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Paper Code : CE(PC)401 Soil Mechanics - I
UPID : 004445

Time Allotted : 3 Hours   *Full Marks :70*

The Figures in the margin indicate full marks.
Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer *any ten* of the following :   [1 x 10 = 10]

   (I) Which method suitable for determination of permeability of clayey soil?

   (II) What will be the intensity of shear stress at a depth of 4m and at a radial distance of 1m from concentrated load of 20 kN?

   (III) Field test for determining shear strength of soil is_____.

   (IV) A mixture of rock debris and organic materials which develop on the earth's surface and nurture life is called _____ .

   (V) The plasticity characteristics of clays are due to _____ .

   (VI) The methods suitable for the determination of the permeability of sandy soil is _____ .

   (VII) Quick sand is a condition occurring on _____ soil .

   (VIII) The Boussinesq influence factor for r/z ratio equal to 1 is given by ____%.

   (IX) Write down the Mohr's Coulomb failure envelope equation.

   (X) The co-efficient of uniformity for gravel is _____ .

   (XI) Rise of water table above the ground surface causes equal increase in_____ and total stress.

   (XII) If the permeability of a soil is 0.8mm/sec the type of soil is_____.

Group-B (Short Answer Type Question)

Answer *any three* of the following :   [5 x 3 = 15]

2. A 1.2m layered soil (n=0.35,G=2.65) is subjected to upward seepage head of 1.85m. what depth of coarse sand would be required above the existing soil to provide FOS is 2 against piping. Assume coarse sand has same porosity and specific gravity as the soil and there is neglected head loss in sand.   [5]

3. The vertical stress at some depth below the corner of a 2m×3m rectangular footing due to a certain load intensity is 100 kN/m². What will be the vertical stress in kN/m² below the centre of a 4m×6m rectangular footing at the same depth and same load intensity?   [5]

4. A sample of saturated cohesionless soil tested in the drained triaxial test show an angle of internal friction of 30 degree. Determine the deviator stress at failure for the sample if the confining pressure is 200kpa.   [5]

5. A soil mass has a bulk unit weight of 20 kN/m³ with water content of 19 %, compute dry unit weight, voids ratio, porosity, degree of saturation and submerged unit weight. Take G = 2.7.   [5]

6. In the falling head permeability test, in the duration of 3 hours, the initial head of 1000 mm is dropped to 350 mm. The diameter of the standpipe is 0.5 cm. The length and diameter of the soil specimen are 20 cm and 10 cm, respectively. What is the coefficient of permeability (mm/s) of the soil?   [5]

Group-C (Long Answer Type Question)

Answer *any three* of the following :   [15 x 3 = 45]

7. (a) What do you mean by deviator stress and cell pressure on a triaxial test apparatus?   [5]

   (b) A triaxial test was performed on dry cohesionless soil under a confining pressure of 144.00 kN/m². If the sample fails when the deviator stress reaches 395.8 kN/m², determine the soil angle of internal friction.   [10]

8. (a) Write a short note on Atterberg's limits.   [5]

   (b) A cube of dried clay having sides 4 cm long has a mass of 110 g. The same cube of soil, when saturated at unchanged volume has a mass of 135 g. Draw the soil element showing the volumes (cm) and weights of the constituents, and then determine the specific gravity of soil solids and the voids ratio.   [10]

9. (a) Write a short note on Free Water, Hygroscopic water and Capillary Water. [5]

   (b) Clay layer of thickness 10m is overlying the impermeable rock. The G.W.T is observed at 3m distance from a ground level. Soil s subjected to capillary rise of 1.2 m from G.W.T level. The soil in the capillary zone is 50% saturated .If G=2.65 and e= 0.6,then determine the total stress, neutral stress and effective stress diagram. Assume if any data needed. [10]

10. (a) State Factors Affecting Permeability. [5]

    (b) A constant head permeability test was run on a sand sample 16 cm in length and 60 cm2 in cross-sectional area. Porosity was n = 40%. Under a constant head of 30 cm, the discharge was found to be 45 cm3 in 18 seconds. Calculate the coefficient of permeability. Also, determine the discharge velocity and seepage velocity during the test. [10]

11. (a) Write a short note on Newmark's influence chart. [5]

    (b) A water tank is supported by a ring foundation having an outer diameter of 10 m and an inner diameter of 7.5 m. The ring foundation transmits uniform load intensity of 160 kN/m². Compute the vertical stress induced at a depth of 4m below the centre of the ring foundation, using (a) Boussinesq analysis and (ii) Westergaard's analysis, taking $\mu = 0$ [10]

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