FINAL EXAMINATION
SEMESTER II, SESSION 2016/2017

COURSE CODE	:	SKAA 2722 / SAB 2722
COURSE	:	GEOTECHNIC 1
PROGRAMME	:	SKAW / SAW
DURATION	:	2 HOURS 30 MINUTES
DATE	:	JUNE, 2017

INSTRUCTION TO CANDIDATES:

1. ANSWER ALL QUESTIONS

WARNING!

Students caught copying/cheating during the examination will be liable for disciplinary actions and the faculty may recommend the student to be expelled from the study.

This examination question consists of (9) printed pages only.

QUESTION 1

(a) An L-shaped foundation with an uniform stress of 100 kPa is shown in **Figure Q1a**. Determine the vertical stress change, $\Delta\sigma$ at 5 m below the **Point D** by Fadum's method.

(8 marks)

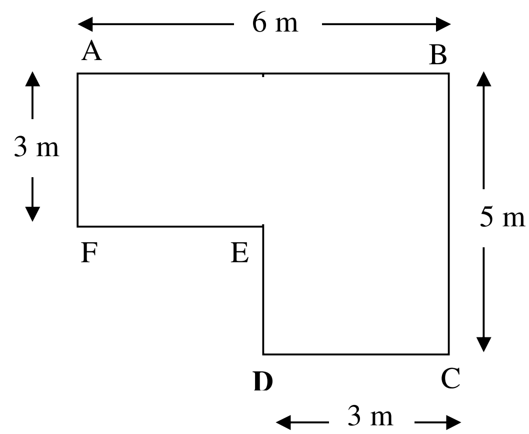


FIGURE Q1a

(b) The movement of retaining wall in general resulting in either active or passive earth pressure. In brief, explain the concepts of active and passive earth pressures. Sketch a figure to help your explanation.

(5 marks)

(c) **Figure Q1c** shows a frictionless wall with the ground water table is located 4 m below the ground surface and cohesion strength, c for all soils is 0 kN/m^2. By using Rankine Theory, determine the following:

(i) The active lateral earth pressure distribution with depth acting on the back of the wall.

(ii) The passive lateral earth pressure distribution with depth acting on the back of the wall.

(iii) The magnitude and location of the lateral active and passive forces acting on the back of the wall.

(20 marks)

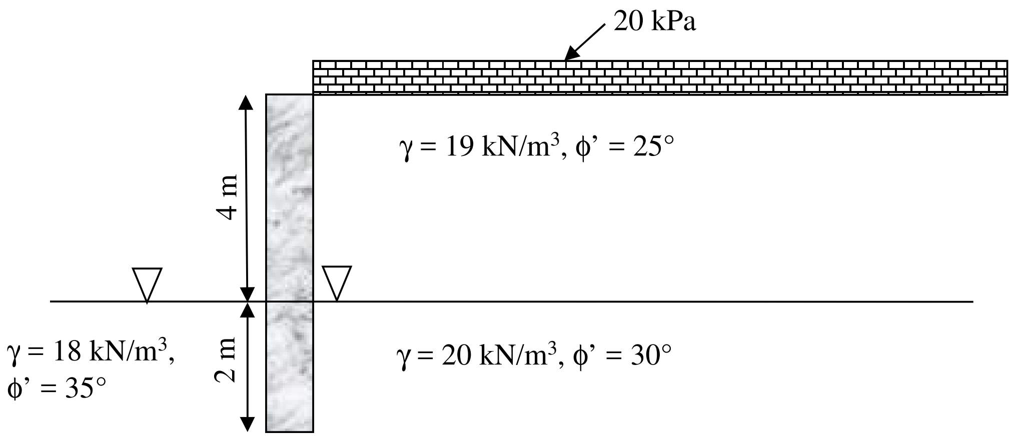
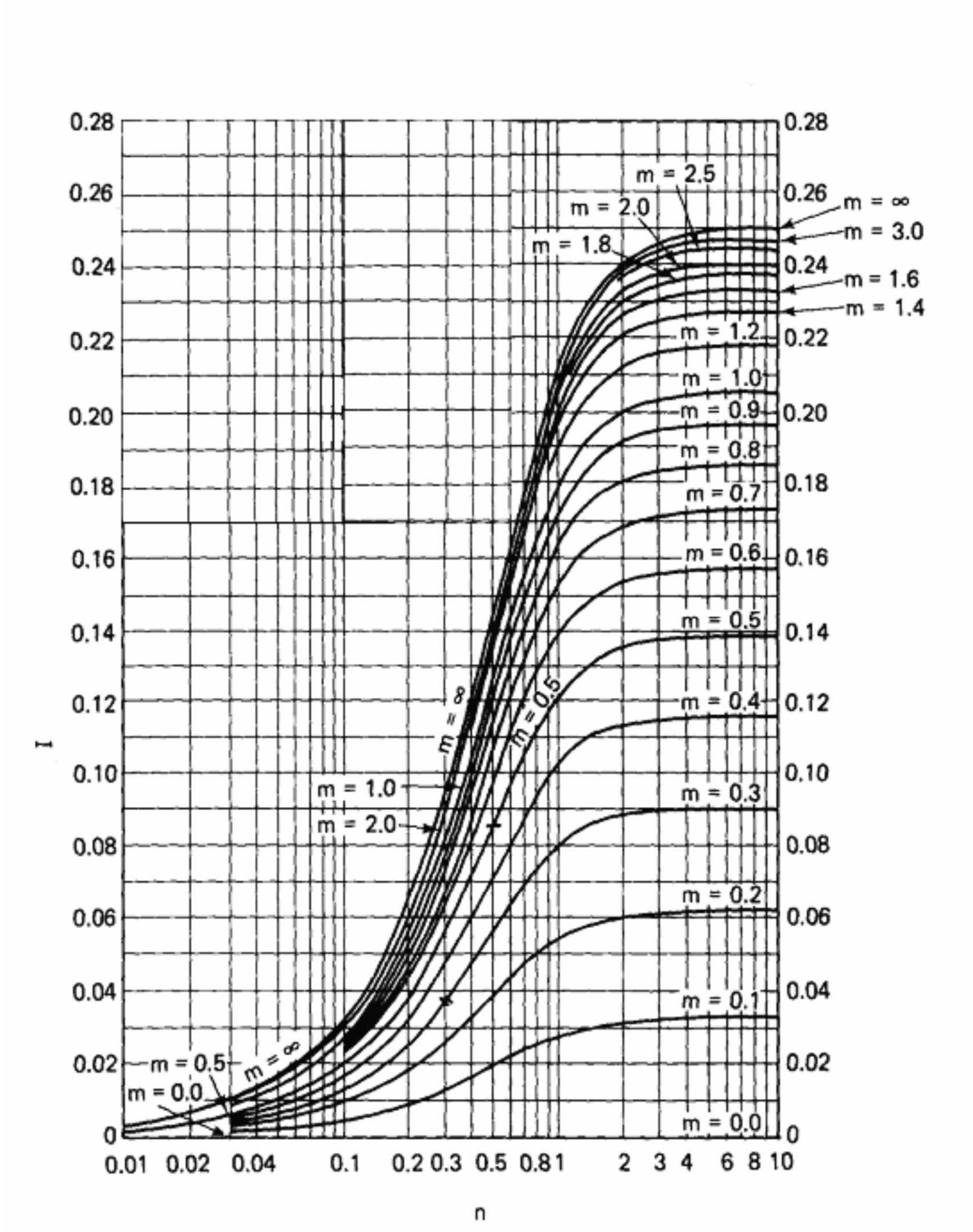


FIGURE Q1c

(33 marks)



0.28
0.26
0.24
0.22
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0
I
n
0.01 0.02 0.04 0.1 0.2 0.3 0.5 0.8 1 2 3 4 6 8 10
m = ∞
m = 3.0
m = 2.5
m = 2.0
m = 1.8
m = 1.6
m = 1.4
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

Fadum chart

QUESTION 2

(a) Explain briefly the different between compaction and consolidation. State the definition for preconsolidation pressure, normally consolidated soil and overconsolidated soil.

(5 marks)

(b) A soil profile is shown in **Figure Q2b**. The base of the foundation is 3 m by 6 m and it exerts a total load of 2700 kN. The initial void ratio in- situ, e_o and liquid limit, *LL* of the compressible clay layer are 1.38 and 85%, respectively.

i. Compute the settlement of the clay layer caused by primary consolidation if the clay is normally consolidated, given $C_c = 0.009(LL\text{-}10)$.

(17 marks)

ii. Compare the settlement of the clay layer caused by primary consolidation in part (i) if now the preconsolidation pressure, p'_c =190 kN/m^2, given C_r=1/5C_c. Use C_c obtained in part (i).

(5 marks)

iii. Calculate the time will it take for half the expected consolidation settlement in part (i) to take place if given the coefficient of consolidation, c_v = 4.96 x 10^{-6} m^2/min.

(3 marks)

iv. Determine the time will it take for 90% the expected consolidation settlement in part (ii) to take place if the clay layer is now underlain by impermeable bedrock.

(3 marks)

(NOTE: Use Fadum chart on page 4 to calculate the vertical stress increase, $\Delta\sigma$ in the soil profile)

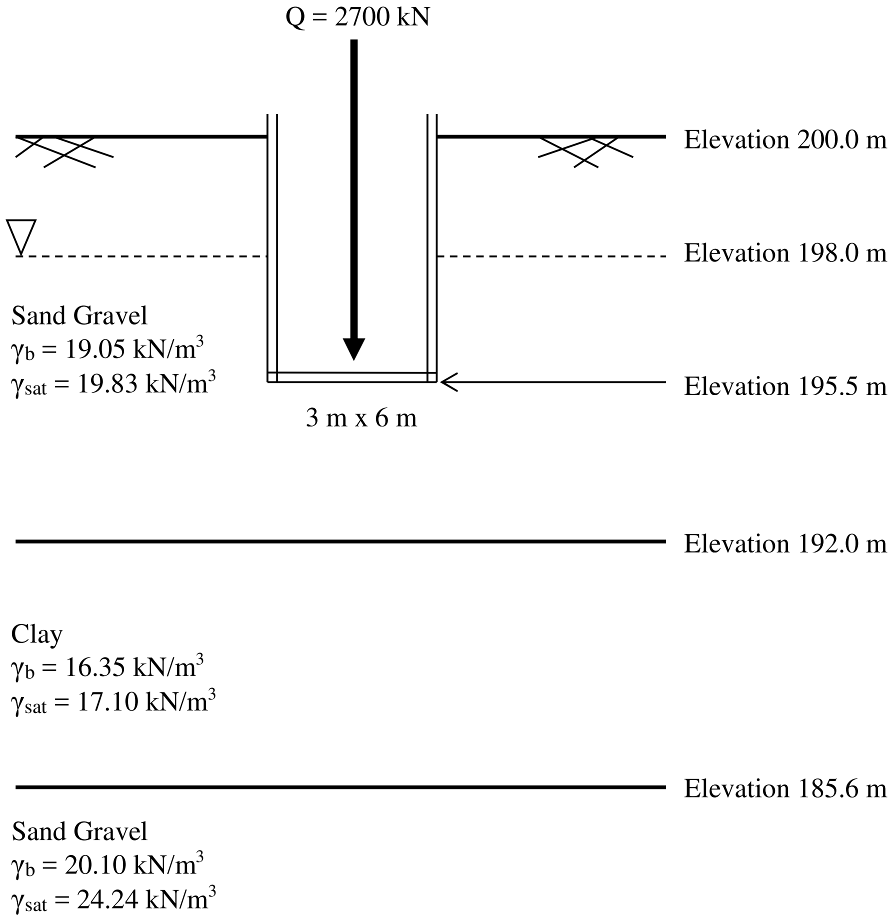


FIGURE Q2b

(33 marks)

QUESTION 3

(a) By the aid of diagram, please explain the principal of slope stability.
(*6 marks*)

(b) State the type of equilibrium (force, moment, or both equilibrium) for the formulations of Fellenius, Bishop, and Morgenstern-Price methods.
(6 marks)

(c) **Figure Q3(c)** shows an infinite slope inclined at 20^0. If the groundwater level is found nowhere in the infinite slope:

(i) Determine the safety factor against sliding at potential failure surface at 8 m depth from the ground.
(*6 marks*)

(ii) Determine the critical height of the slope.
(6 *marks*)

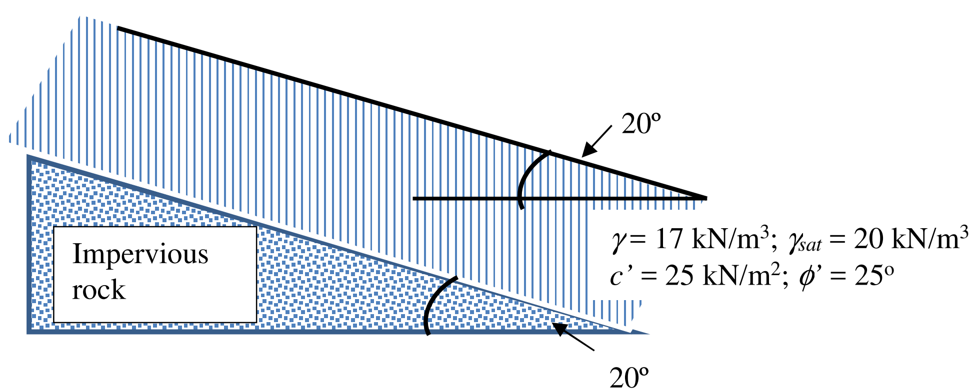


FIGURE Q3c

(d) **Figure Q3(d)** shows a cutting in saturated clay is inclined at a slope of 1 vertical:1.5 horizontal and has a vertical height of 10 m. The saturated unit weight, γ_{sat} of the soil is 22 kN/m^3 and its undrained cohesion, c_u is 35 kN/m^2. The area of slip mass is 71.64 m^2 and θ is 67.4^0. Determine the factors of safety against shear failure along the potential slip circle shown in **Figure Q3(d)** by using Moment Method for the conditions in tension crack with full of water..
(10 marks)

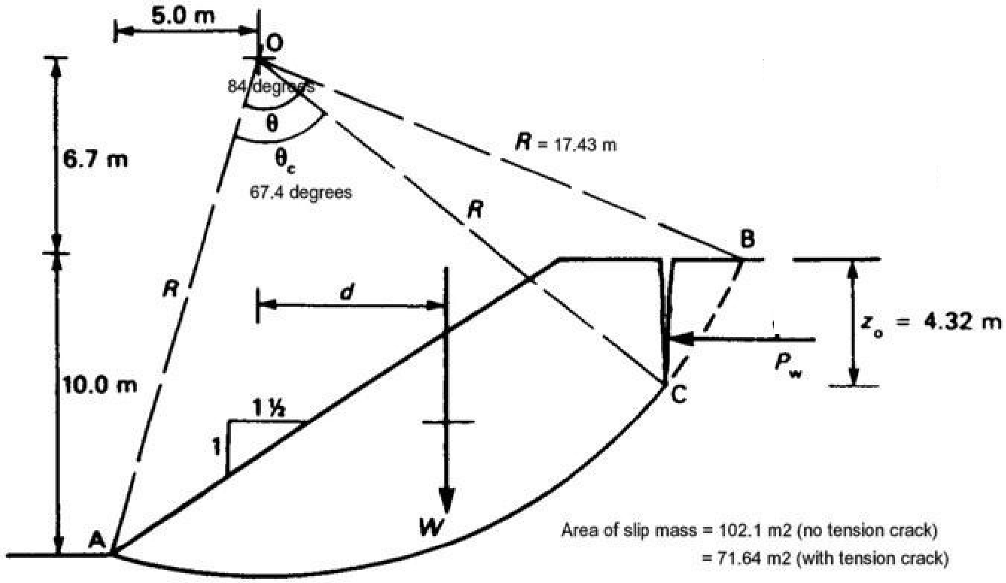


FIGURE Q3d

(34 marks)

EQUATIONS

$$\Delta H = \frac{C_c}{1+e_0}\log(\sigma_1'/\sigma_0')H_0$$

$$\Delta H = \frac{C_r}{1+e_0}\log(\sigma_1'/\sigma_0')H_0$$

$$\Delta H = \frac{C_r}{1+e_0}\log(\sigma_c'/\sigma_0')H_0 + \frac{C_c}{1+e_0}\log(\sigma_1'/\sigma_c')H_0$$

$$F_s = \frac{c\ell R^2}{Wx} = cR^2\theta$$

$$F_s = \frac{\sum c'\ell_i + \sum (W_i\cos\alpha_i - u_i\ell_i)\tan\phi'}{\sum W_i \sin\alpha_i}$$

$$F_s = \frac{c}{\gamma H\cos^2\beta\tan\beta} + \frac{\tan\phi}{\tan\beta}$$

$$c_d = \frac{\gamma H}{4}\left[\frac{1-\cos(\beta-\phi_d)}{\sin\beta\cos\phi_d}\right]$$

$$H_{cr} = \frac{4c}{\gamma}\left[\frac{\sin\beta\cos\phi}{1-\cos(\beta-\phi)}\right]$$

$$F_s = \frac{c\ell R^2}{Wx} = \frac{c\,R^2\theta}{Wd + P_w y_c}$$

$\sigma = \{(1-m)\gamma + m\gamma_{sat}\}\, z\cos^2\beta$

$\tau_m = \{(1-m)\gamma + m\gamma_{sat}\}\, z\sin\beta\cos\beta$

$u = mz\gamma_{sat}\cos^2\beta$