Model question paper

V Semester B.Tech Degree Examination [Civil Engineering]

13.504 GEOTECHNICAL ENGINEERING – I (C)

Instructions: Graph sheets may be supplied on request. Assume any missing data suitably.

PART A (Answer all questions) **(20marks)**

1. What are the major soil deposits of India? Discuss the characteristics of any one of them.
2. In a liquid limit test, the number of blows corresponding to 20% and 60% water contents were 100 and 10 respectively. Determine the flow index and liquid limit of the soil.
3. Define zero air voids curve. What is its practical significance ?
4. Define overconsolidated state of a clay strata. Discuss its practical significance.
5. What is meant by (i) liquefaction and (ii) thixotropy of soils.

PART B (Answer any one full question from each module)

Module I

(a) What are the limitations of Stokes' law in sedimentation analysis? In a hydrometer analysis, 0.5N of dry soil was mixed in water to form 10^{-3} m^3 of uniform suspension . The corrected hydrometer reading after a lapse of 30minutes from the start of sedimentation was 15 and the corresponding effective depth was 0.11m. G =2.72, viscosity of water =0.00085 N.sec./m^2. Determine the coordinates of the corresponding point on the grain size distribution curve. **(14marks)**

(b) Derive the relationship between specific gravity of soil solids, void ratio, and bulk density of a saturated soil mass. **(6marks)**

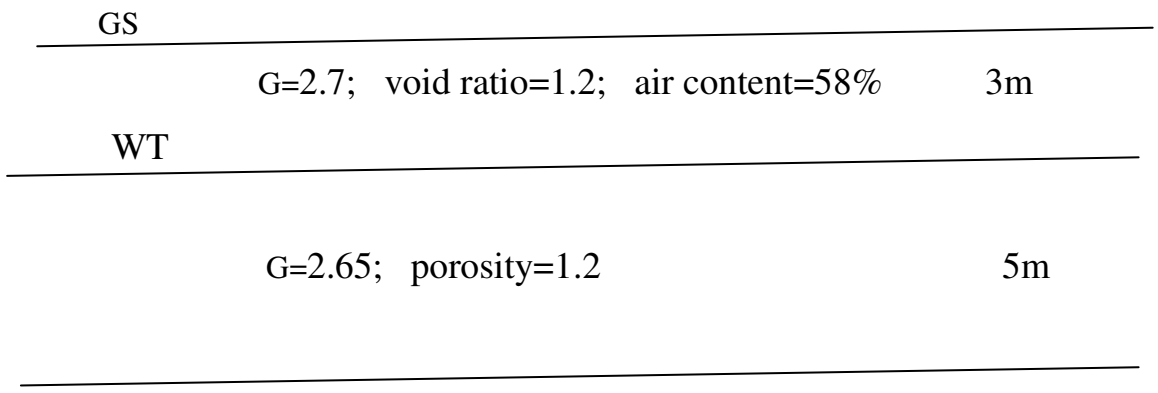
6. (a) A sample of fine grained soil has liquid limit, natural water content and liquidity index of 40%, 32% and 0.5 respectively. Classify the soil as per Indian Standards. **(10marks)**

   (b) For a road embankment, soil is to be compacted to a dry density of 19kN/m^3 at a water content of 16%. The soil is to be collected from a borrow area where the in-situ bulk density is 17kN/m^3. Compute the volume of the borrow area soil and the

volume of water to be added in the field corresponding to a finished embankment volume of 1500m^3.
(10marks)

Module II

7. (a) Mention any four factors affecting permeability of soils. How do each of these factors influence the 'k' values ?
(8marks)
(b)Compute the total, neutral and effective stresses at 3m and 8m depths for the soil profile shown below:
(12marks)



8. (a) Compare I.S. Light and Heavy compaction tests w.r.t. weight of rammer, height of free drop, number of layers and compactive energy imparted.
(5marks)
(b) The following data were recorded in a constant head permeability test:
Head lost over a sample length of 0.18 m = 0.24m; Internal diameter of permeameter
= 0.075m; Quantity of water collected in 60 s = 626 ml; void ratio of soil sample = 1.2.
Calculate the coefficient of permeability of the soil. Also determine the seepage velocity and discharge velocity during the test.
(15marks)

Module III

9. A clay soil, tested in a consolidometer, showed a decrease in void ratio from 1.20 to 1.10 when the pressure was increased from 50 to 100kPa. If the coefficient of consolidation determined in the test for the given stress increment was 10 m^2/yr, calculate the coefficient of compressibility and the coefficient of permeability. If the sample tested in the lab was taken from a clay layer 3.0 m in thickness, determine the consolidation settlement corresponding to the given stress increment. **(20marks)**

10. Following results were recorded from a consolidation test on a specimen of saturated clay. The water content of the sample at the end of the test was28% and the specific gravity of the soil particles was 2.72. Plot the e – log σ^1 curve and determine the compression index. **(20marks)**

Effective stress (kN/m^2)	0	50	100	200	400	800	0
Sample thickness (mm)	19.70	19.30	19.15	18.85	18.56	18.36	18.90

Module IV

11. In a direct shear test conducted on a dense sand, the sample fails at a shear stress of 75kN/m^2, when the normal stress was held constant at 100 kN/m^2. Draw the Mohr circle for the failure condition and determine (a) the angle of shearing resistance, (b) the orientation of the major and minor principal planes and the stresses acting on them, and (c) the orientation of the plane of maximum shear stress. If a specimen of this soil were to be tested in a triaxial shear test under *CD* conditions at a cell pressure of 125 kN/m^2, at what axial stress would the sample fail? **(20marks)**

12. (a)What is the maximum height to which a 30^o slope can be made in a soil with c=12kPa; Angle of internal friction = 15^o and γ= 17.5kN/m^3, if the required factor of safety is 1.5?

(14 marks)

Slope angle	Stability number			
	$\Phi = 5^o$	10^o	15^o	20^o
30^o	0.110	0.075	0.053	0.035

(b) Suggest any three methods to improve the stability of slopes. **(6 marks)**