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B Tech Civil (Semester – 5th)

GEOTECHNICAL ENGINEERING

Subject Code: BTCE-502

Paper ID: 5110702

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. Write Principal types of soils.
b. Define plasticity index?
c. Differentiate Standard Proctor from Modified Proctor test.
d. Define over-consolidation ratio.
e. Name the factors affecting permeability.
f. What is the effect of water table fluctuation on effective stresses?
g. Draw and label the different types of finite and infinite Slope failure.
h. Give complete name of soil groups: SM, GW–GM
i. Define 'Co-efficient of volume change'.
j. Define critical hydraulic gradient.

Section – B **(5 marks each)**

Q2. Explain the concept of O.M.C. and zero air void line with the help of a diagram.

Q3. In a lab, the consolidation test was performed on a specimen of clay 3 cm thick. The sample was drained at top and bottom. The time required for 50% consolidation of the sample was observed to be 15 minutes. Determine the coefficient of consolidation of clay.

Q4. What is Mohr's strength theory for soils? Sketch typical strength envelopes for clean sand.

Q5. Calculate the coefficient of permeability of a soil sample 8 cm in height and cross-sectional area 60 cm square. It is observed that in 12 minutes, 600 ml of water passed down under an effective head of 50 cm. On oven drying the test specimen weighs 750gm. Take 2.70 as specific gravity of soil, calculate the seepage velocity of water during the test.

Q6. Describe the methods for determination of Specific gravity of fine-grained soil.

Section – C **(10 marks each)**

Q7. The Atterberg limits of a clayey soil are as LL = 52%, PL = 30% and SL = 18%. If the specimen of this soil shrinks from a volume of 39.5 cc at LL to a volume of 24.2 cc at SL, Find specific gravity of the soil.

Q8. Write short notes on the following:

a. Sieve analysis
b. Triaxial shear test
c. Causes of over consolidation.

Q9. a) Draw a typical stress-strain and volume change curve for loose and dense sand.

b) Following are the results of two drained tri-axial tests on the same clay samples.

i. Sample I: $\sigma_3 = 70 kN/m^2$, $\sigma_d = 173 kN/m^2$
ii. Sample II: $\sigma_3 = 105$ kN/ m^2 , $\sigma_d = 235$ kN/m^2 .
iii. Determine the shear strength parameters. (σ_3 = Cell Pressure, σ_d = Deviatoric stress)