UTM Faculty of Civil Engineering
UNIVERSITI TEKNOLOGI MALAYSIA

FINAL EXAMINATION
SEMESTER II SESSION 2014/2015

COURSE CODE	:	SKAA 2722
COURSE	:	GEOTECHNICS 1
PROGRAMME	:	SKAW
DURATION	:	2 HOURS 30 MINUTES
DATE	:	JUNE 2015

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 (8) printed pages only.

QUESTION 1

(a) List and explain the categories of lateral earth pressure coefficients.

(6 marks)

(b) A C-shape foundation is loaded by uniform loads as shown in Figure Q1b. By using Fadum's method, analyse the vertical stress increase, $\Delta\sigma$ at depth 3 m below point A. Given the Fadum chart in Figure Q1(b)-2.

(12 marks)

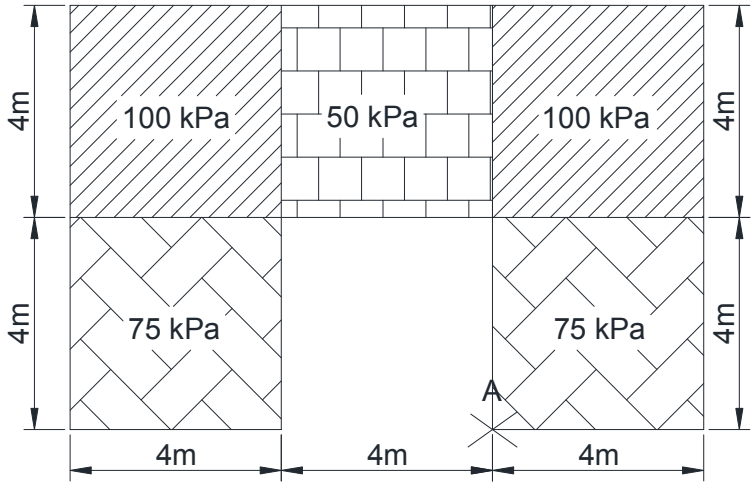

FIGURE Q1b

(c) Parameters for a soil profile of an excavation area (Figure Q1c) are as follows:

(i) Sketch the distribution of active and passive pressures on the right and left of the sheet pile, respectively. Use angle of friction, $\phi = 20^0$ and cohesion, $c = 0$ kN/m^2 for all layers.

(5marks)

(ii) Determine the resultant force and its distance from the base of the wall.

(10 marks)

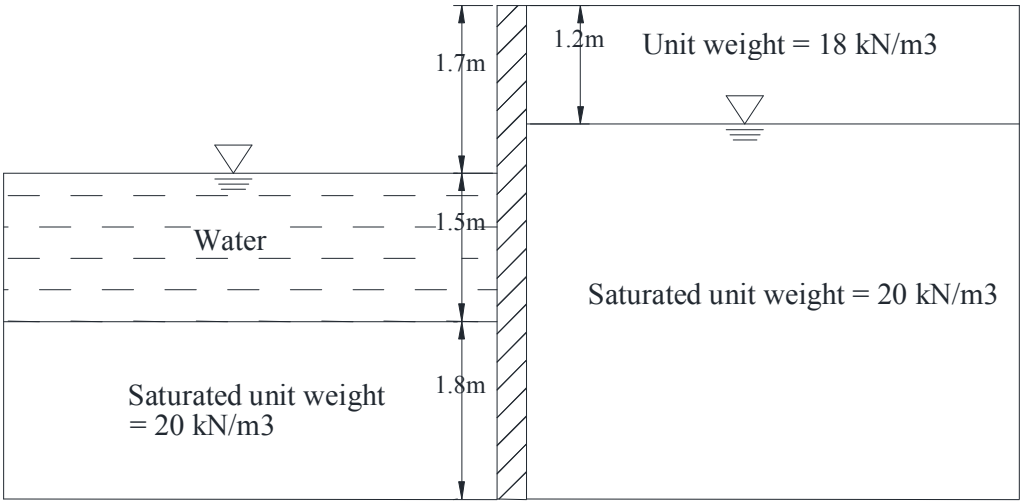

FIGURE Q1c

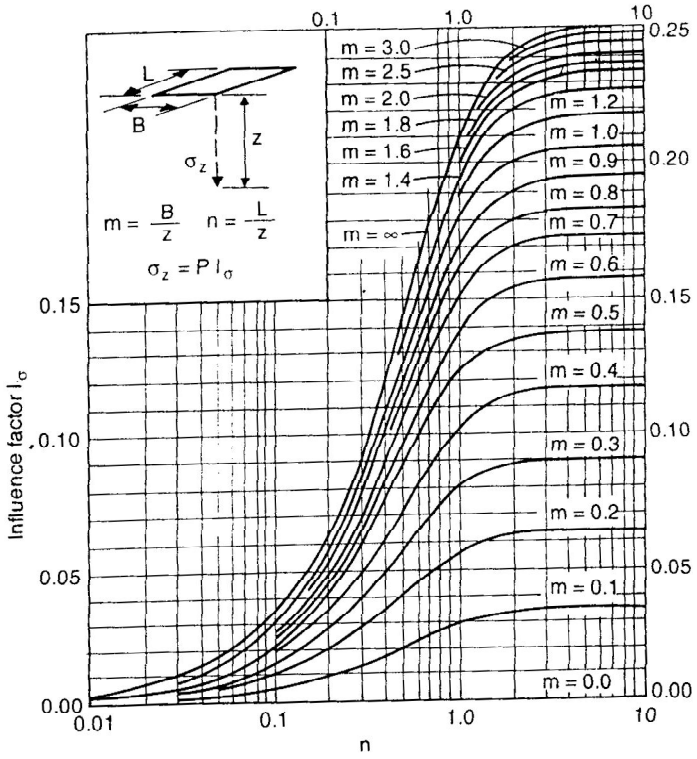

FIGURE Q1(b)-2

QUESTION 2

(a) Explain briefly the difference(s) between compaction and consolidation. State the definitions for preconsolidation pressure and over-consolidation ratio.

(2 marks)

(b) The compression readings in Table Q2(b) were obtained in an oedometer test on a 50 mm diameter specimen of saturated clay. The initial thickness, H_i and initial water content, w_i of specimen were 20 mm and 27.8%, respectively. Given: the specific gravity, G_s = 2.65, mass of wet soil + ring = 128.02 g, mass of the ring = 67.94 g and the final water content, w_f = 27.7%.

Table Q2(b)

Effective Stress, p'(kN/m^2)	**Cumulative dial gage readings (after 24 hr) (mm)**
0	0.000
12.5	0.101
25	0.251
50	0.493
100	1.330
200	2.297
400	3.563
800	4.742
200	4.612
100	4.351

(i) Based on the oedometer test result shown in Table Q2(b), plot the e- p' curve on semi-log graph (Page 5).

(12 marks)

(ii) Determine the degree of saturation, S_r of the specimen before and after the oedometer test.

(4 marks)

(iii) Find the preconsolidation pressure, p_c' for the clay sample by using Cassagrande Method (1936)

(4 marks)

(iv) Determine the compressibility index, c_c, and the swelling index, C_r from the e- p' curve.

(3 marks)

(v) Determine the coefficient of volume compressibility, m_v for effective stresses range of 25 kN/m^2 to 50 kN/m^2 and 100 kN/m^2 to 200 kN/m^2.

(3 marks)

(vi) If the saturated clay is found 5 m thick *in-situ*, compute the total settlement, S_T after 25 years (primary consolidation, S_c + secondary settlement, S_s) for the clay layer when the increment stress, $\Delta\sigma$ on the clay is 30 kN/m^2. Given recent overburden pressure, p_o' on the clay = 120 kN/m^2, t_p = 1.5 year and C_∞ = 0.0021.

(3 marks)

(vii) Calculate the time it will take for 90% of the expected primary consolidation settlement, S_c in part (v) to take place if the clay layer is underlain by impermeable bedrock. Given the coefficient of consolidation, c_v = 1.52 m^2/year.

(3 marks)

QUESTION 3

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

(*6 marks*)

(b) Please list three (3) factors that could contribute to the slope failure.

(*3 marks*)

(c) Figure Q3(c) shows an infinite slope inclined at 25^0. 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.

(*4 marks*)

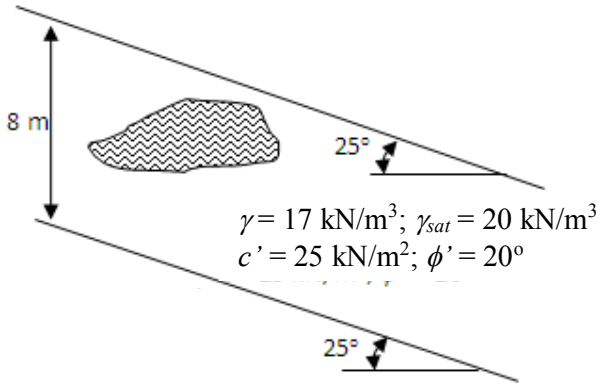

FIGURE Q3(c)

(d) Figure Q3(d) shows a slope of cohesive soil with a trial failure surface. A uniformly distributed load of 25 kN/m^2 is applied on the top of the slope. In addition, a 3 m deep tension crack develops and filled with water. Based on the total stress concept moment method, determine the Factor of Safety, FOS of the slope if the weight of the sliding wedge is 6500 kN/m. Please provide your comment on the FOS result. Given the c_u = 35 kN/m^2.

(*14 marks*)

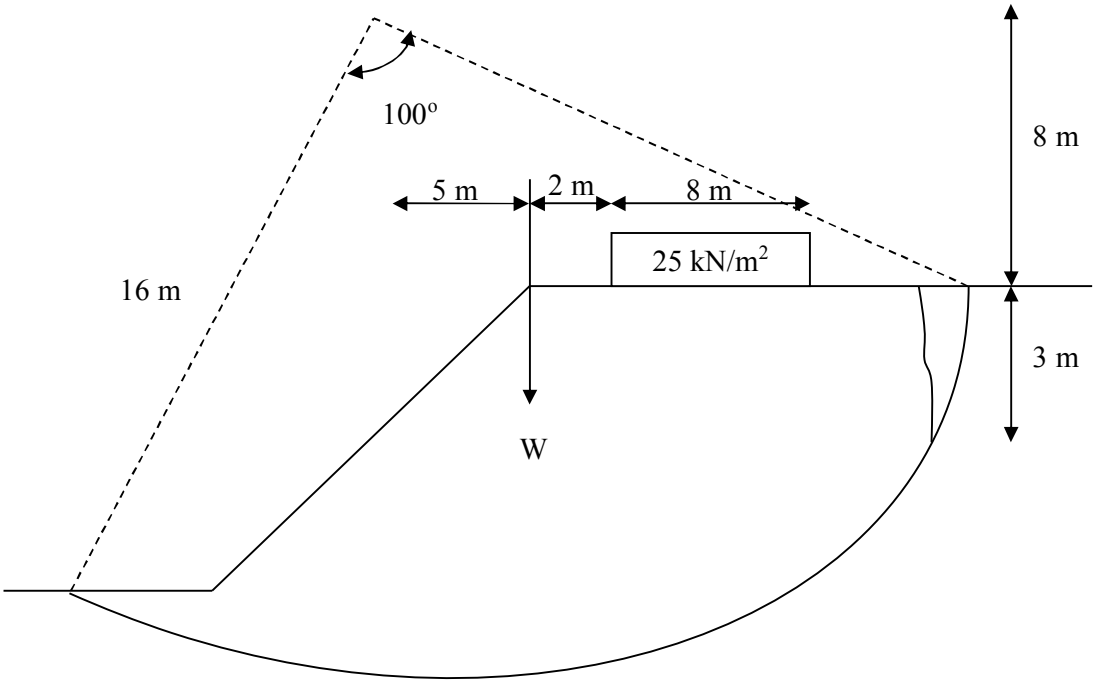

FIGURE Q3(d)

EQUATIONS

$$\Delta\sigma_z = \frac{2qz^3}{\pi(r^2 + z^2)^2}$$

$$K_a = \frac{1-\sin\phi}{1+\sin\phi}$$

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

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

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

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