

**EXAMINATION FOR THE CERTIFICATE IN STRATA CONTROL**

**COAL OPTION**

<b>SUBJECT:</b>  CHAMBER OF MINES OF SOUTH AFRICA CERTIFICATE IN STRATA CONTROL (COAL.)  <b>SUBJECT CODE:</b> COMCSCC  <b>EXAMINATION DATE:</b> 11 MAY 2021  <b>TIME:</b> 14:30 to 17:30 (3 HOURS)	<b>EXAMINER:</b> CHARL SKINNER  <b>MODERATOR:</b> GRAHAM PRIEST  <b>TOTAL MARKS:</b> [100]  <b>PASS MARK:</b> 60%
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NUMBER OF PAGES: 4

**SPECIAL REQUIREMENTS:**

**1. Answer ALL the questions**

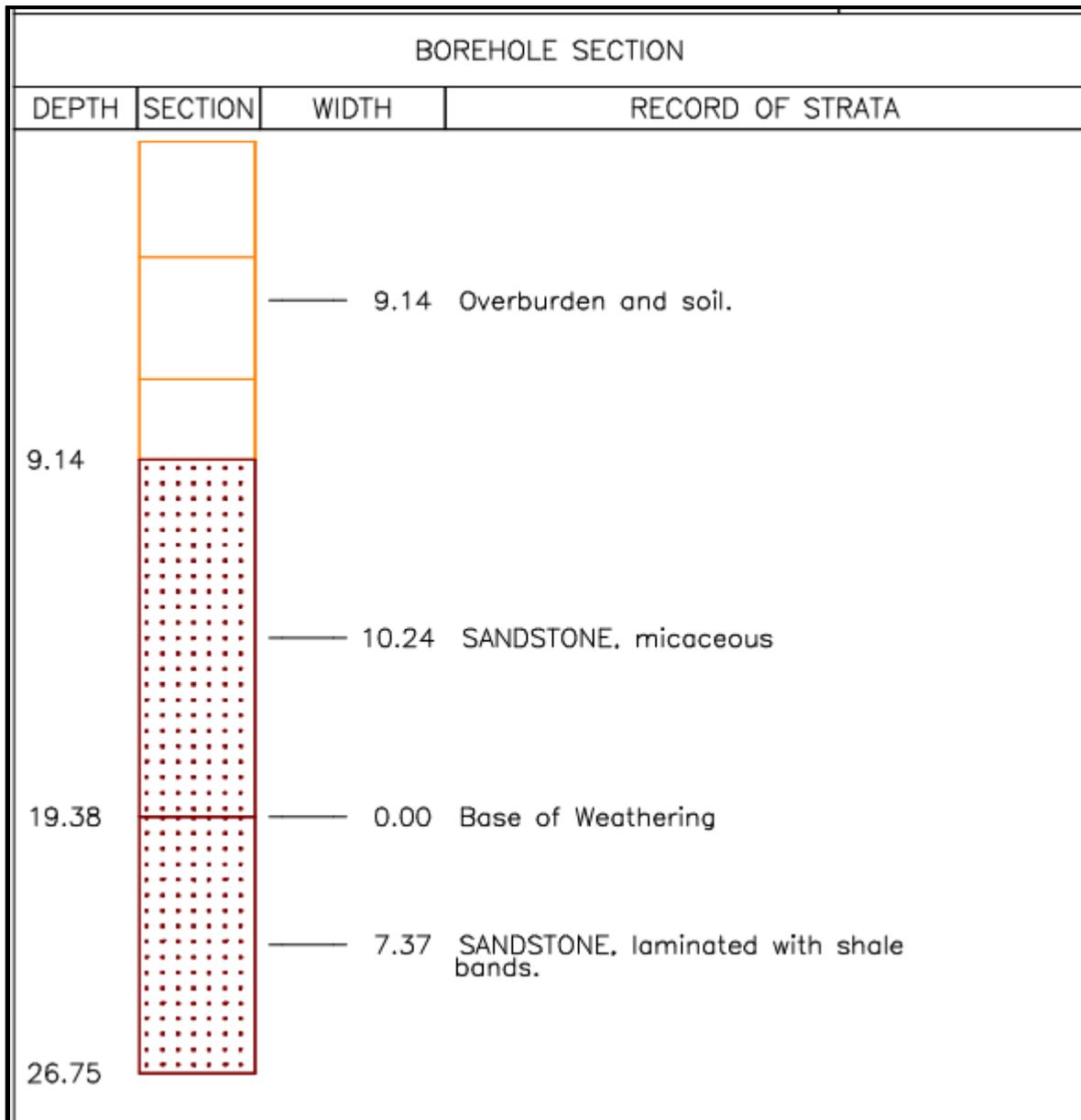
- References other than those provided are not permitted.
- Hand-held electronic calculators may be used.
- Put your examination number on the outside cover of each book used and on any graph paper or other loose sheets handed in.

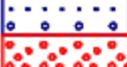
**NB: your name must not appear on any answer book or loose sheets.**

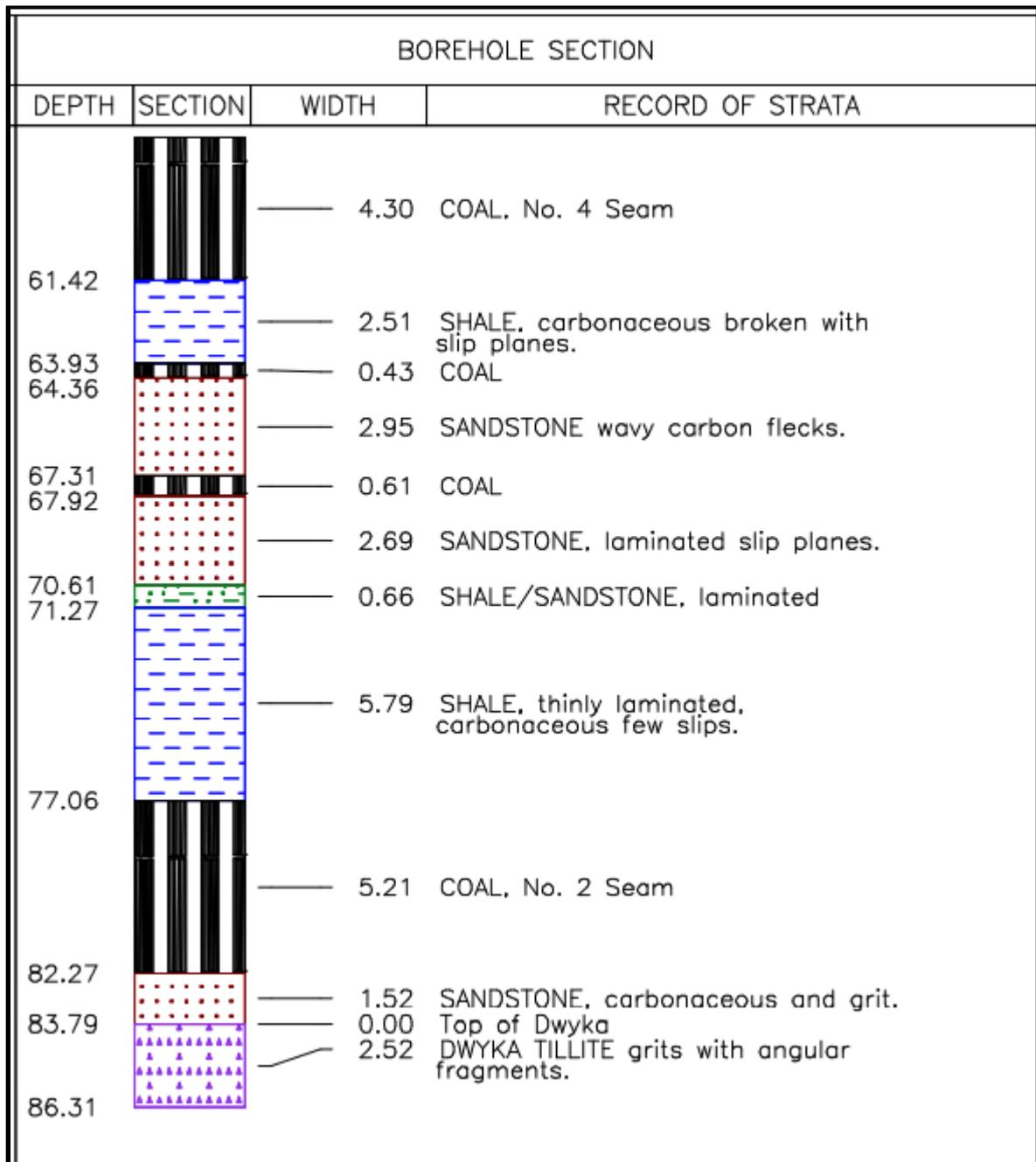
- Write in ink on the **RIGHT HAND SIDE** of the paper only (only content on the right hand pages will be marked).
- Show all calculations on which your answers are based. Calculations which are not methodical and use the correct units will lose marks.
- State all assumptions you have made.
- Illustrate 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 and units which are typical of practical conditions.
- The use of cellular phones and other devices e.g., smart-watches 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			
DEPTH	SECTION	WIDTH	RECORD OF STRATA
		11.22	SANDSTONE, laminated with carbon flecks.
37.97		0.23	SHALE, thinly laminated, carbonaceous
38.20			
39.24		1.04	SANDSTONE, laminated shale and coal stringers.
41.35		2.11	COAL, No. 5 Seam
42.42		1.07	SANDSTONE, massive dirty.
44.50		2.08	SANDSTONE, thinly laminated some shale bands.
44.83		0.33	SANDSTONE carbon bearing.
47.50		2.67	SHALE/SANDSTONE, laminated slip planes.
50.50		3.00	SHALE/SANDSTONE, thinly laminated, carbonaceous alternating.
51.61		1.11	SHALE, thinly laminated, carbonaceous
53.77		2.16	GRIT, massive
54.56		0.79	GRIT to shale, mixed sediments.
56.08		1.52	GRIT, massive
57.12		1.04	CONGLOMERATE, carbonaceous mixed sediments, graded.



- Calculate the Factor of Safety using the Van Der Merwe 2003 formulae for the main development of this continuous miner section for the number 4 Seam? (10)
- What is the Factor of Safety if a 30m Waste Dump is placed on the workings with a density of 2000kg/m<sup>3</sup>? (5)
- Calculate the areal percentage extraction for a 9 road panel taking into account the barrier pillar, given the situation above? (2)
- Comment on the long term stability. (2)

1.2 The following information is given:

- Mining height = 4m
- Depth to roof = 78m
- Panel width = 154m
- Extraction percentage = 75%

Calculate the maximum vertical subsidence expected in the event of system pillar failure. (2)

1.3 Use your answer for 1.2 and calculate the maximum expected tilt. (2)

1.4 By using a sketch, illustrate the maximum half profile for subsidence. (2)

**(25)**

### **QUESTION 2 (SUPPORT DESIGN)**

2.1 What is the maximum Tensile stress of a 0.5m coal layer in a 7.2m bord width? (2)

2.2 Would you expect the layer to be stable? (1)

2.3 What is the deflection of a shale layer (Density 2000kg/m<sup>3</sup>) roof of 0.1m thick when the bord width is 7.2m and the Young's Modulus is 2GPa? (3)

2.4 What is the pull-out load where the bolt is 20mm diameter, the bit is 25.6mm, using a 23mm resin capsule and a capsule length of 1000mm for a resin-rock Shear Strength of 2000kPa? (10)

2.5 List 3 controllable and 3 uncontrollable parameters affecting roof stability (6)

2.6 List 3 causes of Roof failure (3)

**(25)**

### **QUESTION 3 (SURFACE MINING)**

3.1 List 5 types of rock failures that can be found on a strip mine and what conditions/causes lead to them? (5)

3.2 With the aid of a sketch, draw a cross section showing the typical lay-out of a surface strip mine. (3)

3.3 List 5 typical controls that can be found in a dragline operation to ensure the high wall and low wall is stable? (5)

3.4 Your Mine Manager must backfill an old box cut by using a tipping and dozing method. The old box cut is filled with water. He has requested that you provide him with recommendations on how to proceed. List your recommendations (5)

3.5 List 4 parameters that you will need to do Numerical Modelling with SLIDE to determine the slopes FOS and POF? (4)

3.6 Define Limit Equilibrium. (3)

**(25)**

#### **QUESTION 4 (GENERAL)**

4.1 List 5 factors influencing the interaction between 2 seams (5)

4.2 List 4 factors that comprises a coal pillar system and how the factor influences the strength? (4)

4.3 List the functions of Barrier Pillars. (4)

4.4 List the Guidelines for Shallow Workings pillar design (5)

4.5 Define k-ratio (3)

4.6 Define the following:

- Active support
- Passive support
- Soft support
- Stiff support (4)

**(25)**

## FORMULA SHEET

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

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

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

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

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

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

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

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

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

$$\tau = \frac{P_f}{\pi DL_b}$$

$$L_b = \frac{d_c^2 L_c}{D^2 - d^2}$$

$$\eta = \frac{q L^4}{32Et_\sigma^4}$$

$$S_m = 0.8h_e$$

$$S_m = 0.5h_e$$

$$S_m = 0.4h_e$$

$$T_m = 21.6S_m + 7\text{mm/m}$$

**TOTAL MARKS (100)**