(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2130   Roll No. ☐☐☐☐☐☐☐☐☐☐

B. Tech
(SEMESTER-V) THEORY EXAMINATION, 2012-13
GEO-TECHNICAL ENGINEERING

Time : 3 Hours]   *[Total Marks : 100*

Note :   This questions paper has **three** sections **A, B** and **C**. The number of questions and the marks allotted are mentioned against each section. Assume any missing data suitably.

Section – A

1.   This section has question No. **1** of **10** parts. Attempt all parts. Each part carries equal marks.   **2 × 10 = 20**

   (a)   Explain the terms, Bentonite, Black Cotton Soil and Hard Pan.

   (b)   Define :
   - (i)   Void Ratio
   - (ii)   Porosity
   - (iii) Degree of saturation

   (c)   For a well graded soil, draw the typical grain size distribution curve and explain the salient features.

   (d)   State Darcy's law of permeability.

   (e)   What is the process of consolidation of soil ? Distinguish between consolidation and compaction process.

   (f)   The permeability of a soil is 1×10^{-3} cm/s at void ratio 0.4. Find the permeability of soil when the void ratio increases to 0.6.

   (g)   List the assumptions made in the Boussinesq theory.

   (h)   Distinguish between direct shear test and tri-axial shear test of soil.

   (i)   Explain the Mohr-Coulomb strength envelope.

   (j)   Describe the Terzaghi's analysis of bearing capacity of shallow foundation.

Section – B

2. This section has question no. **2** of **six** parts. Attempt any **five** parts. Each part carries equal marks. **6 × 5 = 30**

(a) Establish the relationship between bulk unit weight of soil, specific gravity, void ratio and degree of saturation. What do you understand by consistency of soil ? Explain the different states of consistency. **6**

(b) Define liquid limit and plastic limit. Determine the liquid limit from the following test data performed on a soil. **6**

Number of blows	38	34	20	12
Water content (%)	16	17	20	22

(c) Derive the desired relation of a falling head permeability test. **6**

(d) A circular area is loaded with a uniform load intensity of 100 kN/m^2 at ground surface. Calculate the vertical pressure at point P so situated on the vertical line through the centre of loaded area that the area subtends an angle of 90° at P. Use Boussinesq equation. **6**

(e) An in-situ vane shear test was conducted in a clay soil at the bottom of a borehole. A torque of 153 Nm was required to shear the soil. What was the undrained strength of clay ? The vane was 100 mm in diameter and 150 mm long. **6**

(f) Write short notes on : **6**

(i) SPT

(ii) DCPT

Section – C

Attempt **all** questions. Each questions carries equal marks : **10 × 5 = 50**

3. Attempt any **two** parts. Each part carries equal marks.

(a) Write note on water content and its determination in a soil sample. **5**

(b) A partially saturated soil from an earth fill has a natural water content of 19% and bulk unit weight of 19.33 kN/m^3. Assuming the specific gravity of soil solids as 2.6, calculate the degree of saturation and void ratio. If subsequently the soil gets saturated determine the dry and saturated unit weight. **5**

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(c) The following observations were obtained in field test :

    (i)   Wt. of core cutter   1060 gm

    (ii) Volume of core cutter   995 cm^3

    (iii) Wt. of cutter + wet soil 3030 gm

    (iv) Water content of soil   16%

Determine dry unit weight, void ratio and degree of saturation of soil in its field condition. Assume sp. gravity of soil as 2.70   5

4. Attempt any **two** parts. Each part carries equal marks :

(a) What kind of improvement of the engineering properties of a soil mass can be brought about through compaction ?   5

(b) Discuss the factors that influence permeability of soils and mention the manner in which they do so. Comment on validity of Darcy's law for soil.   5

(c) The in-situ void ratio of a granular soil deposit is 0.50. The maximum and minimum void ratios of the soil were 0.75 and 0.35. Gs = 2.67. Determine the relative density and relative compaction of the deposit.   5

5. Attempt any **two** parts. Each part carries equal marks.

(a) What are the factors that influence the height of capillary rise in soils ? What is most significant consequence of capillarity on soil behaviour ?   5

(b) How do you obtain a time-settlement relationship for a clay stratum ?   5

(c) A normally consolidated clay layer settled by 20 mm when the effective stress was increased from 25 to 50 kN/m^2. What will be its settlement when the effective stress is increased from 50 to 100 kN/m^2.   5

6. Attempt any **two** parts. Each part carries equal marks.

(a) How do you define "failure" in soils ? According to Mohr-Coulomb criteria, how is the failure plane recognized and how is shear strength defined.   5

(b) What is the significance of pore pressure coefficients ? Illustrate the answer by an example.   5

(c) An unconfined compression test was conducted on an undisturbed sample of clay. The sample had a diameter of 37.5 mm and was 80 mm long. The load failure measured by the proving ring was 28 N and the axial deformation of the sample was 13 mm. Determine the unconfined compressive strength and untrained shear strength of the clay.   5

7. Attempt any **two** parts. Each part carries equal marks.

   (a) In a site investigation for the design of foundations of a major structure, what kind of detailed information do you setout to obtain. 5

   (b) What was the correction that must be applied to the field N-values for sand before they are used in design charts and empirical correlations ? 5

   (c) Explain quick sand condition. Give expression for critical hydraulic gradient along with its significance. 5

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