Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.Tech (CE)/SEM-6/CE-601/2012

2012

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.

GROUP – A

(Multiple Choice Type Questions)

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

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

   a) 15 b) 25

   c) 30 d) 35.

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

   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) decrease 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) If in an unconfined compression test on stiff clay the failure plane made an angle of 52° to the horizontal, then what would be the angle of shearing resistance ?

a) 16° b) 14°

c) 12° d) 13°

vii) A cohesive soil yields a maximum dry density of 16 kN/m^3 during a standard proctor compaction test. If the specific gravity is 2·65, then what would be its void ratio ?

a) 0·552 b) 0·625

c) 0·712 d) 0·583.

viii) Relationship between dry density γ_d, percentage air voids n_a, water content w and specific gravity G of any soil is

a) $\gamma_d = \frac{(1 + n_a) G\gamma_w}{1 + wG}$ b) $\gamma_d = \frac{(1 + n_a) G\gamma_w}{1 - wG}$

c) $\gamma_d = \frac{(1 - n_a) G\gamma_w}{1 + wG}$ d) $\gamma_d = \frac{(1 - n_a) G\gamma_w}{1 - wG}$.

ix) 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.

x) 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.

xi) The factor of safety (F) against sliding is given by

a) $\frac{\tau}{\tau_f}$ b) $\frac{\tau_f}{\tau}$

c) $\frac{\tau_f}{\sigma}$ d) $\frac{\sigma}{\tau_f}$.

xii) For slope angle 90° and depth factor $\left(D_f\right)$ 1, stability number $\left(S_n\right)$ is equal to

a) 0·271 b) 0·361

c) 0·261 d) 0·219.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Describe the limitations of direct shear test.

3. List the assumptions of Rankine's & Coulomb's earth pressure theory.

4. Compute the active earth pressure at a depth of 4·5 m in sand whose angle of friction is 37° and density 15·6 gm/cc in dry state. Also compute the active earth pressure if the water table is at a depth of 1·5 m below the ground level. Assume submerged density of soil 0·985 gm/cc.

5. a) Define the term critical void ratio and explain its significance.

   b) Explain briefly quick test and slow test.

6. The following data have been obtained in a standard proctor test conducted on a soil in the laboratory.

Water content %	5·02	8·81	11·25	13·05	14·40	19·25
Weight of container and compacted soil (kg.)	3·58	3·730	3·932	4·000	4·007	3·907

The specific gravity of the soil particle is 2·77. The container is 944 cm^2 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.

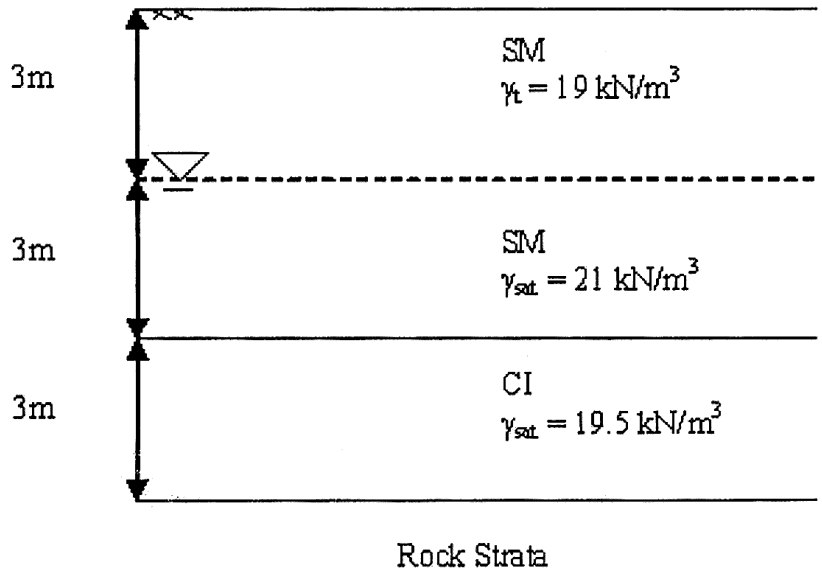
7. If a drained triaxial compression test conducted on dry sand, failure occurred when the deviator stress was 218 kN/m^2 at a confining pressure of 61 kN/m^2. What is the effective angle of shearing resistance and the inclination of failure plane to major principal plane ?

GROUP – C

(Long Answer Type Questions)

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

8. State Terzaghi's theroy of one dimensional consolidation and derive the one dimensional consolidation equation.



A sample of CI soil at midpoint of the layer was obtained by making a bore hole. A consolidation test was conducted on the sample and data obtained are given as follows :

Dimensions of the consolidation ring : 7·6 cm diameter and 2 cm in height

Mass of the consolidation ring : 95 g

(Mass of wet sample + mass of ring)

at the beginning of the test : 280·6 g

(Mass of dry sample + mass of ring)

after oven drying at the end of the

test : 242·5 g

Assume $G = 2{\cdot}7$

Pressure $\left(kN/m^2\right)$	0	25	50	100	200	400	800
Dial reading (mm)	9·72	9·57	9·40	9·23	9·05	8·35	7·65

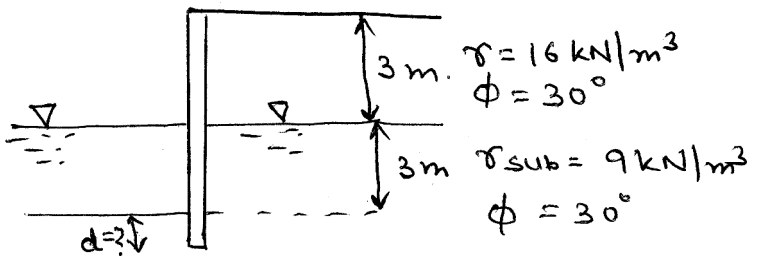
i) Calculate the void ratio at the end of the each pressure increment and draw the e-logσ curve and determine C_c.

ii) Compute a_v and m_v for the stress range of 150 - 350 kN/m^2.

iii) Determine preconsolidation pressure, σ_c and identify whether the soil is normally or over-consolidated.

5 + (5 + 2 + 3)

9. Determine the depth of penetration of the cantilever sheet pile shown in the figure. The water level on both sides is same



10. a) The following data relate to a triaxial compression test performed in a soil sample

Test No.	Chamber pressure $\left(kN/m^2\right)$	Max. deviator stress $\left(kN/m^2\right)$	Pore pressure at max deviator stress $\left(kN/m^2\right)$
1	80	175	45
2	150	240	50
3	210	300	60

Determine the effective cohesion and effective angle of friction.

b) How are triaxial compression tests classified according to drainage conditions ? 10 + 5

11. a) Explain the friction circle method for analyzing slope stability.

b) A slope is to be constructed in a soil for which $\overline{C}$ = 0 and $\overline{\phi}$ = 36°. It is to be assumed that the water may occasionally reach the surface of a slope, with seepage taking place parallel to the slope. Determine the maximum slope angle for a factor of safety 1·5, assuming a potential failures surface parallel to the slope. What would be the factor of safety of the slope constructed at this angle, if the water table should be well below the surface ? The saturated unit weight of the soil is 19 kN/m^3. 6 + 4 + (3 + 2)

12. a) Define and explain what is meant by compaction and how is it controlled in the field.

b) An earth slope of clayey soil having c = 55 kN/m^2 and Φ = 0 corresponding to a trail slip circle *AB* we have the following data :

i) Radius of slip circle = 19 m

ii) Weight of Wedge *ABD* = 2050 kN

iii) Distance of W from AO = 9 m

iv) Angle δ subtended by the arc AB at the centre = 64·5°

Determine the factor of safety against sliding along the slip surface. 6 + 9