Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2013/2014

COURSE NAME	:	ENGINEERING GEOLOGY
COURSE CODE	:	BFC 21303
PROGRAMME	:	2 BFF
EXAMINATION DATE	:	JUNE 2014
DURATION	:	3 HOURS
INSTRUCTION	:	A) ANSWER ANY **THREE (3)** QUESTIONS IN PART A B) ANSWER QUESTION **Q5** IN PART B

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

PART A

Q1 (a) Explain the significance of Laboratory Testing of Rocks and Soils in the design and construction of geotechnical structures.

(8 marks)

(b) Rocks have inherent planes of weaknesses (cleavage, bedding planes, joints, faults and weathered zones). Give an illustrated explanation on how the orientation and spacing of these weaknesses affect the laboratory testing and the performance of geotechnical structures in rock.

(8 marks)

(c) Write short notes with suitable illustrations to differentiate between the following terms;

i) Direct test and Indirect test

ii) P wave velocity and S wave velocity

iii) Brazilian test and Point Load Index Test

(9 marks)

Q2 (a) Diagenesis is a sequence of processes exclusive to the formation of sedimentary rocks. Draw an illustrated diagram with a brief description of these main geological processes.

(5 marks)

(b) Explain how the knowledge gained through the study of rocks is important to Civil and Construction Engineers.

(5 marks)

(c) How would you distinguish sedimentary rocks from igneous and metamorphic rocks in the field and in the laboratory.

(4 marks)

(d) Briefly describe how igneous rocks are classified. Write down the names of at least **THREE (3)** common igneous rocks and indicate how they are placed within the igneous rock classification.

(5 marks)

(e) With the aid of suitable diagrams differentiate between ripple marks, mud cracks, grain boundaries and foliation.

(6 marks)

Q3 (a) Explain briefly any **ONE (1)** of the following properties of mineral.

i) Crystal form

ii) Luster

(6 marks)

(b) Erosion is an important agent that breakdown the rock and transport the surficial rock debris as result from erosion of rocks by physical or chemical weathering.

i) Name **THREE (3)** types of erosion agents.

(3 marks)

ii) Explain the relevant factors that determine the rates of erosion.

(6 marks)

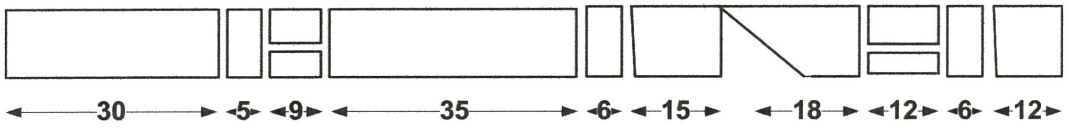
(c) Explain in detail the erosion by wind.

(10 marks)

Q4 (a) Draw a diagram of the internal structure of Earth and briefly describe the core, mantle, asthenospere and lithosphere.

(6 marks)

(b) Total length of rock coring was 1.5 m. Calculate the Rock Quality Designation (RQD), Total Core Recovery (TCR) and Solid Core Recovery (SCR) for rock coring below.



All dimension in cm.

(6 marks)

(c) Ground investigations are necessary for engineering geologists to prepare their recommendations for construction work on civil engineering site.

(i) Discuss **TWO (2)** limitations commonly associated with a borehole investigation.

(4 marks)

(ii) With indicating any limitations, explain **ONE (1)** geophysical method that can be used to complement a bore hole investigation.

(3 marks)

(d) Discuss briefly the difference between resistivity and seismic refraction methods of ground investigation.

(6 marks)

PART B

Q5 (a) Discontinuities are formed due the rocks forming processes as well as through the geological processes. Explain **THREE (3)** types of discontinuities and their relation to geological processes.

(5 marks)

(b) The parameters of rock cut slope were investigated and tabulated in **Table 1**. A discontinuity survey was conducted along the cut slope and results for the discontinuity sets orientations are given in **Table 2**. A study of the joint sets showed that all joint surfaces had a friction angle of 30°.

Table 1

Slope dip direction	= 180°
Slope face angle	=65°
Height of rock slope	= 80 m
Depth of tension cracks	= 5 m
Unit weight of the rock	= 25 kN/m^3
Unit weight of water	= 9.81 kN/m^3
Cohesion of the discontinuity	= 100 kPa
Friction angle for the discontinuity	= 35°

Table 2

Joint set 1	Joint set 2	Joint set 3	Joint set 4	Joint set 5
090°/20°	20°/70°	220°/50°	355°/65°	170°/40°

(i) Analyze the entire failure mode of the rock slope as well as the criterion as an evidence using Figure **Q5b(i).**

(8 marks)

(ii) Calculate the factor of safety for planar failure mode using formula in Figure **Q5b(ii)** when the tension crack is completely filled with water.

(6 marks)

(iii) To avoid the rock slope failure, one of the option is changing the slope dip direction. Recommend the new direction of the slope dip direction without changing the slope face angle.

(6 marks)

- END OF QUESTION -

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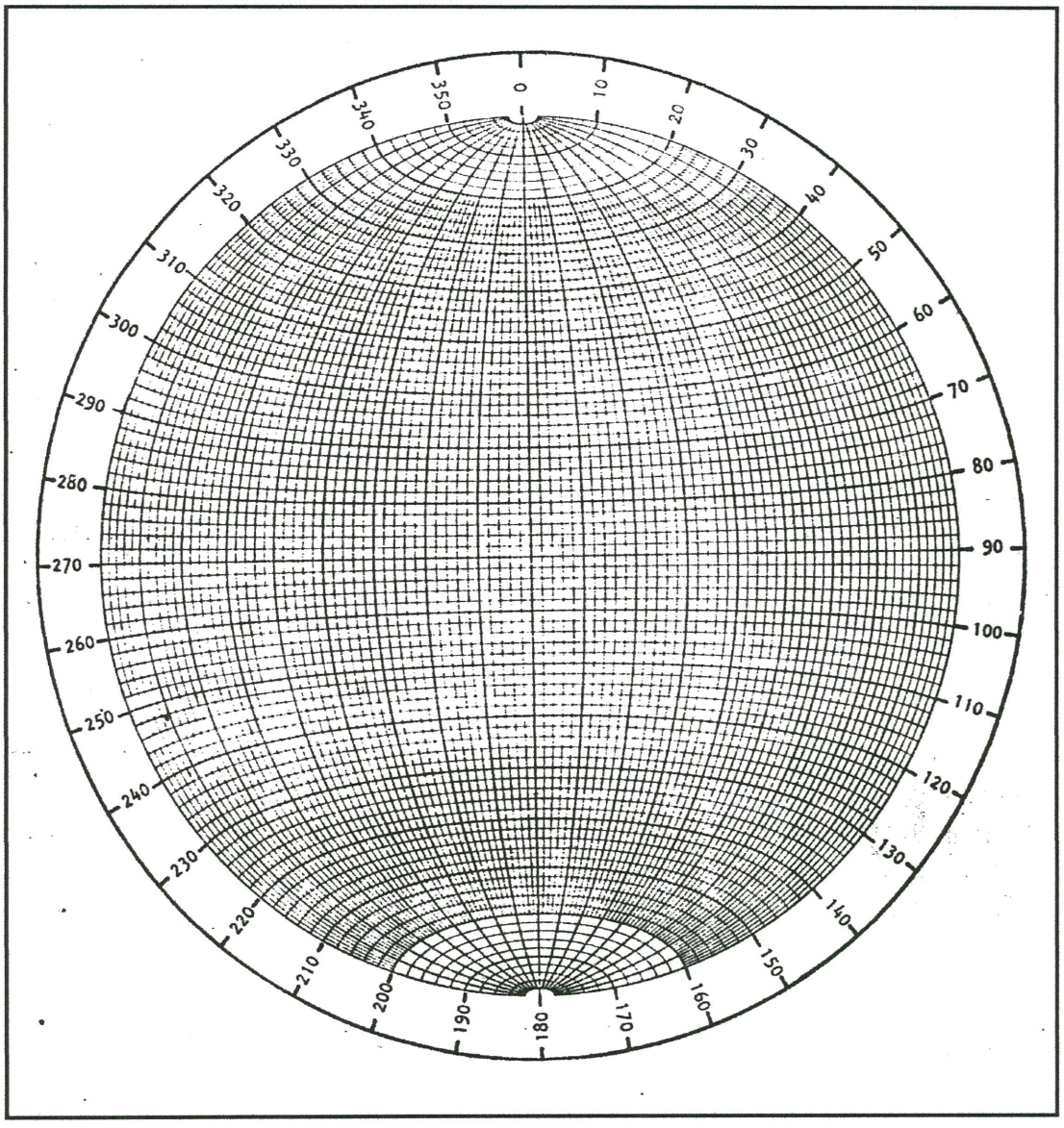

FIGURE Q5c(i): Equatorial equal-area stereo-net marked in 2° intervals

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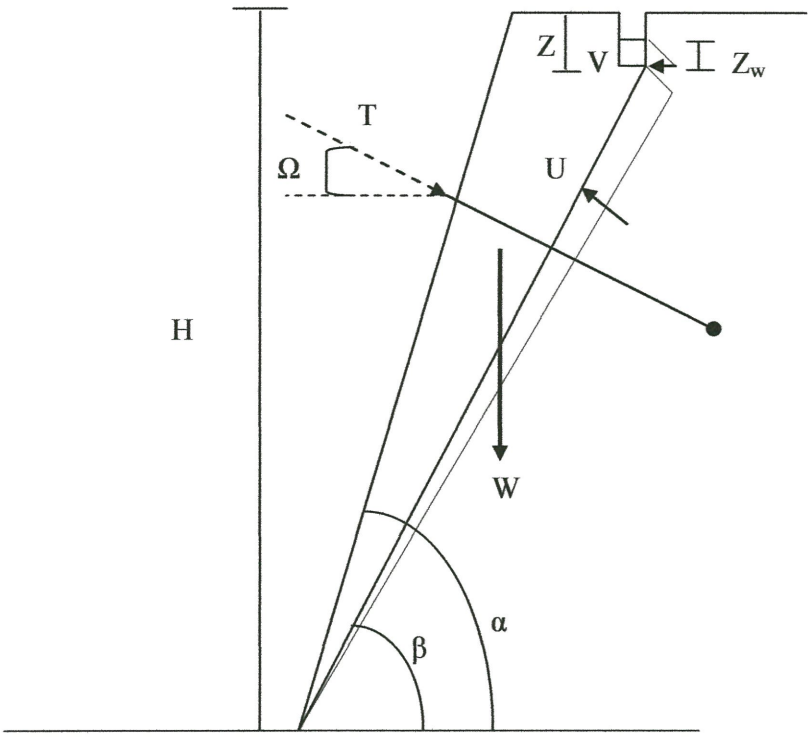

Given:

$$\textbf{FOS} = \frac{cA + [W\cos\beta - U - V\sin\beta + T\sin(\Omega+\beta)]\tan\phi}{W\sin\beta + V\cos\beta - T\cos(\Omega+\beta)}$$

$A = (H-Z).\text{cosec}\,\beta$

$$W = \tfrac{1}{2}\gamma_r H^2\left[\left(1-\left(Z/H\right)^2\right)\cot\beta - \cot\alpha\right]$$

$U = \tfrac{1}{2}\,\gamma_w.Z_w.(H-Z).\text{cosec}\,\beta$

$V = \tfrac{1}{2}\,\gamma_w.Z_w^2$

$$\text{cosec}\,\beta = \frac{1}{\sin\beta} \qquad \sec\beta = \frac{1}{\cos\beta} \qquad \cot\beta = \frac{1}{\tan\beta}$$

FIGURE Q5c(ii)