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B. Tech Civil Engg. (Semester – 5th)
GEOTECHNICAL ENGINEERING
Subject Code: BCIES1522
Paper ID: 19110717

Time: 03 Hours **Maximum Marks: 60**

Instruction for candidates:

1. Section A is compulsory. It consists of 10 parts of two marks each.
2. Section B consist of 5 questions of 5 marks each. The student has to attempt any 4 questions out of it.
3. Section C consist of 3 questions of 10 marks each. The student has to attempt any 2 questions.

Section – A **(2 marks each)**

Q1. Attempt the following:

a) Define 'Degree of saturation'. Can it exceed 100 %?
b) What type of roller is most suitable for compacting sub grade with high plastic clays?
c) © What is Darcy's Law? Write its TWO limitations.
d) Give complete name of soil groups: SM, GW-GM
e) Define Toughness Index.
f) What is OMC? What is its importance?
g) For clayey soil, which laboratory method, you will prefer for determining permeability? Give reason in support.
h) Give the equation used in Vane Shear Test.
i) What is Secondary Consolidation? Why does it take place?
j) 'Moisture content of soil sample is used for various other laboratory tests' Give its applications.

Section – B **(5 marks each)**

Q2. The values of liquid limit and plasticity index of a soil were respectively reported as w_L= 36% and I_p = 10%. If the sample of this soil is dried from its state at plastic limit, the volume change is 28% of its own volume. Similarly, when the sample is dried from its state of liquid limit, the volume change is 40% of its own volume at liquid limit. Determine the shrinkage limit. What is shrinkage ratio and volumetric shrinkage?

Q3. In a falling head permeameter, if the time intervals for drop in levels from h_1 to $h_2$and h_2 to h_3 are equal, prove that; $h_2=(h_1 x\ h_3)^{0.5}$

Q4. A sample, 75 mm in diameter and 20 mm high, taken from a clay layer 10 m thick, was tested in an Oedometer with drainage at the upper and lower boundaries. It took the laboratory sample 15 minutes to reach 50% consolidation. If the clay layer in the field has the same drainage condition as the laboratory sample, calculate how long it will take the 10

m clay layer to achieve 50% and 90% Consolidation. How much more time would it take the 10 m clay layer to achieve 50% consolidation, if drainage existed on only one boundary?

Q5. Write in brief about (a) Stability Number (b) Friction Circle Method

Q6. A soil sample in its natural state has, when fully submerged, a water content of 32.5 %. Determine the void ratio, dry and total unit weights. Calculate the total weight of water required to saturate a soil mass of volume 10 m^3. Assume G_s= 2.69.

Section – C **(10 marks each)**

Q7. What is the effect of compaction on the engineering properties of the soil? How would you decide whether the soil should be compacted the dry of the optimum or the wet of the optimum? Also explain, how the result of compaction test be used to select the range of water content that can be allowed to secure a relative compaction of 96% in the field?

Q8. Following are the results of shear box test on a soil sample:

Sample	I	II	III	IV
Normal stress in kg/cm^2	0.25	0.75	1.50	2.50
Shear stress at failure in kg/cm^2	0.60	0.80	1.05	1.45

(a) Determine the values of cohesion intercept and angle of shearing resistance.

(b) If the specimen of the same soil is tested in a Tri-axial Apparatus, estimate the deviator stress at which the sample will fail for a cell pressure of 100 kg/cm^2

Q9. Write short notes:

(a) Particle Size Analysis

(b) Mohr-Coulomb Theory