

EXAMINATION FOR THE CERTIFICATE IN STRATA CONTROL

COAL OPTION

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA CERT. IN STRATA CONTROL (COAL.) SUBJECT CODE: COMCSC EXAMINATION DATE: 03 NOVEMBER 2020 TIME: 14:30 – 17:30 (3 HOURS)	EXAMINER: CHARL SKINNER MODERATOR: GRAHAM PRIEST TOTAL MARKS: [100] PASS MARK: 60%
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NUMBER OF PAGES: 6

SPECIAL REQUIREMENTS:

1. Answer **ALL** the questions
2. References other than those provided are not permitted. **Formulas are indicated on page 6 of this questionnaire**
3. Hand-held electronic calculators may be used.
4. Put your Identification number (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.

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

QUESTION 1 (PILLARS)

1.1 A new mine needs to be developed in the Witbank area. The following geological borehole stratigraphy data is available.

BOREHOLE SECTION				BOREHOLE SECTION			
DEPTH	SECTION	WIDTH	RECORD OF STRATA	DEPTH	SECTION	WIDTH	RECORD OF STRATA
20.75			Base of Friable Weathering	33.01		2.40	SANDSTONE/SILTSTONE, grey, interaminated, interbedded
23.60			Base of Weathering	34.29		1.28	SILTSTONE/SANDSTONE, dark, grey, interaminated, interbedded
24.34			2.85 SANDSTONE/SILTSTONE, grey, interaminated, interbedded	34.44		0.15	SANDSTONE, green, Medium-Grained, glauconitic
			0.74 SANDSTONE, grey, with minor silty laminae, Slightly weathered	36.49		0.44	COAL, No. 4 Roof Seam
			0.00 Base of Hard Weathering			1.61	COAL, No. 4 Top Seam
			5.97 SANDSTONE, white, Medium-to-Fine-Grained, with minor silty laminae			2.04	COAL, No. 4 Main Seam
30.31			0.30 DOLERITE, Pale, grey, finely crystalline Chilled.	38.53		0.68	COAL, No. 4b Seam
30.61				39.21		0.38	MUDSTONE, grey, slightly carbonaceous
				39.59		2.71	SILTSTONE, grey
				42.30		0.40	COAL, No. 3 Seam
				42.70		2.61	SILTSTONE, grey, with minor sandy laminae
				45.31		0.79	SANDSTONE, white, with minor silty laminae
				46.10		7.10	SANDSTONE, white, Coarse-to-Medium-Grained
				53.20		0.22	SILTSTONE/SANDSTONE, grey, interaminated, interbedded
				53.42		1.08	SANDSTONE, white, Coarse-to-Medium-Grained
				54.50		0.71	SANDSTONE/SILTSTONE, grey, interaminated, interbedded
				55.21		3.25	SILTSTONE, dark, grey
				58.46		3.14	SILTSTONE, grey, slightly, Sandy, with minor sandy laminae
				61.60			

- Calculate the Factor of Safety using the Van Der Merwe 2003 formulae for the main development of this continuous miner section? (10)
- Name 5 factors that influence sinkhole development? (5)
- Calculate the areal percentage extraction for an 11 road panel taking into account the barrier pillar, given the situation above? (2)

1.2 Your Mine Manager wants to start with partial pillar extraction on the mine to increase the life of the mine by taking a 3.6m lift down the centre of each pillar.

A panel that was mined as secondary development has been identified.

Given:

- Depth to roof = 89m
- Bord width = 6.8m
- Mining height 3.8m

Using Salamon & Munro, calculate the Factor of Safety of the original pillar and then the factor of safety after the cut has been taken? (8)

(25)

QUESTION 2 (SUPPORT DESIGN)

2.1 During a routine visit to one of the underground sections, you observe the following:

- Stonedust peeling off on the right hand side of all the roadways in the splits close to the pillar corners.
- Some of the roof bolt plates close to these corners are showing signs that the bearing plates are deforming.
- There is a prominent floor roll running diagonally across the section.
- There is some dampness around the roof bolt plates.
- The bord widths are measured at 7.2m
- Pillar centres are 17m x 19m
- There is a fall of ground in R3 – R4 split 22 in a single lift. The material that has failed shows sharp edges.

Answer the following:

- a) What do we call it when there is signs of deformation in the corners where the roof and pillar make contact? (2)
- b) What is the cause of this deformation? (2)
- c) Explain why the bearing plates on the bolts are deforming? (4)
- d) Give recommendations on how to manage this situation. (5)

2.2 With the aid of a sketch explain how compressive and tensile stresses act in the material of a cantilever beam. (2)

2.3 The mine you are working on is mining the 4 Seam in the Witbank area. The seam is 5.2m thick. Due to quality reasons, you are selectively mining the bottom 4m of the seam. The Seam is divided into 3 geological domains, S4Main, S4Roof, S4Top. The mining horizon will be focussed on the extraction of S4M. (8)

Above the seam there are competent and self-supporting thick sandstone layers.

Your fall of ground database shows that 95% of the time in the event of a fall of ground, the fall won't extend into the sandstone.

Calculate the support design you would recommend using the suspension method. In your answer, state the following:

- Length of roof bolt.
- Spacing between bolts.
- Diameter and length of resin capsule to ensure full column installation.
- Assumptions made.

2.4 Explain the principle of how a full column pre-tensioned roof bolt installation works.
(2)

(25)

QUESTION 3 (FUNDAMENTALS)

3.1 Define the following (supply units where possible):

- a) Stress (2)
- b) Strain (2)
- c) Young's Modulus (2)
- d) Shear force (2)
- e) Poisson's ratio (2)

3.2 Explain with the aid of sketches the following

- a) Positions of maximum and minimum tensile and compressive stresses in a clamped beam (2)
- b) Stress vs. Strain failure curve (3)
- c) Distribution of stress around a roadway (2)
- d) NEVID method (3)

3.3 Explain the following equation and what it is used for:

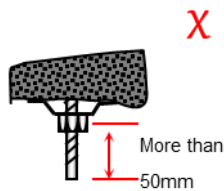
$$Q = \left(\frac{RQD}{Jn} \right) \times \left(\frac{Jr}{Ja} \right) \times \left(\frac{Jw}{SRF} \right) (5)$$

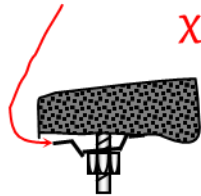
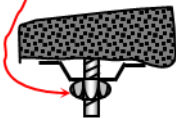
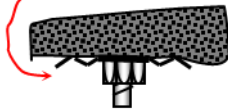
(25)

QUESTION 4 (GENERAL)

4.1 List the advantages and disadvantages of pillar extraction (6)

4.2 Complete the table below (8)

Symptom	Cause	Remedy
Bolt protruding too far 		

Loose washer 		
Rounded nut 		
Deformed washer 		

- 4.3 You are called to a section underground where a roof extensometer has been activated in an intersection. The Mine Overseer is requesting that you give him recommendations. Explain how you will approach this scenario and identify the cause of the deformation. (4)
- 4.4 You are attending a monthly planning meeting, one of your underground sections will be approaching a dyke in the next week. The section must mine through the dyke since a sizeable portion of the reserve is available beyond the dyke. Explain the recommendations that you will give to the relevant people attending the meeting on how to manage the section as well as the expected conditions that they may encounter. (4)
- 4.5 You are called by a Mine Overseer requesting your assistance. The Mine Overseer needs to brush for air crossings in one of the sections. Mining height is usually 3.5m high but he needs to increase this to 5.5m. He will need to brush for 3 splits, from L4 to R4 in the section. Explain the risks and controls he will encounter and needs to implement. (3)

(25)

TOTAL MARKS (100)

FORMULA SHEET

$$S = 7,2 \frac{w^{0.46}}{h^{0.66}}$$

$$S = 3.5 \frac{w^{0.8}}{h}$$

$$L = \frac{0.025HC^2}{w^2}$$

$$FS = \frac{S}{L}$$

$$FS = 288 \frac{w^{2.46}}{Hh^{0.66}(w+b)^2}$$

$$\theta_t = \frac{\gamma L^2}{2t}$$

$$\theta_t = \frac{3\gamma L^2}{t}$$

$$\theta_t = \frac{3\gamma L^2}{4t}$$

$$SF = \frac{nP_f}{\left(\frac{2}{3}\right)pgt_{lam}}$$