Ref. No. EX/CON/T/221/2018

B. E. CONSTRUCTION ENGINEERING 2ND YEAR 2ND SEMESTER - 2018

SUBJECT: Soil Mechanics I

Time : Three Hours **Full Marks : 100**

Part I

<table>
<tr><th></th><th>Question No.</th><th></th><th>Marks</th></tr>
<tr><td>CO1 [07]</td><td>Q1a.</td><td>Define shrinkage limit</td><td>02</td></tr>
<tr><td></td><td>Q1b.</td><td>The shrinkage limit test data on a clay soil sample is as follows.
Weight of shrinkage dish and saturated soil = 39.78 gm
Weight of shrinkage dish and oven dry soil = 31.46 gm
Weight of shrinkage dish = 11.65 gm
Volume of shrinkage dish = 17.29 cm³
Total volume of oven dry soil cake = 11.00 cm³
Calculate the shrinkage limit.</td><td>05</td></tr>
<tr><td>CO2 [10]</td><td>Q2.</td><td>Write a short note on anyone of the following
a) Plasticity chart b) Identification of organic soil</td><td>05</td></tr>
<tr><td></td><td>Q3.</td><td>Sieve analysis test results of a soil sample are given below
<table>
<tr><td>Sieve Size (mm)</td><td>10.0</td><td>4.75</td><td>2.36</td><td>1.18</td><td>0.600</td><td>0.425</td><td>0.300</td><td>0.150</td><td>0.075</td></tr>
<tr><td>Weight retained (gm)</td><td>Nil</td><td>8</td><td>38</td><td>56</td><td>42</td><td>12</td><td>14</td><td>10</td><td>12</td></tr>
</table>
Total weight of soil taken for sieve analysis = 200 gms.
Colour : Whitish gray
Relative density : Medium Dense
Write down the classification symbol and description of the soil samples</td><td>05</td></tr>
</table>

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<table>
<tr><th></th><th>Question No.</th><th colspan="4"></th><th>Marks</th></tr>
<tr><td>CO3 [8]</td><td></td><td colspan="4">Answer either question (4) or question (5) in this block</td><td></td></tr>
<tr><td></td><td>Q4a.</td><td colspan="4">In a falling head permeability test the initial head (at t = 0) is 50cm. The head drops by 4cm in 12 minutes. Calculate the time required to run the test if the final head is to be 20cm.</td><td>06</td></tr>
<tr><td></td><td>Q4b.</td><td colspan="4">What is the critical hydraulic gradient of a sand layer if specific gravity and void ratio are 2.66 and 0.69 respectively?</td><td>02</td></tr>
<tr><td></td><td>Q5</td><td colspan="4">A bed of sand consists of three horizontal layers of equal thickness. The value of K for the upper and lower layers is 1.50m x 10^{-4} cm/sec and that of the middle layer is 2 x 10^{-3} cm/sec. What is the ratio of the average co-efficient of permeability of the combined soil layer in the horizontal direction to that in the vertical direction ?</td><td>08</td></tr>
<tr><td>CO4 [10]</td><td>Q6.</td><td colspan="4">The sub-soil profile at a site is given below.</td><td>10</td></tr>
<tr><td></td><td></td><td colspan="2">Depth (m)</td><td rowspan="2">Description</td><td rowspan="2">Soil parameters</td><td></td></tr>
<tr><td></td><td></td><td>From</td><td>To</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>0.00</td><td>3.00</td><td>Yellowish brown sand</td><td>Void ratio e = 0.40
Specific gravity G=2.66</td><td></td></tr>
<tr><td></td><td></td><td>3.00</td><td>10.00</td><td>Medium stiff grey silty clay</td><td>Balk Density = 1.85 t/m³</td><td></td></tr>
<tr><td></td><td></td><td colspan="4">The water table is at 1.00m below ground level. Draw the variation of total, neutral and effective pressure with depth.</td><td></td></tr>
</table>

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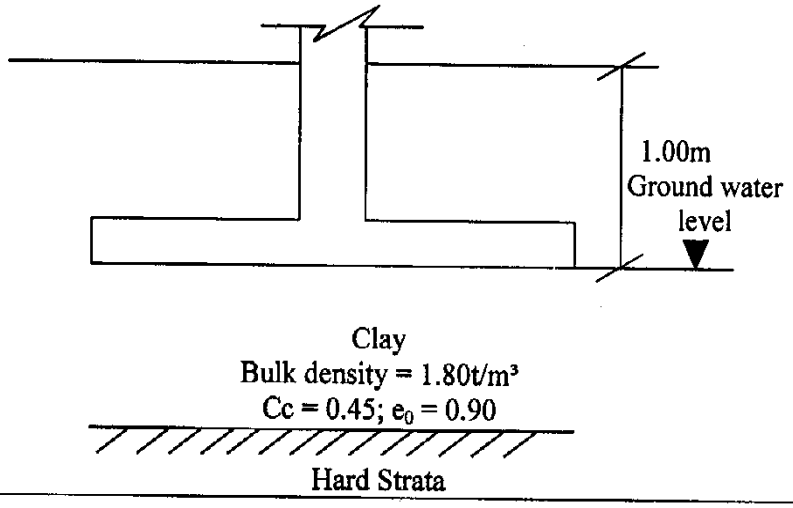
Part I

	Question No.		Marks
CO5 [15]		**Answer any two questions from (7a), (7b) and (7c) in this block**	
	Q7a.	A 20mm thick undisturbed sample of a saturated clay is tested in the laboratory with drainage being allowed both through the top and bottom surfaces. The soil sample reaches 50 percent degree of consolidation is 60 minutes. If the clay layer from which the sample was obtained is 4m thick and is free to drain through both top and bottom surface, calculate the time required by the clay layer to undergo the same degree of consolidation. What would have been the time of consolidation if the clay layer is free to drain only through the top surface ?	7.5
	Q7b.	A square footing of size 2.00m x 2.00m is placed at a depth of 1.00m below ground level. The footing carries a load of 50 ton from the superstructure. The soil profile is shown below. Calculate the total settlement of the clay strata. 	7.5
	Q7ci.	Define normally consolidated clay and pre-consolidated clay	2.5
	Q7cii.	Describe the process of determination of pre-consolidation pressure of a clay strata.	5

SOIL MECHANICS-I PART- II FULL MARKS : 50

Answer either Question [2 (a)] or Question [2 (b) (i) + 2 (b) (ii)]

Similarly answer either Question [3 (a) (i) + 3 (a) (ii)] or Question [3(b) + 3 (b) (ii)] and

Answer either the question 4(a) or 4(b) (i) + 4 (b) (ii)

Different part of the same question should be answered together. [Assume relevant data if required]

CO-1

Q-1 (a) Soil from borrow pit with a water content of 14% and specific gravity of 2.65 is to be used for construction of an embankment with a finished volume of 40000 cubic metre to achieve a target dry density of 1.75 gm/ cm^3 when mixed with 18% moisture. Calculate the volume and weight of the soil to be excavated from borrow pit. (10)

OR

(b) A 1000 cc core cutter weighing 946 gm was used to determine the in-situ density of soil in a road embankment. The weight of the core cutter with soil was found as 2768 gms . If the moisture content of the soil was found as 12% from laboratory test with a specific gravity of 2.68, then find the bulk unit weight , dry unit weight , void ratio, saturated density and degree of saturation of the soil. (10)

CO-2

Q-2 (a) A standard Proctor test data are given below. Draw the moisture density relation and find out OMC and Maximum dry density of soil. Also draw the zero air void line to check the correct ness of moisture density relation. (10)

OR

(b)(i) Explain different types of equipment to be used in field compaction for compaction in clay as well as sandy soil. (ii) Explain the factors on which affect the field compaction of soil . (6+ 4)

CO-3

Q-3 (a)(i) Describe the formula for determination of vertical stress as developed by Boussinesq and Westergaard stating relevant assumption. Compare the Influence coefficient of Boussinesq and Westergaard graphically for a point load of with increase in depth. Assume relevant data if required.

(ii) Explain the procedure to find vertical stress at a point outside of an uniformly distributed rectangular load . (10+ 5)

OR

(b) (i) Two line loads with intensity of 10 KN/m and 15 KN/m are acting parallel and 4 m away from each other . A point load of 30 KN is acting at the middle of two line loads. Find out the increase in vertical stress at 6 m below the point load.

(ii) Explain the significance of stress isobar. (10+ 5)

CO-4

Q-4.(a) In a CU test a NC Clay sample was consolidated under a stress of 180 KN /m^2 , which failed on a deviator stress of 140 KN /m^2 . The pore pressure at failure was 70 KN /m^2 . Determine analytically the shear strength parameters and principal stress ratio, both in terms of total and effective stress . Find out the Pore pressure co efficient A_f. (15)

OR

(b) (i) Discuss with reasons , the suitability of direct shear test and unconfined compression test for different types of soil. (4)

(ii) Direct Shear test was carried out on samoles of compacted sand . The shear box dimension was 60 mm X 60 mm . The readings obtained are given below.

Normal Load (N)	Shear load at failure (N)	
	Peak	Ultimate
110	95	65
225	195	135
340	294	200

Determine the angle of shearing resistance of the sand (i) in the dense compacted state and (ii) in a loose state. (11)