Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2014/2015

COURSE NAME	:	GEOTECHNICS II
COURSE CODE	:	BFC 34402
PROGRAMME	:	3 BFF
EXAMINATION DATE	:	DECEMBER 2014 / JANUARY 2015
DURATION	:	2 HOURS
INSTRUCTION	:	1. ANSWER **ALL** QUESTIONS IN PART A 2. ANSWER ANY **TWO (2)** QUESTIONS IN PART B

THIS QUESTION PAPER CONSISTS OF **EIGHT (8)** PAGES

PART A

Q1 (a) Unrestrained slope can be defined as an exposed ground surface that stands at an angle with the horizontal. Basically, the slope can fail in various modes.

List down **Five (5)** major categories of slope failure with the aid of sketches.

(10 marks)

(b) As a consultant, you are engaged by local authority to propose methods to improve the stability of a cut slope beside the highway.

(i) What will be the main **Three (3)** corrective or preventive measures that need to be considered in improving the stability of slopes?

(6 marks)

(ii) The following constraints were identified during the field trip: area was constrained, soft metasedimentary materials were exposed after cut, high groundwater table in the slope.

You are required to evaluate the potential risks and also propose an integrated slope protection system to increase the stability of this cut slope.

(10 marks)

(c) A slope shown in **Figure Q1** was constructed on homogenous soils.

It is assumed that no reduction on pore water pressure occurs while ongoing construction and pore water pressure is predicted as $r_u = 0.30$ for the average values.

The soil's cohesion and internal friction angles are determined as $c' = 5$ kPa and $\phi' = 35°$, respectively.

The slope was equally sliced and the particular information on the slices was given in **Table Q1** as follow.

Table Q1

Slices	W (kN/m)	Angles, α°
1	157	- 13
2	487	- 4.5
3	927	6
4	1202	17
5	1348	28
6	1294	40.5
7	835	53.5

Determine the factor of safety, FS, by using the following formula:

$$FS = \frac{\sum [c'l + W(\cos\alpha - r_u \sec\alpha)\tan\phi']}{\sum W \sin\alpha}$$

(14 marks)

PART B

Q2 (a) (i) Briefly describe what is capillary rise that normally occur in soil?

(4 marks)

(ii) What are the factors that may affect capillary rise in soil?

(6 marks)

(b) (i) What is defined as "flownet" and what is the application of "flownet"?

(4 marks)

(ii) Briefly describe any **Three (3)** constraints for sketching flownet.

(6 marks)

(c) The soil at the left side of the sheet pile wall as shown in **Figure Q2** was slightly dredged below the original level for constructing foundation. The flow net underneath the sheet pile wall was shown in **Figure Q2** and the details of the site were:

$H = 8.0$ m, $k = 4 \times 10^{-5}$ m/s, $\gamma_{sat} = 18.50$ kN/m^3 (sandy clay)

Distances: AB = 2 m, BC = 2 m, CD = 1.5 m, DE = 1 m

Determine :

(i) The flow of water, q (quantity per day) per meter of wall.

(4 marks)

(ii) Pore pressure at point C and D in the front of the sheet pile wall by taking the final dredge line as datum.

(6 marks)

Q3 (a) The lateral earth pressure can be determined via Rankine's theory, Coulomb's theory and Culmann's theory.

(i) Briefly explain what are the **Two (2)** major differences in the assumptions taken by Rankine and Coulomb method.

(4 marks)

(ii) Why Coulomb's method also know as "Sliding wedge analysis"?

(4 marks)

(b) In practice, the common types of retaining walls constructed can be divided into two major categories: rigid retaining walls and mechanically stabilized earth (MSE) walls.

Briefly describe with the sketches if possible, the **Four (4)** common types of rigid retaining walls.

(8 marks)

(c) A frictionless retaining wall was constructed to support backfill soil of 8 m in height. The properties of the retained soil are shown in **Figure Q3**.

Determine:

(i) The active force, Pa per unit length of wall by using the Rankine's method

(8 marks)

(ii) The location of the resultant force for this case.

(6 marks)

Q4 (a) The three types of settlement of a soil are the initial settlement, the primary consolidation settlement and the secondary consolidation settlement.

Briefly describe the factors involved in determining the magnitude of the settlement in any one of the settlement type.

(6 marks)

(b) Define or briefly explain, if necessary with the help of diagrams, the following terms:

(i) the coefficient of consolidation, c_v,
(ii) the coefficient of compressibility, a_v,
(iii) the coefficient of volume compressibility, m_v, and
(iv) the compression index, C_c.

(8 marks)

(c) A soil profile at a construction site is as shown in **Figure Q4**. Sand layer above the groundwater table and underneath the ground water table are reported as 2.0 m and 2.5 m in depth, respectively. Whereas, the clay layer is found to be 5 m in depth. The results of a laboratory consolidation test conducted on a specimen collected from the middle of the clay layer are as shown in the figure. A surcharge load of 100 kN/m^2 was applied at the ground surface.

Determine the settlement of the clay layer caused by primary consolidation if:-

(i) The clay is normally consolidated,

(ii) The clay is over consolidated with an over consolidation ratio (OCR) of 1.2.

(16 marks)

- END OF QUESTION -

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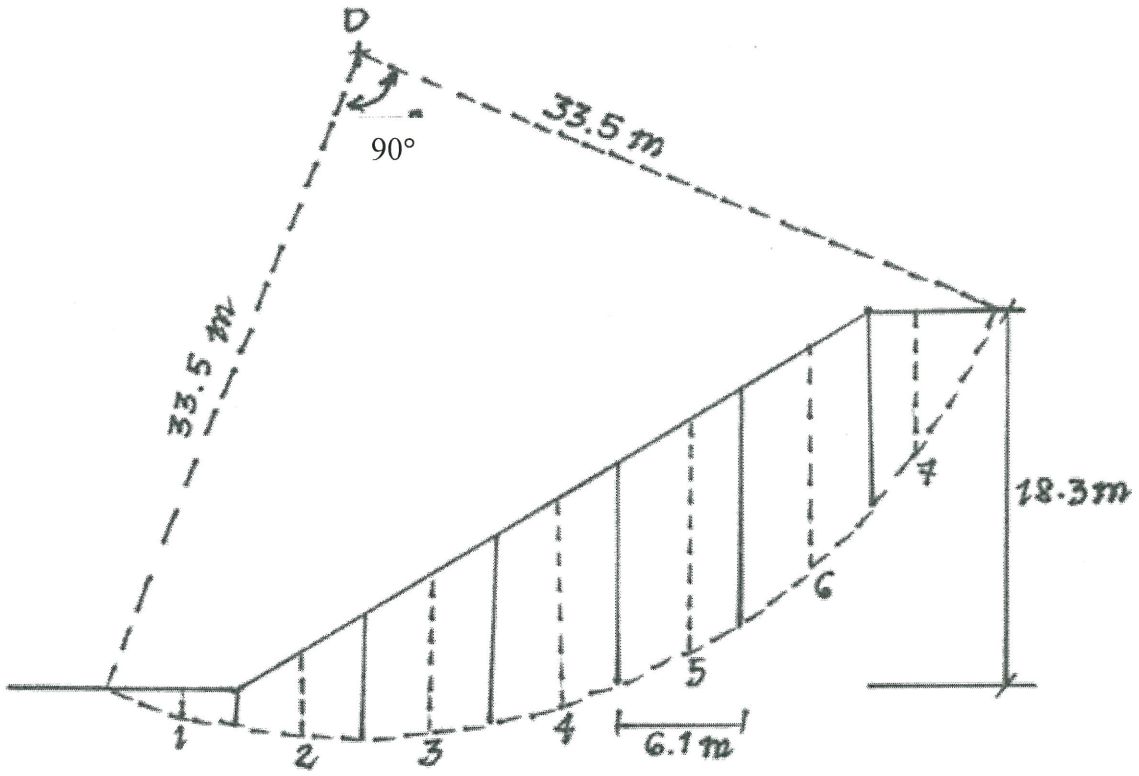

FIGURE Q1

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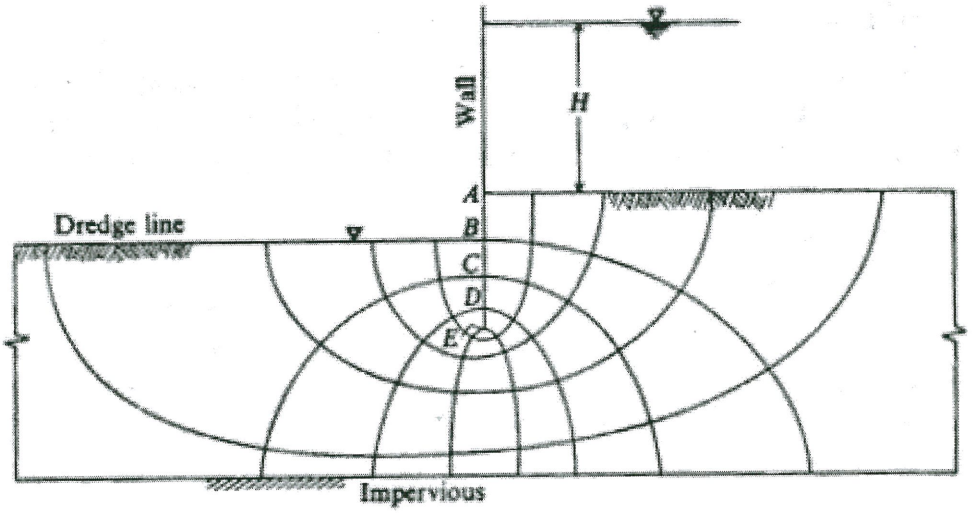

FIGURE Q2

Surcharge, q = 20 kN/m^2

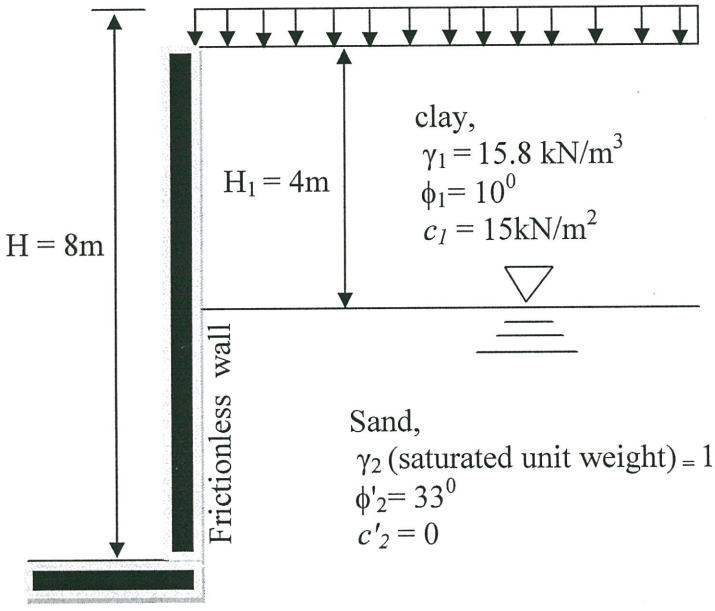

FIGURE Q3

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Sand

Bulk unit weight, $\gamma_b = 16.8$ kN/m^3

GWT----------

Sand

Saturated unit weight, $\gamma_{sat} = 18.2$ kN/m^3

Clay

$C_c = 0.4$

$C_s = 0.06$

$e_o = 0.7$

Saturated unit weight, $\gamma_{sat} = 19.1$ kN/m^3

Bedrock

FIGURE Q4