

Department of Civil Engineering

Katihar Engineering College, Katihar

B.Tech 6th semester

Assignment (Geotechnical Engineering-II)

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Deadline: 27/10/2023

Q.1 Fill the correct answer with correct explanation

(i) In an unconsolidated undrained triaxial test, it is observed that an increase in cell pressure from 150 kPa to 300 kPa leads to a pore pressure increase of 70 kPa. It is further observed that, an increase of 50 kPa in deviator stress results in an increase of 25 kPa in the pore pressure. The value of Skempton's pore pressure parameter B is -----

(ii) A drained triaxial compression test on a saturated clay yielded the effective shear strength parameters as $c' = 20$ kPa and $\phi' = 22^\circ$. Consolidated Undrained triaxial test on an identical sample of this clay at a cell pressure of 150 kPa developed a pore water pressure of 100 kPa at failure. The deviator stress (expressed in kPa) at failure is -----

(iii) A 5 m high vertical earth retaining wall retains a dry granular backfill with angle of internal friction of 20° and unit weight of 20 kN/m³. If the wall is prevented from yielding (no movement), the total horizontal thrust (in kN per unit length) on the wall is-----

(iv) Assume that the back of the retaining wall to be smooth and vertical and height of retaining wall to be 6 m. What is the magnitude of total at-rest thrust acting on the wall (in kN/m) if the backfill has unit weight of 20 kN/m³ and shear strength test results of backfill give $\sigma_3 = 50$ kN/m² and $\sigma_1 = 150$ kN/m² is -----

(v) A homogeneous clay layer 12 m thick is expected to have a ultimate settlement of 332 mm. After a time span of 3 years the average settlement was measured to be 152 mm. The degree of consolidation----- m²/year if two-way drainage exists.

Q.2 A retaining wall 6 m high, with a smooth vertical back is pushed against a soil mass having $c' = 40$ kN/m² and $\phi' = 15^\circ$ and $\gamma = 19$ kN/m³. What is the total Rankine passive pressure, if the horizontal soil surface carries a uniform load of 50 kN/m²? What is the point of application of the resultant thrust?

Q.3 A retaining wall 6 m high, vertical back, supports a saturated clay soil with a horizontal surface. The properties of the backfill are:

$$\phi_u = 0, \quad c_u = 35 \text{ kN/m}^2, \quad \gamma = 17 \text{ kN/m}^3$$

Assuming the back of the wall to be smooth, determine:

(a) the depth of tension cracks

(b) the critical depth of a vertical cut

(c) the total active thrust against the wall and its point of application, if cracks are formed in the tension zone.

Q.4 In an in situ vane shear test on a saturated clay, a torque of 35Nm was required to shear the soil. The diameter of the vane was 50 mm and length 100 mm. Calculate the undrained shear strength of the clay. The vane was then rotated rapidly to cause remoulding of the soil. The torque required to shear the soil in the remoulded state was 5 Nm. Determine the sensitivity of the clay.

Q.5 The coordinates of two points on the virgin compression line are as below:

$$\sigma_1' = 400 \text{ kPa} \qquad e_1 = 0.8$$

$$\sigma_2' = 800 \text{ kPa} \qquad e_2 = 0.75$$

In the field, a 3m thick normally consolidated layer of the soil subjected to construction load and the average effective vertical stress increased from 250 kPa to 450 kPa. Determine

(a) The compression index and initial void ratio of the clay layer

(b) The consolidation settlement of the layer

Q.6 Describe the Mohr-Coulomb failure theory? Determine the shear strength in terms of effective stress on a plane within a saturated soil mass at a point where the total normal stress is 200 kN/m² and the pore water pressure is 80 kN/m². The effective stress shear strength parameters for the soil are $c' = 16 \text{ kN/m}^2$ and $\phi' = 30^\circ$.