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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016**

COURSE NAME : ENGINEERING GEOLOGY
COURSE CODE : BFC 21303/ BFC 3013
PROGRAMME CODE : BFF
EXAMINATION DATE : JUNE/JULY 2016
DURATION : 3 HOURS
INSTRUCTION : ANSWER ALL QUESTIONS

THIS QUESTION PAPER CONSISTS OF SEVEN (7) PAGES

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- Q1** (a) Explain the major concepts of earth physical features. (4 marks)
- (b) Explain the terms engineering geology and rock mechanics. (5 marks)
- (c) Illustrate and explain the physical properties of streak and hardness in mineral. (6 marks)
- (d) Classify and explain the igneous rock classification based on mineralogical and chemical composition. (10 marks)
- Q2** (a) List **THREE (3)** agents of metamorphism. (3 marks)
- (b) Describe the metamorphism types with particular reference to:
- (i) Contact metamorphism
 - (ii) Regional metamorphism
 - (iii) Dynamic metamorphism
- (3 marks)
- (c) Explain the characteristics of sedimentary rocks with particular reference to:
- (i) Texture
 - (ii) Fossils
 - (iii) Ripple marks
- (6 marks)
- (d) Describe the diagenesis of sedimentary rock specifically on lithification process. (6 marks)
- (e) Explain and illustrate the physical weathering with particular reference to:
- (i) Frost action (3 marks)
 - (ii) Unloading (2 marks)
 - (iii) Organic activities (2 marks)

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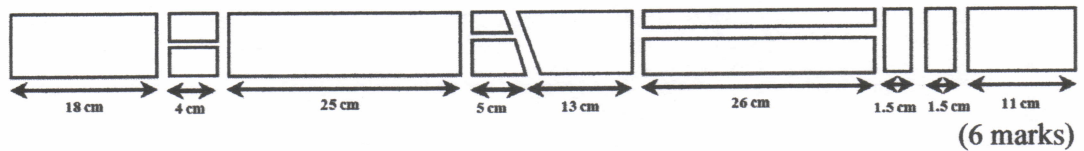
Q3 (a) The configurations of the land surface are the outcome of the geological structure and geological agents.

(i) Sketch and explain the movement of bed load in a stream. (3 marks)

(ii) Classify, sketch and explain all categories of fault. (4 marks)

(b) Discuss the seismic refraction method related to its concepts, applications, advantages and disadvantages. (6 marks)

(c) 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 rock sample below.



(d) Explain the rock testing with particular reference to:

- (i) Point load test
 - (ii) Rebound hammer test
 - (iii) Shear test
- (6 marks)

Q4 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° . The upper slope of rock slope is flatted.

(a) Calculate the factor of safety for wedge failure mode using the formula in **Figure Q4(a)** when the tension crack is completely filled with water. (10 marks)

(b) Calculate the factor of safety for planar failure mode using the formula in **Figure Q4(b)** when the tension crack is completely filled with water. (4 marks)

(c) Calculate the tensional anchor force required to increase the factor of safety to 1.5 using similar condition in **Q4(b)**. The inclined anchor is 20° . (3 marks)

(d) Via maintains the slope angle, interpret a suitable new rock slope dip direction in order to avoid any potential of rock slope failure mode using the equatorial equal-area stereonet in **Figure Q4(d)**. (8 marks)

-END OF QUESTIONS-

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TABLE 1

Slope dip direction	= 270°
Slope angle	=70°
Height of rock slope	= 100 m
Depth of tension cracks	= 3 m
Unit weight of the rock	= 25 kN/m ³
Unit weight of water	= 9.81 kN/m ³
Cohesion of the discontinuity	= 150 kPa
Friction angle for the discontinuity	= 35°

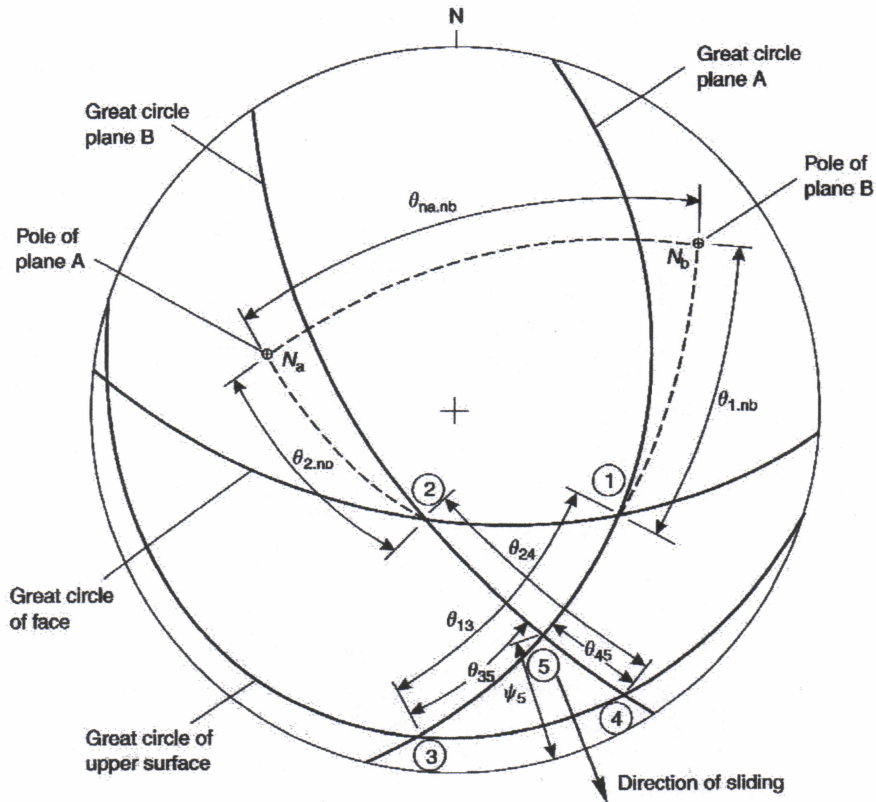
TABLE 2

Joint set 1	Joint set 2	Joint set 3
252°/50°	330°/60°	85°/60°

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Given:

$$Fos = \frac{3}{\gamma H_t} (C_a.X + C_b.Y) + (A - \frac{\gamma_w}{2\gamma}.X)Tan\phi_b + (B - \frac{\gamma_w}{2\gamma}.Y)Tan\phi_b$$

C_a = Cohesion

ϕ_b = Friction angle

H_t = height of wedge

ψ_a = dip angle for plane a

ψ_b = dip angle for plane b

ψ_5 = dip angle for wedge intersection

γ = unit weight of rock

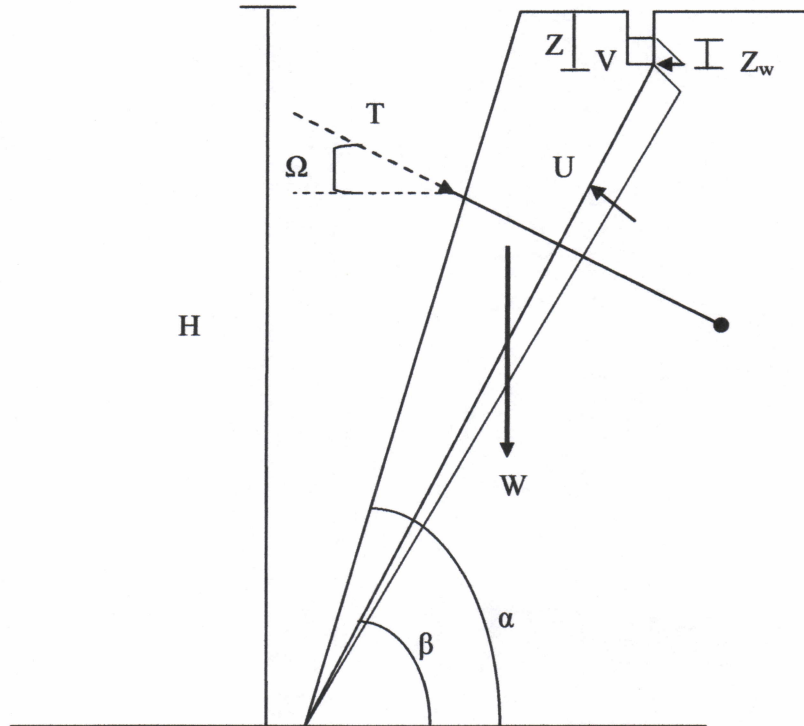
γ_w = unit weight of water

X, Y, A, B is factor which depend upon the geometry of wedge

$$X = \frac{Sin\theta_{24}}{Sin\theta_{45}Cos\theta_{2.na}} \quad Y = \frac{Sin\theta_{13}}{Sin\theta_{35}Cos\theta_{1.nb}} \quad A = \frac{Cos\psi_a - Cos\psi_bCos\theta_{na.nb}}{Sin\psi_5.Sin^2\theta_{na.nb}}$$

$$B = \frac{Cos\psi_b - Cos\psi_aCos\theta_{na.nb}}{Sin\psi_5.Sin^2\theta_{na.nb}}$$

FIGURE Q4(a)

CONFIDENTIAL**FINAL EXAMINATION**SEMESTER / SESSION : II/ 2015/2016
COURSE : ENGINEERING GEOLOGYPROGRAMME : BFF
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$$\text{FOS} = \frac{cA + (W \cos\beta - U - V \sin\beta + T \sin(\Omega + \beta)) \tan\phi}{W \sin\beta + V \cos\beta - T \cos(\Omega + \beta)}$$

A = failure plane area

 ϕ = friction angle

c = cohesion

U = vertical water pressure

W = weight of failure block

V = horizontal water pressure

 β = failure plane angle α = slope angle

H = height of plane

Z = tensional cracks

T = tension of anchor

 Ω = inclined angle of anchor γ_r = unit weight of rock γ_w = unit weight of water

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

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

$$U = \frac{1}{2} \gamma_w Z_w (H-Z) \cdot \text{cosec } \beta$$

$$V = \frac{1}{2} \gamma_w Z_w^2$$

$$\text{cosec } \beta = \frac{1}{\sin \beta}$$

$$\text{sec } \beta = \frac{1}{\cos \beta}$$

$$\cot \beta = \frac{1}{\tan \beta}$$

FIGURE Q4(b)**CONFIDENTIAL**

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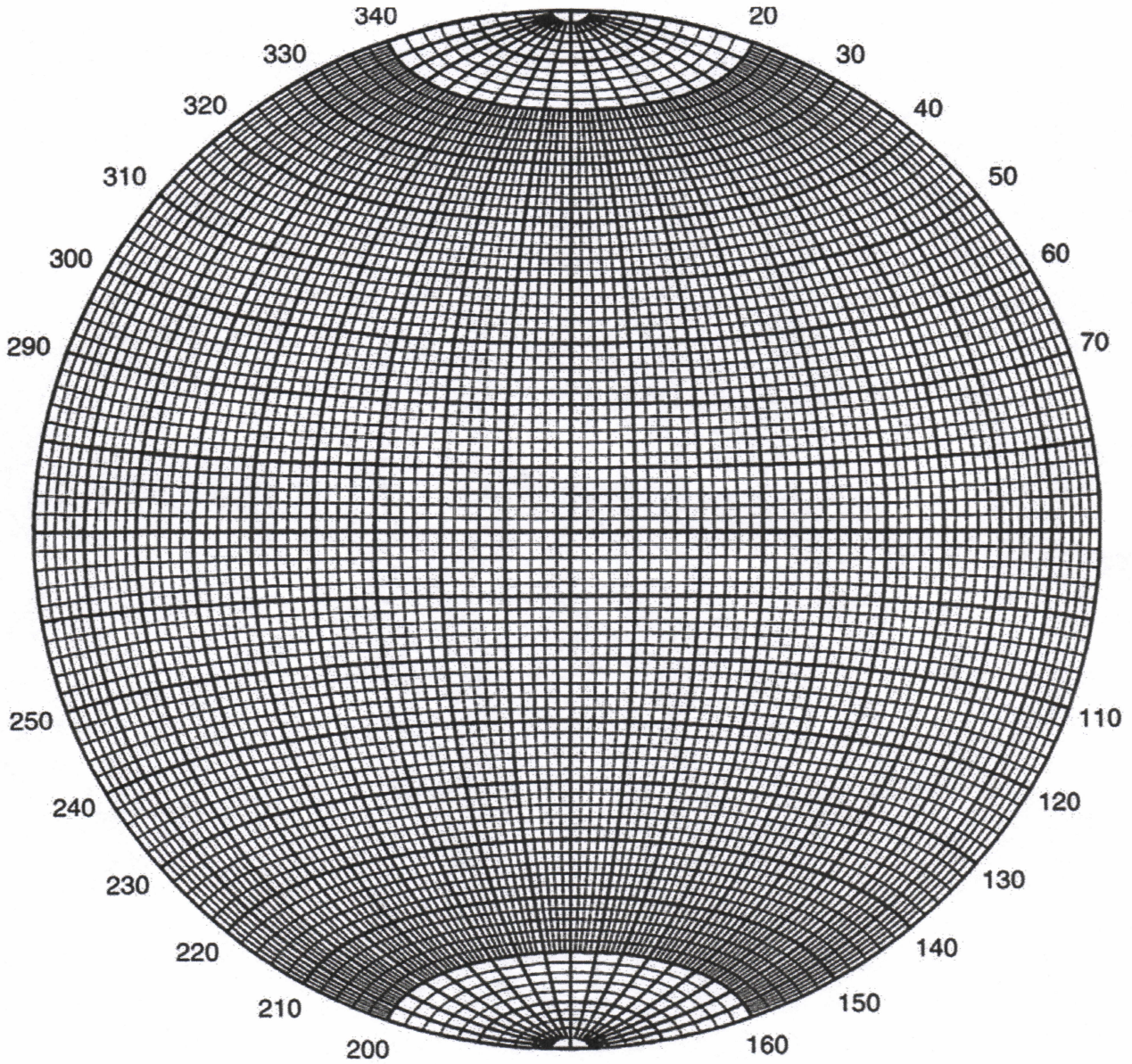


FIGURE O4(d): Equatorial equal-area stereo-net marked in 2° intervals

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