Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

V SEMESTER B.TECH. (CIVIL ENGINEERING) END SEMESTER EXAMINATIONS
NOVEMBER 2018

SUBJECT: GEOTECHNICAL ENGINEERING [CIE 3101]

Date of Exam: **19/11/2018** Time of Exam: **2.00-5.00PM** Max. Marks: **50**

Instructions to Candidates:
- Answer ALL the questions & missing data may be suitably assumed

<table>
<tr><td>1A.</td><td>Differentiate between silica sheet and gibbsite sheet.
An undisturbed specimen of clay was tested in a laboratory and the following results were obtained. Weight of specimen = 2.1 N, Oven dry weight of specimen = 1.75 N. Specific Gravity of soil solids = 2.7. What was the total volume of original undisturbed specimen assuming that the specimen was 50 % saturated?</td><td>(02+02)</td><td>CO1</td></tr>
<tr><td>1B.</td><td>A soil sample has a volume at its liquid limit and shrinkage limit of 40 cm^3 and 23.5 cm^3 respectively. If the liquid limit, plastic limit and shrinkage limit of the soil are 60%, 30% and 20 % respectively, determine i) specific gravity of the soil solids ii) Shrinkage ratio</td><td>(03)</td><td>CO1</td></tr>
<tr><td>1C.</td><td>Classify the inorganic soils A and B given in the table below as per IS classification if soil samples taken for the test is 1000gms. Write steps for
<table>
<tr><th>Soil</th><th>Liquid limit</th><th>Plastic Limit</th><th>passing 75μ sieve</th><th>passing 4.75mm sieve</th><th>D_{10} mm</th><th>D_{30} mm</th><th>D_{60} mm</th></tr>
<tr><td>A</td><td>-</td><td>Non Plastic</td><td>100 gms</td><td>700 gms</td><td>0.2</td><td>0.68</td><td>1.3</td></tr>
<tr><td>B</td><td>32 %</td><td>27%</td><td>130 gms</td><td>980 gms</td><td>0.1</td><td>0.52</td><td>1.1</td></tr>
</table>
classification.</td><td>(03)</td><td>CO1</td></tr>
<tr><td>2A.</td><td>Explain why quick sand condition occurs only in cohesionless soils? Mention any one method to prevent this.</td><td>(03)</td><td>CO2</td></tr>
<tr><td>2B.</td><td>A homogeneous dam is 21.5m high and has a free board of 1.5m. A flow net was constructed and the following results were observed. Number of potential drops = 12, Number of flow channels = 3. The dam has a horizontal filter of 15m length. Calculate i) The discharge/m length of the dam if coefficient of permeability of dam material is 3.2 x 10^{-6} m/sec. ii) Seepage pressure and pore pressure at the point P located 5m below the downstream ground level having number of potential drop of 4.5 iii) The factor of safety against piping if the length of exit field is 3m, determine. Take G = 2.68, void ratio 0.56 and downstream ground level as datum.</td><td>(04)</td><td>CO2</td></tr>
<tr><td>2C.</td><td>A soil sample of length 0.22m was subjected to a constant head permeability test in a permeameter having the area of 28 x 10^{-4} m^2. At a head of 0.35m, a discharge of 90 ml was obtained for a period of 60 seconds. The dry weight of the soil sample used was found to be 1150gms and specific gravity of soil solids was 2.65. determine i) Coefficient of permeability ii) Discharge velocity iii) Seepage velocity.</td><td>(03)</td><td>CO2</td></tr>
<tr><td>3A.</td><td>A falling head permeability test is to be performed on a soil sample whose permeability is estimated to be about 3 × 10^{-5} cm/s. What diameter of the standpipe should be used if the head is to drop from 27.5 cm to 20.0 cm in 5 minutes and if the cross-sectional area and length of the sample are respectively 15 cm^2 and 8.5 cm? What is the time taken for the head to drop</td><td>(02)</td><td>CO2</td></tr>
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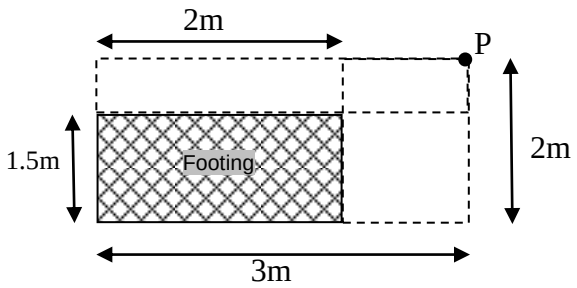
<table>
<tr><td></td><td>from 37.7 cm to 30.0 cm?</td><td></td><td></td></tr>
<tr><td>3B.</td><td>The following are the results of compaction test.
<table>
<tr><td>Weight of mould + wet soil (N)</td><td>28.25</td><td>29.65</td><td>30.5</td><td>30.15</td><td>29.76</td></tr>
<tr><td>Water Content %</td><td>9.8</td><td>12</td><td>14.2</td><td>16.1</td><td>18.3</td></tr>
</table>
Volume of mould = 1000cm^3, weight of mould = 9N, specific gravity of soil solids = 2.7. Plot the compaction curve and determine maximum dry density and optimum moisture content. Also plot the zero air void line.</td><td>(05)</td><td>CO4</td></tr>
<tr><td>3C.</td><td>A clay stratum of 8m thick is located at a depth of 9m below the ground level. The natural moisture content of clay is 40%, its liquid limit is 49% and the specific gravity of soil solids is 2.72. The water table is located at a depth of 4.5m below the ground level. The soil above the clay layer is sand. The unit weight of sand above and below the water table is 18 kN/m^3 and 21kN/m^3 respectively. Due to the construction of a building, the average increase in pressure at the center of the clay stratum is 110kN/m^2. Estimate the expected settlement of the building.</td><td>(03)</td><td>CO4</td></tr>
<tr><td>4A.</td><td>Derive the relationship between the principal stresses and the shear strength parameters.</td><td>(03)</td><td>CO5</td></tr>
<tr><td>4B.</td><td>In a triaxial compression test, a specimen of soil when subjected to a cell pressure of 80 kN/m^2, failed at an additional stress of 195 kN/m^2. The same soil has shown that its unconfined compressive strength is 130 kN/m^2. Determine the shear strength of this soil along a horizontal plane at a depth of 5m in a deposit. The ground water table was found to be at a depth of 2m from ground level. The bulk density of soil above the water table is 18kN/m^3 with 40% saturation. Take specific gravity of soil solids as 2.67.</td><td>(04)</td><td>CO5</td></tr>
<tr><td>4C.</td><td>What are the advantages and disadvantages of direct shear test?</td><td>(03)</td><td>CO5</td></tr>
<tr><td>5A.</td><td>The table shows the effective pressure and the respective change in height for the consolidation test conducted on clay sample in the laboratory.
<table>
<tr><td>Effective pressure (N/mm^2)</td><td>0</td><td>0.5</td><td>1</td><td>2</td><td>4</td><td>8</td></tr>
<tr><td>Change in height (mm)</td><td>-</td><td>0.223</td><td>0.197</td><td>0.203</td><td>0.192</td><td>0.184</td></tr>
</table>
The initial height of the soil sample is 22mm. The initial water content is 41% and specific gravity is 2.75.
i)Calculate the void ratio corresponding to each pressure increment.
ii)Plot void ratio v/s effective stress graph and find compression index.</td><td>(04)</td><td>CO4</td></tr>
<tr><td>5B.</td><td>State and discuss the corrections in hydrometer analysis.</td><td>(02)</td><td>CO1</td></tr>
<tr><td>5C</td><td>A rectangular footing shown in the figure below transmits a uniform pressure of 500kN/m^2 to the underlying soil. Determine the vertical stress at a depth of 2m at point P. Use Boussinesq’s equation.

</td><td>(04)</td><td>CO3</td></tr>
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