M.E. First Semester (Civil Engineering (Geotechnical Engineering)) (Full Time) (C.G.S.- New)

13043 : Advanced Soil Mechanics : 1 SFGE 2

P. Pages : 3 **AW - 3643**

Time : Three Hours Max. Marks : 80

Notes : 1. All question carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Diagrams and chemical equations should be given wherever necessary.
5. Retain the construction lines.
6. Illustrate your answer necessary with the help of neat sketches.
7. Use of slide rule logarithmic tables, Steam tables, Mollier's Chart, Drawing instrument, Thermodynamic table for moist air, Psychrometric Charts and Refrigeration charts is permitted.
8. Solve **any five** questions.
9. Use of pen Blue/Black ink/refill only for writing the answer book.

1. a) Deduce the following conditions for the following cases and state the field example in each case. **8**
i) Plain strain
ii) Plain stress

b) Discuss the degree of isotropy of soil element with respect to elastic constants. **8**

2. a) Determine the principal stresses and octahedral normal and shear stresses it. **8**

$\sigma_x = 25\,kN/m^2 \qquad \tau_{xy} = 30\,kN/m^2$

$\sigma_y = 40\,kN/m^2 \qquad \tau_{yz} = -61\,kN/m^2$

$\sigma_z = 17\,kN/m^2 \qquad \tau_{xz} = -10\,kN/m^2$

b) Construct Mohr circle for the following cases **8**
i) Spherical stress matrix
ii) Deviator stress matrix

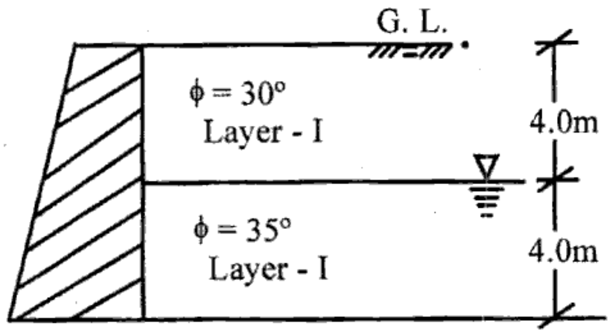
3. a) Calculate the factor of safety with respect to cohesion of a clay slope laid at 1 : 2 to a height of 10.0 m, if the angle of friction $\phi = 10°$, $C = 25\,kN/m^2$ and $J = 19\,kN/m^2$. What will be the critical height of this slope. **8**
Take the value of stability number as 0.064.

b) For a typical trial slip circle, discuss step by step procedure to determine factor of safety by considering equilibrium of trial slip circle. **8**

4. a) A retaining wall of height 10.00 m retains & Cohesionless back fill up to top of its elevation. The back fill is inclined up ward by an angle of 6° from top elevation of wall. The wall is battered away from vertical by an angle of 10°. The back fill is dry having unit weight $18.0\,kN/m^3$ and angle of internal friction as 27°. Determine active thrust per unit of length of wall. Take angle of wall friction as $\frac{2}{3}\phi$. **8**

b) For a retaining wall shown in figure 1. Write step by step procedure to determine active earth pressure by drawing earth pressure diagram. **8**

The back fill is granular having two layers. The ground water table found at a depth of 40m below G.L. The unit wt for layer – 1 was $16.0\,kN/m^3$ and saturated unit wt for layer – II was $19.0\,kN/m^3$.



5. a) Explain and state 3D consolidation equation with diagram and assumption made in developing the equation. Also state the importance of 3D consolidation in geotechnical Engineering. **8**

b) During the construction of a highway bridge the average effective over burden pressure at the middle of clay layer is $210\,kN/m^2$ and the average permanent load on the clay layer is expected to increase by about $100\,kN/m^2$. If sand drains are provided with $H_c = 6.0\,m$ with diameter 20 cm, influence diameter = 3.0 m. $Cv = Cv_T$, Compression index = 0.28 and initial void ratio = 0.90, $Cv = 0.36\,m^2/\text{month}$. The clay is normally consolidated, and surcharge is applied instantaneously. **8**

Also assume that this is no smear case.

Determine :

i) The total primary consolidation of the bridge without pre compression.

ii) Degree of consolidation achieved due to provision of vertical sand drain in nine month.

Given :

Degree of consolidation Ur = 60%	n = 10	n = 15	n = 20
76	0.2816	0.3517	0.4021
77	0.2900	0.3621	0.4141
78	0.2988	0.3731	0.4266
79	0.3079	0.3846	0.4397

6. a) Discuss the step by step procedure to draw a flow net in anisotropic soil deposits. **8**

b) For the hydraulic structure shown in fig. 1. Determine the see page. Loss per day if the length of structure is 350.0 m. Also determine how high water would rise if a piezometer is inserted at A, B and C as shown in figure. **8**

Take coefficient of permeability $= 2\times10^{-2}$ mm / sec .

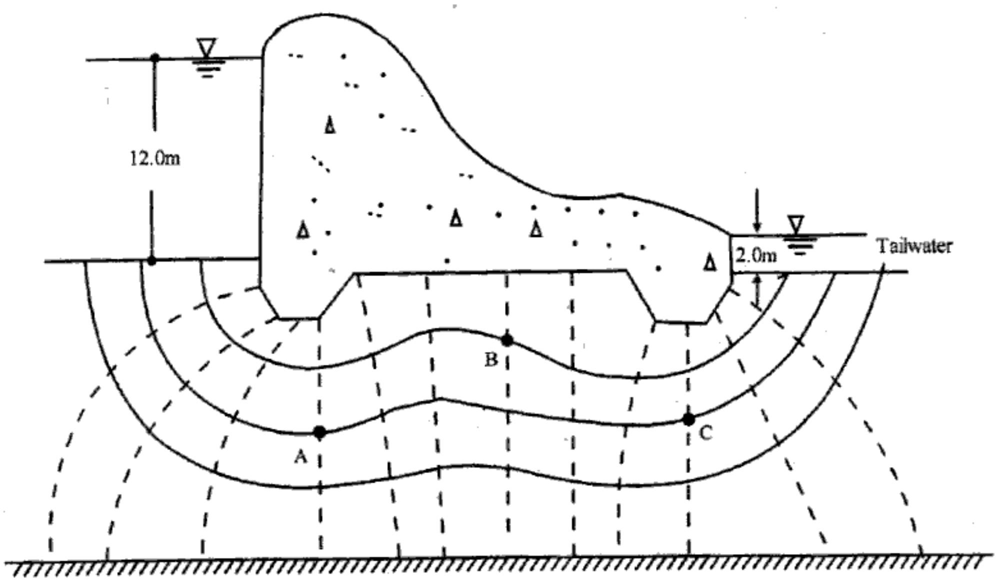


Fig. 1

****