Minerals Council South Africa

EXAMINATION PAPER

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA - CERTIFICATE IN MINE ENVIRONMENTAL CONTROL **PAPER 1** - FLOW DYNAMICS, AIRFLOW, FANS, MINE WATER **SUBJECT CODE:** COMMEC1 **EXAMINATION DATE:** 7 OCTOBER 2024 **TIME**: 14:30 17:30 (3 Hours)	**EXAMINER:** Tsietsi B Letanta **MODERATOR:** Eugene Botha **TOTAL MARKS:** [100] **PASS MARK:** 60%

NUMBER OF PAGES: 4 (including this page)

SPECIAL REQUIREMENTS:

THIS IS **NOT** AN **OPEN BOOK EXAMINATION**.

FORMULA HANDOUTS MUST BE MADE AVAILABLE TO CANDIDATES

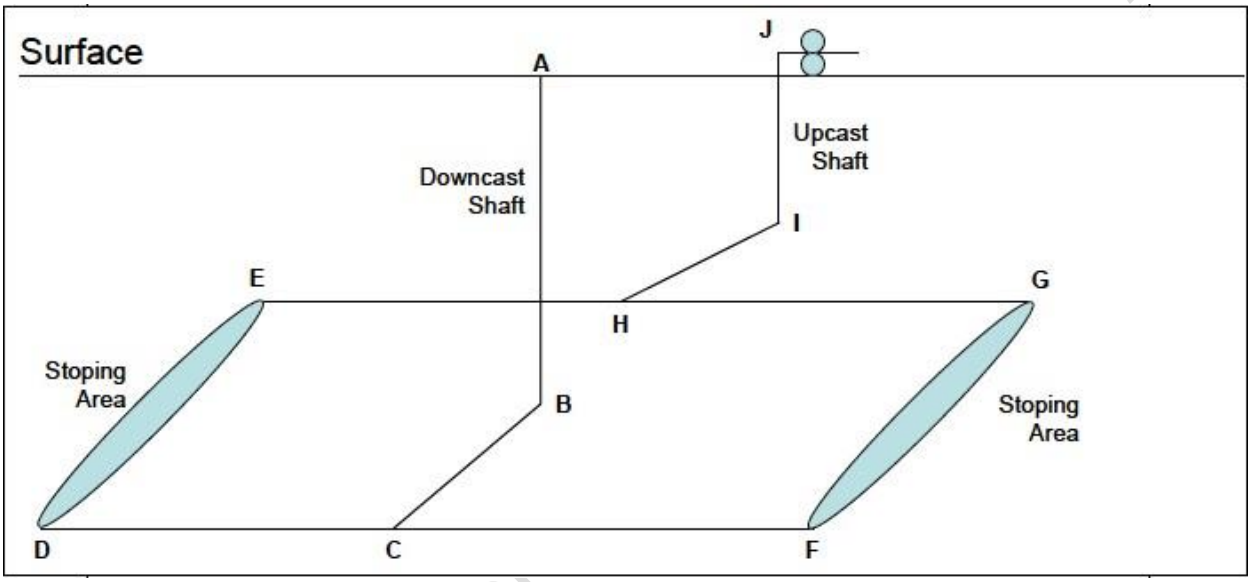
1. Answer all **4** questions in *English*.
2. Write your **ID number** on the outside cover of each book used and on any graph paper or other loose sheets handed in.

   NB: Your name **must NOT** appear on any answer book or loose sheets.
3. Show all calculations **and check calculations on which your answers are based**.
4. Hand-held electronic calculators may be used for calculations only.
5. Write in ink on the **right-hand page** only – the left-hand page will not be marked.
6. Illustrate your answers by means of sketches or diagrams wherever possible.
7. Answers must be given to an accuracy which is typical of practical conditions.

   NB: Ensure that the correct units of measure (SI unit) are recorded as marks will be deducted from answers if the incorrect unit is used (even if the calculated value is correct).
8. In answering the questions, full advantage should be taken of your practical experience as well as data given.
9. Please note that you are not allowed to contact your examiner or moderator regarding this examination.
10. Cell phones and any other electronic devices are **NOT** allowed in the examination room. **Only Calculator**.
11. You are encouraged to make use of the CoMCert Tip-off Hotline whenever you witness or suspect any wrongdoing related to the CoMCert Examinations on landline 0800 118 998 or alternatively you can use email COMCert@tip-offs.com. This tip-off hotline and tip-off email is managed anonymously and confidentially through an independent service provider.

QUESTION 1

This diagram shows the main ventilation connections in a mine. The downcast shaft (A- B) is 5.5m in diameter with an air velocity of 10.5m/s. The upcast shaft (I-J) is 4.0m in diameter. The stoping areas (D-E & F-G) comprise numerous large parallel airways and the resistances in these branches can be assumed to be zero. Ignore the effects of leakage and compressed air. The air density in the fan drift is 1.01kg/m^3. Branch resistances and mean densities are listed in Table 1 below.



Branch	Resistance (Ns^2/m^8)	Density (kg/m^3)
A-B	0.006	1.06
B-C	0.055	1.18
C-D	0.050	1.19
C-F	0.055	1.20
D-E	0	
F-G	0	
E-H	0.038	1.10
G-H	0.040	1.09
H-I	0.006	1.09
I-J	0.0035	1.05

Table 1 – Branch Resistances and Mean Densities.

1.1. Calculate the air quantity at the main fans. (3)

1.2. Calculate the mean velocity in the upcast shaft (2)

1.3. Calculate the main fan pressure (8)

1.4. Calculate the fan shaft power if the main fan is 75% efficient. (2)

1.5. What is the pressure loss in airway B-C? If this airway could be enlarged such that the new corrected resistance was 0.0030Ns^2/m^8, what would be the effect on the fan shaft power? Assume the fan efficiency remains constant. (5)

1.6. Briefly define and list five sources of shock losses in a ventilation duct and indicate what the unit for shock loss is. (7)

[27]

QUESTION 2

2.1 These are the characteristics of part of an underground airway:

- Length - 1 000m
- Dimensions - 4.0m x 3.0m
- K-Factor - 0.015Ns^2/m^4
- Quantity - 102m^3/s
- Density - 1.215kg/m^3

Determine the size of a regulator required to reduce the flow by 15%. (7)

2.2 List the advantages and disadvantages of four different methods of performing mine pressure surveys. (10)

2.3 Briefly describe three forms of energy contained within a mass of air. (6)

2.4 Define natural ventilation pressure [NVP]. (2)

[25]

QUESTION 3

3.1 Discuss considerations that must be made when selecting water flowmeters. (10)

3.2. Describe what is meant by fouling in mine water. (3)

3.3 Which factors influence fouling and how? (12)

[25]

QUESTION 4

4.1 What is the relationship between quantity and pressure for:

a. Laminar flow? (2)

b. Tubular flow? (2)

4.2 List the advantages and disadvantages of the full volume-reduced volume method of pressure surveys. (7)

4.3 Three airways have the following resistances:

4.3.1 A - 0.085 Ns^2/m^8

4.3.2 B - 0.162 Ns^2/m^8

4.3.3 C – 0.024 Ns^2/m^8

4.3.4 These three airways (above) are connected in parallel and the total quantity through the whole system is 230 m^3/s. Calculate the drop in each airway and the volume of air flowing in each airway. (12)

[23]

TOTAL MARKS: [100]