higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS CONTROL
NQF LEVEL 4

(6050414)

19 November 2024 (X-paper)
09:00–12:00

Nonprogrammable calculators may be used.

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. Use only a black or blue pen.
5. 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 Which ONE of the following is not an example of a common process variable?

A Temperature
B Dead time
C Pressure
D Mass

1.2 Variable data can be defined as …

A the countable characteristics of a process.
B the measurable characteristics of a process.
C the variable that is more important than others.
D the variable that is affected by human actions.

1.3 Ranges of values are called the …

A mean.
B mode.
C cells.
D frequency.

1.4 A seismometer measures …

A pressure.
B earthquakes.
C volcanic activity.
D soil.

1.5 The values plotted on a control chart should randomly fall around the …

A lower control limit.
B X-axis.
C upper control limit.
D process centre line.

(5 × 1) **[5]**

QUESTION 2

Give ONE term for each of the following descriptions by writing it next to the question number (2.1–2.5) in the ANSWER BOOK.

2.1 Calculation of control action

2.2 Desired value of a variable

2.3 Diagram that resembles the real-life appearance of process equipment

2.4 Control used in a multiple-loop system

2.5 Device that changes the flow rate in the correct direction to maintain a constant ratio

(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 Deviation does not occur in all processes.

3.2 Backups of all data must always be made when working on a computer.

3.3 Process control systems provide an action that controls the value of the variable.

3.4 A machine normally does manual control.

3.5 PLC hardware needs to withstand temperature changes, vibration and airborne dust.

(5 × 1) **[5]**

TOTAL SECTION A: 15

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SECTION B

QUESTION 4

4.1 List FOUR factors to consider when setting product quality parameters. (4)

4.2 Differentiate between *X-charts* and *R-charts*. (2 + 2) (4)

4.3 Define the term *corrective action*. (2)

4.4 List FOUR details that should be reflected in a record of all nonconforming products. (4)

4.5 State TWO main methods used to perform in-line analysis. (2)

4.6 List FIVE devices used to measure liquid levels. (5)

4.7 Calculate the flow rate of a liquid flowing in a pipe with a diameter of 24 m at an average velocity of 3,5 m/s. (4)

[25]

QUESTION 5

5.1 Name TWO functions of automatic control. (2)

5.2 Briefly explain why plant start-up may lead to many hazards. (3)

5.3 Control systems are used to suppress external disturbances that may destabilise a system.

5.3.1 Name TWO types of control systems. (2)

5.3.2 Name TWO modes of control that are used during plant start-up. (2)

5.3.3 Name TWO control systems used to prevent abnormal conditions. (2)

5.4 Differentiate between a *controller* and a *control interface*. (2 + 2) (4)

5.5 Give FOUR examples of controllers. (4)

5.6 What is a *control bus*? (2)

[21]

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QUESTION 6

6.1 Draw the ISO PFD symbols for each of the following:

6.1.1 Filter

6.1.2 Mixer

6.1.3 Carrying vessel

(3 × 3) (9)

6.2 Draw a cause-effect diagram indicating the reasons why one may be stranded on the outskirts due to a car problem. (10)

6.3 Explain the THREE components of a trouble-shooting guide. (3)

6.4 Explain the role of a process controller during a shutdown in the process industry. (2)

[24]

QUESTION 7

7.1 A PLC is a computing device that enables a user to enter a program using specialised software.

7.1.1 In which THREE situations in industries do PLCs provide control? (3)

7.1.2 Where are PLCs located? (2)

7.2 Give FOUR examples of control signals that are used to execute computations and logical operations. (4)

7.3 Draw a diagram of a closed-loop process with feed-forward control. (6)

[15]

TOTAL SECTION B: 85
GRAND TOTAL: 100

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