Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2022/2023

COURSE NAME	:	GEOTECHNICS II
COURSE CODE	:	BFC 34402
PROGRAMME CODE	:	BFF
EXAMINATION DATE	:	JULY/ AUGUST 2023
DURATION	:	2 HOURS 30 MINUTES
INSTRUCTIONS	1.	ANSWER ALL QUESTIONS
	2.	THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK.**
	3.	STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY EXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

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

Q1 (a) Understanding the movement of fluids that contribute to flow in soils is important for a range of engineering applications to ensure the safety and stability of structures.

(i) Based on your understanding of flow in soils, discuss what is the phenomenon of capillary rise is soils.

(4 Marks)

(ii) Construct a detail diagram of a flow net that occurs on a temporary structure that resist lateral forces exerted by water against an excavation. Also, explain the constrains when construction a flow net.

(6 Marks)

(b) Seepage plays an important part in certain considerations of engineering design of structures. Explain in detail the various engineering applications that considers seepage analysis.

(15 Marks)

(c) **Figure Q1(c)** shows the ring foundation to support a silo. Given $R_1 = 2.5$ m while $R_2 = 5$ m. The total vertical load is 5000 kN.

(i) Plot the vertical stress increase with depth up to 7 m (use 1 m interval) under the center of the ring (point O).

(12 Marks)

(ii) Determine the maximum vertical stress increase and its location.

(3 Marks)

Q2 (a) Consolidation is the process of dissipating excess pore water pressure in the soil. Compare the differences between the sand and saturated clay in terms of consolidation process and settlement behaviour.

(5 Marks)

(b) Briefly describe the differences between normally consolidated soil and oversonsolidated soil. Please give an example of how soil normally consolidates and overconsolidates in your explanation.

(10 Marks)

(c) As consultant for a road construction, you are requested to determine the total settlement for the stretch of road due to consolidation of underlain unconsolidated clay. The cross section for the road embankment and its underlain soil are shown in **Figure Q2(c)** and its details are listed in **Table Q2(c)**.

(15 Marks)

Q3 (a) For the infinite slope shown in **Figure Q3(a)** (consider there is no seepage through the soil), determine:

(i) The factor of safety against sliding along the soil-rock interface.

(2 Marks)

(ii) The height, H, that will give a factor of safety (Fs) of 2 against sliding along the soil-rock interface.

(4 Marks)

(b) A cutting saturated clay in a saturated clay is inclined at a slope of 1 vertical: 1.5 horizontal and has a vertical height of 10.0 m. The bulk unit weight of the soil is 18.5 kN/m^3 and its undrained cohesion is 40 kN/m^2 ($\phi_u = 0$). Determine the factor of safety against immediate shear failure along the slip circle shown in **Figure Q3(b).**

(i) Ignoring the tension crack
Given:
Sector angle, Θ $= 84.06^0$
Area of slip mass,A $= 102.1$ m^2
Centroid distance from O,d $= 6.54$ m

(4 Marks)

(ii) Allowing for tension crack empty of water
Given:
Sector angle, Θ_c $= 67.44^0$
Area of slip mass,A $= 71.64$ m^2
Centroid distance from O,d $= 5.86$ m
Pw = 0

(4 Marks)

(c) Stability of slope for different type of slope need different analysis and concern. Cuttings are excavated, whereas embankments are built. The total stress and pore pressure changed was totally different.

(i) Differentiate the stability of slope in cuttings, in embankment and in natural slope in terms of total stress and pore pressure.

(10 Marks)

(ii) Many methods can be use in slope improvement. Discuss **TWO (2)** methods in slope improvement.

(6 Marks)

- END OF QUESTIONS -

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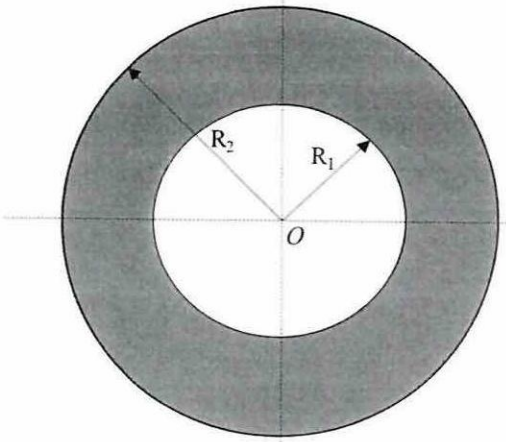

FIGURE Q1(c) : Ring foundation

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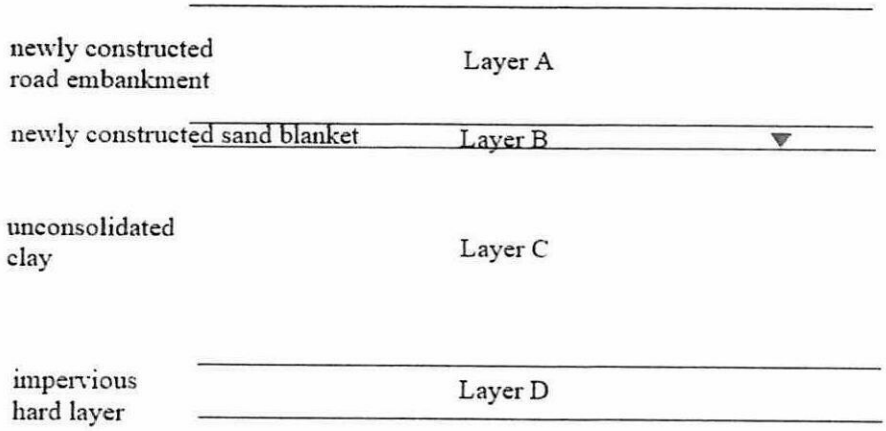

FIGURE Q2(c) : Cross section of road embankment

TABLE Q2(c): Details of soil profile

Layer	Thickness (m)	Soil Properties
A	3	$\gamma_{dry} = 18$ kN/m^3
B	0.5	$\gamma_{dry} = 17$ kN/m^3
C	10	$\gamma_{sat} = 19$ kN/m^3; $e_o = 0.9$; $C_c = 0.36$
D	5	$\gamma_{sat} = 21$ kN/m^3

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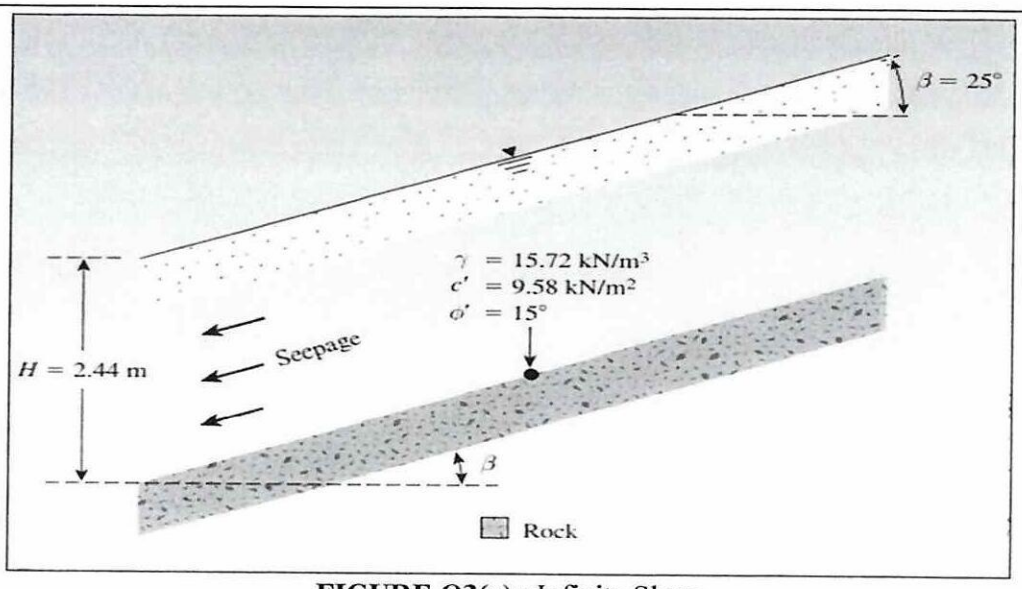

FIGURE Q3(a) : Infinite Slope

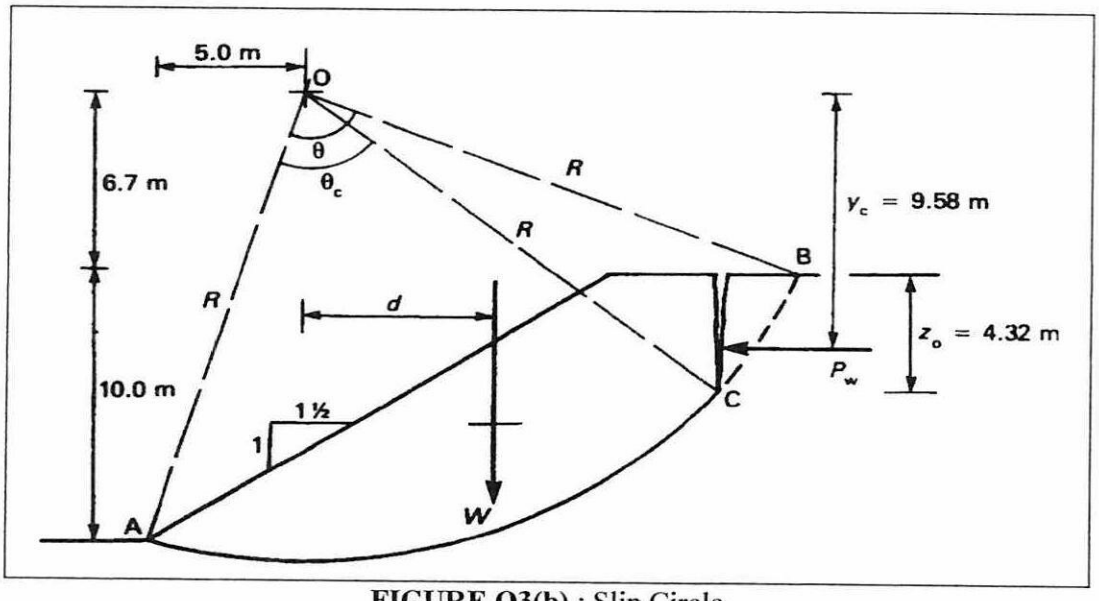

FIGURE Q3(b) : Slip Circle