CONFIDENTIAL

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	GEOTECHNICS
COURSE CODE	:	BFC 31703
PROGRAMME	:	3 BFF
EXAMINATION DATE	:	DECEMBER 2014 / JANUARY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER QUESTION IN SECTION **A** AND THREE **THREE (3)** QUESTIONS IN SECTION **B**

THIS QUESTION PAPER CONSISTS OF **TEN (10)** PAGES

CONFIDENTIAL

SECTION A

Q1 (a) (i) Briefly describe the main difference between 'compaction' and 'consolidation'.

(4 marks)

(ii) List **FOUR (4)** factors that cause settlement of soft soil.

(4 marks)

(iii) What are the **THREE (3)** types of settlement occurring in soils caused by a load.

(3 marks)

(b) For a soil profile as shown in Figure **Q1 (a)**, the preconsolidation (σ_c) for the clay layer is 150 kN/m^3 and $C_s = 0.05$. The percent consolidation versus time factor curve is given in Figure **Q1 (b).**

(i) Calculate the settlement (mm) of the clay layer due to primary consolidation.

(6 marks)

(ii) If the coefficient of consolidation (c_v) for the clay is 0.85 mm^2/min, predict the time (years) required to achieve 90 % consolidation?

(4 marks)

(iii) Determine the settlement (mm) and time (years) at 30% of primary consolidation.

(4 marks)

SECTION B

Q2 (a) Briefly explain any **TWO (2)** differences between the USCS and AASHTO methods for classification of soils.

(4 marks)

(b) In a water content determination procedure, 200 g of the moist soil weighed 160 g after drying in an oven at 105°C. If the specific gravity (G_s) of the particles is 2.68, determine the water content (w), dry density (γ_{dry}), bulk density (γ_b), void ratio (e), porosity (n) and degree of saturation (S_r) of the soil.

(6 marks)

(c) The results of a particle size analysis are given in Table **Q1**.

(i) Plot the particle size distribution curve on the semi-log graph paper.

(5 marks)

(ii) Based on the particle size distribution curve, determine the values of effective size, coefficient of curvature (Cc), and coefficient of uniformity (Cu).

(6 marks)

(iii) Describe the characteristics of the soil sample based on the answers obtained in **Q2 (c) (ii)**.

(4 marks)

Q3 (a) Briefly explain the vadose zone and capillary rise in soil.

(5 marks)

(b) Details of an excavation adjacent to a canal are shown in Figure **Q3**. Determine the quantity of seepage into the excavation if the coefficient of permeability, $k = 4.5 \times 10^{-5}$ m/s. Note that the numbers of flow and equipotential lines must be in round figures.

(7 marks)

(c) (i) Explain in your own words, if necessary with a sketch, what kind of permeability test is suitable to determine the permeability of a sandy material in the laboratory.

(5 marks)

(ii) In a constant head permeability test, the height of the sample, L = 250 cm and cross sectional area of the soil specimen, A = 105 cm^2. If the value of permeability, k = 0.014 cm/sec and a flow rate, q = 120 cm^3/min must be maintained through the soil, determine the head difference and discharge velocity, V, under the test conditions.

(8 marks)

Q4 (a) Explain briefly the application of total shear strength and effective shear strength parameters in the construction.

(5 marks)

(b) (i) Explain briefly the test conditions in terms of back pressure, consolidation, confining pressure and drainage for these triaxial tests: CD, CU, UU and UC.

(5 marks)

(ii) Identify the most suitable triaxial test (i.e. axial compression, lateral compression or lateral extension) to obtain shear strength parameters for foundation loading, passive earth pressure and active earth pressure.

(3 marks)

(c) Consolidated drained triaxial test on a soil sample gave the following results:

Test no.	Confining Pressure (kPa)	Deviator stress at failure (kPa)
1	70	440
2	92	475

(i) Determine the shear strength parameters using Mohr's circles.

(6 marks)

(ii) Did the volume of the samples change? Briefly explain your answer.

(3 marks)

(iii) Was there any pore water pressure build-up (Δu) at the end of the tests? Briefly explain your answer.

(3 marks)

Q5 (a) Briefly describe the differences between the active and passive earth pressure conditions.

(4 marks)

(b) The stability of a retaining wall must be checked for overturning, sliding and bearing capacity. If the Factor of Safety (FS) against sliding is too low, propose **TWO (2)** methods to increase the FS.

(4 marks)

(c) The concrete gravity retaining wall shown in Figure **Q5** supports two layers of soil. By using Rankine's theory, determine the following:

(i) Total active earth pressure per unit length of the wall.

(12 marks)

(ii) The location of the center of total active earth pressure.

(5 marks)

Q6 (a) Briefly explain the factors that triggering the slope failure in Malaysia and the common type of slope failure.

(5 marks)

(b) Discuss the effect of rapid drawdown on slope stability.

(5 marks)

(c) The slope details are shown in Figure **Q6**. The unit weight of both soils is 19 kN/m^3. The undrained strength (c_u) is 30 kN/m^2.

(i) Determine the factor of safety in term of total stress for the slope.

(10 marks)

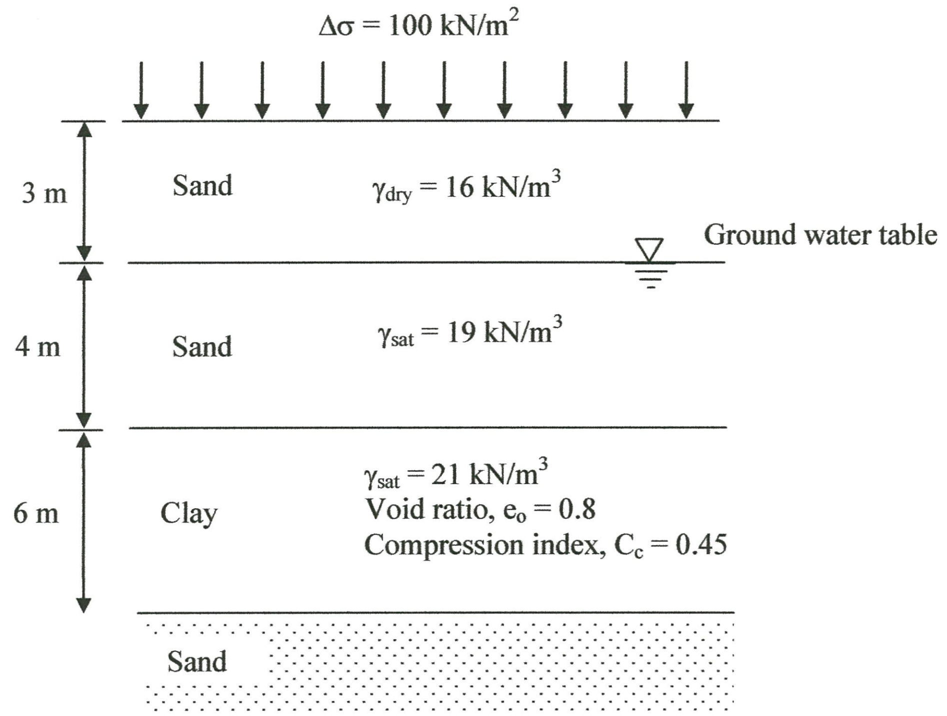
(ii) What is the factor of safety if allowance is made for the development of a tension crack?

(5 marks)

-END OF QUESTION-

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2014/2015 PROGRAMME : 3 BFF
COURSE : GEOTECHNICS COURSE CODE : BFC 31703



FIQURE Q1 (a): Soil Profile

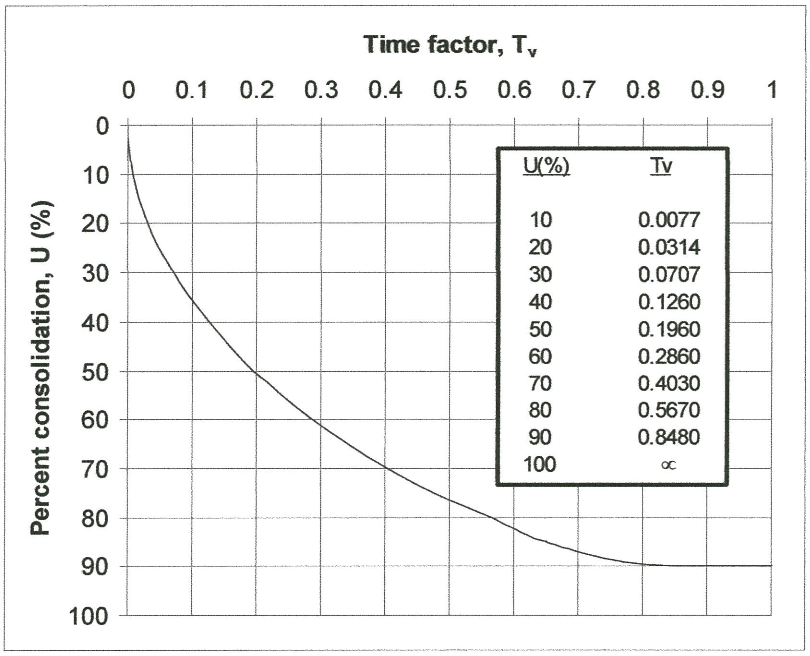


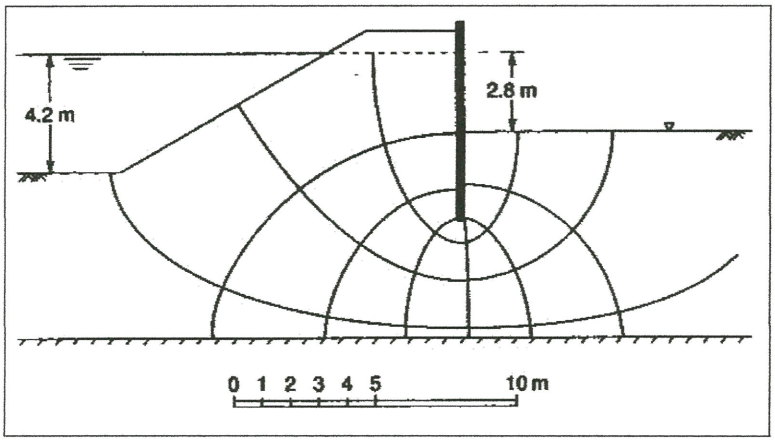
FIGURE Q1(b): Percentage consolidation versus time factor curve.

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2014/2015 PROGRAMME : 3 BFF
COURSE : GEOTECHNICS COURSE CODE : BFC31703

<u>TABLE Q1</u>: Results of a sieve analysis

Sieve Size (mm)	Mass Retained on Sieve (g)
3.3	2
2.00	3.5
1.18	12.5
0.60	57
0.425	62
0.300	34
0.212	18
0.150	12
0.063	13
Pan	6



<u>FIGURE Q3</u>: Details of seepage into an excavation from a nearby canal.

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2014/2015 PROGRAMME : 3 BFF
COURSE : GEOTECHNICS COURSE CODE : BFC31703

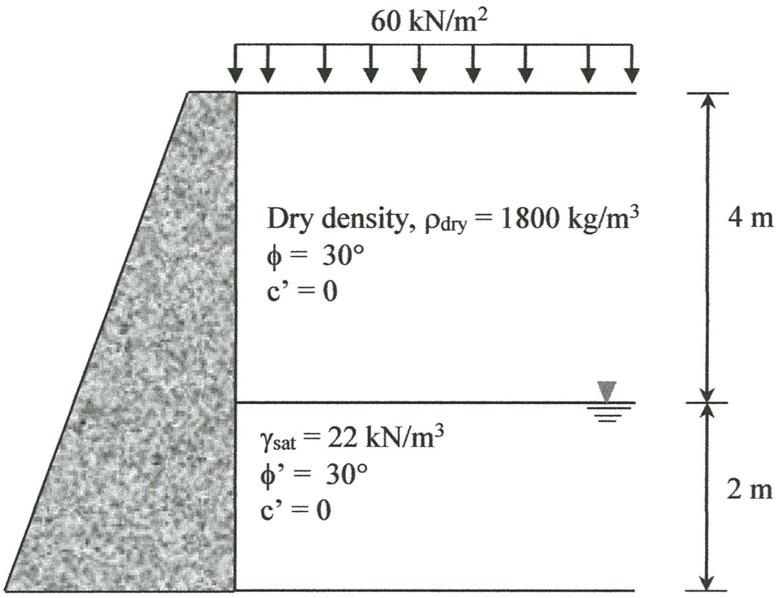


FIGURE Q5: Gravity retaining wall

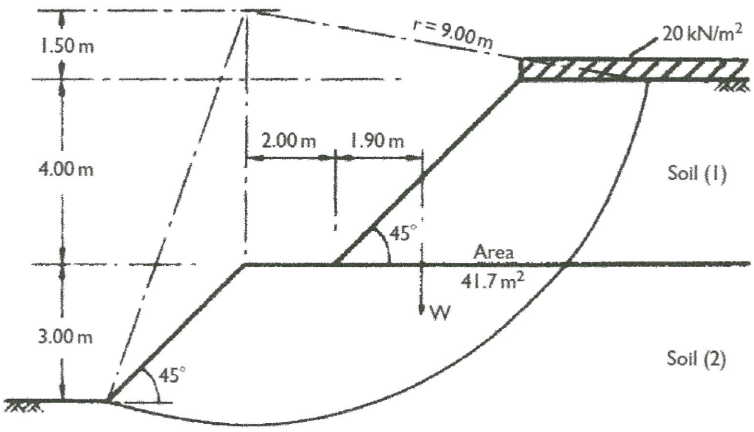


Figure Q6: Slope geometry

FINAL EXAMINATION

SEMESTER / SESSION : SEM I / 2014/2015
COURSE : GEOTECHNICS

PROGRAMME : 3 BFF
COURSE CODE : BFC31703

FORMULAE

$$c_v = \frac{T_v H^2}{t}$$

$$S_p = H\frac{\Delta e}{1+e_o}$$

$$S_p = \frac{C_c H}{1+e_o}\log\left(\frac{\sigma'_o + \Delta\sigma'}{\sigma'_o}\right)$$

$$S_p = \frac{C_s H}{1+e_o}\log\left(\frac{\sigma'_o + \Delta\sigma'}{\sigma'_o}\right)$$

$$S_p = \frac{C_s H}{1+e_o}\log\left(\frac{\sigma'_c}{\sigma'_o}\right) + \frac{C_c H}{1+e_o}\log\left(\frac{\sigma'_o + \Delta\sigma'}{\sigma'_c}\right)$$

$$k = \frac{QL}{Aht}$$

$$k = 2.303\frac{aL}{At}\log_{10}\frac{h_1}{h_2}$$

$$FS = \frac{\sum\left[c'\Delta L + \left(W\cos\alpha - u\Delta L\right)\tan\phi'\right]}{\sum W\sin\alpha}$$

$$FS = \frac{\sum\left[c'\Delta L + W\cos\alpha\tan\phi'\right]}{\sum W\sin\alpha}$$

$$FS = \frac{c_u r^2 \theta}{W_1 l_1 - W_2 l_2}$$