

EXAMINATION PAPER

SUBJECT: CERTIFICATE IN ROCK MECHANICS PAPER 3.1 : HARD ROCK TABULAR	EXAMINER: MCB STANDER
SUBJECT CODE: COMRMC	MODERATOR: KR BRENTLEY
EXAMINATION DATE: 11 MAY 2017	
TIME: 14:30 – 17:30	TOTAL MARKS: [100] PASS MARK: (60%)

Formatiert: Nicht Hervorheben

NUMBER OF PAGES:

THIS IS NOT AN OPENBOOK EXAMINATION – ONLY REFERENCES PROVIDED ARE ALLOWED

SPECIAL REQUIREMENTS:

1. Only answer **FIVE (5)** of the six questions. Answer the questions **legibly** in English.
2. Write your **ID Number** on the outside cover of each book used and on any graph paper or other loose sheets handed in.

NB: Your name **must not** appear on any answer book or loose sheets.

3. Show all calculations **and check calculations on which the answers are based.**
4. Hand-held electronic calculators may be used for calculations. Reference notes may not be programmed into calculators.
5. Write **legibly** in ink on the **right hand page** only – **left hand pages will not be marked.**
6. Illustrate your answers by means of sketches or diagrams wherever possible.
7. **Final answers** must be given to an accuracy which is typical of practical conditions, however be careful not to use too few decimal places during your calculations, as rounding errors may result in incorrect answers.

NB: Ensure that the correct unit of measure (SI unit) are recorded as marks will be deducted from answers if the incorrect unit is used even if the calculated value is correct.

8. In answering the questions, full advantage should be taken of your practical experience as well as data given.
9. Please note that you are not allowed to contact your examiner or moderator regarding this examination.
10. Cell phones are **NOT** allowed in the examination room.

QUESTION 1. GENERAL

Formatiert: Schriftartfarbe:
Automatisch

Choose the **correct** answer?

In your exam book only write the relevant question number and correct answer.

- 1.1 What is the required Support Resistance if the design fall out height is 1.3m, assuming a Factor of Safety of 1.2 must be implemented? (2)

Rock Mass Density = 3 t/m³

Gravitational Acceleration = 9.81 m/s²

$$SR = \frac{F}{A}$$

- (a) 38.26 kN/m² (b) 45.91 kN/m² (c) 31.88 kN/m² (d) 35.22 kN/m²

- 1.2 What is the required Energy Absorption of the support system if the design fall out height is 1.3m, assuming a Factor of Safety of 1.2 must be implemented? (2)

Rock Mass density = 3 t/m³

Gravitational acceleration = 9.81 m/s²

Ejection velocity = 1.5 m/s

Arresting distance = 0.4 m

Stoping width = 1.2 m

$$Ea = mgh + \frac{1}{2}mv^2$$

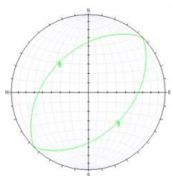
- (a) 15.56 kJ/m² (b) 19.69 kJ/m² (c) 25.48 kJ/m² (d) 23.63 kJ/m²

- 1.3 Which of the following stereonet projections would represent two orthogonal joints with the following orientations?

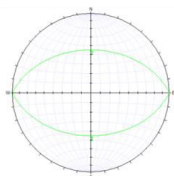
Dip Dip Direction

45° 225°

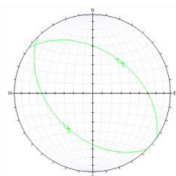
45° 315°



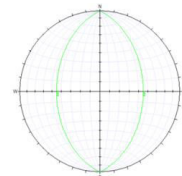
(a)



(b)



(c)



(d)

- 1.4 A rockmass contains three joint sets. Given the following information regarding the Joint sets calculate the RQD? (2)

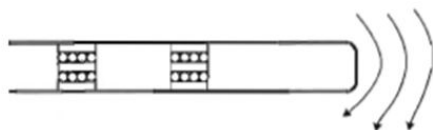
Joint set	Dip	Dip Direction	Spacing	RQD = 115 - 3.3 Jv
J1	45°	35°	0.5m	$Jv = \frac{1}{J_1} + \frac{1}{J_2} + \frac{1}{J_3}$
J2	65°	215°	0.8m	
J3	25°	90°	0.2m	

- (a) 93 (b) 100 (c) 88 (d) 65

- 1.5 Examine the following photograph of a deformed borehole: (2)



Which of the following tunnel locations relative to the stope would tend to show similar rockmass behaviour?



- (a) (b) (c) (d)

Indicate whether the following is **True** or **False**?

In your exam book only write the relevant question number and correct answer.

- 1.6 Monomineralic Rocks is applied to rocks composed of one mineral type only. (2)
Examples would include the **igneous rock Anorthosite** (composed entirely of plagioclase feldspar) and the metamorphic rock **Marble** (composed entirely of **calcite**)
- 1.7 When Arsenopyrite is heated, it becomes magnetic and gives off toxic fumes. (2)
- 1.8 Preconditioning is a controlled blasting method that ensures optimal face advance. (2)
Preconditioning improves rock mass conditions and ensures minimal damage to installed support units. Preconditioning is usually implemented in development ends when poor rock mass conditions are encountered.
- 1.9 ERR (Energy Release Rate) level is directly influenced by stress and convergence. (2)
- 1.10 Paste fill is a Backfill method that utilizes **Classified Cycloned Tailings (CCT)** (2)
prepared from concentrator tailings by hydrocyclone treatment to remove the slimes or clay-sized fraction. In most cases, the highest proportion of the fill product lies in the 40-150µm range of particle size and the proportion of -10µm material is less than 4%. It is very expensive and known as the Rolls Royce of Backfill methods.

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1.11

QUESTION 2. ~~ROCK AND ROCKMASS BEHAVIOUR.~~

2.1

~~With the aid of annotated sketches, depict 6 (six) appropriate gully configurations for high stress conditions?~~

(6)

2.2

~~List and briefly describe how 3 (three) possible problems are dealt with, that may cause unstable rockmass conditions, in gullies located in a high stress environment?~~

(6)

2.3

~~Describe Extension Fractures and Shear Fractures?~~

(8)

Formatiert: Mit Gliederung + Ebene: 2 + Nummerierungsformatvorlage: 1, 2, 3, ... + Beginnen bei: 1 + Ausrichtung: Links + Ausgerichtet an: 0 cm + Einzug bei: 1,02 cm

Formatiert: Standard, Keine, Einzug: Links: 0 cm

Formatiert: Schriftart: 12 Pt.

Formatiert: Schriftartfarbe: Automatisch

Note: Annotated sketches may be used to assist with your description.

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QUESTION 3. ROCK AND ROCKMASS BEHAVIOUR.

3.1 With the aid of annotated sketches, depict 6 (six) appropriate gully configurations for high-stress conditions? (6)

3.2 List and briefly describe how 3 (three) possible problems are dealt with, that may cause unstable rockmass conditions, in gullies located in a high-stress environment? (6)

3.3 Describe Extension Fractures and Shear Fractures? (8)

Note: Annotated sketches may be used to assist with your description.

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QUESTION 4. MINE SEISMICITY

Formatiert: Schriftartfarbe:
Automatisch

4.1 Briefly describe the objectives of Seismic Monitoring in Mines? (10)

4.2 Explain the difference between Hypocentre and Epicentre? (2)

4.3 Describe Seismic Moment? (2)

4.4 Describe Radiated Seismic Energy? (2)

Formatiert: Standard, Keine

4.5 List and briefly describe four potential seismic sources associated with narrow tabular mining environments? (4)

Formatiert: Keine Aufzählungen oder
Nummerierungen

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QUESTION 5. MINING LAYOUT STRATEGIES.

Formatiert: Schriftartfarbe:
Automatisch

5.1 List 6 (six) Ore-body properties that would influence the choice of mining method? (6)

- 5.2 You are part of a project team investigating the mining of a relatively undisturbed Ore-body. The Ore-body dips at approximately 10 degrees and is located between 100m and 400m below surface. The average channel width ranges between 5m and 9m. Which mining method will be best suited for this Ore-body? Explain the fundamental mining and rock engineering principles associated with your chosen mining method? (14)

Note: Annotated sketches may be used to assist with your description.

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QUESTION 6. MINING SUPPORT STRATEGIES.

Formatiert: Schriftartfarbe:
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6.1 Explain the following two terms? (4)

- “Support”
- “Reinforcement”

6.2 Draw an annotated sketch to depict key support characteristics. Indicate on your sketch the following terms and provide a short explanation? (6)

- Pretension.
- Yielding Load and Yieldability.
- Energy Absorption.

6.3 You are required to design a support system for an underground mine. Describe the process that you will follow? (10)

Note: Annotated sketches may be used to assist with your description.

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QUESTION 7. INVESTIGATION TECHNIQUES

Formatiert: Schriftartfarbe:
Automatisch

7.1 With the aid of annotated sketches explain 3 (Three) techniques used to determine in-situ stress in the underground rockmass? (10)

7.2 As part of a final extraction phase the mine where you are employed is planning to remove historically left pillars. You are required to monitor the rock mass behaviour in a selected trial area. Explain **what** you will intend to monitor and **how** you intend to monitor? (10)

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Total Mark = [100]