



EXAMINATION PAPER

SUBJECT: CERTIFICATE IN ROCK MECHANICS PAPER 2: BASIC ROCK MECHANICS PRACTICE SUBJECT CODE: COMRMC DATE: 08 MAY 2024 TIME: 14H30 TO 17H30	EXAMINER: FP MOSIANE MODERATOR: S DURAPRAJ TOTAL MARKS: [100] PASS MARK: (60%)
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NUMBER OF PAGES: 5

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.

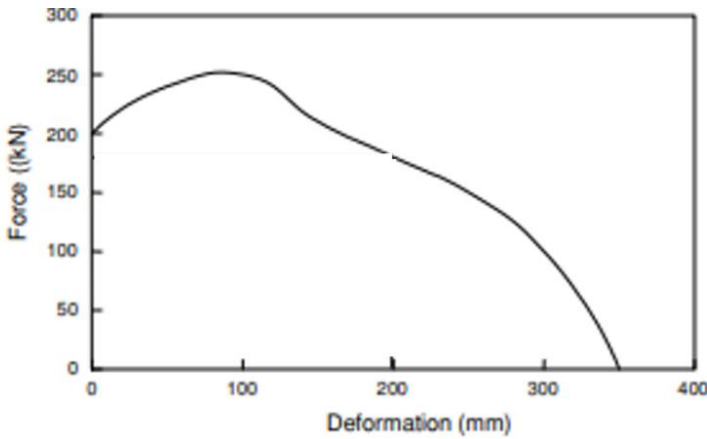
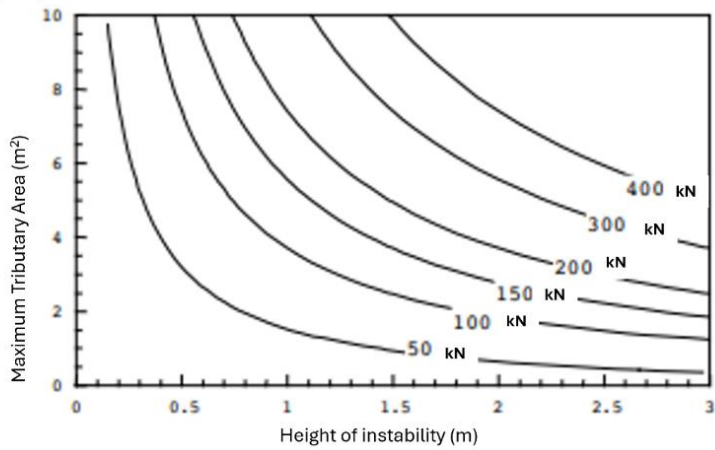
NB: Ensure that the correct unit of measure (SI unit) is recorded as marks will be deducted from answers if the incorrect unit is used even if the calculated value is correct.

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 AND OTHER SMART DEVICES are **NOT** allowed in the examination room.

QUESTION 1. GENERAL MULTIPLE CHOICE AND DEFINITIONS

1.1 In seismology, compression body waves are also known as:				
A. Rayleigh waves	B. Secondary waves	C. Surface waves	D. Primary waves	(1)
1.2 The reduction in amplitude or energy of a wave caused by the physical characteristics of the transmitting medium is called:				
A. Energy distribution	B. Geometric propagation	C. Attenuation	D. Amplitude Gradation	(1)
1.3 According to the simplified tributary area theory (TAT), the factors that influence pillar load are depth, pillar width, pillar centre spacing and rockmass geotechnical characteristics. Which of these factors can be controlled by mining layout?				
A. Pillar centre spacing and depth	B. Pillar width and pillar centre spacing	C. Pillar width and depth	D. Pillar centre spacing and pillar composition	(1)
1.4 If the gold (sampling value) called for at a mine is 250kg/month and the plant recovers 200kg of gold, what is the Mine Call Factor , if a 5% residue is reported on the gold achieved?				
A. 84%	B. 80%	C. 85%	D. 76%	(2)
1.5 Using the equation $N = \frac{W(f\sin\beta - \cos\beta\tan\phi) - cA}{C(\cos\alpha\tan\phi + f\sin\alpha)}$, determine the number (N) of rock bolts required to stabilize a sidewall wedge of weight (W) = 250 kN, ensuring a factor of safety (f) of 1.6. Ignore the cohesive strength (c) of the rock and assume the dip (β), friction angle (φ), angle between the bolts and the normal to the sliding surface (α) and base area of the siding surface (A) to be 60°, 45°, 20° and 15m ² , respectively. Each rock bolt has a load bearing capacity (C) of 90kN.				(2)
1.6 Define and briefly expand on the following terms: 1.6.1 Constitutive Law 1.6.2 Moment Tensor Inversion 1.6.3 Tensile Zone				(3)
				[10]

QUESTION 2. SUPPORT AND PILLAR DESIGN

The improved support design methodology as modified by Roberts,1999 and Daehnke et al,1998 considers various critical rock mass and support parameters, which influence the performance and effectiveness of support systems. 2.1 List and briefly discuss the 5 critical rock mass parameters that need to be considered in deep level underground mining?	(10)
Figure 1 is a force-deformation curve of the support unit. As the newly appointed Rock Engineer you have been requested to trial the support unit at your mine. The closure rate as measured in the stope is 20 mm per metre of face advance and the support unit is to maintain rock mass stability as the face is advanced a further 10m. The mine's fall of ground database suggests the height of instability (b) to be 1.5m. which is also in line with the position of the chromite stringer above the hangingwall at your mine. Figure 2 presents the tributary area requirements for rockfall conditions.  Figure 1: Design force – deformation curve  Figure 2: Tributary area requirements for rockfall condition 2.2. What type of support unit does the Force-Deformation curve in Figure 1 represent?	(1)

Assuming the Tributary Area Theory (TAT) and using the information provided, determine the following:	
2.3 The load carried by each support unit as the face is advanced a further 10m?	(2)
2.4 The maximum tributary area which should be maintained in order for the rock mass to be stable over this deformation range?	(2)
2.5 By means of a simple annotated stope plan sketch, indicate the minimum distance behind the face over which the support performance criteria must be met?	(2)
2.6 Explain why in pillar design , the Tributary Area Theory (TAT) is regarded as a conservative approach and explain what other simple method may be used to provide more optimal results?	(4)
2.7 By means of a simplified flow chart , explain the elastic pillar design process ?	(9)
	[30]

QUESTION 3. FUNDAMENTAL PRINCIPLES OF MINING LAYOUTS

Guidelines for the compilation of codes of practice define special areas as follows, <i>“During the course of routine mining an increased risk of rockfalls or rock bursts may develop. Such areas requiring additional attention and precautions must be designated special areas”</i> .	
3.1 With reference to the statement above, briefly discuss the layout considerations that need to be applied to remnant mining/special areas in deep level mines?	(10)
3.2 With respect to shallow environments, list 4 of the joint configurations that can be encountered.	(4)
3.3 Further explain these various configurations by making use of annotated sketches .	(2)
3.4 Briefly explain the ground control hazards associated with each of these configurations ?	(2)
Adits in rock formations are generally excavated by means of blasting. In this case problems exist due to the possibility of rock falls, especially when the mountain sides are high and steep, or to the movement of rock blocks and wedges or slabs. These problems can occur both during construction and during the tunnel operation.	
3.5 List and briefly discuss some of the active and passive remedial work that can be applied to prevent rock from detaching from the slope?	(12)
	[30]

QUESTION 4. RISK ASSESSMENTS

4.1 In terms of the Health and Safety Act, Act 29 of 1996, what are the legal requirements prescribing the Manager's response in dealing with identified geotechnical risks at a mine?	(5)
4.2. Describe , in a summarized form, the steps to effective Geotechnical Risk Management?	(10)
Chapter 23.4 of the Mine Health and Safety Act of 1996 prescribes that, the employer must report to the Principal Inspector of Mines, dangerous occurrences at the mine. 4.3 With respect to ROCKBURSTS and FALLS of GROUNDS, describe and explain how extensive and what damage must a fall of ground have inflicted underground to qualify as a reportable in line with the above-mentioned act? (Provide any 5 scenarios)	(5)
	[20]

QUESTION 5. INSTRUMENTATION AND MONITORING

5.1 Name any 5 rock engineering parameters that can be monitored in stopes , briefly discussing the reasons why it is important to conduct such monitoring.	10)
	[10]

Total Marks = [100]