. Draw total, effective and neutral stress diagram upto a depth of 6.0 m below ground surface when capillary ris is observed at ground surface. **[6+9]**

2. i) Deduce the relationship :

   $$\sigma_1 = \sigma_3 N\phi + 2C\sqrt{N\phi}$$

   ii) In an in-situ vane shear test in a saturated clay, a torque of 42 Nm was required to shear the soil. The diameter of the vane was 50 mm and length 100 mm. Calculate the undrained shear strength of the clay. What will be sensitivity of the clay if the torque required to shear the soil in the remoulded state is 6 Nm? **[10+5]**

3. i) An undrained soil sample 40 mm dia and 80 mm long was tested in a triaxial apparatus under undrained condition. The sample failed under a deviator load 720 N and cell pressure of 150 kN/m^2 while the measured strain of the sample was 15%. Before the application of cell pressure pore water pressure was zero. The pore water pressure under the application of cell pressure was recorded as 135 kN/m^2 at 0% strain and at 15% strain the pore water pressure was 156 kN/m^2. Calculate the values of pore pressure parameters.

   ii) State and explain different types of Triaxial test. **[9+6]**

4. Write short notes on <u>any four</u> of the following : [4x5]
   i) e – log p curve
   ii) Formation classification of soil
   iii) Newmarks chart
   iv) Modes of occurrence of water in soil
   v) Normally consolidated and over consolidate clay
   vi) Field identification of soil types.

SECOND HALF

(<u>Answer Q.No.5 and any TWO from the rest.</u>)

5. In the field it was observed that water table is at a depth of 3.0 m below the existing ground surface. A mass of soil was taken in an sampling tube of internal diameter of 5 cm. The length of extracted soil sample was 10.2 cm and its weight was measured to be 387 gm. If the specific gravity of the soil solids is 2.70, and weight of the dried sample was 313 gm, find the bulk density in-situ water context, dry density, porosity, void ratio, and degree saturation of the soil sample. The sample was collected from a depth a 1.5 m below the ground surface. [6x3]

6. a) State the assumptions made in the hydrometer analysis for determining the particle size distribution of a soil. What are the limitations of the method? Explain the terms :
      i) Coefficient of curvature
      ii) Uniformity coefficient, and
      iii) Effective size, d_{10}.

   b) For a cohesive soil, liquid limit was determined to be 66% and its plasticity index was 44%. If the natural water content of the soil was 30%, find the (i) Plastic limit and (ii) Liquidity Index. Classify the soil from its plasticity Index. [(2+3+2+2+2)+(3+2)]

7. State Darcy's law for flow of water through pervious soil. What are the differences between discharge and seepage velocity of flow, and the relationship between them? Name the methods of determining coefficient of permeability of soils in laboratory and field. Explain in detail the method of falling head permeameter. If h_1, h_2 and h_3 are heads in a falling head permeameter at start, t secs and 2t secs after start respectively, prove that $h_1 . h_3 = h_2^2$. [3+3+2+2+4+2]

8. State the assumptions made in deriving the expression for vertical stress intensity σ_z at a point inside soil mass due to an applied point load Q at the surface, as done by Boussinesq. Find the vertical stress distribution along the load time due to a point load of 10^T at the surface. Choose at least 3 points at various depths along the load axis, for evaluation of the vertical stress. **[4+3x4]**

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