CBCS SCHEME

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18CV54

Fifth Semester B.E. Degree Examination, June/July 2023
Basic Geotechnical Engineering

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Define the following terms with the help of a phase diagram.
   i) Voids ratio
   ii) Porosity
   iii) Degree of saturation
   iv) Specific gravity **(06 Marks)**

b. Derive the relationship between Porosity and Voids ratio with usual notations. **(04 Marks)**

c. One cum of wet soil weights 20kN, it's dry weight is 18kN specific gravity of solids is 2.67. Determine water content, Porosity, Voids ratio and degree of saturation. Draw the phase diagram. **(10 Marks)**

OR

2 a. 500 grams of dry soil was subjected to sieve analysis. The weight of soil retained on each sieve is as follows :

IS sieve Size	Wt of soil Grams	Is Sieve Size	Wt of soil Grams
4.75mm	10	212μ	40
2mm	165	150μ	30
1mm	100	75μ	50
425μ	85		

Plot the gain size distribution curve and determine the following :
   i) Percentage Gravel (≥ 4.75mm)
   ii) %sand (4.75 – 0.075mm)
   iii) % silt and clay (<0.075mm)
   iv) Effective size
   v) Uniformity coefficient (C_u) and coefficient of curvature (C_c) **(12 Marks)**

b. Draw the volume Vs water content for a fine strained soil and explain various Atterberg limits **(04 Marks)**

c. Explain any 2 methods of field identification of soils. **(04 Marks)**

Module-2

3 a. Name the three clay minerals. Explain the structure of each of them. **(06 Marks)**

b. Differentiate between Flocculent and Dispersed structures in soil, with the help of diagram. **(04 Marks)**

c. During a compaction test, a soil attains a maximum dry density of 18kN/m^3 at a water content of 12%. Determine the degree of saturation and % an voids at maximum dry density. Also find theoretical maximum dry density corresponding to zero air voids at optimum water content. G = 2.67. **(10 Marks)**

OR

4 a. What is field compaction control and how it is achieved. **(04 Marks)**

b. Differentiate between standard proctor test and midfied standard proctor test. **(10 Marks)**

The following data refers to a compaction test as per Indian standard (light compaction)

Water content (%)	8.5	12.2	13.75	15.5	18.2	20.2
Weight of wet sample (Kg)	1.5	1.94	2.00	2.05	2.03	1.98

Volume of the mould = 1000CC and specific gravity G = 2.7

Plot i) Compaction curve and obtain MDD and OMC

ii) Plot 80% and 100% saturation line **(06 Marks)**

Module-3

5 a. List the factors that influence permeability of soils and mention the manner in which they do so. **(08 Marks)**

b. A horizontal stratified soil deposit consists of three layers each uniform in itself. The permeability of three layers are 8×10^{-4}cm/sec, 52×10^{-4} cm/sec and 6×10^{-4} cm/sec and their thickness are 7m, 3m and 10m respectively. Find the effective average permeability of the deposit in horizontal and vertical directions. **(06 Marks)**

c. List the characteristics of flow nets. **(06 Marks)**

OR

6 a. In a falling head test the time taken for fall in head from h_1 to h_2 is equal to that from h_2 to h_3. Deduce the relation between h_1, h_2 and h_3. **(06 Marks)**

b. A sand deposit consists of 2 layers. The top layer is 2.5m thick ($r = 17.1 kN/m^3$) and bottom layer is 3.5m thick ($r_{sat} = 20.65 kN/m^3$). The water table is as a depth of 3.5m from the surface and the zone of capillary saturation is 1m above water table. Show a dimensional sketch and plot variation of final, neural and effective stress. **(09 Marks)**

c. Define discharge velocity and seepage velocity of flow through soils and derive the relation between them. **(05 Marks)**

Module-4

7 a. An uncontained compression test was conducted on an undisturbed sample of clay. The sample has diameter of 37.5mm and was 80mm long. The load at failure measured by the proving ring was 28N and the axial deformation of the sample at failure was 13mm. Determine the uncontained compressive strength and undrained shear strength of clay. **(06 Marks)**

b. Explain the classification of shear strengths based on drainage conditions. **(06 Marks)**

c. $\overline{CU}$ triaxial tests conducted on specimens of a saturated clay soil gave the following results.

Cell pressure $\sigma_3(kN/m^2)$	Deviator stress $\sigma_d(kN/m^2)$	Pure water pressure Vat failure (kN/m^2)
150	102	80
300	200	164
450	304	246
600	405	325

Determine the effective stress strength parameters C′ and Q′ by Mohr circle method. **(08 Marks)**

OR

8 a. State the advantages and disadvantages of direct shear test. **(05 Marks)**

b. In a direct shear test, an a sand sample the normal stress was 200kN/m^2. Draw the Mohr's circle and the strength envelope. Determine : **(10 Marks)**

i) the angle of shearing resistance
ii) the magnitude of the major and minor principal stress
iii) Orientation of the principal stresses.

c. Explain in brief Mohr-Coulomb failure criteria in soils. **(05 Marks)**

Module-5

9 a. Explain spring analogy to illustrate consolidation of soils. **(06 Marks)**

b. The time taken to reach 40% consolidation of a two way drained laboratory sample 10mm thick saturated clay sample is 35sec. Determine the time required for 60% consolidation of the same soil 10m thick on the top of a rock surface subjected to same loading conditions on the laboratory sample. **(08 Marks)**

c. Explain in detail how pre consolidation pressure is determined from Casagrande's method **(06 Marks)**

OR

10 a. What are the Assumptions and Limitations of Terzaghi's one dimensional consolidation theory? **(06 Marks)**

b. Explain in brief normally consolidated, under consolidated and over consolidated soils. **(06 Marks)**

c. Explain in detail square root of time fitting method to determine coefficient of consolidation of soil. **(08 Marks)**

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