Code : 011615

B.Tech 6th Semester Exam., 2016

SOIL AND ROCK MECHANICS

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, selecting any **TWO** questions each from Group—A and Group—B.

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

(v) Things required ... ... Normal Graph Papers ... ...

1. Answer the following questions as directed (any *seven*) :   2×7=14

    (a) Three samples are required to be tested in unconfined compression test.

    (Write True or False)

    (b) "Amongst UU, CU and CD tests, UU test is most conservative of all." Give justification for this statement.

    (c) Vane shear test is performed on

    (i) dry sand

    (ii) wet sand

    (iii) saturated clay

    (iv) dry clay

    (Choose the correct one)

(**2**)

(d) The formula

$$A_c = \frac{V_1 \pm \Delta V}{L_1 - \Delta L}$$

is used to calculate the corrected cross-sectional area of a soil sample for

(i) UCS test

(ii) UU test

(iii) CU test

(iv) CD test

(Choose the correct one)

(e) Why is consolidated drained (CD) triaxial test called a slow test?

(f) Culmann's method and Rebhann's method is based on Rankine's earth pressure theory.

(Write True or False)

(g) What is thixotropy of soil?

(h) Friction circle method of slope stability analysis is based on the assumption that the resultant force R on the rupture surface is vertical to a circle of radius $\gamma = R \sin \phi$ which is concentric with the trial slip circle.

(Write True or False)

(i) As the friction angle increases for an earth fill, the Taylor's stability number for the slope

    (i) increases

    (ii) decreases

    (iii) may increase or decrease

    (iv) remains the same

(Choose the correct one)

(j) Seismic refraction method of rock exploration is suitable for shallow depth.

(Write True or False)

GROUP—A

2. (a) The shear strength parameters of a given soil are $c = 0.26$ kg/cm^2 and $\phi = 21°$. Undrained triaxial test is to be carried out on specimens of this soil. Determine—

    (i) deviator stress at which failure will occur, if the cell pressure be 2·5 kg/cm^2;

    (ii) the cell pressure during the test, if the sample fails when the deviator stress reaches 1·68 kg/cm^2.

$3\frac{1}{2}+3\frac{1}{2}=7$

(b) (i) The stresses acting on an element of elastic soil mass are shown in Fig. 1. Determine the normal and shear stresses on the plane XX.

    (ii) If along the plane XX, the soil has a cohesion of 1·0 kg/cm^2 and the angle of internal friction of 25°, find out whether a shear failure will occur along XX.
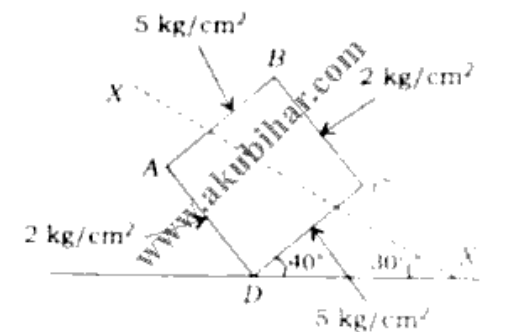
7

Fig. 1

3. (a) An unconfined compression test was performed on an undisturbed sample of normally consolidated clay, having a diameter of 3·75 cm and 7·5 cm height. Failure occurred under a vertical compressive load of 116·3 kg. The axial deformation recorded at failure was 0·9 cm. A remoulded sample of the same

soil failed under a compressive load of 68·2 kg, and the corresponding axial compression was 1·15 cm. Determine the unconfined compression strength and cohesion of the soil in the undisturbed as well as the remoulded state. Also, determine the sensitivity of the soil and hence classify it accordingly.   7

(b) In a CU triaxial test, a soil sample was consolidated at a cell pressure 2 kg/cm^2 and a back pressure of 1 kg/cm^2 for 24 hours. On the next day, the cell pressure was increased to 3 kg/cm^2. This resulted in the development of a pore pressure of 0·08 kg/cm^2. The axial stress was then gradually increased to 4·5 kg/cm^2, which resulted in a failure of the soil. The pore pressure recorded at failure was 0·5 kg/cm^2. Determine Skempton's pore pressure parameters A and B.   7

4. (a) For a cantilever sheet pile, describe with proper diagram, how active and passive earth pressure will develop along its height.   4

(b) For the retaining wall shown in Fig. 2, plot the distribution of active earth pressure and determine the magnitude and point of application of the resultant active thrust :   10

A   Sandy silt,
$\gamma = 1·85$ t/m^3, $\phi = 20°$, $c = 1·0$ t/m^2 1·9 m

B   Loose sand,
$\gamma = 1·72$ t/m^3, $\phi = 30°$ 1·0 m

C   Dense sand,
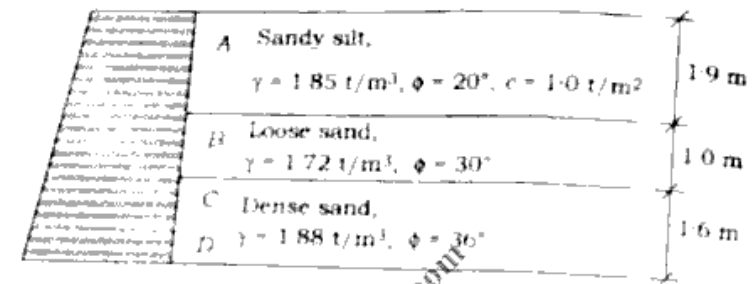D $\gamma = 1·88$ t/m^3, $\phi = 36°$ 1·6 m

Fig. 2

5. (a) A 10 m deep cut, with the sides inclined at 50° to the horizontal has to be made at a site where the subsoil conditions are as follows :

No.	Depth (m)	Type of soil	γ (kN/m^3)	ϕ	c (kN/m^2)
1	0–4	Very soft clay	17·5	0	12
2	4–7	Medium clay	18·0	0	35
3	7–14	Stiff clay	19·0	0	68
4	14–∞	Rock	—	—	—

Compute the factor of safety of the slope with respect to a probable base failure along a slip circle of 13·5 m radius.   10

(7)

(b) For a c-φ soil of infinite, extent prove that the expression of critical height of the soil for which FOS is unity, is

$$H = \frac{c}{\gamma \cos^2 \beta (\tan \phi - \tan \beta)}$$

All the notations used carry their usual meanings.   4

GROUP—B

6. Write about geological/lithological classification of rocks.   14

7. (a) Write about durability property of rocks.   7

(b) Write about point load strength of rocks.   7

8. (a) Write about rock quality designation (RQD).   10

(b) What are the limitations of seismic refraction method of rock exploration?   4

9. (a) Write about sampling techniques of rocks.   7

(b) Write about block shear test on rock cubes.

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