EXAMINATION PAPER

SUBJECT: CERTIFICATE IN ROCK MECHANICS: PAPER 2 **SUBJECT CODE:** COMRME **EXAMINATION DATE:** OCTOBER 2012 **TIME:** 9:00 – 12:00	**EXAMINER:** LJ SCHEEPERS **MODERATOR:** J LUCAS **TOTAL MARKS:** [100] **PASS MARK:** 60%

NUMBER OF PAGES: 4

SPECIAL REQUIREMENTS:

1. **ALL candidates to answer all 5 questions**
2. References other than those provided are not permitted.
3. Hand-held electronic calculators may be used.
4. Write your examination 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.

5. **Write in ink on the RIGHT HAND SIDE of the paper only (only the right hand pages will be marked).**
6. Show all calculations on which your answers are based.
7. Illustrate your answers by sketches of diagrams wherever possible.
8. In answering these questions, full advantage should be taken wherever necessary of your practical experience as well as of the data given.
9. Answers must be given to an accuracy that is typical of practical conditions.

QUESTION 1 Geotechnical characteristics (15 points)

Transfer and complete the table below into your answer sheet. Describe the 3 rock types (coal, quartzite and pyroxinite) in terms of fundamental class (Igneous, sedimentary or metamorphic), mineral content, geological sequence supergroup, active mining area where it can typically be found and its typical strength.

	Fundamental class	Mineral content	Super-group	Active mining area	Typical Strength [MPa]
Coal					
Quartzite					
Pyroxenite					

[15]

QUESTION 2.Rock and rockmass behavior (25 points)

2.1 Describe and explain how rock quality designation (RQD) may be determined from borehole core (2)

2.2 Compare and contrast Barton's Q system, Bieniawski's RMR and Laubscher's MRMR rockmass classification systems and their respective applications. (6)

2.3 Define a seismic event and a rockburst. (3)

2.4 How is a seismic event located? (5)

2.5 How do the rockmass properties influence the location of an event? (3)

2.6 Explain the difference between the terms hypo-centre and epicentreused in describing the location of seismic events (2)

2.7 Sketch and describe the complete stress-strain graph for rock in a triaxial compression test. (4)

[25]

QUESTION 3. Mining layouts (20 points)

3.1 Describe and explain how vertical shafts are protected from the effects of mining induced stresses and displacements (3)

3.2 Describe and explain how the ore around a vertical shaft may be mined early to avoid the necessity of leaving a shaft pillar (5)

3.3 Describe a mining strategy in an ultra-deep level mine. Explain your designed placement of access development (6)

3.4 Describe a mining strategy in a shallow mine. Explain your designed placement of access development (6)

[20]

QUESTION 4.Mining support design (20 points)

4.1 Describe an appropriate support strategy and explain your support design for haulages in an ultra-deep mine implementing the sequential grid mining strategy. (5)

4.2 Describean appropriate support strategy and explain your support design for follow-on development in an ultra-deep mine implementing the longwall mining strategy. (5)

4.3 Describe an appropriate support strategy and explain your support design for access ways in a shallow mine implementing the open stoping mining strategy. (5)

4.4 In an ultra-deep level narrow tabular mine using hydraulically placed classified tailings backfill placed in geotextile bags, a large number of bag failures have been reported. Discuss the potential causes that you would investigate to solve this problem. (5)

[20]

QUESTION 5. Monitoring, numerical modeling and risk assessment (20 points)

5.1 Describe the rock parameters which may be measured and the appropriate instruments to be used in a monitoring program in an aseismic mine. (5)

5.2 Identify, describe and explain the objectives of a seismic monitoring program in a seismically active mine. (6)

5.3 Describe and explain for which rock engineering application the following numerical modelling techniques are suitable (4)

5.3.1 Finite element methods

5.3.2 Finite difference methods

5.3.3 Boundary element methods

5.3.4 Keyblock methods

5.4 List at least 5 parameters to be included in a short-term panel hazard assessment to be used in the planning process on a shallow coal mine. (5)

[20]