higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

PAPERMAKING N4

(11022114)

28 November 2022 (X-paper)
09:00–12:00

Drawing instruments may be used.

This question paper consists of 6 pages.

259Q1E2228

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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 question on a new page.
5. Use only a blue or black pen.
6. Write neatly and legibly.

SECTION A

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QUESTION 1

Indicate whether the following statements are TRUE or FALSE. Choose the answer and only write 'True' or 'False' next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 Optical brighteners make paper appear brightened because of UV wavelengths.

1.2 Alkaline papermaking is usually done at pH ranges of 7 to 9.

1.3 A binder cements the pigment particles firmly to the paper surface as well as to each other.

1.4 Paper grammage is determined by weighing a length of sheet.

1.5 Depithed bagasse is not used to make paper.

(5 × 1) **[5]**

QUESTION 2

Define each of the following papermaking terms. Write only the definition next to the question number (2.1–2.10) in the ANSWER BOOK.

2.1 Wood-free paper

2.2 Freeness

2.3 Consistency

2.4 Deflaking

2.5 Lignin

2.6 Bulk

2.7 Opacity

2.8 Anionic trash

2.9 Contraries

2.10 Embossing

(10 × 2) **[20]**

TOTAL SECTION A: 25

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SECTION B

QUESTION 3: STOCK PREPARATION AND DE-INKING

3.1 Name the type of pulp that can be used for the production of photocopy paper. Give ONE reason for your choice. (2)

3.2 Describe the design and operating parameters of pressure screens. You may include a drawing to aid your description. (5)

3.3 The processing of both *wet broke* and *dry broke* is an integral part of paper-machine operation.

Explain how this is accomplished on a typical high-speed fine-paper machine. (5)
[12]

QUESTION 4: HEADBOX AND DRAINAGE, FOURDRINIER AND TWIN-WIRE MACHINES

4.1 The approach flow system is where final cleaning, screening and dilution take place before the stock goes to the forming section.

Discuss the *design* and *operating parameters* of the approach flow system. (4)

4.2 4.2.1 Why are the total head and headbox levels of crucial importance for efficient wet-end operation? (2)

4.2.2 Explain how these TWO parameters are controlled in air-cushioned headboxes. (4)

4.3 Explain what adjustments you would make in order to correct variations in the CD-basis mass profile in an air-cushioned headbox. (5)
[15]

QUESTION 5: WET-END ADDITIVES

5.1 Explain the term *zeta potential* and its importance to the papermaker. (3)

5.2 Describe how HMW polymers work in the papermaking system. (4)
[7]

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

6.1 The pressing action can be divided into two distinct types, namely pressure-controlled action and flow-controlled action.

Discuss these TWO types of pressing action. (4)

6.2 Explain how the following factors affect water removal in the press section:

6.2.1 Press loading

6.2.2 Sheet temperature

6.2.3 Machine speed

(3 × 1) (3)

6.3 Explain the operation of a three-stage cascade steam-and-condensate system with the aid of a labelled diagram. (8)
[15]

QUESTION 7: SURFACE TREATMENT OF PAPER AND MACHINE CLOTHING

7.1 Name and describe FOUR factors that influence starch pick-up at a size press. (4)

7.2 A well-controlled winding operation is essential for the manufacture of good-quality paper rolls.

Explain how each of the following variables affects the roll-density profile on a conventional two-drum winder:

7.2.1 Rider

7.2.2 Drum-torque differential

7.2.3 Tension

(3 × 2) (6)
[10]

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QUESTION 8: PAPER PHYSICS AND PAPER PROPERTIES

Quality tests are done on finished products in order to ensure that the product meets customer requirements.

What do the following tests tell us about the product?

8.1 Mullen

8.2 Ring crush

8.3 Internal bond

8.4 Scuff resistance

8.5 Cobb value

(5 × 1) **[5]**

QUESTION 9: MACHINE CLOTHING, ROLL CROWNING AND ROLL CARE

In order for a press felt to maintain its permeability, it must be continuously conditioned from the time it is installed until it is removed.

Describe *mechanical* and *chemical* conditioning of press felts. **[10]**

TOTAL SECTION B: 75
GRAND TOTAL: 100

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