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B.TECH
(SEM V) THEORY EXAMINATION 2021-22
GEOTECHNICAL ENGINEERING

Time: 3 Hours   *Total Marks: 100*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1.   **Attempt *all* questions in brief.**   **2 x 10 = 20**

   a.   Explain the flow curve.

   b.   Differentiate cohesive and cohesionless soil.

   c.   Write flow equation for anisotropic soil.

   d.   Write assumptions for Laplace equation.

   e.   Define over-consolidation ratio.

   f.   Discuss the secondary consolidation.

   g.   Write the assumptions of Westargaard theory

   h.   Write the limitations of Triaxial Test.

   i.   Discuss the rotational failure of slope.

   j.   Write the assumptions of Rakine's Earth Pressure theory.

SECTION B

2.   **Attempt any *three* of the following:**   **10 x 3 = 30**

   a.   Illustrate the various structures of Soil.

   b.   Demonstrate the constant head permeability test.

   c.   Explain the Terzaghi's Theory of Consolidation.

   d.   Illustrate Culmann's construction for active pressure.

   e.   Discuss the Taylor's Stability Number.

SECTION C

3.   **Attempt any *one* part of the following:**   **10 x 1 = 10**

   (a)   Derive the relation:
$$\rho_d = \frac{(1-n_a)G\rho_w}{1+wG}$$

   (b)   There are two borrow areas A and B which have soils with void ratios of 0.80 and 0.70, respectively. The in-place water content is 20%, and 15%, respectively. The fill at the end of construction will have a total volume of 10,000 m^3, bulk density of 2 Mg/m^3 and a placement water content of 22%. Determine the volume of the soil required to be excavated from both areas. G = 2.65.
   If the cost of excavation of soil and transportation is Rs. 200/- per 100 m^3 for area A and Rs. 220/• per 100 m^3 for area B, which of the borrow area is more economical?

4.   **Attempt any *one* part of the following:**   **10 x 1 = 10**

   (a)   In a constant head permeameter test, the following observations were taken. Distance between piezometer tappings =100 mm
   Difference of water levels in piezometers = 60 mm

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Diameter of the test sample   = 100 mm
Quantity of water collected   = 350 ml
Duration of the test   = 270 seconds
Determine the coefficient of permeability of the soil.

(b) Explain the process for construction of flow net for determination of discharge through a dam. Discuss the applications of flow net briefly.

5. **Attempt any *one* part of the following:**   **10 x 1 = 10**

(a) A clay layer whose total settlement under a given loading is expected to be 12 cm settles 3cm at end of 1 month after application of load increment. How many months will be required to reach settle of 6cm. Assume layer to have double drainage.

(b) Explain the process involved in determination of compaction in light and heavy compaction test.

6. **Attempt any *one* part of the following:**   **10 x 1 = 10**

(a) A given saturated clay is known to have effective strength parameters of c' = 10 kpa and $\varphi' = 28°$. A sample of this clay was brought to failure quickly so that no dissipation of the pore water could occur at failure it was known that $\bar{\sigma}'_1 = 60$ kPa, $\bar{\sigma}'_3$ = 10 kPa and $u_f = 20$ kPa.
    (i)   Estimate the values of σ_1 And σ_3 At failure.
    (ii)   What was the effective normal stress on the failure plane?

(b) A long strip footing of width 2m carries a load of 400 kn/m. Calculate the maximum stress at a depth of 5 m below the centre line of the footing. Compare the results with 2:1 distribution method.

7. **Attempt any *one* part of the following:**   **10 x 1 = 10**

(a) A smooth vertical wall 5 m high retains a soil with c = 2.5 N/cm2, φ = 30°, and γ = 18 kN/m3. Show the Rankine passive pressure distribution and determine the magnitude and point of application of the passive resistance.

(b) Discuss the stability of slope. Explain various types of slope failure with neat sketches.