higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

PAPERMAKING N4

(11022114)

5 December 2023 (X-paper)
09:00–12:00

Drawing instruments may be used.

This question paper consists of 5 pages.

259Q1G2305

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
PAPERMAKING N4
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Start each section on a new page.
5. Use only a blue or black pen.
6. Write neatly and legibly.

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SECTION A

QUESTION 1

Define each of the following papermaking terms. Write only the definition next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 Shrinkage

1.2 Unbleached

1.3 Water resistance

1.4 Fourdrinier

1.5 Virgin

1.6 Transparent ink

1.7 Smearing

1.8 Reducers

1.9 Metallic ink

1.10 Grammage

(10 × 2) **[20]**

QUESTION 2

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (2.1–2.5) in the ANSWER BOOK.

2.1 Acidity is the degree of acid found in a given paper substance measured by a pH level from 0 to 7.

2.2 Paper grammage is determined by visually inspecting the sheet of paper.

2.3 Binder cements the pigment particles firmly to the paper surface as well as to one another.

2.4 In printing, printed image that runs off the edges of a page is referred to as bleed.

2.5 The Fourdrinier machine was invented in France in 1799 by Louis Robert and was subsequently improved in England, where it was patented by Henry and Sealy Fourdrinier.

(5 × 1) **[5]**

TOTAL SECTION A: 25

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SECTION B

QUESTION 3: STOCK PREPARATION AND DE-INKING

3.1 The refining of pulp at high consistency can be beneficial to the properties of pulp and paper.

What are the benefits of high-consistency refining? (2)

3.2 With the aid of a drawing, explain the operations of a disk save. (6)
[8]

QUESTION 4: HEAD BOX AND DRAINAGE, FOURDRINIER AND TWIN-WIRE MACHINES

4.1 The main function of the approach flow system is to dilute the thick stock.

4.1.1 Why is it necessary to dilute the thick stock? (1)

4.1.2 Explain how dilution is achieved and controlled in an approach flow system. (4)

4.2 Make a labelled drawing of the Fourdrinier section of a paper machine. (5)
[10]

QUESTION 5: WET-END ADDITIVES

5.1 Name FIVE types of additives commonly used in the wet end of a paper machine. (5)

5.2 Give FOUR advantages of retention aids in a papermaking plant. (8)
[13]

QUESTION 6: PRESSING AND DRYING OF PAPER, BOARD AND TISSUE

6.1 Significant savings in energy costs can be made if the amount of water removed at the press section is increased. Explain how the following factors influence water removal in the press section:

6.1.1 Nip impulse (3)

6.1.2 Basis mass (2)

6.1.3 Temperature (1)

6.2 The effective removal of condensate by the use of siphons is crucial for efficient dryer performance.

Describe THREE types of siphons that are commonly used in dryer cylinders and explain their principles of operation. (3 × 2) (6)
[12]

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QUESTION 7: SURFACE TREATMENT OF PAPER

7.1 The various factors affecting the quantity of starch picked up at the size press can be divided into two groups, namely absorption factors and film-splitting factors.

Name these factors and explain how each factor affects starch pickup. (4)

7.2 Explain what is meant by the term *edge relief* on the calendar stack. (2)

7.3 Explain how roll density profile can be controlled on the winder. (5)

[11]

QUESTION 8: PAPER PHYSICS AND PAPER PROPERTIES

8.1 How does refining affect the following paper properties?

8.1.1 Burst strength

8.1.2 Ring crush

8.1.3 Opacity

8.1.4 Tensile strength

8.1.5 Brightness

8.1.6 Formation

(6 × 1) (6)

8.2 Name THREE ways in which a contaminated drier fabric can affect the paper machine. (6)

[12]

QUESTION 9: MACHINE CLOTHING, ROLL CROWNING AND ROLL CARE

The press section can only function effectively if its felts are clean and porous. It is imperative that this important aspect should not be neglected during daily papermaking operations.

Discuss felt cleaning and conditioning under the following headings:

9.1 Economic considerations

9.2 Mechanical cleaning

9.3 Chemical cleaning

(3 × 3) **[9]**

TOTAL SECTION B: 75
GRAND TOTAL: 100

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