SOIL MECHANICS-II (SEMESTER - 6)

CS/B.Tech(CE)/SEM-6/CE-601/09
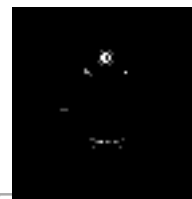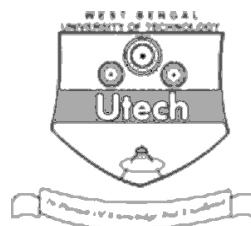
1. ....
      Signature of Invigilator

2. ....
      Signature of the Officer-in-Charge

Reg. No.

Roll No. of the Candidate

CS/B.Tech(CE)/SEM-6/CE-601/09
ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009
SOIL MECHANICS-II (SEMESTER - 6)

Time : 3 Hours]   [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **36 pages**. The questions of this concerned subject commence from Page No. 3.

2. a)   In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question**.

    b)   For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.

3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.

4. Read the instructions given inside carefully before answering.

5. You should not forget to write the corresponding question numbers while answering.

6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.

7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**

8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.

9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided
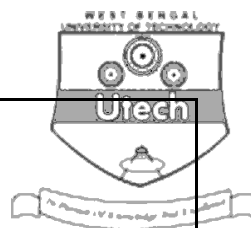
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Marks Obtained

					Group – A					Group – B	Group – C				Total Marks	Examiner's Signature
Question Number																
Marks Obtained																

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Head-Examiner/Co-Ordinator/Scrutineer

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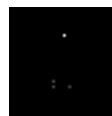
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ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

SOIL MECHANICS-II

SEMESTER - 6

Time : 3 Hours]   [Full Marks : 70

Assume reasonable value of additional data if required.

GROUP – A

(Multiple Choice Type Questions)

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

    i)   An infinite slope is inclined at an angle I and has its angle of internal friction ϕ, the stability number S_n is

        a) $\cos^2 i / (\tan i - \tan \phi)$ b) $\sin^2 i / (\tan i - \tan \phi)$

        c) $(\tan i - \tan \phi) \cos^2 i$ d) $(\tan i - \tan \phi) \sin^2 i.$

    ii) For slopes of limited extend the surface of slippage is usually along

        a) a parabolic arc   b) an elliptical arc

        c) a straight line   d) a circular arc.

    iii) If *S*, *L* and *R* are the arc length, long chord and radius of the sliding circle than the perpendicular distance of the line of the resultant cohesive force by friction circle method is given by

        a) $a = SR/L$ b) $a = LS/R$

        c) $a = LR/S$ d) none of these.

iv) Failure of a slope occurs only when total shear force is

    a) equal to total shear strength

    b) greater than total shear strength

    c) less than total shear strength

    d) none of these.

v) In a triaxial compression test, probable plane of failure making with the horizontal is given by

    a) $(45o - \phi/2)$ b) $(45o + \phi)$

    c) $(45o - \phi/3)$ d) $(45o + \phi/2)$.

vi) Unconfined compressive strength of pure clay soil is 15 kN/m^2. It's cohesion is
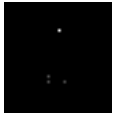
    a) $7 \cdot 5 \text{ kN/m}^2$ b) 15 kN/m^2

    c) 30 kN/m^2 d) 10 kN/m^2.

vii) During excavation of foundation trench in plastic clay having unit weight of $2 \cdot 3$ gm/c.c., the trench collapsed when it reached 4 m depth. On assumption that $\phi = 0$, the value of cohesion of clay was

    a) $2 \cdot 3 \text{ kg/cm}^2$ b) $0 \cdot 23 \text{ kg/cm}^2$

    c) 23 kg/cm^2 d) 230 kg/cm^2.

viii) Depth of tensile zone near the surface of a cohesive fill is

    a) $(c / \gamma) \sqrt{N\varphi}$ b) $(\gamma / c) \sqrt{N\varphi}$

    c) $(2c / \gamma) \sqrt{N\varphi}$ d) $(2c / \gamma) \sqrt{1/N\varphi}$.

5

ix) Which of the following are correct ?

a) $KA = (1 + \sin\varphi)/(1 - \sin\varphi)$

b) $KA = (1 - \sin\varphi)/(1 + \sin\varphi)$

c) $KA = \tan^2(45° + \varphi/2)$

d) $KA = \tan^2(45° - \varphi/2)$.

x) The over consolidation ratio is given by

a) P_c / P_o

b) P_o / P_c

c) $P_o + P_c / P_o$

d) $P_o + P_c / P_c$.

xi) The time factor T corresponding to 10% degree of consolidation is given by

a) 0·005 b) 0·008

c) 0·031 d) 0.

xii) The co-efficient of consolidation C_v is related to the permeability as

a) $C_v = k\, m_v$

b) $C_v = k/\gamma_w\, m_v$

c) $C_v = k(1 + e)$

d) $C_v = k/\gamma_w\, a$.

xiii) In the modified proctor compaction test, the weight of the hammer in kg is

a) 2·89

b) 3·89

c) 4·89

d) 5·89.

xiv) The zero air void line

a) passes above the wet side of the compaction curve, being more or less parallel to it

b) passes above the compaction curve touching the peak

c) passes intersecting the peak of the compaction curve
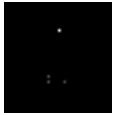
d) none of these.

xv) Compaction of soil is a function of

a) its water content
b) compactive effort applied to the soil

c) type of soil
d) all of these.

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

a) sheet pile wall
b) bulk head

c) cantilever retaining wall
d) masonry retaining wall.

xvii) The most effective method for compacting sand is by using

a) pneumatic rollers
b) sheep foot rollers

c) steel tyred rollers
d) vibration.

xviii) With increase in compaction energy in compaction test

a) $\gamma_{d\,max}$ and OMC both increase

b) $\gamma_{d\,max}$ decreases and OMC increases

c) $\gamma_{d\,max}$ increases and OMC decreases

d) $\gamma_{d\,max}$ and OMC remain constant.

xix) If specific gravity of soil solids of a soil having optimum moisture 16·5% and maximum dry density 1·57 gm/cc, is 2·65, void ratio at optimum moisture content is

a) 0·588
b) 0·688

c) 0·788
d) 0·888.

xx) The solids which do not exhibit any marked optimum moisture content are

a) clays
b) sands

c) both (a) and (b)
d) none of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following.

$3 \propto 5 = 15$

2. Determine the Culmann's method the critical height of an embankment having a slope angle of 40° and the contructed soil having $C^{/}$ = 30 kN/m^2, ϕ = 20° and effective unit weight = 18 kN/m^3. Find the allowable height of embankment if F_c = F_ϕ = 1·25.

3. An excavation is to be made in a soil deposit with a slope of 25° to the horizontal and to a depth of 25 m. The soil has the following properties :

   $C^{/}$ = 35 kN/m^2, ϕ = 15° and γ = 20 kN/m^3.

   a) Determine the factor of safety of the slope assuming full friction is mobilized.

   b) If the factor of safety with respect to cohesion is 1·5, what would be the factor of safety with respect to friction ?

   Given, for ϕ = 15° and angle of inclination = 25°, stability number is given by 0·03

   Given, for stability number 0·047 and angle of inclination 25°, ϕ_m = 13°.

4. Explain the following : Active earth pressure, Passive earth pressure, Deviator stress, Principal stress, Tension cracks.

5. State Rankine's and Coulomb's earth pressure theories with all assumptions thereon.

6. What is the difference between consolidation and compression ? What are meant by normally consolidated, over consolidation and under consolidation soil ?

7. What is meant by degree of consolidation ? What is the relation between degree of consolidation and Time Factor ?

8. What are the different types of compaction equipment ? Discuss their suitability.

9. The *in situ* void ratio of a granular soil deposit is 0·50. The maximum and minimum void ratios of the soil are 0·75 and 0·35. Specific gravity of soil solids, G_s = 2·67. Determine relative density and relative compaction of the deposit.
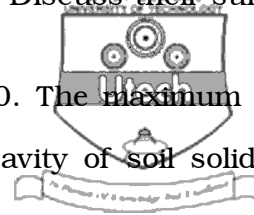
GROUP – C

(Long Answer Type Questions)

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

10. a) What are the compaction energy imparted in light and heavy compaction as per IS specification ?

b) Define CBR.

c) What is zero correction ? Explain with a typical load penetration curve.

d) A sample of soil compacted according to the standard Proctor Test has a density of 2·10 gm/cc at 100% compaction and at the optimum water content of 13%. What is the dry density at zero air voids ? If the voids become filled with water, what would be the saturated density ? $G = 2·67$. $3 + 2 + 3 + 7$

11. a) What do you understand by preconsolidated, normally consolidated and under consolidated clay ?

b) Draw a typical log pressure-void ratio curve and describe how preconsolidation pressure can be determined from it.

c) In an odometer test, a specimen of saturated clay of thickness 19 mm reaches 90% consolidation in 20 minutes. How long it would take a layer of this clay 5 m thick to reach the same degree consolidation under the same stress and drainage conditions ? How long would it take to reach 30% ? $2 + 6 + 7$
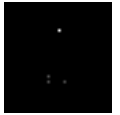
12.   a)   Explain the friction cricle method for analyzing slope stability.

   b)   How can coefficient of consolidation be determined from one-dimensional test by Logarithmic time fitting method ?

   c)   A soil profile consists of a 5 m thick saturated normally consolidated clay layer (WL = 60%, γ_{sat} = 19·5 kN/m^3 , e_0 = 0·7) overlain by a sand strata (G = 2·65, e = 0·7) of 4 m   thickness extended up to ground level. The clay layer is underlain a rock stratum. The water table is at a depth of 2m from ground level. The sand is dry above water table. The system is under a surcharge load of 100 kN/m^2 .

      i)   Draw a neat diagram of the soil profile with all details.

      ii)   Estimate the settlement of the clay strata due to primary consolidation

      iii) If the average value of C_v for the pressure range is 0·4 mm^2 /sec, how long will it take for 50% consolidation ?   5 + 3 + 7

13.   a)   What are the advantages and disadvantages of triaxial test in comparison with direct shear test ?

   b)   A series of triaxial tests were conducted on three identical specimens on saturated clay. The test results are tabulated below : (The stresses are in kPa.)

Specimen	σ_3	$(\sigma_1 - \sigma_3)_f$	Δu_f
A	100	170	40
B	200	260	95
C	300	360	135

Determine the effective shear parameters of the soil.

   c)   What is a 'UC' test ? What are the advantages and disadvantages of this test ?

   d)   What do you understand by a 'stress controlled' and 'strain controlled' tests ?

                                                            4 + 6 + 3 + 2
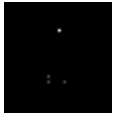
14. a) What do you understand by the active and passive earth pressure ? How will you determine these in cohesionless soils by Rankine's earth pressure theory ?

b) A vertical excavation was made in a clay deposit having unit weight of 20 kN/m^3. It caved in after the depth of digging reached 3 metres. Taking the angle of internal friction to be zero, calculate the value of cohesion. If the same clay is used as a backfill against a retaining wall, upto a height of 9 metres, calculate

i) Total active earth pressure

ii) Total passive earth pressure.

Assume that the wall yields for enough to allow Rankine deformation conditions to establish.   8 + 7

15. a) What are the assumptions made to analyse an anchored sheet pile structure under free earth method of analysis ? Derive the expression of depth of embedment of an anchored sheet pile structure when driven into a cohesive soil.

b) A new canal is excavated to a depth of 5 m below ground level, through a soil having the following characteristics, $C = 12 \text{ kN/m}^2$, $\phi = 15°$, $e = 0·8$ and $G = 2·7$. The slope of banks is 1 in 1. Calculate the factor of safety with respect to cohesion when the canal runs full. If it is suddenly and completely emptied, what will be the factor of safety ?   8 + 7

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END