FINAL TERM PAPER.

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Subject:- Soil Mechanics.

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Q1)a): Define the following.

i): **Isobar:**

Line or curve which connect all the points below the ground surface having same vertical stresses.

In other words, isobar is a contour of equal stresses.

Isobar is useful for determing the effect of load on the vertical stresses at various points.

The Area bounded by isobar is known as Pressure bulb.

This zone of with in which the stresses have significant effect on the settlement of surface

Shape of isobar is a similar to electrical bulb or onion.

2):. Effective Stresses:-

It is the combined effect of total stress and pore pressure that controls soil behavior such shear strength, compression, distortion. The Difference between the total stresses and the pore pressure is called the effective stresses.

Effective Stress = Total Stress − Pore Stress.

or

$$S' = S - u$$

3):- Compaction:-

Compaction is a process that brings about an increase in soil density or unit weight, accompanied by a decrease in air volume. There is usually no change in water content.

4):: Shear Strength::

It is defined as the maximum resistance to shear stresses just before the failure.

Soil are seldom subject to direct shear. However the shear stresses dwelop when the soil is subjected to direct compression.

5):- Shear Parameter:-

Stability Analysis of a rock slope requires assessment of Shear Strength Parameters, that is cohesion (c) and angle of internal friction (ϕ) of the rock mass. Estimates of these parameters are usually not based on extensive field tests.

Q2) Part B):- Write Assumptions of Boussinesq's theory and also explain it's relation for 3 cases of pointed load conditions?

Bousing gave a theoritical solution for the stress distribution in elastic medium which is subjected to concentrated load on it's surface. The solution are commonly used to obtained the stresses in soil mass due to external applied load.

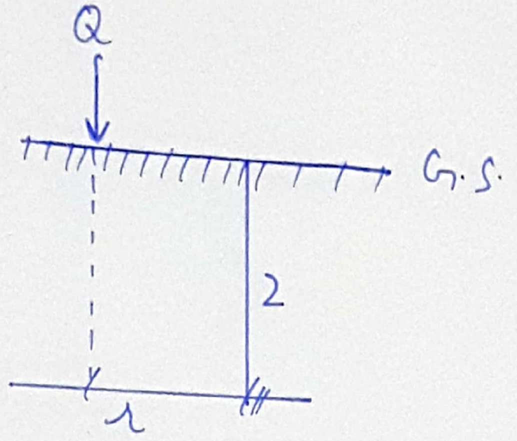
Assumptions:-

For this Boussinesq's made the following Assumptions:-

→ The Soil sample is in Elastic Medium.
→ The soil sample is homogenous.
→ The soil sample is Isotrophic.
→ The soil sample is Weightless.
→ The Soil Sample is free from residual stresses.

→ The Soil mass is Semi infinite means it extends to infinity in downward and lateral direction.

Case-1 :-



δ_z = Vertical stress at depth z.

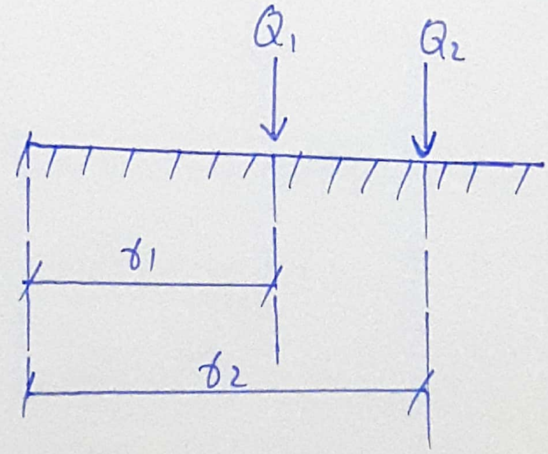
Q = Point on Concentric load.

K_B = Bousineq's Constant / Coefficient.

$$K_B = \frac{3/2\pi}{\left[1+\left(\frac{r}{z}\right)^2\right]^{-5/2}}$$

Case-2.

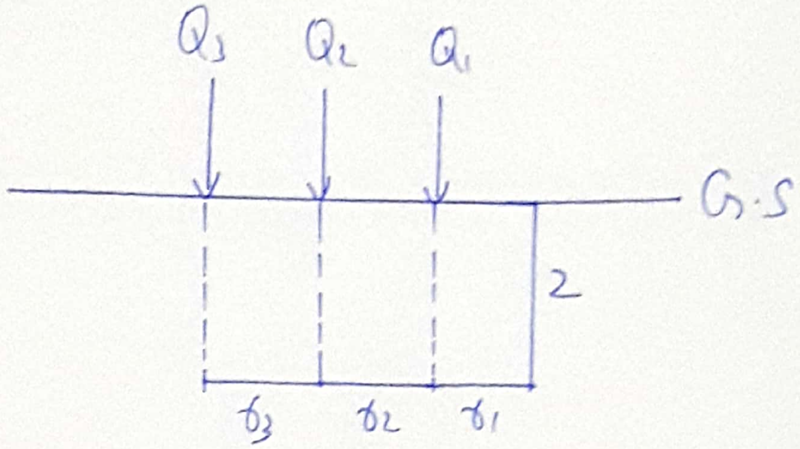
$$\delta_T = \delta_1 + \delta_2$$



$$= \left[\frac{Q_1}{Z^2} \times K_{B1}\right] + \left[\frac{Q_2}{Z_2} \times K_{B2}\right]$$

Total Vertical Stresses $= \left[\frac{Q_1}{Z^2} \times \frac{\frac{3}{2}\pi}{\left[1+\left(\frac{r_1}{2}\right)^2\right]^{5/2}}\right] + \left[\frac{Q_2}{Z^2} \times \frac{\frac{3}{2}\pi}{\left[1+\left(\frac{r_2}{2}\right)\right]^{5/2}}\right]$

Case-3.



$$\delta_T = \delta_1 + \delta_2 + \delta_2.$$

$$= \frac{Q_1}{Z^2} \times K_{B1} + \frac{Q_2}{Z^2} \times K_{B2} + \frac{Q_3}{Z^2} \times K_{B3}.$$

$$= \left[\frac{Q_1}{Z^2} \times \frac{\frac{3}{2}\pi}{\left[1+\left(\frac{r_1}{2}\right)^2\right]^{5/2}}\right] + \left[\frac{Q_2}{Z_2} \times \frac{3/2\,\pi}{\left[1+\left(\frac{r_2}{2}\right)^2\right]^{5/2}}\right]$$

$$+ \left[\frac{Q_3}{Z_3} \times \frac{3/2\,\pi}{\left[1+\left(\frac{r_3}{2}\right)^2\right]^{5/2}}\right]$$

QNo: 2)a):. **Given Data:.**

$V = 65ml$ or $0.000065m^3$

$W = 0.96N.$ As $1ml = 10^{-6}m^3$

$Wd = 0.785N.$

$G_s = 2.65.$

Required:.

Degree of Saturation $(S) = ?$

We know that,

$$\gamma_B = \frac{\gamma_w \times (G_s + e \times S)}{(1+e)} \rightarrow equ (1).$$

$$\gamma_B = \frac{W}{V}$$

$$\gamma_B = \frac{0.96}{0.000065}$$

$$\boxed{\gamma_B = 14769 N/m^3}$$

$\gamma_w = 9800 N/m^3$

As,

$\gamma_s = \frac{W_s}{V_s}$ or $V_s = \frac{W_s}{\gamma_s}$, $V_s = \frac{0.785}{25970}$

$V_s = 0.000030 m^3$

$e = \frac{0.000035}{0.000030}$, $e = 1.167$

As,

$V = V_v + V_s$

or

$V_v = V - V_s$

$V_v = 0.000065 - 0.000030$

$V_v = 0.000035 m^3$

As,

$G_s = \frac{\gamma_s}{\gamma_w}$

or

$\gamma_s = G_s \times \gamma_w$

$\gamma_s = 2.65 \times 9800$

$\gamma_s = 25970 N/m^3$

Putting values in eqn (1)

$$\gamma_B = \frac{\gamma_w \times (G_s + e \times S)}{(1 + e)}$$

$$\gamma_B = \frac{9800 \times (2.65 + 1.167 \times S)}{(1 + 1.167)}$$

i.e.

$$14769 = \frac{9800 \times (2.65 + 1.167 \times S)}{(1 + 1.167)}$$

$$S = 0.527$$

or

$$\boxed{S = 52.7\%}$$

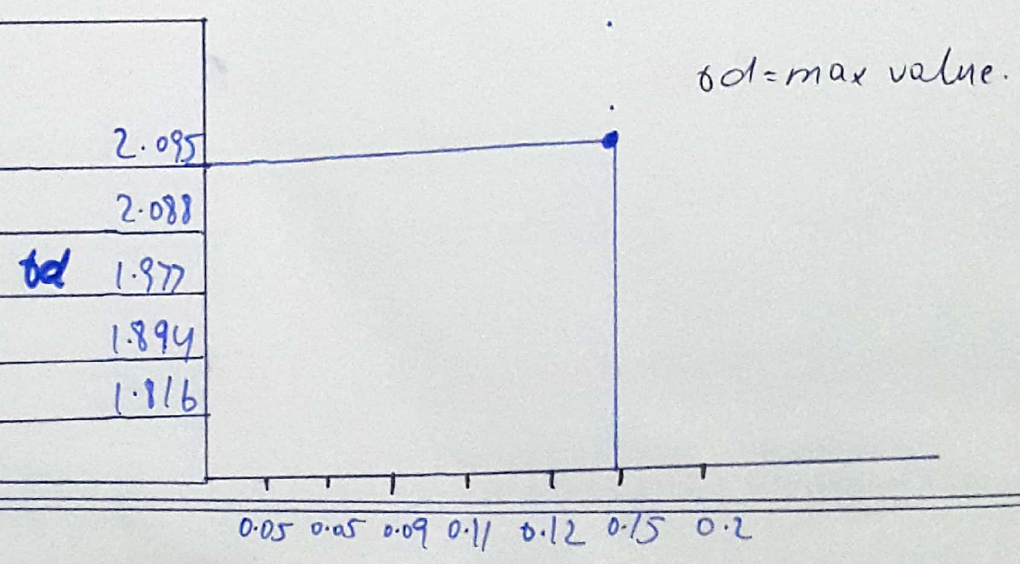
Q NO: 2)B. Given Data:.

Volume of Mould = 9500 cm³

Weight of Sample (g).	Water Content (%)	Bulk Unit wt (g/cm³).
		(g/cm³)
1890	5	1890/950 = 1.989
2140	8	2140/950 = 2.253
2170	9	2170/950 = 2.284
2210	11	2210/950 = 2.326
2220	12	2220/950 = 2.337
2160	15	2160/950 = 2.274
2070	20	2070/950 = 2.179

γd (g/cm³)
1.894
2.086
2.095
2.095
2.086
1.977
1.816

Compaction Curve.



Q4) A) :: Explain CBR Test in detail as a Soil Investigation.

→ It is used for Road Designs.

→ Developed by California State Highway Department.

→ It is a penetration test for evaluation of the mechanical strength of Roads Sub-grade and Sub-base.

$$CBR = \left[\frac{\text{Load required for 0.1" Penetration of the Plunger in Soil Sample}}{\text{Standard load required for 0.1" Penetration of the Plunger in Standard material}} \right] \times 100$$

Q4) b):. Explain the following methods in Detail.

1):- **Probing:-**

Dynamic Probing involves ~~[illegible]~~ driving a steel cone vertically vertically into the ground using a sliding hammer and recording the number of blows for each 100mm of penetration. This results which are obtained from the dynamic probe tests can be correlated to the Standard Penetration Test (SPT).

2):. **Auger Boring:-**

Auger Boring is defined as the trenchless application in which a casing pipe is jacked into the earth's surface while simultaneously rotating helical augers remove the excavated soil. Auger boring works using Archimedes Screw Principle.

3):. Test Pits:.

A trial pit (or test pit) is an excavation of ground in order to study or sample the composition and structure of the subsurface, usually dug during a site investigation, a soil survey or a geological survey. Trial pits are dug before the construction.

4):. Wash Boring:.

Wash Boring is a fast and simple method for advancing holes in all types of soil. Boulders and rock cannot be penetrated by this method. This method consists of first driving a casing through which a hollow drilled rod with a sharp chisel or chopping bit at the lower end is inserted.

5):: Percussion Boring:-

Percussion Boring /drilling is a manual drilling technique in which a heavy cutting or hammering bit attached to a rope or cable is lowered in the open side/hole or inside a temporary casing. The technique is often also refered to as "Cable tool." Usually a tripod is used to support the tools.