



MINERALS COUNCIL
SOUTH AFRICA

EXAMINATION PAPER

SUBJECT: CERTIFICATE IN ROCK MECHANICS PAPER 2: BASIC ROCK MECHANICS PRACTICE SUBJECT CODE: COMRMC2 DATE: 04 NOVEMBER 2020 TIME: 14h30 – 17h30 (3 hours)	EXAMINER: MCB STANDER MODERATOR: KR BRENTLEY TOTAL MARKS: [100] PASS MARK: (60%)
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NUMBER OF PAGES: 4

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

SPECIAL REQUIREMENTS:

1. **Answer All the 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. GEOTECHNICAL CHARACTERISTICS

1.1 List two rock types that occur in each of the following general geological sequences. (4)

- The Karoo sedimentary period
- The Witwatersrand Supergroup
- The Ventersdorp Supergroup
- The Transvaal Sequence

1.2 Consider the following scenario and answer **both (2)** questions below: (6)

A Raise (2.4m high and 1.6m wide) is being developed on the Carbon Leader Reef (CLR) horizon. The average reef dip of the CLR is 20°, dipping in a southern direction and with a channel width of 0.3m.

The raise is approaching a normal down-throw fault with a known displacement of 4m. The fault strikes parallel to the strike of the reef and dips at 40° in a northern direction. It is anticipated that the raise will intersect the fault within 15.0m

An approximate 2.5m thick, weak shale like layer, prone to swelling and deterioration when exposed, is located above the CLR. This layer is known as Greenbar. The CLR and Greenbar is separated by a 2.0m thick competent Quartzite layer.

1.2.1 Draw an annotated sketch indicating a section view of the Raise, displaying the CLR, Greenbar and Fault. (2)

1.2.2 List and briefly describe two rock related hazards that you would anticipate with the negotiation of the fault with the Raise development? (4)

[10]

QUESTION 2. MINE SEISMICITY

2.1 Define a **Seismic Event**? (1)

2.2 Provide a brief description of the **rupture processes** in **solid rock**? (3)

2.3 Provide a brief description of the **rupture processes** along a **pre-existing plane**? (3)

- 2.4 Explain the differences between seismic body waves and seismic surface waves? (4)
- 2.5 Explain the phenomena of **reflection** of seismic body waves? (3)
- 2.6 Explain the phenomena of **refraction** of seismic body waves? (3)
- 2.7 List three possible **damage mechanisms** associated with the potential influence of the occurrence of seismic events in proximity of mining excavations? (3)
- [20]**

QUESTION 3. FUNDAMENTAL PRINCIPLES OF MINING LAYOUTS AND MINING LAYOUT DESIGN

- 3.1 Explain how the removal of broken ore from the following stoping methods is implemented? (8)
- Open stoping and caving methods
 - Shrinkage methods
 - Longwall coal mining methods
 - Track bound narrow tabular stoping methods
- 3.2 Explain how **inclined shafts** are protected from the effects of mining induced stresses and displacements? (4)
- 3.3 List and briefly describe four (4) methods to direct and control air flow in to stope faces? (8)
- [20]**

QUESTION 4. MINING SUPPORT AND MINE SUPPORT DESIGN

- 4.1 Explain the differences between active and passive support? (4)
- 4.2 List two common types of friction anchors and explain how each is installed? (4)
- 4.3 You are required to provide Rock Engineering input in the drafting of a Quality (12)

assurance procedure associated with the application of Shotcrete on your mine. Detail the input that you will provide with reference to Site Examination and Preparation, Mixing and Application of Shotcrete, On-Site Quality Assurance and Off-site Tests to verify product quality.

[20]

QUESTION 5. INVESTIGATION AND EVALUATION

5.1 Explain the principles of the following numerical modelling techniques? (20)

- Finite Element Methods
- Finite Difference Methods
- Boundary Element Methods
- Distinct Element Methods
- Keyblock Methods

[20]

QUESTION 6. DRILLING AND BLASTING

6.1 Describe typical applications of Smooth wall blasting, Post-splitting and Pre-splitting? (6)

6.2 Explain the methods by which de-coupling of explosives is achieved? (4)

[10]

Total Mark = [100]