Name : ....

Roll No. : ....

Invigilator's Signature : ....

CS/B.TECH (CE)/SEM-6/CE-601/2011

2011
SOIL MECHANICS - II

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.

[Graph sheet(s) will be supplied by the institution on demand]

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **ten** of the following :

                                              10 × 1 = 10

    i)   In the light compaction test, the number of blows used pre layer is

         a)   15   b)   25

         c)   30   d)   35.

    ii) The use of sheep's foot rollers to compact cohesionless soils is

         a)   very effective   b)   moderately effective

         c)   effective   d)   ineffective.
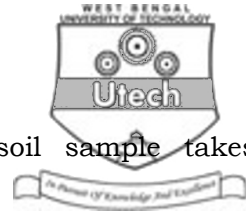
iii) When consolidation of saturated soil sample takes place, the degree of saturation

    a)   decreases

    b)   increases

    c)   remains constant

    d)   decreases initially and then increases.

iv) Which soil parameter is considered as a measure of the degree of over-consolidation ?

    a)   Pre-consolidation pressure

    b)   Compression index

    c)   Over-consolidation ratio

    d)   Coefficient of consolidation.

v) The liquid limit of a saturated normally consolidated soil is 50%. The compression index of the soil for the virgin compression curve will be

    a)   0.36   b)   0.505

    c)   0.605   d)   0.705.

vi) A clay deposit subjected to pressure in the past which is more than the present overburden pressure is known as

    a)   Normally consolidated soil

    b)   Over-consolidated soil

    c)   Under-consolidated soil

    d)   none of these.

vii) What is the result of increase the compacting effort in a fixed amount of soil ?

    a) Maximum dry density and OMC both increase

    b) Maximum dry density increases but OMC decreases

    c) Maximum dry density decreases but OMC increases

    d) Maximum dry density and OMC both decrease.

viii) Shearing strength of cohesion-less soil depends upon

    a) Dry density   b) Void ratio

    c) Loading rate   d) Normal stress.

ix) Most of the shear tests are done in equipment which are

    a) Stress controlled   b) Strain controlled

    c) Drainage controlled   d) Volume controlled.

x) In unconfined compression test, alround stress is

    a) Equal to major principal stress

    b) Half the major principal stress

    c) Equal to zero

    d) Equal to intermediate principal stress.

xi) One of the graphical methods for earth pressure determination is

    a) Newmark's influence chart method

    b) Mohr diagram method

    c) Culmann's method

   d) Taylor's method.
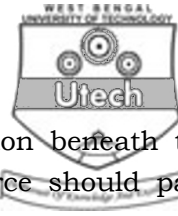
xii) To avoid any tensile pressure generation beneath the gravity retaining wall the resultant force should pass within

a) b/3 to 2b/3

b) 0 to b/2.

c) b/2 to b/4

d) 0 to b.

(xiii) The structure which derives its stability due to self weight is

a) Sheet pile wall

b) Bulk head wall

c) Cantilever retaining wall

d) Masonry retaining wall.

xiv) Bishop's simplified method of slices satisfies

a) All the statical equilibrium condition

b) Only the vertical force equilibrium condition

c) Only the moment equilibrium condition

d) All the conditions except the horizontal force equilibrium condition.

GROUP – B

(Short Answer Type Questions)

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

2. Derive the expression : $P_A = \sigma_Z \, K_A - 2c. \sqrt{K_A}$, where symbols have usual meaning.

3. A soil specimen is of 5m height with a load of $10kN/m^2$. If its Young's modulus is $20kN/m^2$ then, what should be the settlement on this sample ?
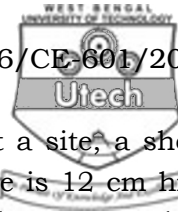
4. At a depth of 5.8m from the ground level at a site, a shear test gave a torque value of 6kN.cm. The vane is 12 cm high and 8 cm across the blades. Compute the shear strength of the soil.

5. A direct box test when conducted on remoulded sample of sand gave the following observations at the time of failure :

Normal load 6 = 288 N

Shear Load = 173 N

Cross-section of the sample is 36 cm^2

Determine

(a) angle of internal friction φ

(b) magnitude and direction of principal stresses in the zone of failure.

Use Mohr's circle method and use graph sheet.

6. Explain the assumptions made by Rankine & Columb in the development of earth pressure theories.

7. State Terzaghi's theory of one dimensional consolidation. Establish the consolidation settlement equation.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

8. a) Calculate the total active thrust on a vertical wall 5m high, retaining a sand of density 1.7 gm/cc for which $\varphi = 35°$, the surface of the sand is horizontal and the water table is below the bottom of the wall.

b) Determine the thrust on the wall if the water table rises to a level 2m below the surface of the sand. The saturated density of the sand is 2gm/cc.

9. a) Two identical specimens of a soil were tested in triaxial apparatus. First specimen failed at a deviator stress of 770 kN/m^2 when the cell pressure was 200 kN/m^2. The second specimen failed at a deviator stress of 1370 kN/m^2 under a cell pressure of 400kN/m^2. Determine the value of c and φ of the soil.

   b) Compare and explain the special features of triaxial test and direct shear test.

   c) Explain briefly unconfined compression test.   5 + 5 + 5

10. The following data have been obtained in a standard Proctor Test conducted on a soil in the laboratory :

Water content %	5.20	8.81	11.25	13.05	14.40	19.25
Weight of container and compacted soils	3.580	3.730	3.932	4.000	4.007	3.907

The specific gravity of the soil particles is 2.77. The container is 944 cm^3 in volume and its weight is 1.978 kg. Plot the compaction curve and determine the optimum water content. Also compute the Void ratio and degree of Saturation at optimum condition.

11. A coffer dam will be constructed of cantilever sheet piling. It will retain soil (bulk density of 2.4 gm/cc and an angle of internal friction 32°), up to a height of 6m. Find the depth to which the piles will be driven assuming that 2/3rd of theoretical passive resistance is developed on the embedded length.
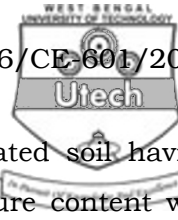
12. A consolidation test was made on a saturated soil having initial thickness of 2 cm. Its natural moisture content was 70 % and the sp. Gr. 2.70. The following results were obtained :

Pressure in kg/cm^2	Compression in cm $\times$ 10^{-4}
0.2	90 $\times$ 10^{-4}
0.5	252 $\times$ 10^{-4}
1.0	406 $\times$ 10^{-4}
2.0	676 $\times$ 10^{-4}
4.0	759 $\times$ 10^{-4}

Find out the void ratio at each increment of load. What will be the value of a_v and m_v for the increase in pressure from 1.0 to 2.0 kg/cm^2.

13. Compute the factor of safety against sliding for the cut shown along the interface between dry clay and shale in the figure below :

γ_{clay} = 19kN/m^3

Interface properties : C = 30kN/m^2, ϕ = 10°