



CHAMBER OF MINES OF SOUTH AFRICA

EXAMINATION PAPER

SUBJECT: CERTIFICATE IN STRATA CONTROL (COAL) SUBJECT CODE:COMSCC EXAMINATION DATE: 9 MAY 2017 TIME: 14:30 – 17:30	EXAMINER: Marc Henderson MODERATOR: Sandor Petho TOTAL MARKS: [100] PASS MARK: 60%
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NUMBER OF PAGES: 5

SPECIAL REQUIREMENTS:

1. Answer **ALL FOUR** 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.
 10. Cell phones are **NOT** allowed in the examination room

QUESTION 1

- 1.1 Explain the difference between stress and force and state the relationship between them
(4)
- 1.2 Explain the difference between UCS and rock mass strength
(4)
- 1.3 What are the tensile and shear strengths of typical roof bolts used on your mine?
(2)
- 1.4 Explain how a roof bolt system can be used to build a beam in laminated material
(4)
- 1.5 You have been asked to comment on core taken from the roof of where a large excavation will be created – what will you look for when evaluating the core?
(4)
- 1.6 What recommendations would you typically include where an excavation is to be blasted into the roof, e.g. for a ventilation crossing?
(4)
- 1.7 What controls would you put in place for using resin in a very cold area?
(2)
- 1.8 Describe a rock mass characterization method of your choice (for example CMRR or Q-system, etc.). Make mention of when you may use such a method and what the limitations to the method may be
(6)

[30]

QUESTION 2

- 2.1 Your colliery employs a bord and pillar mining layout at 100m below surface with a mining height of 4m and a bord width of 6m. Using the pillar strength formula $S=7.2w^{0.46}/h^{0.66}$, what size pillars must be used to provide a safety factor of 1.6? (10)
- 2.2 Draw a curve illustrating how load on a pillar increases with increasing extraction percentage (2)
- 2.3 What implication does extraction percentage have on how sensitive the pillar stability is to mining error? (2)
- 2.4 What is tributary area theory and what must hold true for it to be used? (4)
- 2.5 What effect can pillar scaling have on the adjacent roadway roof? (2)
- 2.6 Draw a stress strain curve illustrating the difference in behavior of slender and squat pillars, explain what you have drawn (5)
- 2.7 Explain why jointing affects the strength of slender pillars more than squat pillars (5)

[30]

QUESTION 3

Your operation mines at a 7.2m bord width, and has a point anchored resin bolt system based on the suspension of laminated material of 0.9m thick to the overlying sandstone. At present, this is achieved using 20mm in diameter by 1.8m length bolts installed 2m apart between individual rows with 4 bolts installed per row, using 26mm diameter holes.

Assume that the weakest interface is between the resin and the rock, with a shear strength of 2MPa.

- 3.1 The Manager has asked you whether the bolt length can be reduced to 1.5m. Perform a calculation to determine whether the bolt length can be reduced. Make allowance for a 1mm reaming difference

(15)

- 3.2 Explain why bolts installed to the sides of a road have greater benefit in terms of beam building than those bolts installed at the center of the road

(2)

- 3.3 Calculate how much longer a 23mm resin capsule has to be if allowance must be made for a 80mm gap at the top of the hole (bolt length is shorter than the hole length by 80mm). The hole has a 28mm diameter

(8)

[25]

QUESTION 4

- 4.1 How many times greater is the stress in a cantilever beam compared to that in a clamped beam

(2)

- 4.2 The colliery at which you work has a competent sandstone beam as the roof; however, the beam is underlain by an 8cm thick siltstone layer. What bolt spacing would be required to keep this layer from breaking if it has a tensile strength of 2MPa and a density of 2500kg/m³?

(13)

[15]

Strata Control Formulae

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

$$S = 3.5 \left(\frac{w}{h} \right) (MPa)$$

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

$$\eta = \eta_o \left(1 + \frac{2 \Delta w_0}{w} \right)^{2,46}$$

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

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

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

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

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

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

$$\tau = c + \sigma_n \tan \phi$$

$$V_s = \frac{4 \pi r^3}{3}$$

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