Section C

5. (a) Explain the Taylor's method to determine the coefficient of consolidation. 5

(b) A consolidation test was performed on a 25 mm thick undisturbed clay sample. 50% consolidation occurred in 5 minutes. The sample was drained both at the top and at the bottom. In the field, the clay layer is 2.4 m thick and is underlain by an impervious rock. Drainage is possible only at the top surface :

(i) Determine the coefficient of consolidation

(ii) Calculate the time in days for 50% and 90% consolidation to take place in the field deposit. 5

6. (a) Describe the Casagrande's method of geometrical construction to find the pre-consolidation pressure. 5

(b) The settlement analysis of a proposed structure indicated that 6 cm of settlement will occur in three years and the total settlement will be 120 mm. The analysis was based on the assumption that the compressible layer is drained

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July-22-00250

B.Tech. EXAMINATION, 2022

Semester IV (CBCS)

GEOTECHNICAL ENGINEERING-I

CE-402

Time : 3 Hours   *Maximum Marks :* 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt *Five* questions in all, selecting *one* question from each Sections A, B, C and D. Q. No. **9** is compulsory.

Section A

1. (a) A soil sample has porosity of 30%, the specific gravity of solids is 2.60. Calculate :
   (i) Void ratio
   (ii) Dry density

(iii) Unit weight if the soil is 50% saturated

(iv) Unit weight if the soil is completely saturated. **2.5**

(b) Determine the field density of a natural soil by using sand replacement method. **2.5**

(c) Explain the BIS plasticity chart and also describe its practical application. **5**

2. (a) The following results were recorded in a shrinkage limit test using mercury :

Mass of container = 15.0 g

Mass of wet soil and container = 70.30 g

Mass of dish = 130.40 g

Mass of dish and displaced mercury = 490.10 g

Mass of dry soil and container = 60.20 g

Volume of wet soil = 32.4 cm³.

Determine the shrinkage limit, the linear shrinkage and the shrinkage ratio. The density of mercury is 13.6 g/cm³. **5**

(b) In a hydrometer test, the initial reading is 1.10. After one hour, the corrected hydrometer reading is 1.05 and the corresponding effective depth is 12 cm. Find the initial weight of soil placed in 1000 cc suspension, the particle size corresponding to the 15 mm reading, and the percentage of particles finer than this size. Take $G = 2.65$, and $\mu = 0.1$ poise. **5**

Section B

3. (a) Derive the Laplace equation, its assumptions and limitations. **5**

(b) A soil profile consists of a surface layer of sand 3 m thick ($\gamma = 16$ kN/m³), an intermediate clay layer 2 m thick ($\gamma_{sat} = 19.25$ kN/m³), and a bottom layer of gravel 4 m thick ($\gamma_{sat} = 19$ kN/ m³). The water table is at the top of the clay layer. Determine the effective stress at various interfaces. There is a surcharge of 48 kN/m² on the ground surface. **5**

4. A three-legged tower forms an equilateral triangle of side 5 m in plan. If the total weight of the tower is 450 kN and is equally carried by all the legs, compute the vertical stress increase caused in the soil by the tower at a depth of 5 m directly below one of the legs and also at the same depth below the centroid of the triangle. **10**

8. (a) Explain in detail about the various types of slope failures. Explain also the Swedish circle method in detail. **5**

(b) In a direct shear test on a specimen of clean dry sand, a normal stress of 180 kPa was applied and failure occurred at a shear stress of 100 kPa. Determine analytically the angle of shearing resistance, the principal stresses during failure, and directions of the principal planes with respect to the direction of the plane of shearing.

5

(Compulsory Question)

9. Write briefly : **2×10=20**

(a) Distinguish between angle of repose and angle of internal friction.

(b) What is an A-line, equipotential line and a flow fline ?

(c) Write the relationship between coefficient of permeability, cofficient of consolidation and unit weight of water.

(d) Briefly explain e-p and e-log p curves.

(e) List any two types of field compaction equipment. Also list any two types of soil structures.

(f) What are the corrections to be applied to hydrometer test readings.

(g) Write the formula to determine height of capillary rise in a soil and mention what each term of the formula stands for.

(h) Explain about poiseuille's law.

(i) Explain quick sand condition. Explain, how the determination of seepage pressure is done ?

(j) Write the relationship between the time factor and degree of consolidation, when the degree of consolidation is greater than 60% ?