



Roll No																			
---------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING**

**August 2024 (Lateral Entry) - END TERM EXAMINATION**

**Summer Term:** 2023-24

**Course Code:** CIV2015\_v02

**Course Name:** Geotechnical Engineering

**Program & Sem:** B. Tech. – DCET & IV Sem

**Date:** 08/Aug/2024

**Time:** 09:30 AM – 12:30 PM

**Max Marks:** 100

**Weightage:** 50%

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Do not write any matter on the question paper other than roll number.
- (iii) Scientific and Non-programmable Calculators are permitted.

**PART A**

**ANSWER ANY 4 QUESTIONS.**

**(4Qx 5M= 20M)**

1. Define: a) Liquid Limit and d) Liquidity index  
b) Consistency index e) Flow Index  
c) Plastic Limit  
(C.O.No.1) [Knowledge]
2. Bring out the differences between compaction and consolidation. (C.O.No.3) [Knowledge]
3. Briefly describe (i) Immediate settlement (ii) Primary Consolidation (iii) Secondary Consolidation. (C.O.No.3) [Knowledge]
4. State Darcy's law and list the limitations of Darcy's law. (C.O.No.2) [Knowledge]
5. A fully saturated soil sample has a water content of 35% and specific gravity of 2.65. Determine its porosity, saturated unit weight and dry unit weight. (C.O.No.1) [Knowledge]

**Part B**

**ANSWER ANY 5 QUESTIONS.**

**(5Qx10M=50M)**

6. A sample of saturated clay has a water content of 30% and unit weight of 20kN/m<sup>3</sup>. Determine its dry unit weight, specific gravity and void ratio. If the degree of saturation reduces to 50%, what will be its unit weight? (C.O.No.1) [Knowledge]

7. Explain the laboratory test conducted to determine the plastic limit of a soil sample. For a soil sample if the plastic limit is 23%, liquid limit is 43.8% and flow index is 32.22, determine the  
i) Plasticity Index and ii) Toughness Index  
(C.O.No.1) [Comprehension]
8. Calculate the co-efficient of permeability of a soil sample, 6 cm in height and 50 cm in cross-sectional area, if a quantity of water equal to 430 ml passed down in 10 minutes, under an effective constant head of 40 cm. With the help of a sketch, describe the test procedure used for determining the coefficient of permeability for the above soil sample.  
(C.O.No.2) [Comprehension]
9. A saturated clay layer of 4m thickness takes 1.5 years for 50% primary consolidation when drained on one side. Its coefficient of volume change ( $m_v$ ) is  $1.5 \times 10^{-3} \text{ m}^2/\text{kN}$ . Determine the coefficient of consolidation in  $\text{m}^2/\text{year}$  and the coefficient of permeability in  $\text{m}/\text{year}$ .  
(C.O.No.3) [Comprehension]
10. List and discuss in detail the factors affecting compaction.  
(C.O.No.3) [Comprehension]
11. Write the expressions for average permeability of layered soil for flow parallel to bedding plane and perpendicular to bedding plane. A horizontal stratified soil deposit consists of 3 layers each uniform in itself, the permeability of 3 layers are  $8 \times 10^{-4} \text{ cm}/\text{sec}$ ,  $52 \times 10^{-4} \text{ cm}/\text{sec}$  and  $6 \times 10^{-4} \text{ cm}/\text{sec}$  and their thickness are 7, 3 and 10m respectively. Find the effective average permeability of the soil deposit in the horizontal and vertical directions.  
(C.O.No.3) [Comprehension]
12. a) Explain under consolidated, normally consolidated and over consolidated soil deposits  
(06 Marks)  
b) Write the expressions for final settlement based on compression index, void ratio and coefficient of volume change. Also, write the expression for degree of consolidation.  
(04 Marks)  
(C.O.No.3) [Comprehension]

### Part C

**ANSWER ANY 2 QUESTIONS.**

**(2Qx15M=30M)**

13. The following are the results of a compaction test:

Mass of mould + wet soil (g)	2925	3095	3150	3125	3070
Water content (%)	10.0	12.0	14.3	16.1	18.2

Volume of mould = 1000ml; Mass of mould = 1200g; Specific gravity of solids = 2.70

- (i) Plot the compaction curve and determine the optimum moisture content and maximum dry density.  
(ii) Plot the zero air void line  
(iii) Also, determine the degree of saturation at the maximum density

(C.O.No.3) [Application]

14. A clay structure of thickness 8m is located at a depth of 6m below the ground surface. It is overlaid by fine sand and the water table is located at a depth of 2m below ground surface. For fine sand submerged unit weight is  $10.2\text{kN/m}^3$ . The moist unit weight of sand located above water table is  $16\text{kN/m}^3$ . For clay layer  $G = 2.76$  and  $w = 25\%$ . Compute the effective stress at the middle of clay layer?

(C.O.No. 2) [Comprehension]

15. In a consolidation test, void ratio of the specimen which was 1.052 under effective pressure of  $185\text{ kN/m}^2$  changed to 0.932 when the pressure was increased to  $429\text{ kN/m}^2$ . Calculate coefficient of compressibility, compression index and coefficient of volume compressibility.  
Also, find the final settlement of the foundation resting on the above type of clay if thickness of the layer is 8m and the increase in pressure in  $10\text{kN/m}^2$ .

(C.O.No.3) [Application]