higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS CONTROL
NQF LEVEL 4

(6050414)

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09:00–12:00

This question paper consists of 6 pages.

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
PROCESS CONTROL
NQF LEVEL 4
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. Diagrams should be neat and clear and a pencil may be used.
7. Write neatly and legibly.

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SECTION A

QUESTION 1

Various options are given as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1–1.5) in the ANSWER BOOK.

1.1 The qualities that a product must have to be used for a specific function, are … properties.

A functional
B physical
C chemical
D aesthetic

1.2 A/An … is a chart that monitors the quantitative characteristics of a process.

A P-chart
B X-chart
C R-chart
D C-chart

1.3 If data is not properly collected, it …

A will not be readable.
B may no longer be representative.
C will be negative.
D will be unimportant.

1.4 … carry information from the measuring elements to the controller.

A Transducers
B Buses
C Transmission lines
D Output modules

1.5 A … is also called a level change.

A run
B cycle
C control chart
D jump

(5 × 2) **[10]**

QUESTION 2

Choose an item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–J) next to the question number (2.1–2.5) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.1	The transmission of signals back and forth.	A	PFDs
2.2	It is process-oriented.	B	SCADA
2.3	Diagrams representing the real-life appearance of the process equipment.	C	information flow
2.4	The procedure where the operator sets the controller's output signal directly to the system.	D	manual control
2.5	A computing device where a user enters a program using specialised software.	E	PLC
		F	DCS
		G	cascade control
		H	decision making
		I	buses
		J	pictorials

(5 × 1) **[5]**

QUESTION 3

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (3.1–3.5) in the ANSWER BOOK.

3.1 The company that produces non-conforming products too often, may lose support and subsidies from the government.

3.2 The proper and efficient way to start up a processing plant depends on the size and type of the plant.

3.3 Plant shut-down cannot be initiated if maintenance is needed because it is automatic.

3.4 Control systems optimise the performance of a process.

3.5 A logic controller is a piece of hardware.

(5 × 1) **[5]**

TOTAL SECTION A: 20

SECTION B

QUESTION 4

4.1 Define the term *product quality specification.* (2)

4.2 Why do variables need to be controlled in a process? (2)

4.3 Name SIX elements starting with an "M", that influence the process. (6)

4.4 Companies have different procedures for documenting non-conforming products.

Describe the type of information that must be found or that is compulsory in each organisation's procedure. (4)

4.5 Give ONE consequence that a company will suffer if it does not comply with the OHS Act. (1)

4.6 In-line analysers are used in industries based on their specific needs.

Name THREE general classes of these needs. (3)

4.7 State THREE main functions common to all analysers. (3)

4.8 Name FOUR categories of level-sensing devices. (4)

[25]

QUESTION 5

5.1 What is a sensor? (2)

5.2 Provide the names of DCS components that carry out the following functions:

5.2.1 A sensor that measures earthquakes.

5.2.2 It monitors a process and makes simple decisions.

5.2.3 It converts measurements to physical quantities that can be transmitted.

(3 × 2) (6)

5.3 Draw the following pictorial diagrams:

5.3.1 Shut-down valve

5.3.2 Flow alarm low

5.3.3 Pressure transmitter no. 2298 reading

(3 × 3) (9)

5.4 What do trends show about a process? (2)

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5.5 Read the scenario below and answer the questions.

A process operator worked night shift and reported to work at 18:00. He read the daily reports before he started working. An incident report of the day stated that a blockage was identified during the day. He started doing the inspection but everything seemed in order. Later in the evening he experienced the same blockage that he attended to earlier. He then discovered that there was no flow in one of the pipes and started following the steps of problem-solving in process control.

5.5.1 The operator uses instruments and historical data from the DCS to identify the symptoms of the problem.

Name THREE instruments that the operator must inspect in this case to solve the problem. (3)

5.5.2 State THREE possible causes of this problem. (3)

5.5.3 State THREE ways in which the operator can verify the possible causes you mentioned in QUESTION 5.5.2. (3)

5.5.4 State TWO immediate changes that the operator can make to ease the problem in the plant. (2)

5.5.5 Explain how the operator would use logic to identify the probable cause of the problem. (2)

5.5.6 State THREE possible solutions to this problem. (3)
[35]

QUESTION 6

6.1 Name THREE types of control systems. (3)

6.2 The start-up procedure in the plant can cause many hazards if correct procedures are not followed.

Name THREE requirements needed for plant start-up procedures. (3)

6.3 What does the acronym HSS stand for? (1)

6.4 Define the term *disturbance.* (2)

6.5 Draw a neat, labelled diagram of a closed-loop process with feedback control. (9)

6.6 Why is it important to add dead time compensation to a feedback control system? (2)
[20]

TOTAL SECTION B: 80
GRAND TOTAL: 100

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