



CHAMBER OF MINES OF SOUTH AFRICA

EXAMINATION

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA CERT. IN STRATA CONTROL (COAL.)	EXAMINER: D. SNYMAN
SUBJECT CODE: COMCSCC	MODERATOR: M. HENDERSON
EXAMINATION DATE: 8 MAY 2018	TOTAL MARKS: [100]
TIME: 14:30 – 17:30	PASS MARK: 60%

NUMBER OF PAGES: 4

SPECIAL REQUIREMENTS:

1. Answer ALL the questions

- References other than those provided are not permitted.
- Hand-held electronic calculators may be used.
- 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.

- Write in ink on the **RIGHT HAND SIDE** of the paper only (only content on the right hand pages will be marked).
- Show all calculations on which your answers are based.
- State all assumptions you have made.
- Illustrate your answers by sketches or diagrams wherever possible.
- In answering these questions, full advantage should be taken wherever necessary of your practical experience as well as of the data given.
- Answers must be given to an accuracy which is typical of practical conditions.
- NO** cell phones allowed in the examination room.

QUESTION 1 (MONITORING)

1.1 During a routine visit to one of your Continuous Miner production sections you observe the following strata behaviour in the roof:

- Tension cracks develop behind the last through road.
- The crack seems to follow a general direction.
- Guttering develops in the roof corners but there is no scaling in the sidewalls.
- On occasions there is slight buckling of the roof bolt plates.

- a) What is the most likely cause of the roof deterioration? (1)
- b) What contributing factors are usually associated with this phenomenon? (4)
- c) What are the most effective operational control measures to combat similar instability problems? (5)

1.2 What unhealthy operational practices can affect the strata stability in the workings of an underground coal mine? (10)

1.3 What factors may affect the stability of the roof of an excavation in faulted and jointed ground? (5)

(25)

QUESTION 2 (SUPPORT DESIGN)

2.1 As part of a life extension project at your mine in the Witbank area, twin haulages are planned to be developed from the workings on the No 4 seam to new reserves on the No 2 seam. The strata that forms the inter-burden consists of laminated sandstone with a lamination thickness of 0.05m. Assume horizontal lamination and negligible cohesion between the layers. What will the maximum roof support spacing be, to ensure stable roof skin conditions in the declined roadways? (State all your assumptions) (7)

2.2 With the aid of a sketch explain how compressive and tensile stresses act in the material of a suspended beam. (3)

2.3 Referring to Question 2.1 above, a 1.0m thick shale layer overlaying the No 2 seam has to be suspended from a self-supporting sandstone layer in the 6.0m wide roadways. Assume that the weakest interface in the system is the resin to rock contact which has a shear strength of 2 MPa. The systematic support system specified for the project is 20mm diameter resin roof bolts installed on a 1.5m by 1.5m square grid. The roof bolter normally drills 26mm diameter holes and can install support units within 0.75m from the sidewall. What is the minimum length of bolts that can be used in this part of the project? (State all your assumptions and show your calculations) (10)

- 2.4 You have been tasked to compile a quality control checklist for the roof bolts that must be received at the mine stores. List and give minimum specifications of the different components on the roof bolts that must be checked. (5)

(25)

QUESTION 3 (BASIC PRINCIPLES)

- 3.1 Twin haulages are developed at a decline of 8 degrees from the horizontal. The centres of the roadways are spaced 25.0m apart. The roadway dimensions are 6.0m wide and 3.0m high. It is planned to develop 4 splits between the two decline roadways. The depth to floor of the No 4 seam is 60.0m and that of the No 2 seam 80.0m. Assume that the relative density of the material to be excavated is 2700kg/m^3 and the bulking factor after the blast is 1.3.

- a) What is the mass of the rock that will have to be excavated from the top of the decline on the No 4 seam to the bottom of the decline on the No 2 seam? (8)
- b) If an LHD with a 5m^3 bucket is used for loading out the faces, how many trips will it have to make during this project? (Assume a 100% load fill) (5)

- 3.2 Explain with the aid of sketches and mathematical equations the following terms. Also supply SI units of measurement where applicable.

- a) Induced stress (3)
- b) Strain (3)
- c) Elastic modulus (3)
- d) Factor of safety (3)

(25)

QUESTION 4 (MINE DESIGN)

- 4.1 At a coal mine with a dipping coal seam, a primary development panel is planned from the outcrop to as deep as possible. The mine opted to standardise to three different pillar sizes namely 18.0m, 24.0m and 30.0m centres. What is the depth ranges where the different pillar sizes can be used if the mining height is 3.5m and the road widths are planned at 6.0m wide? (Ignore the gradient effect on the pillars during your calculations.) (10)

- 4.2 What geological and operational conditions can negatively affect the strength of a coal pillar? (5)

- 4.3 Discuss the surface subsidence effects and contributing factors that can be expected at an underground coal mine. (10)

(25)

FORMULA SHEET

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

$$S = 5.47 \frac{w^{0.8}}{h}$$

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

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

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

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

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

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

$$L_a = \frac{\rho g S^2 t_i}{\tau \pi D_h} + 0.05$$

TOTAL MARKS : 100