THE PAPUA NEW GUINES UNIVERSITY OF TECHNOLOGY

DEPARTMENT OF MINING ENGINEERING

2020 SECOND SEMESTER EXAMINATION

Third Year Mining Engineering

MN314 – GEOMECHANICS II

DATE: **Friday 30th October 2020**

TIME: **8:20 A.M.**

TIME ALLOWED: **3 HOURS**

INFORMATION FOR CANDIDATE:

1. You have ten minutes to read this question paper. You **SHOULD NOT** begin writing during this period.

2. There are **5 (Five) Questions** altogether. You are to answer **ALL 5 (Five)** questions

3. Marks for each question is as indicated. Maximum of **100 marks**.

4. **ALL** answers must be written on the answer booklet provided. No other written materials will be accepted.

5. Write your **NAME** and **STUDENT NUMBER** clearly on the **ANSWER BOOK**. **DO THIS NOW**.

QUESTION 1 (*20 Marks*)

Part A .... *12 marks*

A slope is shown in figure 1. below. AC represents a plane of structural discontinuity without any vertical tension crack.

a) For the wedge ABC derive the limit equilibrium equation to calculate the factor of safety.
b) Use the formular to calculate the factor of safety.

Notes:

Factor of safety = resisting force/inducing force

$$\tau = c + \sigma_n tan\theta$$

τ = shear strength of joint contact

θ = internal friction angle

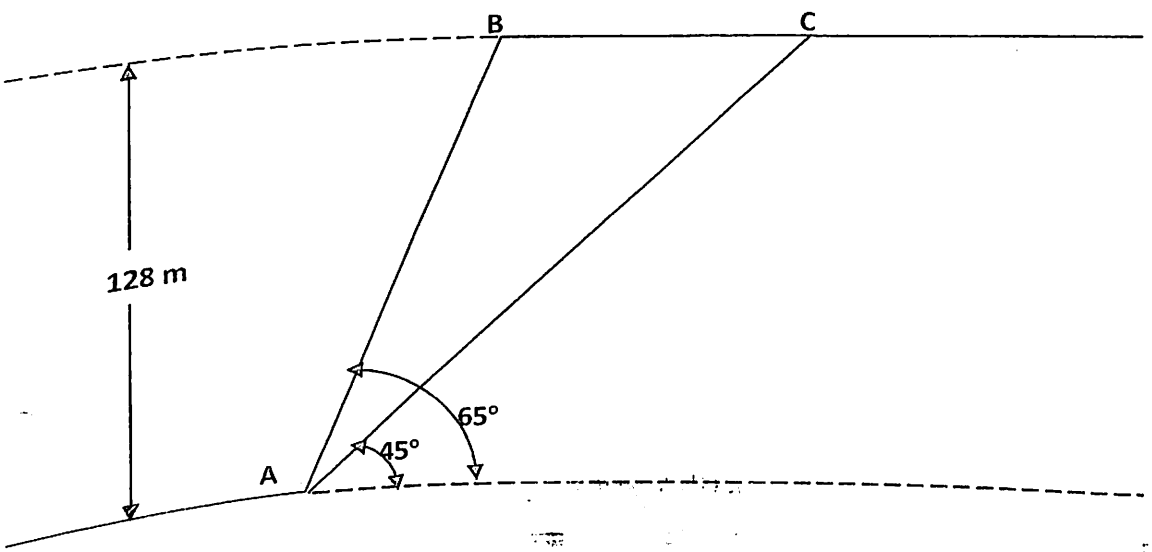
σ_n = normal stress

c = Cohesion

Rock unit weight = 24 kN/m^3

Cohesion (c) = 220 kPa

Friction angle (θ) = 30°



Part B ..... *(8 marks)*

Figure 2 below shows the different geometry of failure types.

a) Name the failure type ..... *(2 marks)*
b) Discuss in detail the mechanics of main cause of each type of failure ..... *(6 marks)*

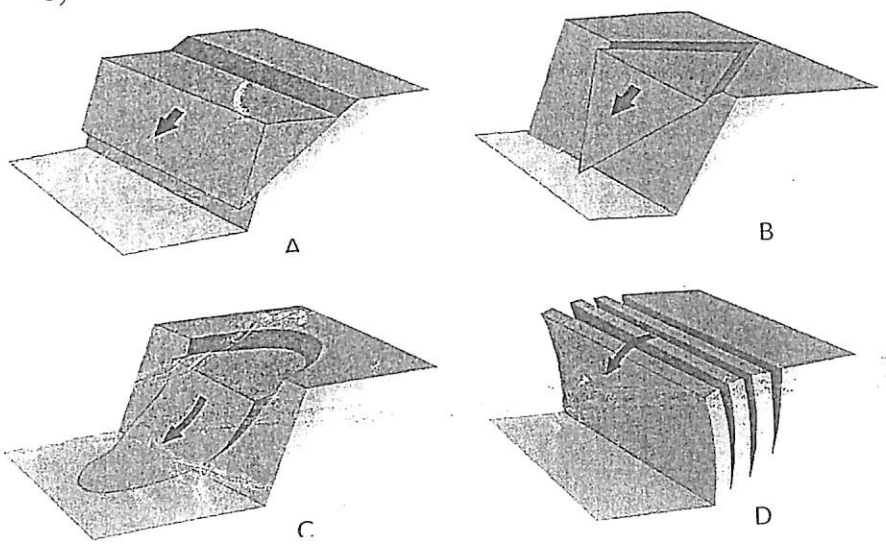


Figure 2

QUESTION 2 *(20 marks)*

Write short notes on any **FIVE** of the following. **MUST** provide diagrams and equation to aid your explanation

i) Conventional methods and Numerical methods of slope stability analysis ... *4 marks*

ii) Effects of water on the slope stability ..... *4 marks*

iii) Plan failure and Circular failure .. ... *4 marks*

iv) Rock bolts .. ... *4 marks*

v) Stereographic projection and limit equilibrium analysis ..... *4 marks*

vi) Effect of cohesion and friction angle on slope stability ..... *4 marks*

vii) Conditions of plan failure ... ... *4 marks*

QUESTION 3 (*20 Marks*)

Read the following statements carefully and rewrite the statement in correct form and in details.

i) As the rockmass behind each slope is simple, standard answers about their stability are always available. ..... ***2 marks***

ii) Vast sums of money can be saved by flattening of pit slopes. .... ***2 marks***

iii) Water is excellent for slope stability and stabilizes the slopes .... ***2 marks***

iv) The plane on which sliding occurs must strike across the slope face for plane failure condition... .... ***2 marks***

v) The angel of internal friction of a failure plane must be greater then the dip of that plane, for a plane failure condition. .... ***2 marks***

vi) Circular failure can ocure in a jointed hard rock mass such as granite .... ***2 marks***

vii) RQD is not very important in evaluating rock mass quality .. .... ***2 marks***

viii) Rock mass strength is same as intact rock strength .... ***2 marks***

ix) Sterographic projection is a numerical technique used to evaluate slope stability ..... ***2 marks***

QUESTION 4. (40 marks)

During your Geology and Geomechanics field trip, you observed different geological formations. For the following locations; A) Markham B) Bena Bridge. C) Chuave to Kundiawa.

For each location, discuss the following:

i) Regional and local geological formations related to slope stability. ..... ***5 marks***

ii) Related slope stability problem and types of failure you would expect and why ..... ***5 marks***

iii) Geological structures that might induce slope stability ..... ***5 marks***

iv) Discuss remedial measures or design approach you would take to minimize the slope stability problem. .... ***5 marks***

Provide diagrams and sketches to aid you discussions.