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10CV54

Fifth Semester B.E. Degree Examination, May 2017
Geotechnical Engineering – I

Time: 3 hrs.

Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO 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. 500 gram of dry soil was subjected to a 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, gram
4.75mm	10	212 μ	40
2.00mm	165	150 μ	30
1.00mm	100	75 μ	50
425 μ	85		

Plot the grain size distribution curve and determine the following :
         (i) Effective size   (ii) Uniformity coefficient   (iii) Coefficient of curvature.   **(08 Marks)**
     b. Explain the corrections to hydrometer reading in sedimentation analysis of soil.   **(06 Marks)**
     c. Derive an expression to find shrinkage limit of soil from dry soil pat, when specific gravity G of soil is known.   **(06 Marks)**

3   a. Explain any 4 tests on field identification of soil.   **(08 Marks)**
     b. Give a detailed description on three clay minerals with neat diagram.   **(06 Marks)**
     c. Draw a neat plasticity chart and explain its use to classify the soil.   **(06 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. List and explain the factors affecting compaction.   (06 Marks)
    b. Explain field compaction control and how it is done.   (06 Marks)
    c. The following are the results of standard compaction test performed on a soil.

Water content%	5	10	14	20	25
Bulk unit wt. kN/m³	17.70	19.80	21.00	21.80	21.60

Find the optimum moisture content and maximum dry density by plotting compaction curve. If G = 2.65, Plot zero air voids line.   (08 Marks)

7   a. Define the following terms with respect to one dimensional consolidation and give the expression for each using standard notations:
        (i)   Compression index   (ii) Coefficient of compressibility
        (iii) Coefficient of volume change.   (06 Marks)
    b. State any 6 assumptions made in Terzaghi's one dimensional consolidation theory.   (06 Marks)
    c. A compressible layer is expected to have total settlement of 15 cm under a given loading. It settles by 3 cm at the end of two months after the application of load increment. How many months will be required to reach a settlement of 7.5 cm? What is the settlement in 18 months? The layer has double drainage.   (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/m² when the cell pressure was 200 kN/m². Second specimen failed at a deviator stress of 1370 kN/m² when the cell pressure was 400 kN/m². Determine the value of shear parameters. If the same soil is tested in a direct shear apparatus with a normal stress of 600 kN/m², estimate the shear stress at failure.   (08 Marks)

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