MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : GTE-102
PUID : 10150 (To be mentioned in the main answer script)

ADVANCED SOIL MECHANICS

Time Allotted : 3 Hours   *Full Marks* : 70

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

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) For a clay slope of height 10 m, the stability number is 0·05, bulk density of soil is 20 kN/m³, then critical height is given to

      a) 1·4 m   b) 21·5 m

      c) 25 m   d) 28 m.

   ii) Coefficient of earth pressure at rest for dry sand having angle of shearing resistance, φ, may be taken as

      a) 0·9 (1 – sin φ)   b) 0·5 (1 – sin φ)

      c) $\dfrac{(1 - \sin \varphi)}{(1 + \sin \varphi)}$ d) (1 – sin φ).

| Turn over

✱✱-MT-168(N)

iii) Depth of digging in pure clay without any protection measure against caving is given by

a) $\dfrac{C}{\gamma}$ 　　　　　b) $\dfrac{2C}{\gamma}$

c) $\dfrac{3C}{\gamma}$ 　　　　　d) $\dfrac{4C}{\gamma}$.

iv) Tension crack is calculated

a) $\dfrac{2c}{\gamma\sqrt{K_A}}$ 　　　　　b) $2c/Ka$

c) $1 + \sin\phi\ /\ 1 - \sin\phi$ 　d) $1 + \sin\phi$.

v) Time factor T subjected to 10% degree of consolidation is

a) 0·005 　　　　　b) 0·008

c) 0·031 　　　　　d) 0.

vi) Thickness of base slab from cantilever retaining wall of height H is taken for trial section as

a) H/2 of H/6 　　　　　b) H/3 to H/8

c) H/10 to H/12 　　　　　d) H/5 to H/8.

vii) For a cantilever sheet pile embedded in cohesive soil pressure diagram towards bottom of dredge line below is

    a) rectangular throughout

    b) rectangular-triangle

    c) triangular-rectangle

    d) triangular-rect-triangular.

viii) Point of rotation of an anchored bulkhead is about

    a) top of wall   b) anchoring point

    c) bottom of wall   d) below dredge line.

ix) Shear test in which full consolidation occurs with no accumulation of ore pressure is

    a) CD   b) CU

    c) UU   d) none of these.

x) Earth pressure at rest is

    a) more than active pressure

    b) less than active pressure

    c) equal to passive pressure

    d) more than passive pressure.

CS/M.TECH/CE/GEO(N)/ODD/SEM-1/GTE-102/2019-20
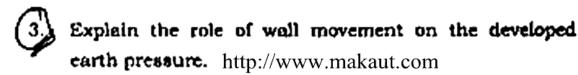
xi) Rankine earth pressure theory assumes

    a)   non-homogeneous backfill

    b)   heterotropic backfill

    c)   homogenous back fill

    d)   all of these.

xii) Cell pressure is required for

    a)   oedometer test

    b)   consistency test

    c)   triaxial test

    d)   direct shear test.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. Prove that coefficient of earth pressure at rest (k_o) in a soil having Poisson's ratio μ is given by $k_o = \dfrac{\mu}{1 - \mu}$.

3. Explain the role of wall movement on the developed earth pressure.   http://www.makaut.com

4. Explain the significance of Hilf's equation in stability analysis of earth dam.

5. Define normally consolidated and pre consolidated clay. How they can be identified in the laboratory.

**-MT-168(N)   4

6. State the advantages of Culman's Method over Rabens method for finding earth pressure on retaining wall graphically.

GROUP – C
(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. State the assumptions made in Bishop's method of stability analysis. Explain the method in detail.

8. A vertical excavation in a clay deposit, causing caving when digging reached a depth of 4 m. Unit weight of the clay is 21 kN/m^3. Estimate the cohesion of the clay. If a retaining wall of height 8 m is made with this clay as backfill, find the total active earth pressure of the wall.

9. An anchored bulkhead of is to be constructed in a cohesionless soil. The ground surface on the back of the bulkhead is horizontal and is level with the top of bulkhead. The dredge line is at 6 m below the top. Water level is at 3 m below the top. Horizontal anchor rods are provided at a depth of 1 m below the top. Saturated and dry unit weight of sand are 2t/m^3 and 1·8t/ m^3 respectively. Angle of shearing resistance of sand is 30°. Point of inflexion is at 0·48 m below dredge line. Determine the depth of embedment and pull in the anchor rod. Use Fixed Earth Method for analysis.

10. a) Explain a method for location centre of the critical slip circle for slope stability analysis.

b) Name different types failure for finite slope.

c) State the assumption made in Bishop's slope stability analysis.

d) State the condition for slope stability analysis in case of an earth dam.

11. Determine the depth of embedment and force in tie rod location at a depth of 1 m below G.L. of an anchored bulkhead driven into an excavation of depth 6 m with the following properties of soil in backfill and below dredge line :

Angle of internal friction 30°, Saturated density $2t/m^3$, Dry Density $1t/m^3$. Water table is at a depth of 3 m below ground level.

Point of inflexion is located at a depth of 0·48 m below dredge line.

Solve the problem by fixed earth method.

12. Derive the three dimensional consolidation equation in polar coordination. Also write the solution of this equation for combined vertical and radical drainage and show how this can be used for sand drains.