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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.

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

- 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 $3 \times 10^5 \text{ mm}^3$ 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 $H_e = 121\text{mm}$. 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 $22 \times 10^{-4} \text{ m}^2$. Calculate the time required for a head drop of 250 to 100mm if the cross sectional area of the stand pipe is $2 \times 10^{-4} \text{ m}^2$. The soil sample is heterogeneous having coefficient of permeabilities $30 \times 10^{-7} \text{ m/s}$ for first 60mm, $4 \times 10^{-6} \text{ m/s}$ in second 60mm and $6 \times 10^{-6} \text{ m/s}$ for last 60mm thickness. Assume flow taking place perpendicular to the bedding plane. (08 Marks)

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42+8 = 50, will be treated as malpractice.

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/m³ and 17.5 kN/m³ 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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