

CHAMBER OF MINES OF SOUTH AFRICA



EXAMINATION FOR THE CERTIFICATE IN ROCK MECHANICS

PAPER 2 (COAL)

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA CERT. IN ROCK MECHANICS – PAPER 2 (COAL OPTION)	EXAMINER: J N VAN DER MERWE
SUBJECT CODE: COMRME	MODERATOR: B MADDEN
EXAMINATION DATE: 19 JUNE 2003	TOTAL MARKS: (100)
TIME: 09h00 - 12h00	PASS MARK: 60%

NUMBER OF PAGES/AANTAL BLADSYE: 8

SPECIAL REQUIREMENTS:

1. **ANSWER ALL THE QUESTIONS**
2. References other than those provided may not be used.
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 on one side of the paper only.
6. Show all calculations on which you base your answers.
7. In answering these questions, take full advantage wherever necessary of your practical experience as well as of the data given.
8. Graph paper is available from the invigilator.
9. A list of formulae and any other essential charts and tables will be issued at time of the examination.

QUESTION 1

- (a) Derive an expression to show what percentage of a pillar's safety factor is lost if its width decreases by 10% while the pillar centre distance, mining height and depth remain the same. (10)
- (b) What precautions with regard to pillar design are to be taken at mining depth less than 40 m? (5)
- (c) Make a neat sketch of the relationship between w:h ratio and pillar strength for constant pillar height for the range of w:h 1 to 10. Indicate which formula you would use for which parts of the curve. (5)

20 marks

QUESTION 2

A survey of roof falls in an area of a particular mine resulted in the information shown in Table 2.1. A representative borehole log is shown in Figure 2.1.

- (a) If you had to design a general support system for this area of the mine based on the suspension principle, what thickness of roof material likely to fail would you consider in your design? If successful, what percentage of roof falls would your design prevent? Motivate your answer. (10)
- (b) Can this thickness of material be suspended from the upper roof layers? Motivate your answer. (5)
- (c) For a bolt spacing of 1.5 m by 1.5 m, how long should the bolts be? Motivate your choice of bolt thickness and hole diameter and state all assumptions. (10)

25 marks

QUESTION 2 (CONTINUED)

Table 2.1

Thickness Of fall (m)	Number of falls	Notes
0.1	43	
0.2	30	
0.3	18	
0.4	20	
0.5	14	
0.6	12	
0.7	3	Joints
0.8	5	Dyke
0.9	2	Dyke
1	1	Dyke
1.1	0	
1.2	0	
1.3	3	Dykes
1.4	0	
1.5	1	Fault

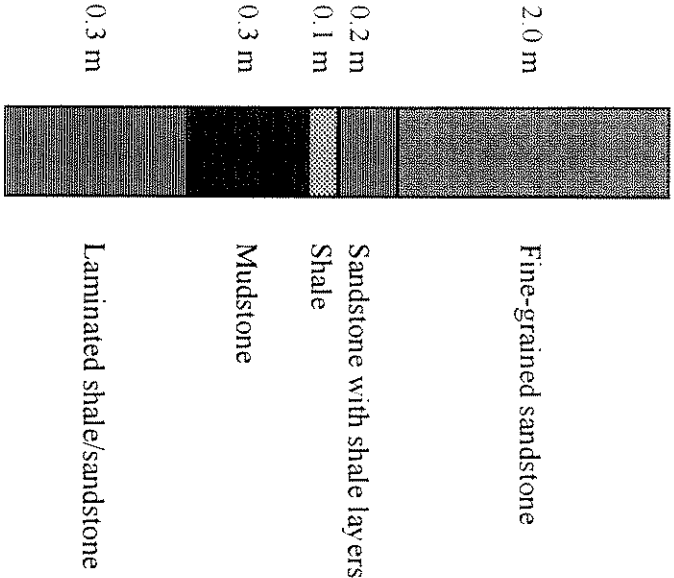


Figure 2.1

QUESTION 3

- (a) Using annotated sketches of the Load/Deformation behaviour of a rock sample and the loading system, explain the reasons for stable and unstable (or violent) rock failure. (12)
- (b) What is the influence of the pillar width-to-height ratio on the mode of failure (i.e. stable or violent failure)? (4)
- (c) What is the influence of the overburden composition and condition on the mode of failure? (4)

20 marks

QUESTION 4

A rural tarred road with a low traffic density is to be undermined by longwalling. The mining depth is 110 m, the mining height is 3.2 m and the panel width is 212 m. The only strata layer of significant thickness in the overburden is a 20 m thick dolerite sill. The depth of the base of the sill is 80 m.

- (a) How much vertical subsidence can be expected and what are the expected maximum magnitudes of induced tilt, compressive and tensile strain? (8)
- (b) What mining induced effects would you expect on the road? (4)
- (c) What precautions for the mining would you recommend? (3)

15 marks

QUESTION 5

All questions must be answered. Indicate your answer on the attached answer sheet. Please make sure that your exam number is written clearly on the answer sheet and hand it in with your examination script.

Note that marks will be deducted for incorrect answers and unanswered questions.

- (a) Roof deflection in the Witbank coalfield -
 - (i) is typically less than 15 mm
 - (ii) usually occurs more than five days after mining had taken place
 - (iii) is linked to the thickness of roof layers
 - (iv) can easily be detected without the aid of instrumentation
- (b) SIMRAC funding is obtained from
 - (i) A tax on the mines based on annual production and safety performance
 - (ii) Equal contributions from the State and the mining industry
 - (iii) A levy from individual mines based on nothing but safety performance
 - (iv) Equal contributions from the State, the mining industry and the CSIR
- (c) Fixed head full column resin roof bolts with dual speed resin can be classified as
 - (i) stiff, passive support
 - (ii) soft, active support
 - (iii) stiff, active support
 - (iv) a waste of money
- (d) The Point of Inflexion on a subsidence profile is that point where
 - (i) maximum subsidence occurs
 - (ii) maximum tilt occurs
 - (iii) maximum tensile strain occurs
 - (iv) surface cracks appear

- (e) The stiffness of the loading system on pillars will be decreased by
 - (i) pillar splitting if the panel width is greater than the mining depth
 - (ii) the presence of faults
 - (iii) reducing the road width
 - (iv) increasing the panel width
- (f) The South African National Institute for Rock Engineering (SANIRE) is
 - (i) a statutory body with graded membership
 - (ii) affiliated to the MQA
 - (iii) a service provider to the MQA
 - (iv) operated by the CSIR
- (g) The “Continuous Miner Correction” for coal pillars
 - (i) is not valid for squat pillars
 - (ii) is a fixed ratio for pillar strength
 - (iii) is a fixed dimension irrespective of pillar width
 - (iv) should not be applied to main development pillars with long expected life
- (h) Roof deflection prior to bolt installation
 - (i) is prevented by restricting the cut-out distance to less than twice the road width
 - (ii) is reversed by pretensioning bolts to more than 80 kN in a thinly laminated roof
 - (iii) does not occur in sandstone roofs
 - (iv) negates beam building
- (i) As pillar height increases,
 - (i) so does the stress on the ribsides
 - (ii) so does the average pillar load
 - (iii) the probability of roof falls increase
 - (iv) the influence of discontinuities become more pronounced

-
- (j) Roof bolt breaker lines
- (i) are required in stooping operations in terms of the Mine Health and Safety Act
 - (ii) are only effective if they are installed during development of a panel before any stooping takes place
 - (iii) must always consist of full column resin bolts
 - (iv) must be supplemented by tell tales in terms of the regulations.

20 marks

TOTAL MARKS: [100]

EXAM NUMBER: _____

QUESTON 5

Question	TRUE	FALSE
a) i)		
ii)		
iii)		
iv)		
b) i)		
ii)		
iii)		
iv)		
c) i)		
ii)		
iii)		
iv)		
d) i)		
ii)		
iii)		
iv)		
e) i)		
ii)		
iii)		
iv)		
f) i)		
ii)		
iii)		
iv)		
g) i)		
ii)		
iii)		
iv)		
h) i)		
ii)		
iii)		
iv)		
i) i)		
ii)		
iii)		
iv)		
j) i)		
ii)		
iii)		
iv)		