Printed Pages : 7

ECE-501

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 100501

Roll No. | | | | | | | | | |

B. Tech.

(SEM. V) (ODD SEM.) THEORY EXAMINATION, 2014-15

GEOTECHNICAL ENGINEERING

Time : 3 Hours] [Total Marks : 100

Note : (1) Attempt all questions.

(2) All questions carry equal marks.

(3) If required any missing data; then choose suitably.

1 Attempt any **FOUR** parts of the following : **5x4=20**

(a) Write a brief note on the soil formation. What are the building blocks of clay minerals ? Explain the three common groups of clay minerals.

(b) Discuss various field and laboratory methods of water content determination of soils.

(c) Explain the following :

(i) Thixotropy of clays

(ii) Corrections in hydrometer analysis.

(d) Derive the functional relationship between γ_d, γ_w, n_a, W and G; $\gamma_d = \frac{(1-n_a)G\gamma_W}{1+WG}$.

(e) A soil sample has 97% of the particles (by weight) finer than 1mm, 58% finer than 0.1 mm, 25% finer than 0.01 mm and 12% finer than 0.001mm. Draw the grain size distribution curve and determine the following :

Percentages of gravel, coarse sand, medium sand, fine sand and silt as per IS soil classification system. Also determine C_u and C_c.

(f) A soil sample assumed to consist of spherical grains all of same diameter will have maximum void ratio when the grains are arranged in a cubical array. Find the void ratio and dry unit weight. Take unit weight of grains as 20 kN/m^3.

2 Attempt any **four** parts of the following : **5x4=20**

(a) The difference in values of capillary rise for fine sand and silt was found to be 4.5 m. If the capillary rise in fine sand is 0.5 m. Compute the difference in size of voids of the two soils.

(b) When the flow lines pass from soil-1 to another soil-2 having a different permeability k_1 and k_2; they deviate from the interface of the two soils. Explain these two conditions; $k_1 > k_2$ and $k_1 < k_2$ with the help of neat sketches.

(c) In a cohessionless soil deposit, the water table is at the ground surface. If the saturated unit weight is 18 kN/m^3, compute the total stress, pore pressure and effective stress at a depth of 5m for the upward flow under a gradient of 0.5.

(d) Derive the 'Laplace Equation' for the two dimensional seepage flow.

(e) The following observations were made in a standard proctor test;

Trial No.	1	2	3	4	5	6
Mass of Wet Soil (kg)	1.70	1.89	2.03	1.99	1.96	1.92
Water Content (%)	7.7	11.5	14.6	17.5	19.7	21.2

Volume of mould is 945 cc and G=2.67. Determine the maximum dry density and optimum moisture content.

(f) Write the short notes on :

(i) Field compaction control

(ii) Effects of compaction and soil properties.

3 Attempt any **TWO** parts of the following : **10x2=2**

(a) Two long boundary walls of small width run parallel to each other at a distance of 3 m apart. The self-weights of the walls are 25 kN/m and 15 kN/m. Plot the distribution of vertical stress intensity due to the walls on a horizontal plane 3 m below the ground level.

(b) Give the assumptions of the Terzaghi's theory for calculating the rate of 1-D consolidation and prove that : $\frac{\partial u}{\partial t} = c_v \cdot \frac{\partial^2 u}{\partial z^2}$.

(c) During a laboratory consolidation test, the time and dial gauge readings obtained from an increase of pressure on the specimen from 50 kN/m^2 to 100 kN/m^2 are given here;

$Time(Min)$	0	0.1	0.25	0.5	1.0	2.0	4.0	8.0
Dial Guage Reading $(cm \times 10^4)$	3975	4082	4102	4128	4166	4224	4298	4420

$Time(Min)$	16.0	30.0	60.0	120.0	240.0	480.0	960.0	1440.0
Dial Guage Reading $(cm \times 10^4)$	4572	4737	4923	5080	5207	5283	5334	5364

Using the logarithm of time method, determine c_v. The average height of the specimen during consolidation was 2.24 cm, and it was drained at the top and bottom.

4 Attempt any **TWO** parts of the following : **10x2=20**

a) Classify shear tests based on drainage conditions. How are these drainage conditions realized in the field ? Explain the advantages of tri-axial shear test over direct shear test.

b) In a tri-axial test of soil specimen was consolidated under a cell pressure of 700 kN/m^2 and the increased pore pressure reading was 450 kN/m^2. The axial load was then increased to give a deviator stress of 570 kN/m^2 and pore pressure reading of 650 kN/m^2. Calculate the pore pressure parameters A and B.

c) A retaining wall with a smooth vertical back face has to retain a backfill of $c-\phi$ soil up to 6 m above ground level. The surface of the backfill is horizontal and it has the following properties : $\gamma=1.9$ t/m³, c=1.7 t/m² and $\phi=15^0$.

(i) Plot the distribution of active earth pressure on the wall.

(ii) Determine the magnitude and point of application of active thrust.

(iii) Determine the depth of the zone of tension cracks.

5 Attempt any **TWO** parts of the following : **10x2=20**

(a) What do you understand by site investigation and why this is necessary before any construction ? Describe various methods of drilling holes for subsurface investigations.

(b) Discuss the various types of bearing capacity failure occurs in soil. What are the assumptions made in Terzaghi's analysis of bearing capacity of a continuous footing ? Write in brief.

A square footing of 2.5 m × 2.5 m size has been founded at 1.2 m below the ground level in a cohesive soil having a bulk density of 1.8 t/m³ and unconfined compressive strength of 5.5 t/m². Determine the safe bearing capacity of the footing for a factor of safety of 2.5 by Skempton's method.

(c) A rectangular footing of 2.4 m × 3.5 m size is to be constructed at 1.5 m below the ground level in a $c-\phi$ soil having the following properties : $C=1.0\ t/m^2$, $\phi=20^0$ and $\gamma=1.75\ t/m^3$.

The footing has to carry a gross vertical load of 70 t, inclusive of its self - weight. In addition, the column is subjected to a horizontal load of 11 t applied at a height of 3.3 m above the base of footing. Determine the factor of safety of the footing against shear failure as per IS : 6403-1981.
