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10CV54

Fifth Semester B.E. Degree Examination, June/July 2018
Geotechnical Engineering – I

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting at least TWO full questions from each part.*
2. Assume missing data suitably, if any.

PART – A

1 a. Derive the following with usual notation.

$$\gamma_{sat} = \frac{\gamma_w (G + e)}{1 + e}.$$ **(06 Marks)**

b. Define: i) Void ratio ii) Porosity iii) Water content iv) Specific gravity. **(04 Marks)**

c. A moist soil sample has a weight of 6.33 N and volume of 3×10^5 mm^3 at a water content of 11%. Taking specific gravity as 2.68, Find void ratio, air content (n_a) degree of saturation. Also determine water content at which soil gets saturated. What will be the unit weight at saturation? **(10 Marks)**

2 a. What is consistency of soil? List and define various consistency limits. **(06 Marks)**

b. List the different methods to determine water content of soil and explain any one method. **(06 Marks)**

c. The results obtained from a liquid limit test on a day sample is as follows. The plastic limit is 13% and natural water content of the soil is 45%.

Number of blows	38	34	20	12
Water content, percent	16	17	20	22

Plot the flow curve and determine:
i) Liquid limit
ii) Flow index plasticity index
iii) Toughness index
iv) Liquidity index. **(08 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. Briefly explain variable head permeameter test and derive the expression to determine coefficient of permeability. **(06 Marks)**

b. List and explain the factors effecting the permeability. **(06 Marks)**

c. On a falling head permeameter the soil sample is having a length of 180mm and 22×10^{-4} m^2. Calculate the time required for a head drop of 250 to 100mm if the cross sectional area of the stand pipe is 2×10^{-4}m^2. The soil sample is heterogeneous having coefficient of permeabilities 30×10^{-7} m/s for first 60mm, 4×10^{-6} m/s in second 60mm and 6×10^{-6} m/s for last 60mm thickness. Assume flow taking place perpendicular to the bedding plane. **(08 Marks)**

PART – B

5 a. Explain Mohr-Coulomb's failure theory of soils. **(06 Marks)**

b. List and explain various shear tests based on drainage conditions. **(06 Marks)**

c. A direct shear test conducted on a soil sample and following results are obtained. The size of the shear box is 60mm × 60mm.

	1	2	3
Normal load, (N)	360	720	1080
Shear load, (N)	268	432	576

Determine shear parameters of soil. Mark failure plane for any one of failure point on a Mohr's circle and obtain principal stress and planes. **(08 Marks)**

6 a. List and explain the factors affecting the compaction of soils. **(06 Marks)**

b. Differentiate between light and heavy compaction tests. **(06 Marks)**

c. A standar proctor test is carried out and results are as follows:

Bulk unit weight, kN/m^3	18	19	19.9	20.8	21	20.5	20.1
Water content, percent	9	11	13	15	16	17	18

i) Plot the compaction and determine maximum dry density and optimum moisture content.

ii) Also plot zero air void line and 10% air void line if the specific gravity of soil solids is 2.60. **(08 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 tri axial shear test with a neat sketch. **(06 Marks)**

b. List and explain the advantages and limitations of direct shear tests. **(06 Marks)**

c. A footing 3.6m × 3.6m for a watch tower carries a load of 90kN and rests on dense sand of 9.0 m thickness overlaying a clay layer of 3.0 m depth. The depth of foundation is 1.5m. The clay layer overlies hard rock. The liquid limit of clay is 54percent, void ratio as 1-08. The saturated unit weights of sand and clay are 18.5 kN/m^3 and 17.5 kN/m^3 respectively. Assume the load distribution as 2V to 1H. Also the site is flooded. Determine the ultimate settlement of clay layer due consolidation. **(08 Marks)**

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