higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

PAPERMAKING N4

(11022114)

2 September 2021 (X-paper)
09:00–12:00

Drawing instruments may be used.

This question paper consists of 5 pages.

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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. Write neatly and legibly.

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QUESTION 1: FIBRES, SECONDARY FIBRES, STOCK PREPARATION

1.1 Indicate whether HARDWOOD or SOFTWOOD is more suitable for the manufacturing of each of the following by writing only 'Hardwood' or 'Softwood' next to the question number (1.1.1–1.1.2) in the ANSWER BOOK.

1.1.1 Photocopy paper

1.1.2 Packaging paper

(2 × 1) (2)

1.2 Explain how refiner plate design influences fibre and paper properties. (5)

1.3 Discuss the design and operating parameters of centrifugal cleaners. (6)

1.4 Explain the operating principles of Deinking cells. (3)

1.5 The processing of broke is an integral part of paper machine operations.

Discuss the methods of handling wet broke on a modern high speed paper machine. (5)
[21]

QUESTION 2: HEADBOX AND DRAINAGE

2.1 2.1.1 What is the purpose of the tapered distribution header? (1)

2.1.2 Make a labelled sketch of the distribution header and describe its operation. (4)

2.2 Explain, with the aid of a drawing, how total head and headbox level can be controlled in air-cushioned headboxes. (5)

2.3 The layout of a twin-wire forming section for a new high-speed newsprint machine must be designed.

2.3.1 Draw a labelled diagram of the forming section showing the chosen drainage equipment. (5)

2.3.2 Give the reason for the selection of each type of drainage equipment. (3)

2.4 Foil blades are an essential component of all modern forming sections.

2.4.1 Describe the principle of operation of the foil blade. (1)

2.4.2 What adjustments can be made in order to improve water removal? (2)

2.4.3 Which factors must be considered when selecting foil blades? (2)
[23]

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QUESTION 3: WET-END ADDITIVES

3.1 Explain *zeta potential* and why it is important to the papermaking process. (3)

3.2 Modern high-speed paper machines place exceptionally high demands on retention and may require dual polymer programmes.

3.2.1 What are the benefits of dual retention aid systems? (2)

3.2.2 Describe the application principles of dual polymer systems. (4)

3.3 3.3.1 Describe the problems experienced on a paper machine due to pitch. (2)

3.3.2 List two sources of pitch. (2 × ½) (1)

[12]

QUESTION 4: PRESSING AND DRYING

4.1 Make a labelled drawing of a three-nip press section including felts, showers, and the sheet run. (8)

4.2 Explain *nip impulse* and how it affects water removal in the press section. (2)

4.3 Make a labelled diagram of the three-stage cascade steam and condensate system and describe its operation. (9)

[19]

QUESTION 5: SURFACE TREATMENT, COATING, WINDING, AND FINISHING

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

5.2 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:

5.2.1 Rider (3)

5.2.2 Drum torque differential (3)

5.2.3 Tension (1)

[11]

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QUESTION 6: PAPER PROPERTIES AND PHYSICS

6.1 What is the definition of opacity and why is it important to the end user? (2)

6.2 Describe THREE factors which can influence opacity. (3)
[5]

QUESTION 7: MACHINE CLOTHING, DOCTORS, SHOWERS, AND ROLLS

7.1 Name all showers found on the Fourdrinier section and the press section of a paper machine and state the purpose of each. (4)

7.2 Doctor blades play an important role in improving paper machine runability by ensuring that all roll surfaces are free of contaminants which can accumulate during normal operation.

Discuss doctor blade design, operation and maintenance. (5)
[9]

TOTAL: 100

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