UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014

COURSE NAME	:	GEOTECHNICS II
COURSE CODE	:	BFC 33802
PROGRAMME	:	2 BFF
EXAMINATION DATE	:	DECEMBER 2013/JANUARY 2014
DURATION	:	2 HOURS
INSTRUCTION	:	ANSWER **THREE (3)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **SEVEN (7)** PAGES

Q1 (a) Explain briefly the phenomenon of piping in granular material with the help of appropriate diagram.

(4 marks)

(b) With the aid of diagram, discuss the retentation and permeability criteria in filter design.

(5 marks)

(c) A concrete hollow box culvert is shown in Figure **Q1(c).**

(i) Determine the minimum wall thickness to prevent uplift using a factor of safety of 1.2 if the groundwater rise to the surface. The unit weight of concrete is 24 kN/m^3.

(12 marks)

(ii) If the weight of the culvert is restricted so that uplift can occur. Describe one possible method to prevent uplift.

(4 marks)

Q2 (a) Explain briefly the difference between Rankine's and Coulomb's theory for calculation of lateral earth pressure.

(5 marks)

(b) The sheet pile was installed into the soil for excavation works as shown in Figure **Q2(b).**

(i) Plot the variation of active and passive lateral pressures with depth.

(10 marks)

(ii) Calculate the resultant active and passive force per unit length of the wall.

(6 marks)

(iii) Determine the location of resultant force.

(4 marks)

Q3 (a) Explain briefly the consolidation process by the mechanical piston and spring anology.

(4 marks)

(b) With the help of appropriate diagram, describe the initial compression, primary consolidation and secondary consolidation.

(4 marks)

(c) For a soil profile as shown in Figure **Q3(c)(i)**, pressure in the past (σ_c) for the clay layer is 250 kN/m^3 and $C_r = 0.05$. The degree of consolidation versus time factor curve is given in Figure **Q3(c)(ii)**.

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

(8 marks)

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

(4 marks)

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

(5 marks)

Q4 (a) What are the difference between Ordinary and Bishop's simplified method of slices in term of their assumption.

(4 marks)

(b) Explain briefly the effect of groundwater level rising due to heavy rainfall in slope stability.

(4 marks)

(c) The ordinary method of slices has been used to analyse the stability of the proposed cut slope as shown in Figure **Q4(c)**. Some of the required data are listed in Table **1**. Determine the factor of safety against sliding for the trial failure surface. Assume the pore water pressure ratio, r_u for each slices is 0.65.

(17 marks)

-END OF QUESTION-

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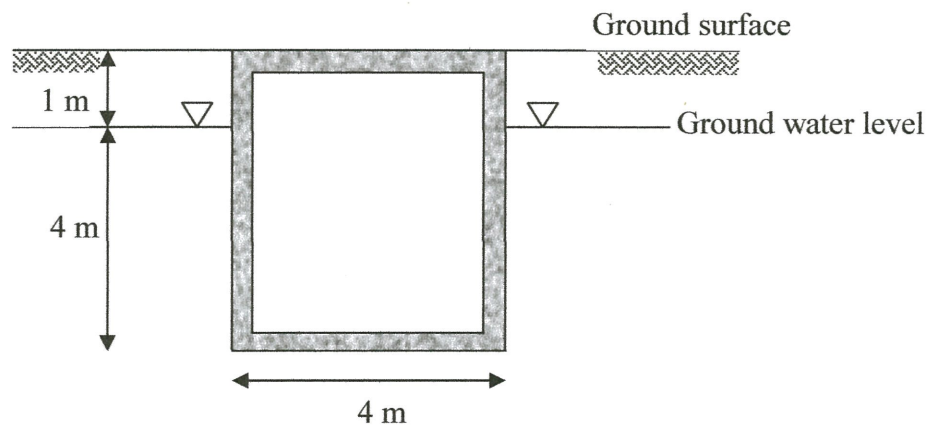
FIGURE Q1(c) : Hollow box culvert
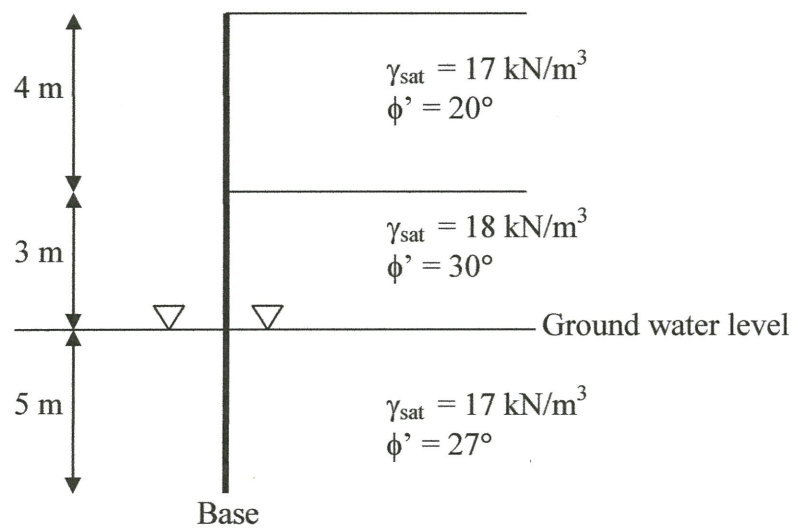
FIGURE Q2(b) : Sheet pile

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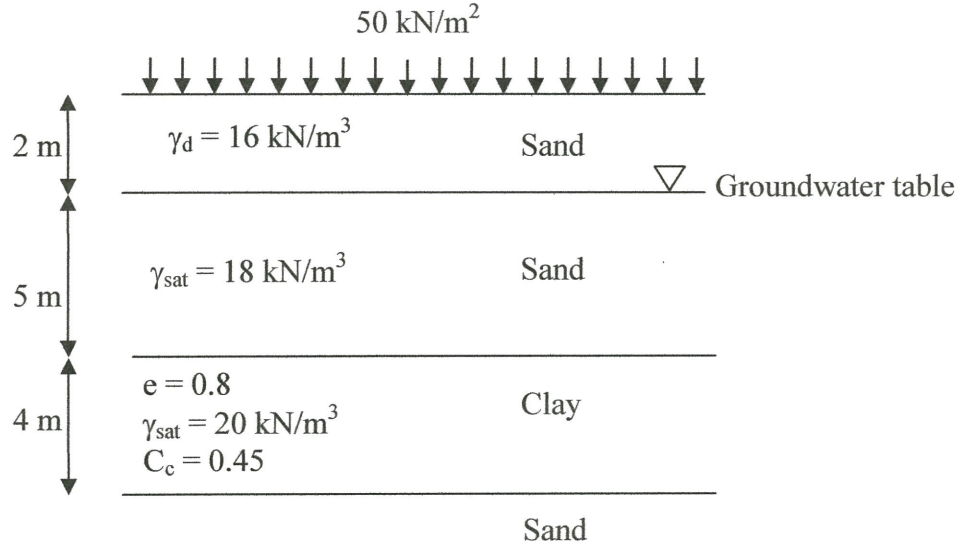
FIGURE Q3 (c)(i) : Soil profile
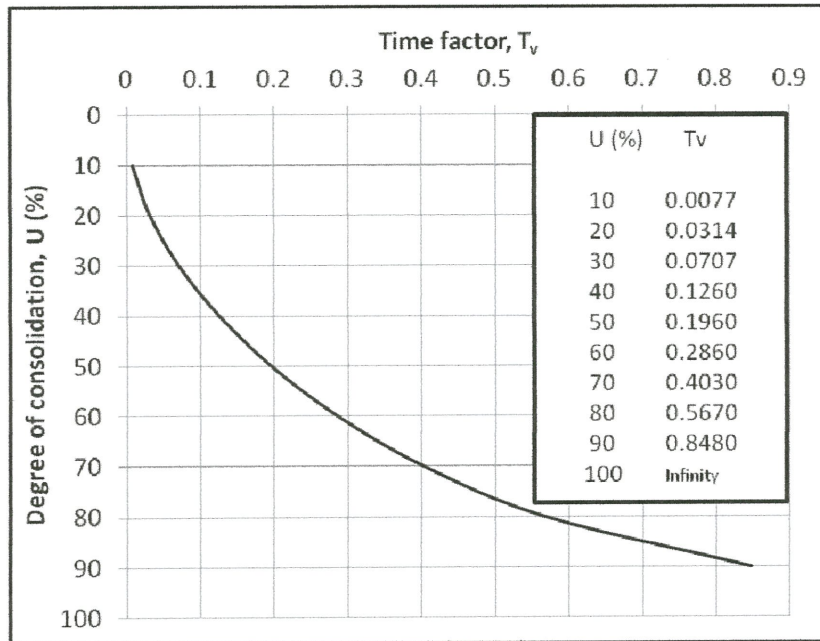
FIGURE Q3(c)(ii): Time factor and degree of consolidation

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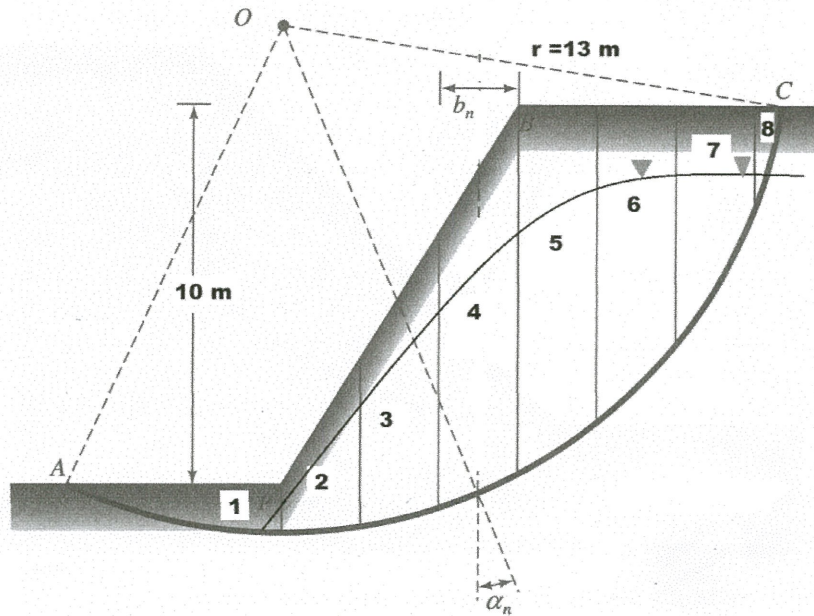
FIGURE Q4 (c) : Failure surface

Table **1**: Data for stability analysis of slope

Slice no.	Effective weight, W (kN/m^2)	α_n (°)
1	66.69	-10
2	111.19	6
3	228.89	14
4	326.08	24
5	346.59	34
6	285.44	46
7	171.19	61
8	14.69	74

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LIST OF FORMULA

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

$$q = kH\left(\frac{N_f}{N_d}\right)n$$

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

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

$$\Delta L_n = \frac{b_n}{\cos\alpha_n}$$

$$FS_s = \frac{\sum_{n=1}^{n=p}\left(c'\Delta L_n + W_n \cos\alpha_n \tan\phi'\right)}{\sum_{n=1}^{n=p} W_n \sin\alpha_n}$$

$$FS_s = \frac{\sum_{n=1}^{n=p}\left(c'\Delta L_n + \left(W_n \cos\alpha_n - u_n \Delta L_n\right)\tan\phi'\right)}{\sum_{n=1}^{n=p} W_n \sin\alpha_n}$$