UNIVERSITY OF JOHANNESBURG

PROGRAM	:	BACCALAUREUS INGENERIAE *CIVIL ENGINEERING*
SUBJECT	:	**GEOTECHNICAL ENGINEERING 3A**
CODE	:	**GTG3B21**
DATE	:	EXAMINATION NOV 2014
DURATION	:	08:30 - 11:30
WEIGHT	:	50:50
TOTAL MARKS	:	100

EXAMINER	:	DR FN OKONTA
MODERATOR	:	DR HA QUAINOO
NUMBER OF PAGES	:	3 PAGES AND 2 ANNEXURES

INSTRUCTIONS	:	QUESTION PAPERS MUST BE HANDED IN.

INSTRUCTIONS TO CANDIDATES:

PLEASE ANSWER ALL THE QUESTIONS.
PLEASE NUMBER ALL QUESTIONS EXACTLY AS QUESTION PAPER.

QUESTION 1 (20 MARKS)

1.1) a) Compute the induced vertical stress by a rectangular uniformly loaded area of q = 100kPa and dimensions L=4.5 and B=3, using the approximate method. b) what would the slope 1H:xV be for the average induced stress at z_f computed by the method in 1.1 be to equate to a value at the same depth computed using analytical solution (ie would it be flatter or steeper than 1H:2V, and why). (13)

1.2). Of the methods available to compute vertically induced stresses by a uniformly loaded platform, which method would you use and why, highlight both advantages and disadvantages of the chosen method. (7)

QUESTION 2 (20 MARKS)

2.1) Explain why the stress-strain curve from the oedometer test is normally represented by the plot of void ratio instead of strain on the vertical axis, (7)

2.2) A consolidation test is being performed on a 75.0mm diameter saturated soil specimen that had an initial height 20mm and an initial w=38.8%. If Gs = 2.69 a) compute the initial void ratio, b) if 10% reduction in the sample size occurs after minutes of starting the test, compute the final void ratio, c) the resulting strain (13)

QUESTION 3 (20 MARKS)

3.1). A consolidation test has been performed on a sample obtained from a saturated clay at a point 6.5m below the ground surface. The groundwater table is at the ground surface and the unit weight of the clay is 18.5kN/m^3. The measured preconsolidation stress was 260kPa. a) determine is the soil is normally consolidated or not, b) compute the overconsolidation margin and the overconsolidation ratio, c) compute the preconsolidation stress at a depth 12m in the same soil. (10)

3.2) Explain the terms overconsolidation margin and the overconsolidation ratio, and discuss associated errors in using the overconsolidation ratio over such depths as stated in 3.1) (10)

QUESTION 4 (20 MARKS)

4.1) Discuss the shortcomings of the Log-Time method and why you would recommend the Square Root of time method in determining the time-settlement curve. (5)

4.2) A 12.0m thick clay stratum with a double drainage is to be subjected to an induced stress from a 4.5m high proposed fill with e =1.13 and Gs = 2.68. If cv = 3.5 x 10^{-3} m^2/day compute the hydrostatic, excess and total pore water pressure, at a point 2.7m into the clay layer 10years after load was applied (15)

QUESTION 5 (20 MARKS)

5.1) Slope stability analysis reveal that under geostatic stresses the slope is safe, describe ways that may destabilize the slope. (10)

5.2) Determine the effective normal stress that produces an FoS = 2.5 at a point in a strata that is subject to a shear stress of 10kPa, and shear strength is defined by equation 1. ..(10)

$$\tau = 10 + \sigma' \tan 28 \quad \text{.......................................} \quad (1.1)$$

YOU MAY USE ANY OF THE FOLLOWING EQUATIONS AND TABLES

$$e = (1-\varepsilon_z)(1+e_0) - 1 \quad U = \left[1 - 10^{-\left(\frac{0.085+T_v}{0.933}\right)}\right] x100\% \qquad U = \sqrt{\frac{4T_v}{\pi}} x100\%$$

$$\sigma'_{zo} = \sum \gamma H - u \qquad \delta_{c,ult} = \sum \left(\frac{Cc}{1+e_0}\right) H \log\left(\frac{\sigma'_{zf}}{\sigma'_{zo}}\right) \qquad \rho_d = \frac{M_s}{V}$$

$$S = \frac{wG_s}{e} x\ 100\% \qquad G_s = \frac{M_s}{V_s \rho_w} \qquad e = \frac{G_s \gamma_w}{\gamma_d} - 1$$

$$\gamma_d =$$

$$\sigma'_m = \sigma'_c - \sigma'_{z0} \qquad OCR = \frac{\sigma'_c}{\sigma'_{z0}}$$

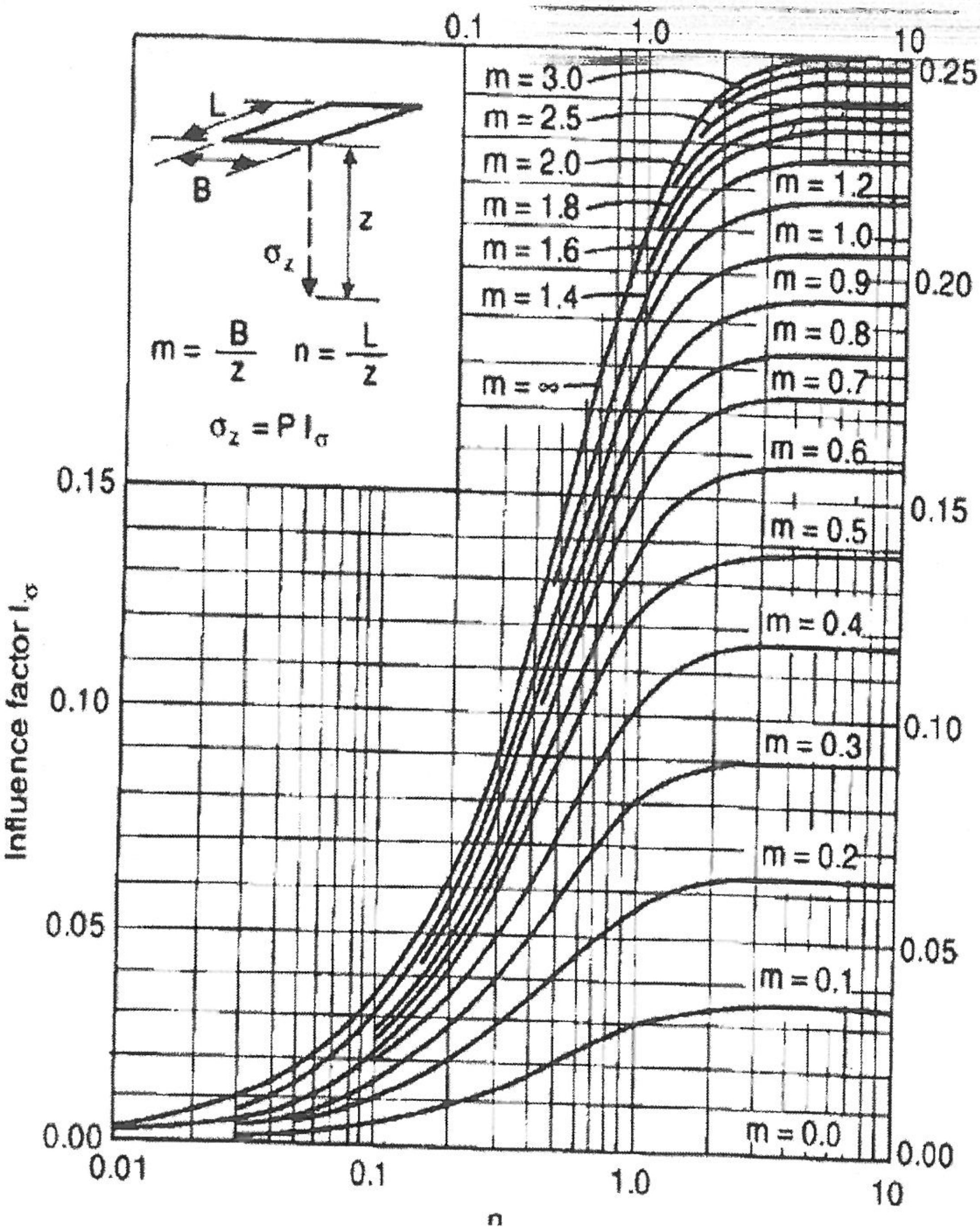
$$\gamma_{sat} = \frac{G_s + e}{1+e}\gamma_w \qquad \delta_{c,ult} = \sum \left(\frac{Cr}{1+e_0}\right) H \log\left(\frac{\sigma'_{zf}}{\sigma'_c}\right) + \left(\frac{Cc}{1+e_0}\right) H \log\left(\frac{\sigma'_c}{\sigma'_{zo}}\right)$$

$$T_v = \frac{c_v t}{H_{dr}^2} \qquad \sigma'_h = K\sigma'_v \qquad I = \frac{LB}{(L+zf)(B+zf)}$$

$$\frac{u_e}{\Delta\sigma_z} = \sum_{N=0}^{\infty}\left(\frac{4}{(2N+1)\pi} sin\left[\frac{(2N+1)\pi}{2}\left(\frac{z_{dr}}{H_{dr}}\right)\right] e^{-\left[\frac{(2N+1)^2\pi^2}{4}T_v\right]}\right)$$

$$\delta_{c,ult} = \sum \left(\frac{Cc}{1+e_0}\right) H \log\left(\frac{\sigma'_{zo} + \gamma_{fill} H_{fill}}{\sigma'_{zo}}\right)$$

$$\delta_{c,ult} = \sum \left(\frac{Cr}{1+e_0}\right) H \log\left(\frac{\sigma'_{zf}}{\sigma'_c}\right) + \left(\frac{Cc}{1+e_0}\right) H \log\left(\frac{\sigma'_c}{\sigma'_{zo}}\right)$$


0.1
1.0
10
L
B
z
σ_z
$m = \frac{B}{z}$ $n = \frac{L}{z}$
$\sigma_z = P I_\sigma$
m = 3.0
m = 2.5
m = 2.0
m = 1.8
m = 1.6
m = 1.4
m = ∞
m = 1.2
m = 1.0
m = 0.9
m = 0.8
m = 0.7
m = 0.6
m = 0.5
m = 0.4
m = 0.3
m = 0.2
m = 0.1
m = 0.0
Influence factor I_σ
0.25
0.20
0.15
0.10
0.05
0.00
0.01
0.1
1.0
10
n