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10CV54

Fifth Semester B.E. Degree Examination, July/August 2022
Geotechnical Engineering – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

PART – A

1 a. With the help of a three phase diagram, define
i) Voids ratio ii) Water content iii) Degree of saturation of a soil mass
Give the relationship for each. **(06 Marks)**

b. With usual notations prove that
$\gamma = \gamma_d + S_r (\gamma_{sat} - \gamma_d)$ **(08 Marks)**

c. A compacted sample of soil with a bulk density of 20 kN/m^3 has a water content of 15%. What are its dry density and degree of saturation? If the sample is allowed to get fully saturated without any increase in volume, what would be its bulk density? Assume G = 2.65. **(06 Marks)**

2 a. What are index properties? List various index properties. **(06 Marks)**

b. With the help of particle size distribution curves, explain well graded, poorly graded, fine gained and coarse grained soils. **(08 Marks)**

c. A pycnometer test for the determination of water content of a soil sample, having G = 2.70, yielded the following data : weight of moist soil mass = 230.75g
Weight of pycnometer + soil + water = 3092.85g
Weight of pycnometer full of water = 2965.2g
Calculate the water content of the soil. **(06 Marks)**

3 a. Mention three different clay minerals commonly present in soils. Explain their structure with neat sketches. **(06 Marks)**

b. Explain BIS classification of soil system. **(06 Marks)**

c. An oven dried sample of 50g passing through 75 micron sieve is taken for hydrometer analysis. The corrected hydrometer reading in 1000ml soil suspension at 2 mins elapse time interval is 25. The effective depth corresponding to $R_h = 25$ is $H_e = 121$mm. Taking G = 2.7 and viscosity as 0.01 poise calculate the diameter and percent finer. **(08 Marks)**

4 a. List and explain the factors affecting coefficient of permeability of soils. **(06 Marks)**

b. Derive expressions for determining the average permeability through stratified soil deposit when the flow is
i) Parallel to bedding plane
ii) Perpendicular to bedding plane. **(06 Marks)**

c. A soil sample of height 6 cm and area of C/S 600 cm^2 was subjected to a falling head permeability test. In a time interval of 5 min, the head dropped from 60 cm to 20 cm. If the cross-sectional area of stand pipe is 2 cm^2, compute the coefficient of permeability of the soil sample. If the same sample is subjected to a constant head of 18 cm, calculate the total quantity of water that will be collected after flowing through the sample, during the same time interval. **(08 Marks)**

PART – B

5 a. Explain the sensitivity and thixotrophy of clay. **(06 Marks)**

b. List the factors affecting shear strength of soils. **(06 Marks)**

c. In a deposit of fine sand the water table is 3 m below the ground surface, but sand upto a height of 1 m above water table is saturated by capillary water. The sand above this height may be considered dry. For the sand G = 2.68 and n = 40%. Calculate the effective stress at depth of 8m. **(08 Marks)**

6 a. What do you understand by field control of compaction? Explain proctor needle method. **(08 Marks)**

b. Following are the observations of a compaction test :

Water content (%)	7.7	11.5	14.6	17.5	19.5	21.2
Weight of wet soil (N)	16.67	18.54	19.92	19.52	19.23	18.83

If the volume of compaction mould is 950CC, assume G = 2.65

i) Draw the compaction curve

ii) Report the maximum dry unit weight and optimum moisture content

iii) Draw 100% saturation line. **(12 Marks)**

7 a. Explain theory of consolidation with spring analogy concept. **(06 Marks)**

b. Explain different types of deposits based on consolidation theory. **(06 Marks)**

c. Define the following terms:

i) Coefficient of compressibility.

ii) Coefficient of volume change.

iii) Coefficient of compression index. **(08 Marks)**

8 a. Explain briefly how triaxial shear tests are classified based on drainage conditions. **(06 Marks)**

b. An confined compression test was conducted on an undisturbed sample of clay. The sample has a diameter of 38 mm and was 76 mm long. The load at failure measured by proving ring was 28 N and the axial deformation of the sample at failure was 13 mm. Determine the unconfined compressive strength and the undrained shear strength of the clay. **(06 Marks)**

c. Two identical soil specimen were tested in a triaxial apparatus. First specimen failed at a deviator stress of 770 kN/m^2 when the cell pressure was 200 kN/m^2. Second specimen failed at a deviator stress of 1370 kN/m^2 when the cell pressure was 400 kN/m^2. Determine the value of shear parameters. If the same soil is tested in a direct shear apparatus with a normal stress of 600 kN/m^2, estimate the shear stress at failure. **(08 Marks)**

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