



PROGRAM : **BENG
MINING ENGINEERING**

SUBJECT : **GEOTECHNICAL ENGINEERING 3A**

CODE : **GEMIN3A**

DATE : **MAIN EXAMINATION
29 MAY 2019**

DURATION : **3 HOURS (8H30 -10H30)**

TOTAL MARKS : **100 Marks**

WEIGHTING : **60% YrMark**

EXAMINER : **WB MOTLHABANE**

MODERATOR : **J. MARITZ**

INSTRUCTIONS: PLEASE READ INSTRUCTIONS!!

- 1. ANSWER ALL QUESTIONS FULLY!**
 - 2. UNDERLINE AFTER EACH QUESTION AND LABEL THE QUESTIONS AS LABELLED IN THE PAPER**
 - 3. NO CELLPHONES (SWITCH-OFF)**
 - 4. DO NOT USE TIPPEX.**
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QUESTION ONE

- a. A mine dump in a small mining town is located next (and along) the main access road into town. The dump is 300m long and divided into 5 sections of varying heights: 8m, 12m, 20m and 25m. The internal friction angle of the dump material is 30 degrees, density 2.5 g/cm³ and the internal cohesive strength of 5 kpa. Average angle of repose of the dump material is 60 degrees. The town experiences heavy rainfall throughout the year.

Investigate the safety of motorists driving along this route throughout the year and provide recommendations where necessary.

[20]

- b. A block wedge with a potential for planar failure is observed on a high wall face. A wedge block has height of 3m and base area 2m x 3m and is inclined by 50 degrees from the horizontal. Four (4) cable anchors are installed horizontally to support this block wedge on the basis of a factor of safety of 2. The following information is also given:

Cohesive strength of the failure plane and friction angle of the failure – 30kpa & 30°, respectively.

Uplift and horizontal pressures due to water – 2kN & 0.5kN, respectively.

Rock Density – 2.8 tons/m³

- i. Determine the tension in each cable bolt. **[10]**
- ii. Quantify the effect that water drainage (pumping) would have on the stability of the wedge. **[5].**

[Question 1: 35 MARKS]

QUESTION TWO

- a) Bord and Pillar Section A with square pillars is situated 70m below surface and has the following layout parameters:

Factor of Safety: 2

Mining height: 3m.

Pillar Centre: 14m

Another Bord and Pillar Section B situated 90m below surface has the same mining parameters. Determine the percentage difference in the maximum subsidence for both panels.

[15]

- b) Three geophones (G1, G2 & G3) were installed in a mine at X;Y coordinates: G1 (11; 4), G2 (10; 7) & G3 (2, 10). The difference in arrival times of P and S waves are, 0.112, 0.1 and 0.12, respectively. Locate the position of the event using triangulation method.

Poisson Ratio = 0.25

Young's Modulus = 65 Gpa

Rock Density = 2.75 t/m³

[15]

[Question 2: 30 Marks]

QUESTION THREE

- a. Differentiate between seismic event and a rock burst. [3]
b. Differentiate between crush types and slip type events. [4]
c. Calculate the difference in arrival times at the geophone between the P and S waves emanating from the same source, given that:

Poisson's ratio = 0.3

Distance between source and Seismometer = 600m

Modulus of Elasticity = 60 GPa

Rock Density = 3 tons/m³

[15]

- d. Discuss four (4) types of data you may have to collect when performing rock mass characterization. [4]
e. Distinguish between Core Recovery and RQD and illustrate with relevant expressions for both. [4]
f. Explain which (and why?) is the more stable pit slope configuration between convex and concave shaped pit configurations. [5]

[Question 3: 35 Marks]

TOTAL MARKS [100]