Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

V SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: **GEOTECHNICAL ENGINEERING [CIE 3101]**

REVISED CREDIT SYSTEM

(15 /11/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitable assumed.
- Normal graph sheet can be used.

1A. Using basic definitions of soil mass obtain the relationship between degree of saturation, voids ratio, specific gravity and water content. **2**

1B. Classify the two inorganic soil samples as per IS, if total sample taken for test is 1000gms. Write steps for classification. **4**

	Soil A	Soil B
finer than 4.75mm	400gms	100gms
Finer than 75 microns	100gms	620gms
Liquid Limit %	30	40
Plastic Limit %	10	25.4
Cu	3	2.2
Cc	1.2	1.6

1C. A sample of saturated soil has a volume of $1x10^{-4}$ m^3 and weight 2.1 $x10^{-3}$ kN. When the soil is completely dried, the volume of the sample is $9x10^{-5}m^3$ and its weight is 1.74 x 10^{-3} kN. Determine i) initial water content ii) shrinkage limit iii) specific gravity iv) voids ratio **4**

2A. Explain with neat sketches the three layered clay minerals. Give examples for each. **3**

2B. A soil sample of particle size ranging from 0.075 mm to 0.003 mm is put on top of the water surface in a tank. Depth of water in the tank is 3m. Estimate the time required for the first particle and also the entire sample to reach the bottom of tank. Assume μ = 0.01 poise and G = 2.7 **2**

2C. Following are the results of consolidation test on a soil sample of initial thickness 25 mm, water content of 32 % and G=2.78. Calculate the void ratio corresponding to each pressure increment. Plot voids ratio vs effective stress graph. Determine coefficient of volume compressibility and coefficient of compressibility for the pressure increment from 214 to 480 kN/m^2 **5**

Pressure (kN/m^2)	0	54	214	480	960	1500
Change in height (mm)	0	0.56	1.99	2.49	3.76	3.78

3A. In a falling head permeability test, the sample is 18cm long and diameter 9.2cm. Calculate the time required for head to drop from 185cm to 90cm, if diameter of stand pipe used is 1.5cm. The sample is a layered soil having permeability (k) and thickness **3**

<table>
<tr><td></td><td>(z) as follows. Frist layer: k=1.8 x 10^{-4} cm/sec, z = 5cm; Second layer: k=4.1 x10^{-4} cm/sec, z = 7cm; Third layer: k=7.4 x 10^{-4}cm/sec, z = 6cm. Assume flow is perpendicular to planes.</td><td></td></tr>
<tr><td>3B.</td><td>Define discharge velocity and seepage velocity. Derive relation between them.</td><td>2</td></tr>
<tr><td>3C.</td><td>For the soil shown in the figure 3C draw the flow net for the flow of water through it and calculate seepage if k = 4.2 x 10^{-5} cm/sec. ii) seepage pressure at points A and C. iii) Rise in water level in stand pipe inserted at points A and B. iv) Factor of safety against piping at point C(specific gravity of soil = 2.68,voids ratio = 0.52)</td><td>5</td></tr>
<tr><td>4A.</td><td>For a concentrated load of 480kN acting on the ground surface draw an isobar for vertical stress of 48 kN/m ^{2}</td><td>4</td></tr>
<tr><td>4B.</td><td>A saturated clay layer of 6m thick is overlain by sand of 5m deep. The water table is 3m below the ground surface. The unit weight of sand is 17 kN/m^3 and 19 kN/m^3 above and below water table respectively. The clay layer has specific gravity of 2.59 and voids ratio of 0.55. Determine the total and effective stresses at 9m below the ground surface. If capillary water rises 1m above the water table, find the effective stress at 9m from ground surface.</td><td>2</td></tr>
<tr><td>4C.</td><td>Differentiate between consolidation and compaction. Also explain mass spring analogy for consolidation of soil.</td><td>4</td></tr>
<tr><td>5A.</td><td>During a compaction test, a soil attains a maximum dry density of 19 kN/m^3 at an optimum moisture content of 10%. Determine the degree of saturation and percentage air voids at maximum dry density. Also find the theoretical maximum dry density corresponding to zero air voids at optimum moisture content. Specific gravity of soil solids is 2.7</td><td>2</td></tr>
<tr><td>5B.</td><td>State the limitations of direct shear test. A direct shear test on soil sample gave the following data:
<table>
<tr><td></td><td>1</td><td>2</td></tr>
<tr><td>Normal Stress (kN/m^2)</td><td>140</td><td>280</td></tr>
<tr><td>Shear Stress (kN/m^2)</td><td>110</td><td>130</td></tr>
</table>
What would be the axial stress at failure, if unconfined compression strength test is carried on same soil.</td><td>4</td></tr>
<tr><td>5C.</td><td>The triaxial shear test was carried out on soil samples gave following results:
<table>
<tr><td>Cell pressure, kN/m^2</td><td>50</td><td>100</td><td>150</td></tr>
<tr><td>Deviator stress, kN/m^2</td><td>78</td><td>130</td><td>190</td></tr>
<tr><td>Pore water pressure, kN/m^2</td><td>30</td><td>60</td><td>80</td></tr>
</table>
Plot Mohr's circle for effective stresses and obtain effective shear strength parameters</td><td>4</td></tr>
</table>

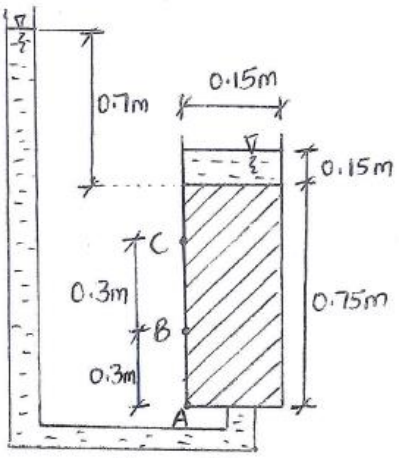
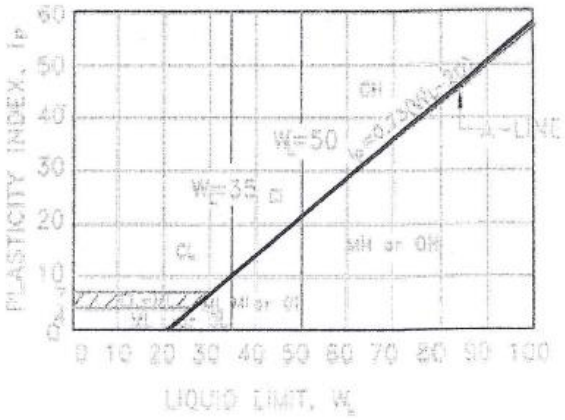


Figure 3C



Plasticity Chart