

[Total No. of Questions: 09]
Uni. Roll No.

[Total No. of Pages: 02]

Program: **B.Tech. (Batch 2018 onward)**
Semester: **5th**
Name of Subject: **Geotechnical Engineering**
Subject Code: **PCCE – 114**
Paper ID: **16391**
Scientific calculator is Allowed

MORNING
13 MAY 2023

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

- 1) Parts A and B are compulsory
- 2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
- 3) Any missing data may be assumed appropriately

Part – A

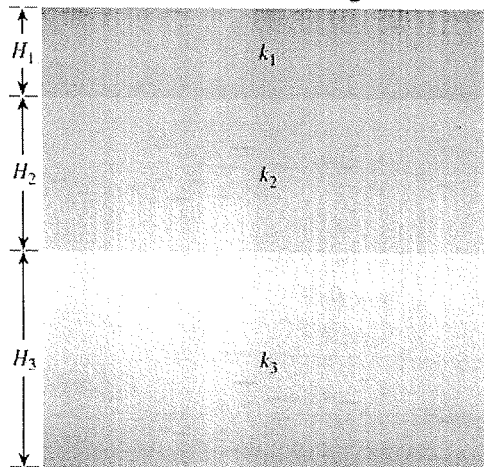
[Marks: 02 each]

- Q1** (a) Define relative density of soil.
(b) The mass of an empty jar was 0.498kg. When completely filled with water, its mass was 1.528kg. An oven dried sample of soil of mass 0.198kg was placed in the jar and water was added to fill the jar and its mass was found to be 1.653kg. Determine the specific gravity of particles.
(c) List any two methods of compaction used in field.
(d) What is meant by activity and sensitivity of soil?
(e) The following data were recorded in a constant head permeability test: Internal diameter of the permeameter = 7.5cm, head lost over a sample length of 18cm = 24.7cm, quantity of water collected in 60sec = 626ml. Calculate the coefficient of permeability of the soil.
(f) Differentiate between primary consolidation and secondary consolidation.

Part – B

[Marks: 04 each]

- Q2** What are the factors that affect compaction? Discuss in brief.
Q3 Describe direct shear test. What are its limitations?
Q4 A layered soil is shown in Figure-1.



Given:

- $H_1 = 2$ m and $k_1 = 10^{-4}$ cm/sec
- $H_2 = 3$ m and $k_2 = 3.2 \times 10^{-2}$ cm/sec
- $H_3 = 4$ m and $k_3 = 4.1 \times 10^{-5}$ cm/sec

Estimate the ratio of equivalent hydraulic conductivity / permeability,

$$\frac{k_{H(eq)}}{k_{V(eq)}}$$

Figure-1

- Q5** A soil has a liquid limit of 25% and a flow index of 12.5%. If the plastic limit is 15%, determine the plasticity index and the toughness index. If the water content of the soil in its natural condition in the field is 20%, find the liquidity index and the relative consistency.

- Q6 A partially saturated sample from a borrow pit has a natural moisture content of 15% and bulk unit weight of 1.9g/cc. The specific gravity of solids is 2.70. Determine the degree of saturation and void ratio. What will be the unit weight of the sample on 100% saturation?
- Q7 Define total stress, neutral stress and effective stress. Show the variation of all these with respect to the depth of sub soil. What is the effect of surcharge on the effective stress?

Part – C

[Marks: 12 each]

- Q8 What is the use of classification of soils? Discuss in detail Indian Standard soil classification system. Also show Indian Standard Classification for fine grained soils on plasticity chart.

OR

Field engineers are often found talking of OMC conditions while earthen embankments or roads are constructed. Define and explain this term, bringing out clearly the importance it possesses and the methods by which it is controlled.

- Q9 (a) The consolidation settlement of a new structure founded on a 5m thick layer is estimated as 6.5cm. The structure was found to have settled by 1.6cm in 6months after the completion of construction. If the clay layer is underlain by rock and overlain by a layer of coarse sand, determine; the time required for 50% consolidation to occur and the amount of settlement which will take place in the next six months.
- (b) A footing has a size of 3m x 1.5m and it causes a pressure increment of 200kN/m² at its base (*Figure-2*). Determine the consolidation settlement at the middle of the clay layer. Take unit weight of water as 10kN/m³.

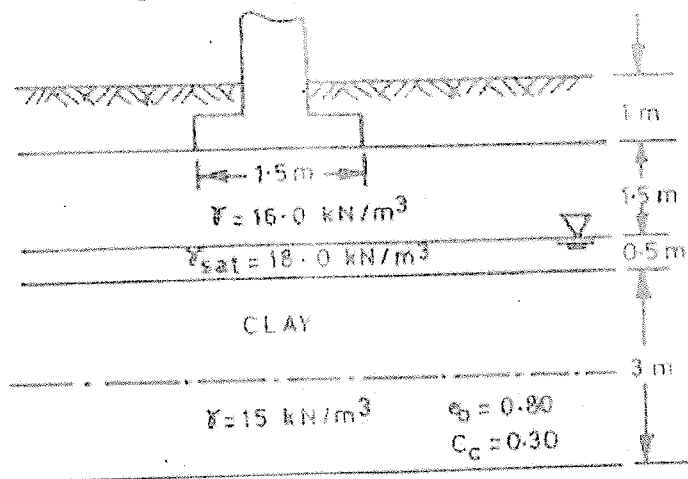


Figure-2

OR

The following results were obtained from a series of consolidated undrained (CU) tests on an over consolidated clay.

Sample No.	Cell pressure (kN/m ²)	Deviator stress (kN/m ²)	Pore water pressure (kN/m ²)
1	125	510	-70
2	250	620	-10
3	500	850	+120

Plot the strength envelopes in terms of total stresses and effective stresses and hence determine the cohesion intercept and the angle of shearing resistance.
