QUIZ – I

CIVE 431
Soil Mechanics

SPRING XXXX
Professor: Salah Sadek

CLOSED BOOK/NOTES, 1.5 HOURS

Programmable calculators are not allowed. Return the scratch paper with the Question Sheet.

Answer in the Provided Boxed Space

Name : _____ **ID #:** _____

Answer as required the following questions and problems. Write your answers in the boxes provided, or indicate where appropriate whether the statements are true or false by putting a circling the T or F on the line to the right. (No credit will be given to answers or writing outside the boxes).

Q1. Engineering Judgment is needed in all phases of engineering practice, even more so in Geotechnical Engineering. Why do you think that is?

Q2. Choose one of the Statements below in reference to the Specific Surface Area of clay soils, SSA. Indicate your choice by placing a checkmark in the box:

- ❑ $SSA_{KAOLINITE} > SSA_{SMECTITE} > SSA_{ILLITE}$
- ❑ $SSA_{KAOLINITE} > SSA_{ILLITE} > SSA_{SMECTITE}$
- ❑ $SSA_{ILLITE} > SSA_{SMECTITE} > SSA_{KAOLINITE}$
- ❑ $SSA_{SMECTITE} > SSA_{ILLITE} > SSA_{KAOLINITE}$
- ❑ $SSA_{SMECTITE} > SSA_{KAOLINITE} > SSA_{ILLITE}$

Q3. A clay is stronger at a Liquidity Index of 1.0 than at a Liquidity Index of 0.5.

T F

Q4.

A highly sensitive clay soil was tested in the laboratory and reported to have the following properties:

(a) Wet unit weight $\gamma_t = 14.1$ kN/m^3
(b) Void ratio, e = 4.3
(c) Saturation, S = 90%
(d) Specific Gravity, $G_s = 2.75$
(e) Water content, w = 141%

In rechecking the above values ***one*** was found to be inconsistent with the rest. Find the inconsistent value and report it correctly.

The *inconsistent* value is :

The *correct* value should be:

Q5.

Calculate the maximum possible void ratio *and* porosity for a collection of ping pong balls. The diameter of the ping pong balls is 30mm.

$\mathbf{e_{max}}$ **=**

$\mathbf{n_{max}}$ **=**

Q6.

As a result of compaction a 1m thick stratum was reduced in height by 3cms. Before compaction the void ratio of the stratum was determined to be $e_0 = 0.94$, the water content was $w_0 = 16\%$ and $G_s=2.67$

Determine:

- The void ratio after compaction: **e =**
- The porosity after compaction: **n =**
- The Dry unit weight of the compacted soil: **γ_d =**
- The Degree of Saturation after compaction: **S =**

Q.7 The Unified Soil Classification System is very practical because it is based only on particle size.

T F

Q.9 The zero air voids line represents points on a γ_d vs w plot with samples having the same void ratio.

T F

Q.10 A soil has a min. possible void ratio of 0.35 and a max. possible void ratio of 0.9. A sample in the field has a void ratio of 0.75. What is its relative density?

D_R =

Q11.

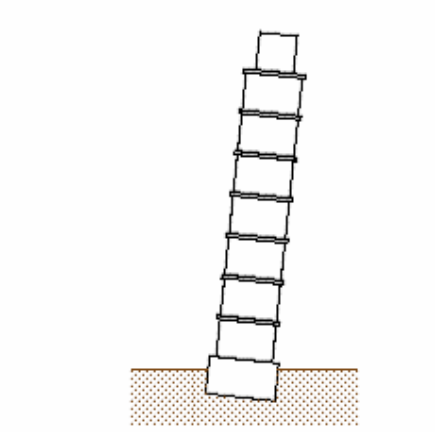
Why is the hydraulic conductivity of a clay so much lower than that of a sand ***at the same dry density*** ?

Where is that reflected in the Kozeny-Carman equation below (In what term(s))?

$$k = \frac{\rho . g}{\mu . k_0} \frac{1}{T^2} \frac{1}{S_0^2} \frac{e^3}{1+e}$$

Q12.

A possible explanation for the leaning Tower of Pisa is that the subsoil contains a compressible clay layer of variable thickness. On what side of the tower do you think that the clay layer is ***thickest?*** Indicate your answer on the Figure below.



Q13.

A certain soil has a hydraulic conductivity of k=0.005 cm/sec. This value was measured during the summer. In winter, given that temperatures are lower and if we suppose that the viscosity of water, μ, is changed by a factor if 1.5, estimate the value of k in winter.

k_{winter} =

Q14.

The void ratio (e) of a soil layer is initially 0.63. The thickness of the layer is 4.60 m. After compaction the layer its void ratio is reduced to 0.55. Calculate the final thickness of the layer, t, in meter.

t =