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B. Tech. (C) / III **J**

Paper ECE–303— SOIL MECHANICS AND FOUNDATION ENGINEERING

Time : 3 hours *Maximum Marks* : 70

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt any five questions. Assume specific gravity of the soil as 2·65.

1. (*a*) How is the shrinkage limit determined in the laboratory? Discuss its practical significance. 7

   (*b*) The Atterberg's limits of a soil are given below. Draw the plasticity chart and classify the soil.

   LL=41%, PL=29%, SL 18%. 7

2. (*a*) Prove that the average permeability parallel to the bedding plane is greater than that perpendicular to bedding plane. 7

   (*b*) A homogeneous earth dam, 30 m high has a free board of 1·5 m A flownet was constructed and the following results were noted:

   No. of flow channels =3
   No. of potential drops =12.

   The dam has a 18 m long horizontal filter at its downstream end. Calculate the seepage loss

across the dam per day, if the width of the dam be 200 m and coefficient of permeability of soil be $3 \cdot 55 \times 10^{-6}$ m/sec. 7

3. (*a*) What are the assumptions of Boussinesq's equation?

A concentrated load of 40 kN is applied vertically on a horizontal ground surface. Determine the vertical stress intensities at the following points:

(*i*) At a depth 2 m below the point of application of load.

(*ii*) At a depth of 3 m and at a radial distance of 1 m from the line of action of load. 7

(*b*) Explain how preconsolidation pressure is determined.

A 6 m thick clay layer is drained at both top and bottom. Determine the time required for 50% consolidation of the layer due to an external load. Take $C_v = 5 \times 10^{-4}$ cm^2/sec. 7

4. (*a*) Discuss in brief the factors affecting compaction.

The OMC of a soil is 16·5% and its MDD is 1·57 g/cc. Determine degree of saturation and percentage air voids at OMC. Also determine theoretical dry density at OMC corresponding to zero air void lines. 7

(*b*) What are the demerits of direct shear test?

A cylinder of soil fails under an axial stress of 8 T/m^2. The failure plane makes an angle of 48° with the horizontal. Calculate the angle of friction and cohesion of the soil. 7

5. (*a*) Differentiate active and passive earth pressure.

A 20 m high vertical retaining wall supports a cohesionless fill of unit weight 18 kN/m^3. The upper surface of the fill rises from the edge of the wall at an angle of 10° to the horizontal. Assuming angle of shearing resistance to be 30°, determine the active earth pressure on the wall. 7

(*b*) What are the forces acting on bulkheads? Discuss.

An anchored sheet pile wall is to support a mass of cohesionless soil upto a height of 6 m with horizontal surface. The anchor ties are 1 m below the top. Find the minimum length of piles for stability. 7

6. (*a*) What are the various methods of site exploration? Explain any *two* in details. 7

(*b*) Explain Swedish circle method for the analysis of stability of finite slope. Discuss Taylor's stability number. 7

7. (*a*) Differentiate general shear failure and local shear failure.

A strip footing 1 m wide at its base is located at a depth of 0·8 m below ground surface. The

properties of foundation soil are $c = 30$ kN/m^2, $\phi = 20°$, $\gamma = 18$ kN/m^3. Determine safe bearing capacity by Terzaghi's analysis. The bearing capacity factors for $\phi = 13 \cdot 58°$ are given below:

$N_c = 11 \cdot 8$, $N_q = 3 \cdot 9$, $N_\gamma = 1 \cdot 7$ 7

(*b*) What is negative skin friction?

Determine the safe load that can be carried by a pile having gross weight of 1·5 t, using Hiley's formula. Given:

Weight of hammer = 2 t

Height of fall = 91 cm

Efficiency of hammer = 75%

Average penetration under the last 5 blows = 10 mm

Length of pile = 22 cm

Diameter of pile = 30 cm

Coefficient of restitution = 0·55. 7

8. Write short notes on any *four*:

(*i*) Pile cyclic load test

(*ii*) Proportioning of footing for equal settlement

(*iii*) Heaving of bottom of excavation

(*iv*) Friction circle method

(*v*) Field compaction and control

(*vi*) Clay minerals. $4 \times 2\frac{1}{2} = 14$

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