Q1

Answer A or B

A:

For a given soil show that (1): \( \gamma_d = \frac{e_s \gamma_w}{(1+e)\gamma_w} \) ; (2): \( n = \frac{\gamma_{sat} - \gamma_d}{\gamma_w} \) ; (3): \( s = \frac{wG_s \gamma_{wet}}{(1+w)G_r \gamma_w - \gamma_{wet}} \)

B:

The moist weight of 0.2 ft³ of a soil is 23 lb. The moisture content and the specific gravity of the soil solids are determined in the laboratory to be 11% and 2.7, respectively. Calculate the following: a. Moist unit weight (lb/ft³); b. Dry unit weight (lb/ft³); c. Void ratio; d. Porosity; e. Degree of saturation (%); f. Volume occupied by water (ft³).

20 M

Q2

A:

For a soil, the plastic limit test data are provided in the table below.

<table>
<thead>
<tr>
<th>Attempt No.</th>
<th>Mass of can (g)</th>
<th>Mass of wet soil + can (g)</th>
<th>Mass of dry soil + can (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>21.22</td>
<td>22.04</td>
<td>21.91</td>
</tr>
<tr>
<td>2</td>
<td>25.75</td>
<td>26.54</td>
<td>26.42</td>
</tr>
<tr>
<td>3</td>
<td>22.42</td>
<td>23.52</td>
<td>23.36</td>
</tr>
</tbody>
</table>

(i) If LL = 30%, what is the plasticity index of the soil; (ii) determine the liquidity index if the natural water content is 23 %; (iii) classify the soil using the plasticity chart provided. (13 Mark)

B:

Following are the results of a field unit weight determination test on a soil with the sand cone method:

• Calibrated dry density of Ottawa sand = 1667 kg/m³
• Calibrated mass of Ottawa sand to fill the cone = 0.117 kg
• Mass of jar + cone + sand (before use) = 5.99 kg
• Mass of jar + cone + sand (after use) = 2.81 kg
• Mass of moist soil from hole = 3.331 kg
• Moisture content of moist soil = 11.6%

Determine the dry unit weight of compaction in the field. (12 Mark)

25 M

Q3

(i) Show the steps of how to determine the pre-consolidation pressure for over-consolidated clay of medium plasticity. Use graphical illustration to explain your steps.

(ii) Show the steps of how to determine the coefficient of consolidation. Use graphical illustration to explain your steps.

(iii) Explain the case of active lateral earth pressure.

30 M
The results of two drained triaxial tests on a saturated clay are as follows:
Specimen 1: \( \sigma_3 = \overline{\sigma}_3 = 70 \text{ kN/m}^2, \) \((\Delta\sigma_d)_f = 130 \text{ kN/m}^2;\) specimen 2: \( \sigma_3 = \overline{\sigma}_3 = 160 \text{ kN/m}^2, \)
\((\Delta\sigma_d)_f = 223.5 \text{ kN/m}^2.\) Determine the shear strength parameters, \(c, \phi.\)