

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA CERT. IN STRATA CONTROL (COAL)	EXAMINER: L MUNSAMY
SUBJECT CODE: COMCSC	MODERATOR: B MADDEN
EXAMINATION DATE: 24 OCTOBER 2007	TOTAL MARKS: [100]
TIME: 09h00 - 12h00	PASS MARK: 60%

NUMBER OF PAGES: 5

SPECIAL REQUIREMENTS:

1. **Answer ALL FIVE questions**
 2. References other than those provided are not permitted.
 3. Hand-held electronic calculators may be used.
 4. Put 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 unless stated otherwise.

QUESTION 1 – Terms and Definitions (10 Marks)

With the aid of sketches explain what is meant by the following terms and where appropriate give their units of measurement

- | | | |
|------|-------------------------------|-----|
| 1.1. | Uniaxial Compressive Strength | (2) |
| 1.2. | Poisson's Ratio | (2) |
| 1.3. | Density | (2) |
| 1.4. | Force | (2) |
| 1.5. | Cohesion | (2) |

QUESTION 2 – Openpit (25 Marks)

2.1. Explain with the aid of sketches the following types of slope failures:

- | | | |
|---------------------|-----|-----|
| a) Toppling failure | (3) | |
| b) Circular Failure | (3) | |
| c) Plane Failure | | (3) |
| d) Wedge Failure | (3) | |

2.2 Define the term Risk (3)

2.3. You are the appointed Strata Control Officer in an Open Pit Coal mine. The highwall has been experiencing a number of slope stability problems. Briefly describe the process you would follow to resolve the slope stability issue. (10)

QUESTION 3 (15 Marks)

The Colliery you are working is using 1.5m long, 18mm diameter bolts installed in a 28mm diameter hole as standard support. The bolt is installed with 1 capsule of resin that measures 23mm in diameter and is 600mm long. Underground observations indicate that the hole may not be full column resin grouted. As part of the investigation determine:

- 3.1. The annulus volume (5)
- 3.2. Volume of resin (2)
- 3.3. Length of hole left ungrouted after the bolt is installed. (6)
- 3.4. The length of capsule required to achieve full column grouting (2)

QUESTION 4 (30 marks)

Paper Colliery is planning to mine the 2-seam in the Witbank area. The manager at the mine has requested that you assist with the design (layout and support) to be used in 2-seam. You have been supplied with the following information:

- Depth below surface = 75.2m
- Seam height = 4.6m
- Planned bord width = 6.2m
- Planned pillar width = 12.8m
- Roof consists of 0.35m thick shale overlain by 1m thick coal and 2m thick sandstone
- Planned 18mm diameter bolts installed in a 25mm diameter hole.
- Full column resin grouted, pre tension of 50kN
- Shale density is 1.8t/m³
- Maximum load of 18mm bar is 17t

- 4.1. Calculate the pillar factor of safety (5)
- 4.2. Calculate the pillar factor of safety using the continuous miner adjustment formula (4)
- 4.3. If the manager requests that the design be based on a Safety Factor of 1.6 only what would be the pillar width. Comment on this pillar width as to how applicable and practical it would be. (6)
- 4.4. What is the most suitable support mechanism for the current situation. (3)
- 4.5. Calculate the bolt density i.e. the number of bolts in a row and row spacing required to achieve desired support resistance. Assume design is at a factor of safety of 1.5. (12)

Question 5 (10 marks)

The planning department at your Colliery is planning to undermine the mine village and wants you to lead the process involved in being able to undermine the village. The coal seam is 80m below surface.

5.1 Briefly explain the process you would follow in achieving permission to undermine the road. (5)

5.2 What are the key aspects that you would investigate from a rock engineering point of view to ensure surface stability? (5)

Question 6 – Mining Layouts (10)

6.1 Briefly describe a stooping operation. Use sketches to describe the mining method and clearly annotate the sketches showing key aspects of the operation. (5)

6.2. Briefly describe a longwall mining operation. Use sketches to describe the mining method and clearly annotate the sketches to show the key aspects of the operation. (5)

Strata Control Formulae

$$S = 7,2 \frac{w^{0,46}}{h^{0,66}}$$

$$L = \frac{25 H C^2}{w^2}$$

$$\eta = \eta_o \left(1 + \frac{\Delta w_o}{w}\right)^{2,46}$$

$$n = SF \frac{pgt}{Pf}$$

$$Lb = \frac{d_c^2, Lc}{D^2 - d^2}$$

$$\tau = \frac{Pf}{\pi . D . Lb}$$

$$\eta = \frac{\gamma L^4}{23 E t^2}$$

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

$$FS = 288 \frac{w^{2,46}}{Hh^{0,66}(w+b)^2}$$

$$\sigma_s = 7.2 \frac{R_0^{0.5933}}{V^{0.0667}} \left\{ \frac{0.5933}{\varepsilon} \left[\left(\frac{R}{R_o} \right)^\varepsilon - 1 \right] + 1 \right\}$$