



EXAMINATION PAPER

SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA: INTERMEDIATE CERTIFICATE IN MINE ENVIRONMENTAL CONTROL PAPER 1 SUBJECT CODE: COMIMEC EXAMINATION DATE: 12 MAY 2017 TIME: 14:30 – 17:30	Examiner: Kgoshana Jeremiah Mndebele Moderator: Inus Labuschagne TOTAL MARKS: [100] PASS MARK: [60%]
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NUMBER OF PAGES: 4

SPECIAL REQUIREMENTS:

THIS IS **NOT** AN OPEN BOOK EXAMINATION. THERE IS NO FORMULA HANDOUT

INSTRUCTIONS TO CANDIDATES:

1. Answer all questions **legibly** 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.

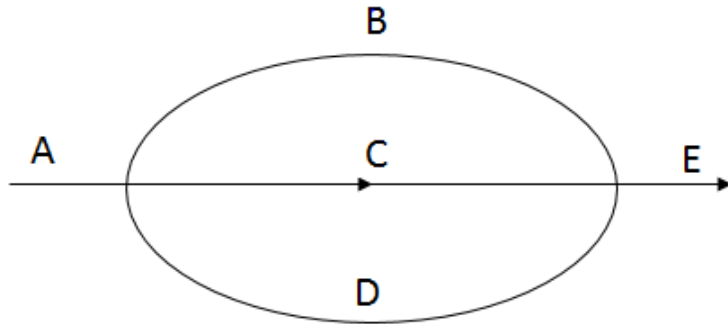
3. Show all calculations **and check calculations on which the answers are based.**
4. Hand-held electronic calculators may be used for calculations.
5. Write **legibly** in ink on the **right hand page** only – **left hand pages will not be marked.**
6. Illustrate your answers by means of sketches or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

NB Ensure that the correct unit 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 are **NOT** allowed in the examination room.

QUESTION 1

- 1.1. The sketch below shows diagrammatically a layout of an underground Gold Mine where there is a combination of three airways in series and parallel.



The resistances of the various airways are as follows:

$$A = 0,008 \text{ Ns}^2/\text{m}^8$$

$$B = 0,009 \text{ Ns}^2/\text{m}^8$$

$$C = 0,022 \text{ Ns}^2/\text{m}^8$$

$$D = 0,02 \text{ Ns}^2/\text{m}^8$$

$$E = 0,18 \text{ Ns}^2/\text{m}^8$$

If the total air quantity flowing through this section is $120\text{m}^3/\text{s}$, calculate:

- a) The overall resistance of the section. (5)
 - b) The overall pressure required. (3)
 - c) The air quantities in each airway. (6)
- 1.2 The energy input to a winch motor is 500kW and the output power is 400kW. Calculate the efficiency of the winch motor. (5)
- 1.3 A tunnel in an underground mine has a resistance of $0,135\text{Ns}^2/\text{m}^8$ and allows $125\text{m}^3/\text{s}$ of air to pass through it towards a return airway system. The air density in the tunnel is $1,3\text{kg}/\text{m}^3$. The tunnel is $3,5\text{m} \times 2,8\text{m}$ with a friction factor of $0,017\text{Ns}^2/\text{m}^4$. First determine the length of this tunnel and then the pressure loss in the tunnel. (5)
- 1.4 Define Fan Total Pressure (FTP). (1)
- [25]**

QUESTION 2

- 2.1 Make a hand drawn sketch of an Exhaust-Overlap (Force-Exhaust) ventilation system in a cross cut or a heading. (3)

If this system is to ventilate a development end that is 200m long and 3 m x 3 m in size, state the air quantities you would suggest:

- a) At the face; (2)
 - b) At the force column discharge; (2)
 - c) In the over-lap; (1)
 - d) At the exhaust column intake; and (2)
 - e) At the exhaust column discharge. (2)
- 2.2 List five characteristics of an ideal dust filter. (5)
- 2.3 Give five main sources of fires underground. (5)

[22]

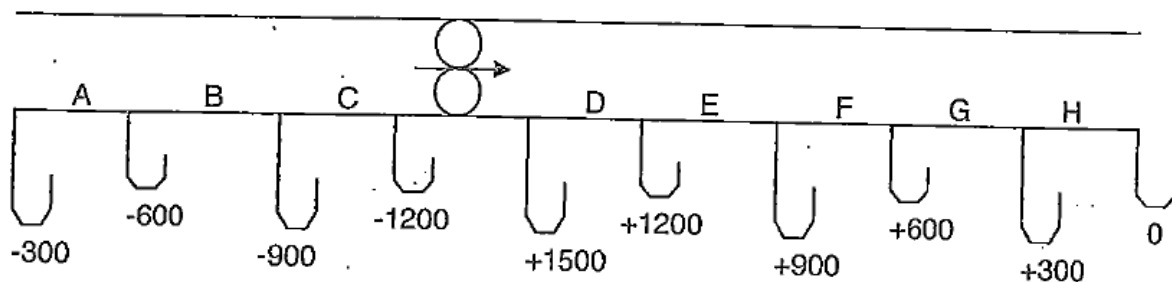
QUESTION 3

- 3.1 State five requirements of an ideal Ventilation door (airlock) installation. (5)
- 3.2 A 45kW fan is to be installed on a 760mm diameter ventilation column in an ultra-deep section of a mine. The column length will be 200m with a frictional k-factor of $0,0037 \text{Ns}^2/\text{m}^4$. The fan will be operating at a density of $1,5 \text{kg}/\text{m}^3$.
- 3.2.1 Draw the fan performance and column resistance curves on the graph paper and determine the fan operating point. Show the table and calculations in your examination book. (6)
- 3.2.2 Determine the fan operating point and comment on the suitability of a standard 45kW fan to be used in the ultra-deep level mining. (2)
- 3.2.3 Make a recommendation to management regarding the type of fans to be purchased in future for the ultra-deep level mining project. (2)

[15]

QUESTION 4

- 4.1 Name five types of refrigeration systems. (5)
- 4.2 Explain the term "Refrigeration". (2)
- 4.3 Calculate the approximate depth in metres for a mine in Gauteng area where the underground barometric pressure is 107KPa. (2)
- 4.4 List five factors causing resistance to airflow. (5)
- 4.5 The sketch below represents a duct of uniform size, and static pressure readings taken equal distances apart.



- 4.5.1 Determine the fan operating pressure. (3)
- 4.5.2 What is the pressure loss at section C. (3)
- 4.6 Mine Ventilation is a continuous supply of adequate and qualitative air to all parts of a mine. State the four main reasons why ventilation is required. (4)

[24]

QUESTION 5

- 5.1 Escape routes are an integral part of the mines escape strategy. State three requirements of escape routes. (3)
- 5.2 The cost of electricity is expected to increase to 80c per kW hour in 2018.
- 5.2.1 Calculate the expected operating cost per annum for a 45kW auxiliary fan. Assume: The fan was operating for the full year. (4)
- 5.2.2 Calculate the operating cost of a 45kW fan per month. The fan duty is $12\text{m}^3/\text{s}$ at 1500 Pa. (3)
- 5.3 List four indicators of a fan operating in a stall zone. (4)

[14]

TOTAL MARKS: [100]