Ref. No. EX/CON/T/221/2019

B. E. CONSTRUCTION ENGINEERING 2ND YEAR 2ND SEMESTER - 2019

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>Q1.</td><td>Liquid Limit test was conducted on a soil sample. The test data are as follows
<table>
<tr><td>Number of blows</td><td>47</td><td>34</td><td>22</td><td>16</td></tr>
<tr><td>Weight of wet soil and container</td><td>57.49</td><td>49.11</td><td>66.94</td><td>49.92</td></tr>
<tr><td>Weight of dry soil and container</td><td>47.22</td><td>40.72</td><td>52.57</td><td>40.27</td></tr>
<tr><td>Weight of container</td><td>21.53</td><td>21.23</td><td>21.99</td><td>20.96</td></tr>
</table>
Calculate the liquid limit of the soil sample</td><td>07</td></tr>
<tr><td>CO2 [10]</td><td></td><td>Answer any one from question (2) and question (3) in this block</td><td></td></tr>
<tr><td></td><td>Q2.a.</td><td>Visual identification and laboratory test results on a of soil sample are as follows.
Write down the classification symbols and description of the soil samples.
Colour : Grey
Natural Moisture Content : 35.0%
Liquid Limit : 42.0%
Plastic Limit : 27.0%</td><td>05</td></tr>
<tr><td></td><td>Q2.b.</td><td>Write a short note on any one of the following
i) Dry strength test ii) Dilatancy Test</td><td>05</td></tr>
</table>

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Part I

	Question No.		Marks
	Q3.	The combined grain size analysis of a soil sample is carried out. The test data are as follows.	10

Sieve Analysis

Sieve size (mm)	4.750	2.000	1.180	0.600	0.425	0.300	0.150	0.075
Weight retained (gm)	–	–	0.01	0.02	0.03	0.17	0.12	0.46

Hydrometer Analysis

Time (minutes)	0.5	1.0	2.0	4.0	8.0	15.0	30.0	60.0	120.0	1440.0
Hydrometer reading	1.030	1.029	1.028	1.024	1.0185	1.014	1.010	1.009	1.007	1.005

Total soil sample taken for test : 50 gm

Specific gravity of soil solid : 2.67

Viscosity of water : 7.83milipoise

Specific gravity of water : 0.9963

Meniscus correction : + 0.0005

Diameter of c/s area of cylinder : 7.2cm

Volume of the hydrometer bulb : 100cc

h : 16.3cm

Distance from neck to hydrometer reading 1.030 is 1.46cm

Distance between major graduations, i.e. between 1.025 & 1.030 etc. is 1.75cm.

Draw the grain size distribution curve and find out the percentage of sand, silt and clay.

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Part I

	Question No.		Marks
CO3 [08]		**Answer any two from question (4a), question (4b) and question (4c) in this block**	
	Q4.a.	Derive the expression for equivalent co-efficient of permeability in horizontal direction for a three-layer soil system. The individual layer thicknesses are H_1, H_2 and H_3 while the co-efficient of permeability are k_1, k_2 and k_3 respectively.	04
	Q4.b.	Calculate the co-efficient of permeability of a soil sample 7cm in height and 50 cm² in cross section area. 500ml of water passed down in 12 minutes under the effective constant head of 50cm.	04
	Q4.c.	The following details refer to falling head permeability test conducted at the laboratory Sample thickness : 2.5 cm Diameter of the sample : 7.5 cm Diameter of the stand pipe : 10 mm Initial head of water in the stand pipe : 100 cm Water level in the stand pipe after 03h 20min. : 80 cm Determine the co-efficient of permeability of the soil.	04
CO4 [10]	Q5.	The sub-soil profile at a site is given below.	10

Depth (m) From	Depth (m) To	Description	Soil parameters
0.00	5.00	Loose brownish grey silty sand	Bulk density : 1.850t/m³
5.00	12.00	Medium dense grey silty sand	Bulk density : 1.950t/m³
12.00	15.00	Dense yellowish brown silty sand	Bulk density : 1.980t/m³

The ground water table is at ground surface. Draw the variations of total, effective and neutral pressure with depth.

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B.E CONSTRUCTION ENGINEERING 2nd YEAR 2nd SEMESTER EXAMINATION 2019

Soil mechanics-I Part-II Full marks -50

Answer any two questions

Q-1.

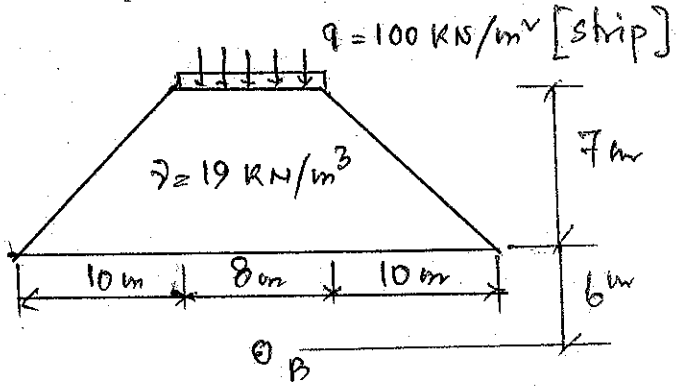
(a) In a CU test on a NC Clay under a stress of 200 kN /m^2 failed with a deviator stress of 150 kN /m^2 . The pore water pressure at failure was 75 kN /m^2 . Determine analytically the shear strength parameters both in terms of total and effective stresses. Also find out the values of principal stress ratio (σ_1/σ_3) and (σ'_1/σ'_3) at failure. Determine the value of Skempton's pore pressure coefficients A and B. (12)

(b) Prove analytically that $c = q_u/2$ in a unconfined compression test. Moreover, explain the concept with Mohr circle . (8)

© Explain the principle of determination of sensitivity of clay using Vane shear test. (5)

Q-2.

(a) Determine the stress at point B as shown in fig-A below an embankment load. (12)



(Fig-A)

(b) Explain he difference between Westergaard and Boussinesq's theory for determination of vertical stress under point load . (6)

© Explain the principle of sand replacement method. (7)

Q-3(a) Describe different types of rollers in various types of soil. (4)

(b) Explain the variation of moisture density relationship in a clayey soil with special reference to standard and modified proctor test. (6)

© The mass of a moist soil sample with a volume of 0.0060 m^3 is 10.8 kg. The moisture content and the specific gravity of soil solids were 13.2% and 2.67 respectively. Determine (i) (v) bulk density (ii) dry density © void ratio (iv) porosity and (v) degree of saturation . [Use both analytical and block diagram] (15)