Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014

COURSE NAME	:	ENGINEERING GEOLOGY
COURSE CODE	:	BFC 21303 / BFC 3013
PROGRAMME	:	2 BFF
EXAMINATION DATE	:	DECEMBER 2013/JANUARY 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 **SEVEN (7)** PAGES

PART A

Q1 (a) List **FOUR (4)** internal layers of the earth based on physical properties.

(4 marks)

(b) Discuss the convection current.

(3 marks)

(d) Explain the phenomenon of the repeated reversals of earth magnetic field.

(4 marks)

(e) Explain the convergent boundaries.

(6 marks)

(f) Explain the reason why colour is not suitable for mineral identification.

(4 marks)

(g) Explain the method to differentiate quartz and calcite mineral based on physical properties.

(4 marks)

Q2 (a) Discuss the igneous rock classification based on textures and silica content.

(9 marks)

(b) Compare in term of texture and silica content between:

(i) Granite and rhyolite

(ii) Gabbro and Basalt

(4 marks)

(c) Evaluate the relationship between silica content, minerals and weathering rate.

(4 marks)

(d) Discuss the chemical sedimentary rocks with relevant examples.

(4 marks)

(e) Explain the differences between:

(i) Shale and sandstone

(ii) Conglomerate and breccias

(iii) Marble and limestone

(4 marks)

Q3 (a) Describe **THREE (3)** types of metamorphic and give relevant examples.

(3 marks)

(b) Explain how the foliation influences the rock mass strength.

(3 marks)

(c) Erosion is one of the important agents of removal and transportation of surficial materials which are the product of physical and chemical breakdown of rocks by process of weathering.

(i) Compare the textures and properties of residual soil and transported soil.

(3 marks)

(ii) Describe **THREE (3)** types of load carried by streams.

(3 marks)

(iii) Explain **FOUR (4)** types of sediment that accumulate in continental environment with their important individual characteristics.

(4 marks)

(d) Explain the terms of oxidation and hydrolysis in chemical weathering

(3 marks)

(e) Explain the rate of weathering based on climate.

(3 marks)

(f) With suitable illustrations, explain the differences between:

(i) Normal and lateral faults

(ii) Joint and faults

(iii) Strike and dip direction

(3 marks)

Q4 (a) With suitable illustrations, explain the differences between:

(i) Direct and indirect tests

(ii) Uniaxial Compression test and Rebound hammer test

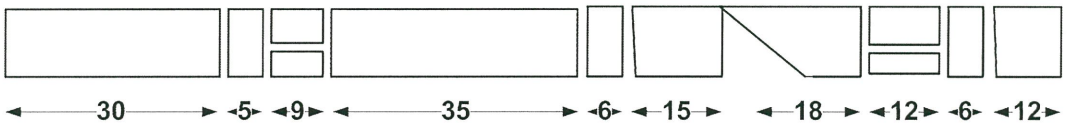
(iii) Brazilian test and Sound Velocity test

(6 marks)

(b) Explain why the compression wave velocity of saturated clay is higher than unsaturated compacted soil.

(4 marks)

(c) 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)

(d) 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.

(2 marks)

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

(3 marks)

PART B

Q5 (a) A rock slope can fail due to different mode mechanism. Explain these mode mechanisms of failure.

(4 marks)

(b) Explain why the discontinuities data presentation using pole density is needed in rock slope stability analysis.

(4 marks)

(c) The parameters of rock cut slope was 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 35°.

Table 1

Slope dip direction	= 090°
Slope face angle	=60°
Height of rock slope	= 40 m
Depth of tension cracks	= 3 m
Unit weight of the rock	= 26 kN/m^3
Unit weight of water	= 9.81 kN/m^3
Cohesion of the discontinuity	= 50 kPa
Friction angle for the discontinuity	= 35°

Table 2

Joint set 1	Joint set 2	Joint set 3	Joint set 4	Joint set 5
105°/52°	45°/70°	145°/30°	320°/80°	275°/70°

(i) Analyze the entire failure mode for both proposed rock slope as well as the criterion as an evidence using Figure **Q5c(i).**

(8 marks)

(ii) Calculate the factor of safety for planar failure mode using formula in Figure **Q5c(ii)** in two conditions:
(a) when the tension crack and slope is dry, and
(b) when the tension crack is completely filled with water.

(4 marks)

(ii) Recommend a suitable rock slope dip angle in order to avoid potential any mode rock slope failure.

(2 marks)

(iii) Suggest the effect of the new rock slope dip angle.

(3 marks)

- END OF QUESTION -

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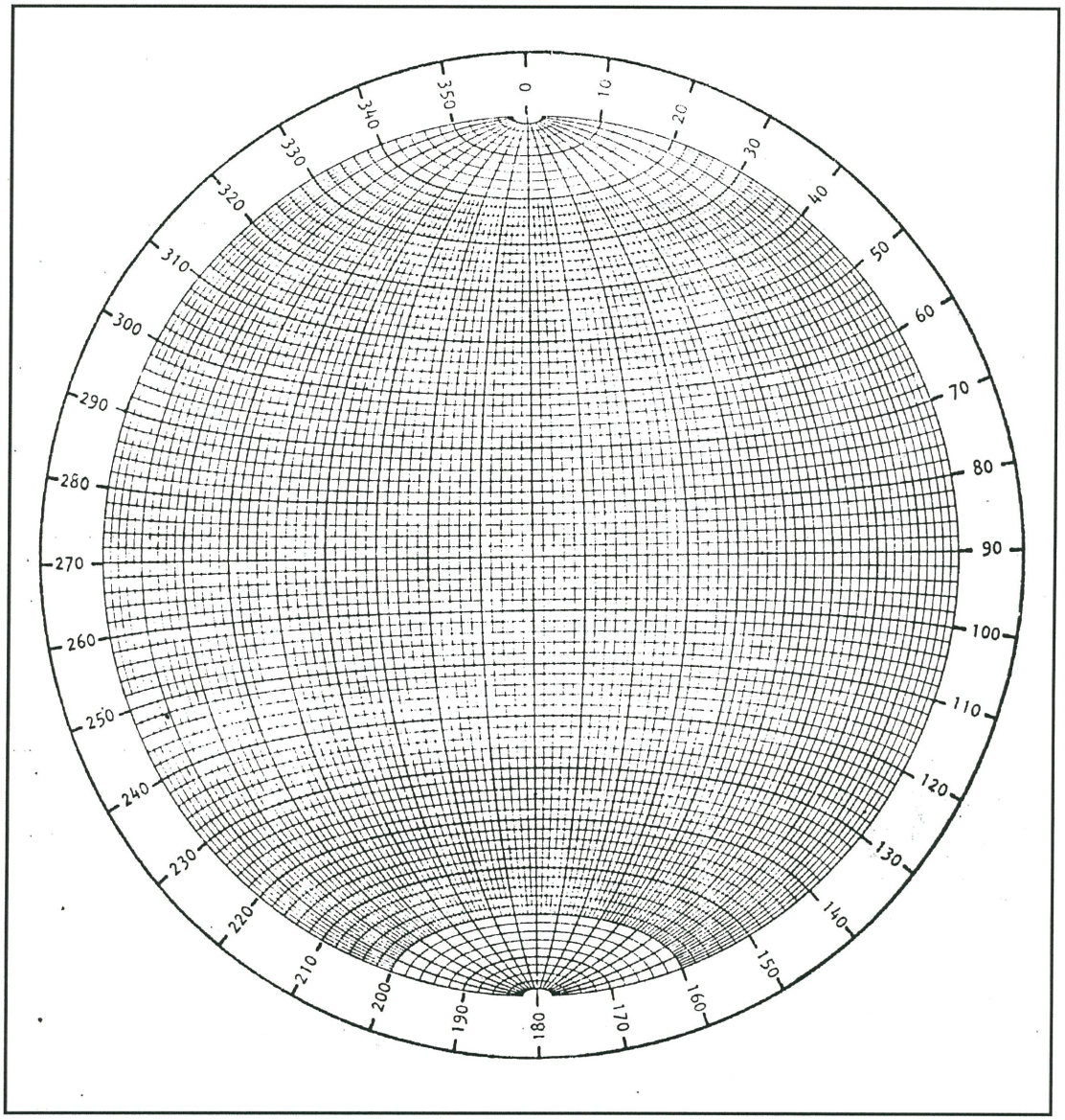

FIGURE Q5c(i): Equatorial equal-area stereo-net marked in 2° intervals

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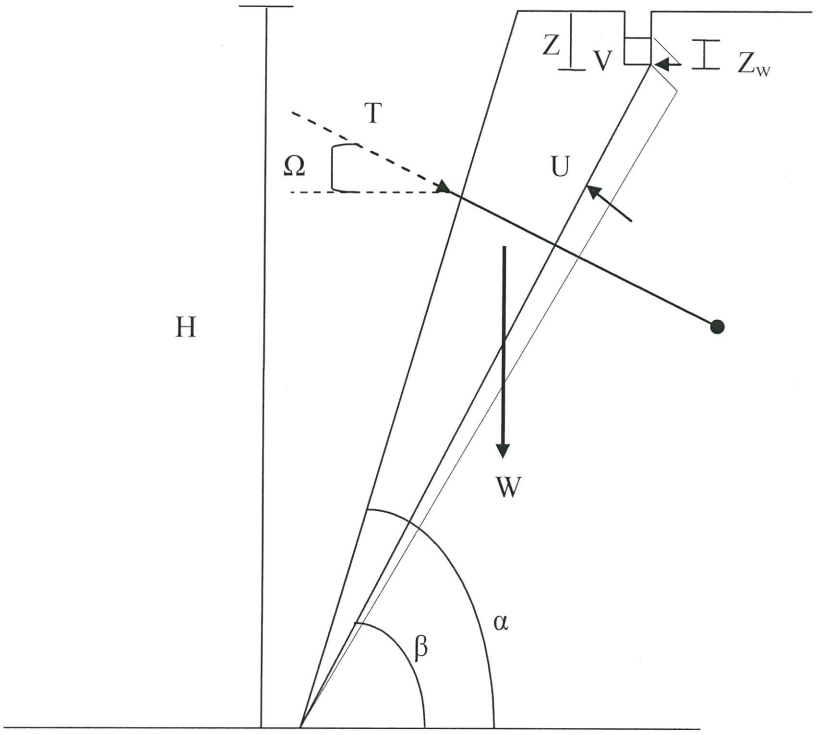

Given:

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

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

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

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

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

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

FIGURE Q5c(ii)