Code : 011509

B.Tech 5th Semester Exam., 2017

SOIL MECHANICS—I

Time : 3 hours   Full Marks : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are **NINE** questions in this paper.

(iii) Attempt **FIVE** questions in all.

(iv) Question No. **1** is compulsory.

(v) Assume any suitable data if required.

1. Choose the correct option (any *seven*) : 2×7=14

(a) The liquid limit and plastic limit of sample are 65% and 29% respectively. The percent of soil fraction with grain size finer than 0·002 mm is 24. The activity ratio of the soil is

    (i) 0·5

    (ii) 1·0

    (iii) 1·5 ✓

    (iv) 2·0

(2)

(b) The dry soil has mass specific gravity of 1·35. If the specific gravity of solids is 2·7, then the void ratio will be

    (i) 0·5

    (ii) 1·0 ✓

    (iii) 1·5

    (iv) 2·0

(c) Consistency as applied to cohesive soils is an indicator of its

    (i) density

    (ii) moisture content ✓

    (iii) shear strength

    (iv) porosity

(d) A soil has a discharge velocity of 6×10^{-7} m/s and a void ratio of 0·5. It's seepage velocity in m/s is

    (i) 18×10^{-7} ✓

    (ii) 12×10^{-7}

    (iii) 6×10^{-7}

    (iv) 3×10^{-7}

(e) In a uniform semi-infinite aquifier, the dependable discharge of a lone circular open well is increased most easily by

(i) increasing the diameter

(ii) making it into one with a square kerb   akubihar.com

(iii) deepening the well

(iv) providing coarser screening filter

(f) The change that takes place during the process of consolidation of a saturated clay would include

(i) an increase in pore water pressure and an increase in effective pressure

(ii) an increase in pore water pressure and a decrease in effective pressure

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(iii) a decrease in pore water pressure and a decrease in effective pressure

(iv) a decrease in pore water pressure and an increase in effective pressure

(g) In the consolidated drained test on a saturated soil sample, pore water pressure is zero during

(i) consolidation stage only

(ii) shearing stage only

(iii) Both (i) and (ii)

(iv) loading stage

(h) Settlement due to creep in soils is contingent on   akubihar.com

(i) primary consolidation

(ii) secondary consolidation

(iii) initial settlement

(iv) compaction settlement

(i) The configuration of flow nets depends upon the

(i) boundary condition of flow

(ii) difference in head between u/s and d/s sides

(iii) permeability of the soil

(iv) amount of seepage that takes place

(j) In a Mohr's diagram, a point above Mohr's envelope indicates

    (i) safe condition

    (ii) imaginary condition

    (iii) imminent failure condition

    (iv) condition of maximum obliquity

2. (a) Define water content, void ratio, degree of saturation and specific gravity.   6

   (b) A partially saturated sample from a borrow pit has a natural moisture content of 15% and bulk unit weight of 1·9 g/cc. The specific gravity of solids is 2·7. Determine the degree of saturation and void ratio. What will be the unit weight of the sample on saturation?   8

3. (a) Define liquid limit, plastic limit, shrinkage limit and shrinkage ratio.   6

   (b) The liquid limit and plastic limit of a soil are 50% and 25%, respectively. When the soil was dried from its state at liquid limit, the decrease in volume was 40% of the volume at liquid limit. When it was dried from its state at plastic limit, the volume decrease was 20% of the volume at plastic limit. Determine the shrinkage limit and shrinkage ratio.   8

4. (a) Explain the effective stress in a partially saturated soil.   6

   (b) In a falling head permeability test on a sample 12·2 cm high and 44·41 cm^2 in cross-sectional area, the water level in a standpipe of 6·25 mm internal diameter dropped from a height of 75 cm to 24·7 cm in 15 minutes. Find the coefficient of permeability.   8

5. A retaining wall 2 m in height has a smooth vertical surface. The backfill has a horizontal levelled surface with the top of retaining wall. The density of the backfill is 1·8 t/m^3, shearing resistance angle of 30° and cohesion zero. A uniformly distributed surcharge load of 3 t/m^2 intensity is acting on the backfill. (a) Calculate the magnitude and point of application of active earth pressure per meter length of the retaining wall, (b) If during rainy season water table rises behind the wall to a height of 1 m above the base of the retaining wall, workout the effect on the value of active earth pressure if there is no change in the angle of shearing resistance. Submerged unit weight of backfill is 1·25 t/m^3.   14

6. (a) Explain initial compression, primary consolidation and secondary consolidation. 6

   (b) Under a certain loading, a layer of clay is expected to undergo full settlement of 18 cm. Also it is expected to settle by 5 cm in the period of first 2 months of loading. Find the time required for the clay layer to settle by 10 cm. 8

7. (a) Explain the quicksand condition. 6

   (b) A soil, specific gravity 2·67, has a moisture content of 20% when fully saturated, 2·0 cm thick sample of this soil tested in a consolidometer shows a compression of 0·050 cm when the load is increased from 45 kN/m^2 to $90 \, kN/m^2$. Compute the compression index of the soil. akubihar.com 8

8. What will be the gross and net safe bearing capacity of sand having $\phi = 30°$ and density $2 \cdot 1 \, t/m^3$ below (a) 1·0 m wide strip footing and (b) $1 \cdot 0 \, m \times 1 \cdot 0 \, m$ square footing placed at a depth of 1·2 m below the ground?

Take factor of safety as 2·5.

Also take, $N_c = 30 \cdot 14$, $N_q = 18 \cdot 4$, $N_\gamma = 22 \cdot 4$. 14

9. Determine the axial stress at failure for a dry dense sand in triaxial loading if $\sigma_3 = 300 \, kN/m^2$. A previous test had given $\sigma_3 = 150 \, kN/m^2$, $\sigma_1 = 735 \, kN/m^2$ at failure. 14