UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME : GEOLOGY ENGINEERING

COURSE CODE : BFC 21303 / BFC 3013

PROGRAMME : BACHELOR OF CIVIL ENGINEERING WITH HONOURS

DATE : JUNE 2015/JULY 2015

DURATION : 3 HOURS

INSTRUCTION : A) ANSWER ONLY **THREE (3)** QUESTION IN PART A

B) ANSWER **ALL** QUESTIONS IN PART B

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

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PART A

Q1 (a) Discuss the igneous rock classification based on silica content and gives an example of each.

(9 marks)

(b) Briefly describe the following physical property of a mineral:-

(i) Colour

(ii) Streak

(iii) Luster

(iv) Hardness

(8 marks)

(c) Briefly describe the tectonism process that changes the earth's structure.

(3 marks)

(d) Explain the factor of the rock composition in controlling the rate of weathering via rock examples.

(5 marks)

Q2 (a) Discuss the seismic refraction method related to its concepts, applications, advantages and disadvantages.

(8 marks)

(b) Justify how foliation planes in metamorphic rocks may become critical to the stability of the material in rock slope or excavation.

(5 marks)

(c) Give your opinion on how to evaluate the rock mass strength.

(5 marks)

(d) Illustrate the compositional layers and mechanical layers of earth.

(3 marks)

(e) Explain **TWO (2)** different processes of weathering.

(4 marks)

Q3 (a) With suitable illustration, explain the following terms:-

(i) Lithification process

(ii) Clastic sedimentary rock

(iii) Organic sedimentary rock

(iv) Inorganic chemical sedimentary rock

(12 marks)

(b) The standard length of the rock core was 1.5 m for each sequence of the rock drilling work. Calculate the Rock Quality Designation (RQD), Total Core Recovery (TCR) and Solid Core Recovery (SCR) for the obtained rock sample below.

| 33.6 cm | 16.8 cm | 19 cm | 9 cm | 11.5 cm | 25 cm |
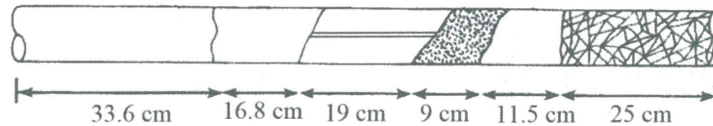
(6 marks)

(b) Explain the importance of studying mineral in civil engineering.

(4 marks)

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

(3 marks)

Q4 (a) Explain in detail the erosion by wind.

(8 marks)

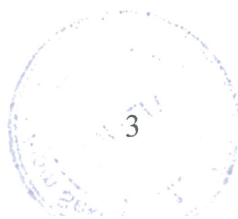(b) Define the term of rock mechanics and explain the important scopes of rock mechanics.

(6 marks)

(c) List the index test in rock testing.

(3 marks)

(d) Explain the metamorphism grades for a parent rock of shale.

(8 marks)

PART B

Q5 (a) Briefly explains the discontinuity characteristics that should be recorded in the assessment of the rock slope stability.

(2 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	= 70°
Height of rock slope	= 80 m
Depth of tension cracks	= 3 m
Unit weight of the rock	= 25 kN/m³
Unit weight of water	= 9.81 kN/m³
Cohesion of the discontinuity	= 100 kPa
Friction angle for the discontinuity	= 30°

TABLE 2

Joint set 1	Joint set 2	Joint set 3
120°/60°	240°/70°	170°/55°

(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 Q1b(ii)** when the tension crack is completely filled with water.

(5 marks)

(iii) Recommend a suitable new rock slope dip direction in order to avoid potential any mode rock slope failure.

(10 marks)

-END OF QUESTION-

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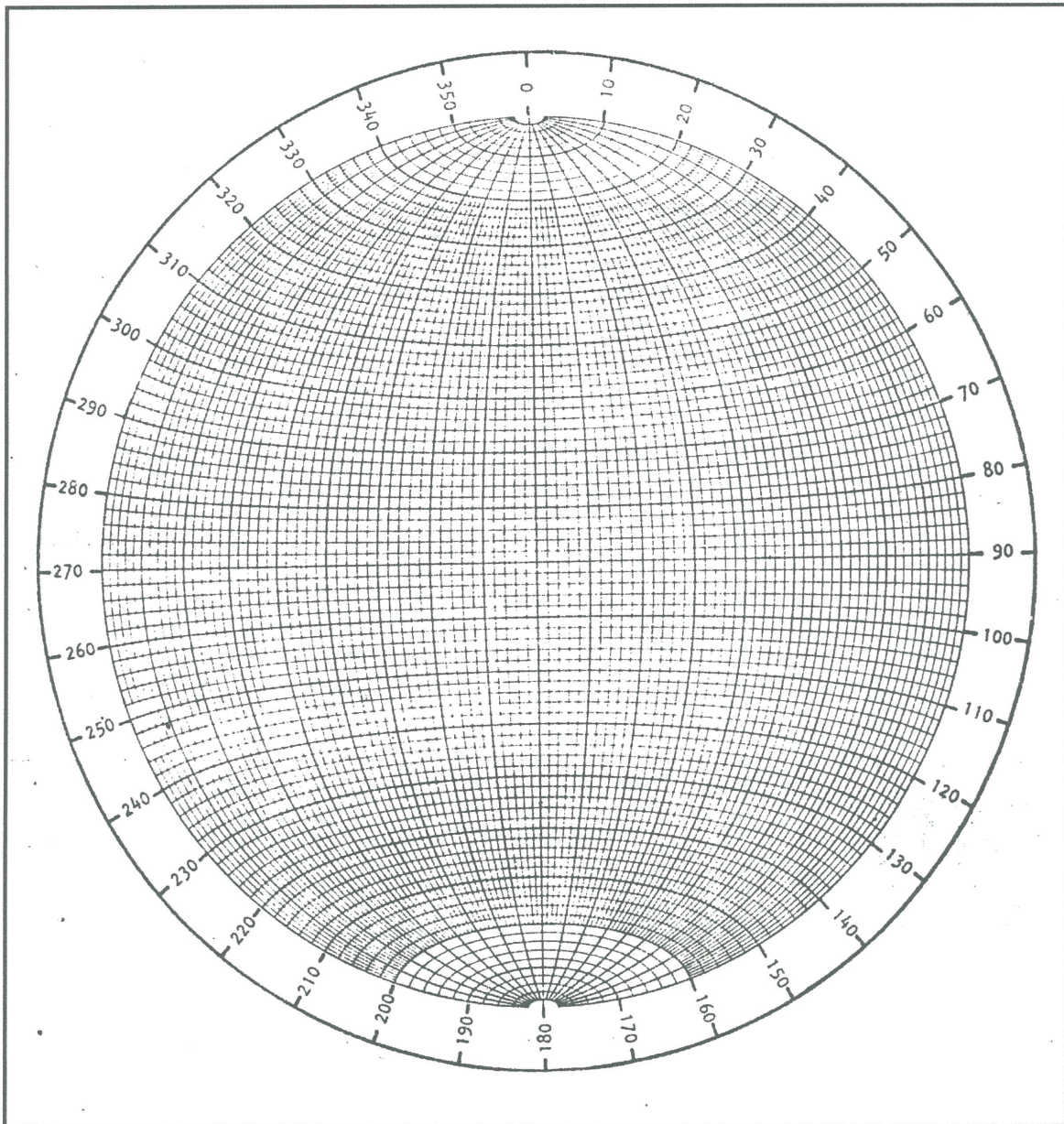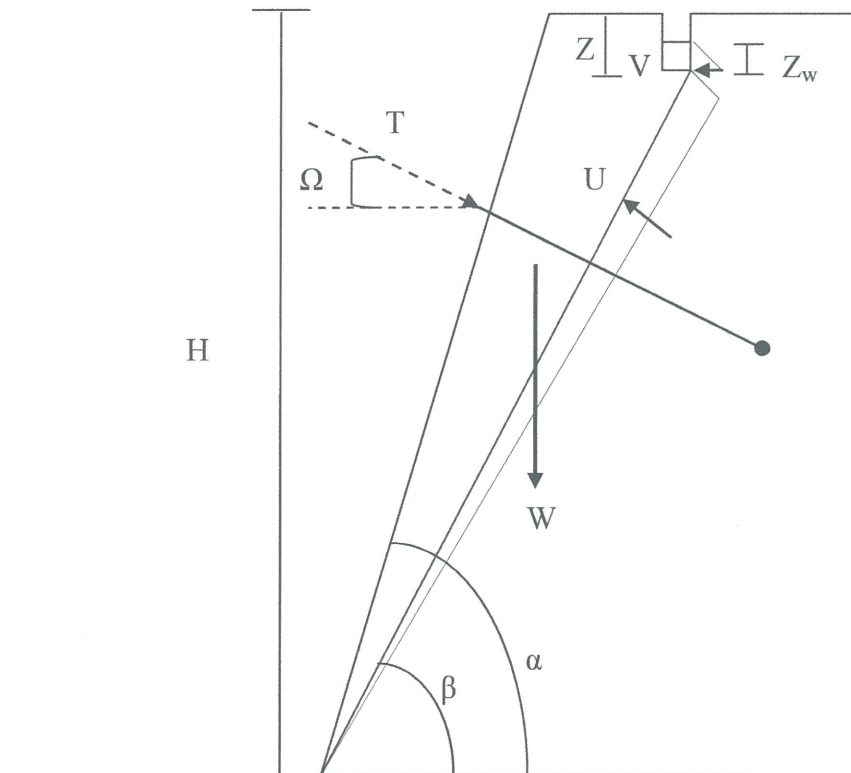COURSE : ENGINEERING GEOLOGY   COURSE CODE : BFC 21303 / BFC 3013

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

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Given:

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

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

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

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

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

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

FIGURE Q5c(ii)