

Minerals Council South Africa



EXAMINATION PAPER

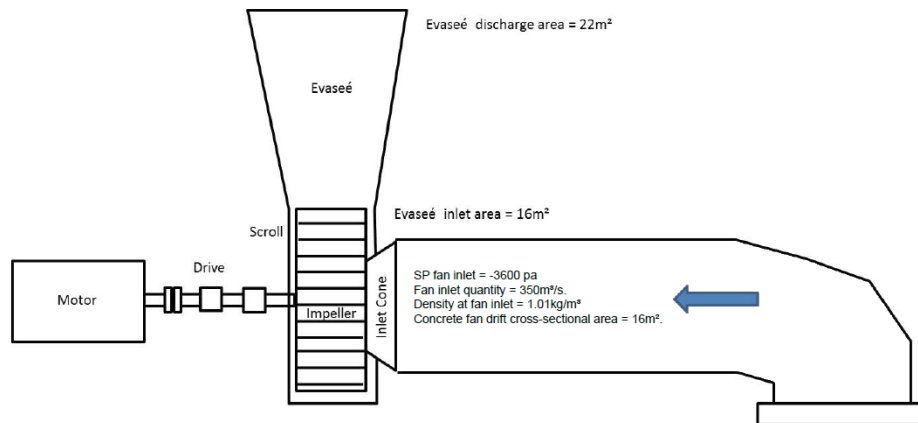
SUBJECT: CHAMBER OF MINES OF SOUTH AFRICA - CERTIFICATE IN MINE ENVIRONMENTAL CONTROL PAPER 1 - FLOW DYNAMICS, AIRFLOW, FANS, MINE WATER SUBJECT CODE: COMMEC1 EXAMINATION DATE: 06 OCTOBER 2025 TIME: 14:00 – 17:00 (3 HOURS)		EXAMINER: Tsietsi B Letanta MODERATOR: Eugene Botha TOTAL MARKS: [100] PASS MARK: (60%)
NUMBER OF PAGES: 5 (including this one)		
<u>SPECIAL REQUIREMENTS:</u> <i>All candidates are advised to read the below instructions/requirements and adhere to them. Not adhering to them could lead to the loss of marks.</i> THIS IS <u>NOT</u> AN <u>OPEN BOOK EXAMINATION</u>. FORMULA HANDOUTS AVAILABLE 1. Answer all 4 questions <u>legibly</u> in English. 2. Write your <u>ID number</u> on the outside cover of each book used and on any graph paper or other loose sheets handed in. <u>NB:</u> Your name <u>must not</u> appear on any answer book or loose sheets. 3. Show all calculations and <u>check calculations on which the answers are based</u>. 4. Hand-held electronic calculators may be used for calculations. 5. Write <u>legibly</u> in ink on the <u>right-hand page</u> only – <u>left hand pages will not be marked</u>. 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. <u>NB:</u> Ensure that the correct unit of measure (SI unit) is recorded as marks will be deducted from answers if the incorrect unit is used. (Even if the calculated value is correct). 8. Please note that you are not allowed to contact your examiner or moderator regarding this examination. 9. Cell phones and any other electronic devices are <u>NOT</u> allowed in the examination room. <u>Only Calculator</u> 10. 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

- 1.1. It is required to speed a fan up from 8.4r/s to 10.5r/s. The motor pulley diameter is 180mm and the fan pulley diameter is 208mm.

Determine two methods of achieving the desired speed and give the necessary pulley diameters. (5)

- 1.2. The sketch below represents a main surface fan on a large mine.



Given;

- The quantity measured at the fan inlet = 350m³/s.
- The air density at the fan inlet = 1.01kg/m³ (assume no change in air density across the fan).
- The cross-sectional area of the concrete duct leading to the fan inlet = 16m².
- The static pressure measured at the fan inlet = -3600Pa.
- The evaseé efficiency = 93%
- The inlet and discharge areas of the evaseé are 16m² and 22m² respectively.

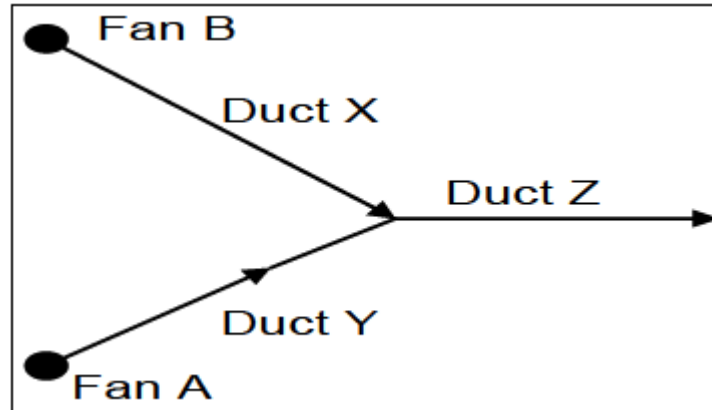
Determine the total pressure (FTP) at which this fan is operating. (13)

- 1.3. Name and discuss five places in a ventilation circuit where shock losses may occur and discuss the causes of each. (10)

[28]

QUESTION 2

- 2.1 The duct system shown in the sketch below consists of two fans, A and B, arranged as shown on three ventilation columns, X, Y, and Z.



The characteristic curves of the two fans are shown on the attached graph page.

Note: Data to re-create the fan curves is supplied on the graph paper at the end of this **Question Paper**.

The duct resistances are as follows:

- Duct X – $70 \text{ N s}^2/\text{m}^8$
- Duct Y – $20 \text{ N s}^2/\text{m}^8$
- Duct Z – $7.5 \text{ N s}^2/\text{m}^8$

2.1.1. What air quantity flows in each of the three ducts?

2.1.2. At what quantities and pressures do the two fans operate?

Show all graphical workings on the graph provided. **Make sure you write your examination number on the graph and hand it in with your answer book.** (20)

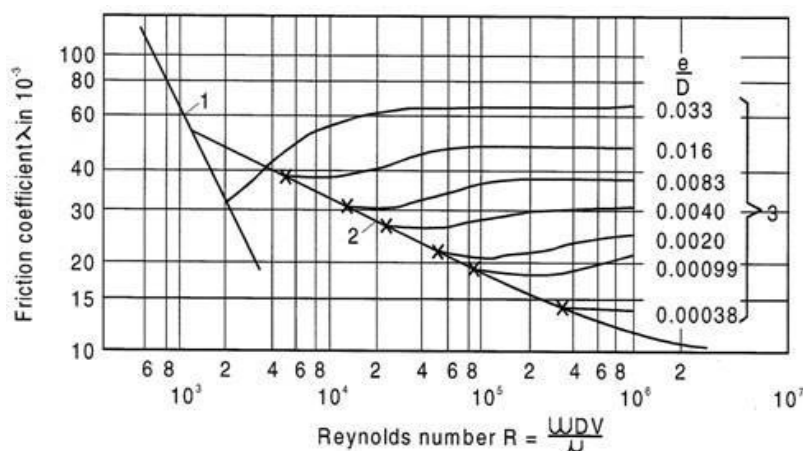
- 2.2 State Bernoulli's equation in full for the ideal incompressible fluid in terms of pressure and give the units of each symbol. (6)

[26]

QUESTION 3

- 3.1 80l/s of water at a temperature of 11.0°C flows through a 1155m length of 256 mm diameter piping. The co-efficient of dynamic viscosity of this water is 1.75×10^{-3} kg/ms. Assume the fluid density = 1000 kg/m^3 .

Make use of the Stanton – Nikuradse diagram below to determine the head loss along this pipe. Express your answer in terms of metres head (m) and pressure loss (kPa). (14)



- 3.2 List five factors which should be considered when taking bacteriological samples of mine water. (5)
- 3.3 How is water with a scaling tendency treated? (4)
- [23]**

QUESTION 4

- 4.1 Mention five ways to address Diesel emissions on a mine (5)
- 4.2 A decision has been taken to develop a sampling strategy for diesel emissions on the mine. What fundamental questions need to be answered before implementing the sampling strategy? (6)
- 4.3 Briefly describe 5 issues to consider when designing ventilation for bord-and-pillar mines. (5).
- 4.4 Mention any five methods of controlling the performance of an axial flow fan (5)
- 4.5 State the typical velocities for the following: (2)
- Return airway.
 - Downcast shaft.

[23]**TOTAL MARKS: [100]**

GRAPH PAPER FOR QUESTION 2.1

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