higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS CONTROL
NQF LEVEL 3

(6050403)

12 March 2020 (X-paper)
09:00–12:00

This question paper consists of 5 pages.

553Q1S2012

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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 black or blue pen.
6. Write neatly and legibly.

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SECTION A

QUESTION 1

Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 The main function of an instrument is to measure the value of a process variable.

1.2 Control, in terms of process instrumentation, involves comparing a known value (set point) to the measured value.

1.3 Displays can be digital or analogue.

1.4 An orifice gauge is made up of a thin hole in the middle.

1.5 Laminar flow occurs when fluid undergoes irregular functions and mixing.

1.6 Turbulent flow occurs when fluid travels in regular paths.

1.7 When the Reynolds number is less than zero the flow in a pipe is turbulent.

1.8 Radio-signal systems send messages in waves through the air.

1.9 Feed forward control is used to make up for uncontrolled disturbance in a system.

1.10 Reboilers are not classified according to application.

(10 × 1) **[10]**

QUESTION 2

Choose a term from COLUMN B that matches a description in COLUMN A. Write only the letter (A–F) next to the question number (2.1–2.6) in the ANSWER BOOK.

COLUMN A		COLUMN B	
2.1	Giving an early warning of possible hazards	A	measurement
2.2	Comparing the set point to the measured values	B	quality
2.3	Measured values indicated on a gauge and stored on a paper	C	safety
2.4	Product manufactured according to specification	D	throughput
2.5	Measuring the value of a process variable	E	recording
2.6	Number of measurable items passing through a system	F	control

(6 × 2) **[12]**

TOTAL SECTION A: 22

SECTION B

QUESTION 3

3.1 Name SIX categories of automatic recorders that write data on a chart and store it in a computer. (6)

3.2 Draw a differential U-tube equal-leg manometer. (6)

3.3 Give FOUR advantages of thermocouples. (4)

3.4 Differentiate between *indirect* and *direct* level measurement. (2 + 2) (4)

3.5 Define the term *interlock*. (2)

[22]

QUESTION 4

4.1 Draw a simple sketch to illustrate the control loop for the temperature control of a distillation column feed. (6)

4.2 State THREE purposes of a process-flow diagram (PFD). (3 × 2) (6)

4.3 State the purpose of an actuator. (2)

4.4 State the purpose of a trip. (3)

[17]

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QUESTION 5

5.1 Name and explain THREE basic control modes used in process control. (11)

5.2 Explain the problem-solving methodology process step by step. (6)

5.3 Explain each of the following terms:

5.3.1 Zero setting

5.3.2 Calibration

5.3.3 Bias setting

5.3.4 Ratio setting

(4 × 3) (12)

5.4 State FOUR effects that the environment in which instruments must function can have on the quality and stability of the instrument state. (4)

5.5 State SIX common problems that cause signal-transfer failure in an electrical system. (6)

[39]

TOTAL SECTION B: 78
GRAND TOTAL: 100

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