Ministry of Higher Education
El-Minia High Institute of
Engineering and Technology
Program: Architecture Department

2018-2019 -Mid Term Exam
Course Title:Soil Mechanics And Foundations
Course Code: ARE 208
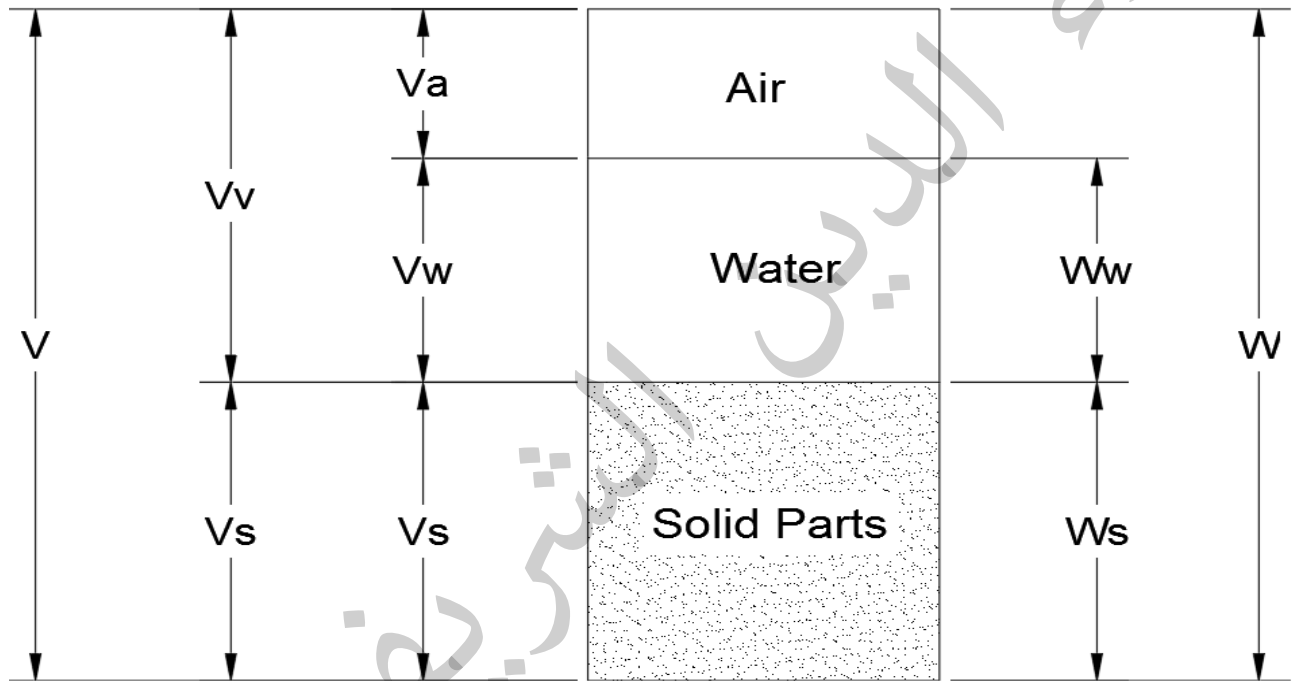**Time Allowed: 1.5 Hours**

Assume Any Missing Data

Question # 1: (20 points(A=6 Points , B= 4 Points , C=10 Points))

A- Draw 3-phase diagram , define and show how to calculate each of the following

ارسم نظام الثلاث مجالات للتربه وقم بتعريف وتوضيح كيفية حساب ما يلي

Porosity - Bulk Density - Specific Gravity – Water Content

المساميه – الكثافة المبللة – الوزن النوعي – محتوى الرطوبه

$e = \frac{V_v}{V_s}$ (1.5 Point) , $G_S = \frac{W_S}{V_S}$ (1.5 Point) , $\gamma_b = \frac{W_b}{V}$ (1.5 Point) $W_c = \frac{W_w}{W_s}$ (1.5 Point)

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B- في الحالتين تكون كل الفراغات مشبعه بالماء لكن الفرق عندما تكون العينه مغموره فان قوة المياه تدفع العينه الى اعلى مما يؤدي الى نقص الكثافة
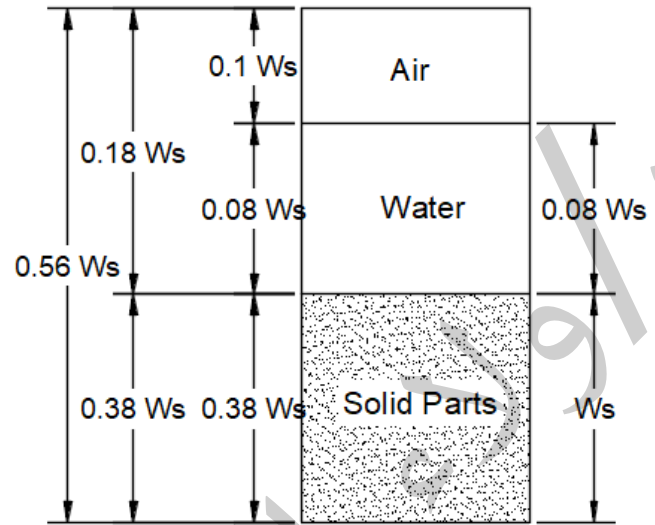
Prove The Following : $\gamma_{Sub} = \gamma_{Sat} - 1$

$$\gamma_{Sub} = \frac{W_{Sub}}{V} = \frac{W_{Sat} - \gamma_w V}{V} = \gamma_{Sat} - 1 \ (\textbf{4 Points})$$

C- A dry sand unit weight of 1.78 t/m³ and specific gravity of 2.62, During rain fall the degree of saturation increases to 38 % assuming the volume of the sand remains constant , determine the wet density and water content of sand after being wet
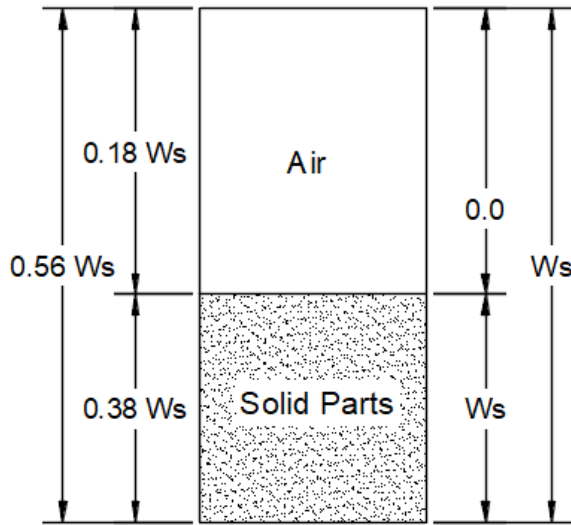
Case Of Dry Sand

Case Of Wet Sand

Case 1 Dry sand as shown in fig 1

$\cdot \gamma_d = \dfrac{W_s}{V}$, 1.78 V = W$_s$,,, So V = 0.56 W$_s$

$\cdot G_s = \dfrac{W_s}{V_s}$, 2.62 = $\dfrac{W_s}{V_s}$,,,, So V$_s$ = 0.38 W$_s$

Case 2 Wet Sand

V = Constant = 0.56 W$_s$

$\cdot S = \dfrac{V_w}{V_v}$, So V$_w$ = 0.38 V$_v$

From Figure V$_v$ = V − V$_s$ = (0.56-0.38) W$_s$ = 0.18 W$_s$

V$_w$ = 0.38 * 0.18 W$_s$ = 0.07 W$_s$

$\gamma_b = \dfrac{W_b}{V} = \dfrac{(1+0.07)Ws}{0.56\,Ws} = 1.91\ \text{t/m}^3$

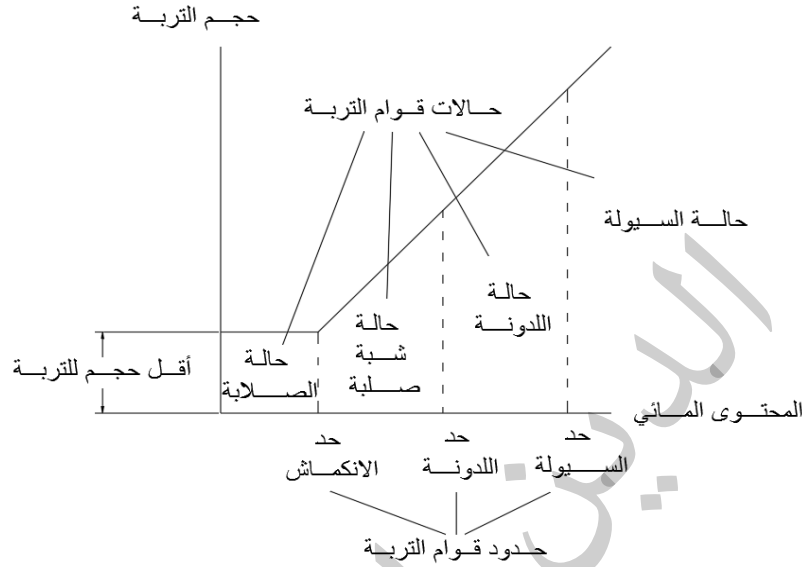W$_c$ = $\dfrac{W_w}{W_s}$ = 0.07 W$_s$ / W$_s$ = 7%

Question # 2: (20 points(A=5 Points ,B=5 Points , C=10 Points))

A-How to determine Density using sand Cone وضح كيفية تعيين الكثافه باستخدام المخروط الرملي

B-Draw Wc , V Chart For Clay Soil and Show Where is States Of Soil and It's limits

ارسم المنحنى الذي يبين العلاقه بين الحجم والمحتوى المائي للطين و بين عليه (مع الشرح) مجالات التربة و حدود اتربرج

حجـم التربــة

حــالات قـوام التربــة

حالــة السـيولة

حالـة اللدونـة

حالـة شـبة صلابة

حالـة الصـلابة

أقـل حجـم للتربـة

المحتـوى المـائي

حد السـيولة   حد اللدونـة   حد الانكمـاش

حـدود قـوام التربـة

C- A Sample Of clay has liquid limit 62% and it's plasticity index is 32%

- a- **What is the state of consistency of the soil if the soil and its natural state has a water content of 34%**

- b- **Calculate the shrinkage limit if the void ratio of the sample at the shrinkage limit is 0.7**

    assume G_s=2.7

a- $I_l = (W_c - P.L) / P.I$, $W_c = 0.34$, L.L.= 0.62 , P.I = 0.32 , P.L = 62-32 = 0.30

$I_l = (0.34 - 0.30) / 0.32 = 0.125$ The consistency of the soil is very stiff

b- S.L. = e / G_s = 0.7 / 2.7 = 25.9