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Question Paper Code : 80357

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024

Fourth/Fifth Semester

Civil Engineering

CE 8491 – SOIL MECHANICS

(Common to : Environmental Engineering)

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define Degree of Saturation and Shrinkage ratio.

2. A soil has Void ratio 0.65 and Specific gravity 2.80. Determine unit weight of soil.

3. Write down the methods available for determination of permeability in the laboratory.

4. State Darcy's Law.

5. Recall the principle behind Newmark's influence chart.

6. Outline the Boussinesq formula for vertical stress distribution in soil under a point load.

7. Show the Coulomb's expression for Shear strength.

8. Classify the types of shear test based on drainage conditions.

9. Name the different types of Slope Failure.

10. Differentiate Finite slope and Infinite slope.

PART B — (5 × 13 = 65 marks)

11. (a) Compile about the grain size distribution of soil by

    (i) Sieve Analysis (6)

    (ii) Sedimentation Analysis (7)

Or

(b) A soil mass in its natural state is partially saturated having a water content of 17.5 percent and void ratio of 0.87. Determine the degree of saturation, total unit weight, dry unit weight. What is the weight of water required to make a mass of 10 m³ volume to get saturated? Assume G = 2.69.

12. (a) The water table under a deposit of sand 8 m thick is at a depth of 3 m below the ground surface. Above the water table, the sand is saturated with capillary water. The bulk density of sand is 19.62 kN/m³. Calculate the effective pressure at 1 m, 3 m and 8 m below the ground surface. Hence plot the variation of total pressure, neutral pressure and effective pressure over a depth of 8 m.

Or

(b) Demonstrate in detail, the field determination of permeability with neat sketches.

13. (a) A concentrated point load of 200 kN acts at the ground surface. Find the intensity of vertical pressure at a depth of 10 m below the ground surface and situated on the axis of the loading. Determine the vertical pressure at a point at a depth of 5 m and at a radial distance of 2 m from the axis of loading. Using Boussinesq analysis.

Or

(b) Elaborate the Vane Shear test and classify the methods adopted in this test – Fully Submerged Vane and Partially Submerged Vane.

14. (a) Illustrate the triaxial shear tests based on drainage and their applicability. Mention its merits and demerits.

Or

(b) An Unconfined Compression test was conducted on an undisturbed clay sample. The sample had a diameter of 37.5 mm and length 80 mm. Load at failure measured by proving ring was 28 N and the axial deformation at failure point was 13 mm. Determine the Unconfined compressive strength and the undrained shear strength of clay. Envisage and plot all the results on Mohr's Circle.

15. (a) Assess the various methods to protect slopes from failure with clear sketch. Also list out the factors to be considered in selection of suitable method.

Or

(b) A canal with a depth of 5 m has banks with slope 1:1 the properties of soil are $C = 20 \, \text{kN/m}^2$, $\phi = 15°$, $e = 2.6$. Interpret the factor of safety with respect to cohesion

(i) When canal runs full and (6)

(ii) It is suddenly and completely emptied (7)

PART C — $(1 \times 15 = 15 \text{ marks})$

16. (a) Elaborate the IS Soil classification of System for soil.

Or

(b) Derive the equation for Terzaghi's theory of one dimensional consolidation with a neat sketch

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