



EXAMINATION PAPER

SUBJECT: CERTIFICATE IN ROCK MECHANICS PAPER 2: BASIC ROCK MECHANICS PRACTICE SUBJECT CODE: COMRMC2 EXAMINATION DATE: 09 OCTOBER 2019 TIME: 14:30 – 17:30	EXAMINER: MCB STANDER MODERATOR: KR BRENTLEY TOTAL MARKS: [100] PASS MARK: (60%)
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NUMBER OF PAGES: 6

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

Indicate whether the following statements are **True or False?**

(10)

Statements:

1.1 General rock types in the immediate vicinity of Coal ore bodies are known to be Sandstone, Siltstone, Shale and Mudstone. The geotechnical importance of these rock types is that:

- Massive sandstone bridges across roadways,
- Laminated shale affects roof stability when present,
- Strengths of materials affect surface if caving occurs,
- Weathered material can assist caving and even result in 'plug' failures between pillars and;
- Jointed rock mass affects roof displacement.

1.2 A General rock type in the immediate vicinity of Manganese ore bodies is known to be Banded iron stone. The geotechnical importance of this rock type is that:

- Extremely laminated with weak cohesion between beddings.
- Span control is critical to prevent unravelling and significant support systems may be required to re-enforce the rockmass.
- Jointing is present in the rock and provides surface that allows freedom of movement in excessive spans.

1.3 General rock types in the immediate vicinity of gold ore bodies are known to be Quartzite, Shale and Lava. The geotechnical importance of these rock types is that:

- Siliceous quartzite presents a risk to violent failure. Argillaceous quartzite increases closure into mined out voids. Crossbedding causes stability problems.
- Rock mass is laminated, requiring span controls to ensure stability.
- Shale exposure results in collapses of the hangingwall unless small spans are maintained. Shale presence increases potential for bed separation and instability.
- Lava is jointed and in some areas of very poor quality. Several different lava types

exist, and each is associated with different behaviours, such as western area formation (WAF), which has poor strength and requires small spans to maintain stability.

1.4 General rock types in the immediate vicinity of diamond ore bodies are known to be Dolomite, Quartzite, Lava, Shale, Mudstone, Dolerite and Kimberlite. The geotechnical importance of these rock types is that:

- Dolomite is in essence massive, but jointed and very competent.
- Quartzite is often interbedded with shale and provides a well-laminated rock mass with little cohesion on bedding planes.
- Joints provide the freedom for displacements if uncontrolled.
- The lava is jointed but is in most instances very competent.
- Strong Kimberlite dykes and sills extended into openings formed in the host rock during the violent rupture process associated with the formation of Kimberlite volcanos.
- Kimberlite dykes and sills contain exceptionally high-quality diamonds.

1.5 General rock types in the immediate vicinity of Platinum and Chrome ore bodies are known to be Pyroxenite, Norite and Anorthosite. The geotechnical importance of these rock types is that:

- Normally very competent material with a large number of joints that traverse the rock.
- Presence of chromite layers within the material provides low cohesion surfaces that become unstable if not adequately supported.
- Stress fracturing of Norite materials appears to be very different to the other materials and care should be taken to limit Norite exposure in the hangingwall.

1.6 An Aquifer is an impermeable unit that will neither store nor transmit water.

1.7 Porosity is a key property of rock types forming an Aquifer that prevents the transmission of water and makes the rock type impermeable.

1.8 Stereo net projections of joints contained in rock masses are only used to present the

complexity of rockmass structure in a logical format in Feasibility Documents. This is required to indicate the degree of complexity of the host rock surrounding ore bodies and provides warning to investors.

- 1.9 Striations are linear furrows or grooves that result from movement on a fault or of a glacier on its base. Striation marks are therefore good indicators of the direction of movement.
- 1.10 Slickenside is a surface that is smoothly polished as a result of frictional movement between two closely spaced bodies of rock and as a result the surface may be striated. The slickenside is common along fault or shear zones.

[10]

QUESTION 2. MINE SEISMICITY

- 2.1 What **general parameter** is used to **express the strength** of seismic events recorded on a mines seismic network? (1)
- 2.2 List the **two non-primary source parameters** that are used to determine the parameter to express the strength of recorded seismic events? (2)
- 2.3 Provide the **mathematical equation** used to calculate the value used to express the strength of seismic events recorded on a mines seismic network? (2)
- 2.4 Recorded information, obtained from a seismic system installed on a mine, are analysed and various periodic reports are generated. The various reports are aimed at providing information regarding the seismic response measured on the mine. (15)

Explain **how** you would apply seismic information **to provide Rock Engineering input** to be timeously considered and integrated in **Mine Design, Planning and Operations?**

[20]

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

- 3.1 **List and Describe three (3) methods** that may be applied to **avoid leaving shaft pillars** in the vicinity of vertical shafts? (15)

Note: Annotated sketches may be used to substantiate your answer.

[15]

QUESTION 4. AUDITING FOR BEST PRACTICE

- 4.1 The Guidelines issued by the Chief Inspector of Mines regarding the Compilation of the Mandatory Rock Related Codes of Practices for various mining operations refers to an efficacious Rock Engineering Support Service (RESS) (10)

Explain the Purpose and the Envisaged basic supportive, functions and duties of an efficacious Rock Engineering Support Service (RESS)?

[10]

QUESTION 5. INVESTIGATION AND EVALUATION

- 5.1 Regarding measuring instruments **Explain** the following terms: (4)

- Accuracy
- Error
- Sensitivity
- Precision

- 5.2 Explain the installation procedure of a Doorstopper Strain Cell? (10)

- 5.3 What is a Piezometer? (1)

[15]

QUESTION 6. DRILLING AND BLASTING

- 6.1 In the period during and following the passage of a detonation wave along an explosive charge, the rock around the blast hole is subjected **three (3)** phases of loading. (15)

List and Explain the three (3) phases of loading?

Note: Annotated sketches may be used to substantiate your answer.

[15]

QUESTION 7. LEGAL COMPLIANCE AND GENERAL MANAGEMENT

- 7.1 Regulation 14.1.(8) of the Mine Health and Safety Act 29 of 1996, requires the Employer to timeously consider and integrate the input of a competent person in Mine Design, Planning and Operations. (15)

Explain the input you will provide **as the competent person** in each of the listed areas?

[15]

Total Mark = [100]