01104

B.Tech. Civil (Construction Management) / B.Tech. Civil (Water Resources Engineering)

Term-End Examination

June, 2011

ET-501(A) : SOIL MECHANICS

Time : 3 hours   *Maximum Marks : 70*

Note :   *Answer **any five** questions. Assume any missing data.*
*Use of calculator is **permitted**.*

1.   (a)   The weight of a soil in its dry state is 150.5 N.   **7**
         When some water is added to it, its weight
         increases to 180.3 N. Its volume is 0.01 m^3.
         $G = 2.65$.

         Calculate : (i)   moisture content

                        (ii)   void ratio

                        (iii)   dry unit weight and

                        (iv)   moist unit weight.

     (b)   The initial moisture content of a soil is 7%,   **7**
         at a porosity of 0.35. The specific gravity of
         solids is 2.65. Determine the quantity of
         water to be added to 1 m^3 of soil in order to
         saturate it completely.

2.   (a)   What is particle size distribution curve ?   **7**
         Explain its significance in soil engineering.

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(b) Compute the shrinkage limit and the specific gravity of solids. 7

Volume of saturated soil = 9.75 mL

Mass of saturated soil = 16.5 gm

Volume of dry soil after shrinkage = 5.4 mL

Mass of dry soil after shrinkage = 10.9 gm

3. (a) Discuss Indian Standard Soil classification system. 7

(b) The result of sieve analysis and consistency limits are as follows : 7

Percentage passing 75 μ sieve = 4%

Percentage retained on 4.75 mm sieve = 50%

Coefficient of curvature = 2

Uniformity coefficient = 7

Liquid Limit = 15

Plasticity Index = 3

Classify the soil according to BIS system.

4. (a) What are different methods for determination of the coefficient of permeability in a laboratory ? Discuss their limitations. 7

(b) The Falling Head Permeability test was conducted on a soil sample of 4 cm diameter and 18 cm length. The head fell from 1.0 m to 0.4 m in 20 min. If the cross sectional area of the stand pipe was 1 cm^2, determine the coefficient of permeability. 7

5. (a) Discuss the followings : 4x2=8

   (i) The compaction method.

   (ii) Effect of moisture content on compaction.

   (iii) The zero air void line.

   (iv) Compaction curve.

   (b) The results of Standard Proctor compaction 6 tests on a soil are as follows :

   Plot the data and determine (i) Optimum Moisture Content and (ii) Maximum Dry Density. Draw the zero air void line and the 10% Constant percent air void line
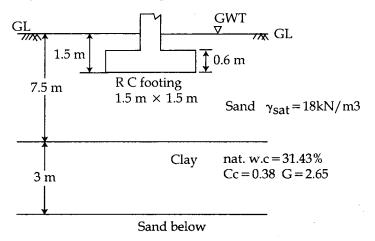
   $G_s = 2.65$, $\gamma_w = 10$ kN/m^3

Moisture (%) content	6.76	8.50	9.39	11.07	11.94	12.88
Wet unit weight (kN/m^3)	20.94	22.48	22.29	21.37	20.82	19.97

6. Write short notes on *any four* of the following. 4x3½=14

   (a) Difference between compaction and consolidation with examples.

   (b) Differentiate between primary consolidation and secondary consolidation.

   (c) Factors affecting shear strength.

   (d) Methods of improving slope stability.

   (e) Triaxial shear test on soils.

   (f) Sand Drains.

7. A reinforced concrete footing carrying a load of 800 kN is to be constructed. The clay is found to be normally consolidated, having the compression index Cc equal to 0.38 and natural water content of 31.43%. $G_s = 2.65$. The saturated unit weight of the overlaying sand is 18 kN/m³. Determine the consolidation settlement of the footing due to clay. Assume unit weight of concrete = 24 kN/m³

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GL
GWT
GL
1.5 m
0.6 m
7.5 m
R C footing
1.5 m × 1.5 m
Sand $\gamma_{sat} = 18$ kN/m3
Clay   nat. w.c = 31.43%
3 m   Cc = 0.38 G = 2.65
Sand below