higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS CONTROL
NQF LEVEL 3

(6050403)

11 December 2020 (Y-paper)
13:00–16:00

This question paper consists of 6 pages.

579Q1N2011

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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

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

1.1 Which of the following statements about a conventional rotameter is correct?

A Its scale is non-linear
B Its metering area is constant
C Its pressure drop is variable
D Its design is self-cleaning

1.2 The following element develop a differential pressure proportional to flow:

A Pitot tube
B Orifice plate
C Venturi tube
D All the above

1.3 Which of the following is not a positive displacement meter?

A Target meter
B Rotating vane meter
C Dry gas bellows meter
D Piston meter

1.4 What happens when a fluid is forced to flow in a widening pipe?

A Its pressure decreases.
B Its flow is turbulent.
C Its velocity decreases.
D Its volume decreases.

1.5 Which device is used to restrict fluid flow for measuring?

A Flow nozzle
B Venturi tube
C Manometer
D Orifice plate

(5 × 2) **[10]**

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QUESTION 2

Complete the following sentences by filling in the missing word. Write only the word next to the question number (2.1–2.5) in the ANSWER BOOK.

2.1 … is the science of measurement and control.

2.2 An … receives a signal from a transmitter.

2.3 An error that occurs when one makes an incorrect reading is called …

2.4 … is defined as force per unit area

2.5 The rate at which a substance moves is called …

(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 (3.1–3.7) in the ANSWER BOOK.

3.1 A vacuum in a Bourdon tube pressure gauge is sensed as a reverse motion.

3.2 The inclined leg manometer is used to measure extremely high pressures.

3.3 When pressure is applied to a material, it creates strain or deformation.

3.4 The term *oscillate* means a body moves or swings back and forth at a regular speed.

3.5 *Capacitance* is the inability of a material to store an electrical charge.

3.6 A control loop controls a single process variable.

3.7 A variable is anything that can be measured, controlled (directly or indirectly) or manipulated.

(7 × 1) **[7]**

TOTAL SECTION A: 22

SECTION B

QUESTION 4

4.1 Define the following terms:

4.1.1 Calibration

4.1.2 Flow diagram

4.1.3 Bimetallic element

4.1.4 Offset

4.1.5 Distributed control systems

(5 × 2) (10)

4.2 State FOUR advantages of thermocouples. (4)

4.3 Explain the operating principles of a radiation pyrometer by means of a drawing. (10)

4.4 Flumes and weirs are channel shapes that are designed to change the flow pattern or direction of a fluid.

4.4.1 Name TWO commonly used types of flumes. (2)

4.4.2 Name TWO commonly used types of weirs (2)

4.5 Explain *viscosity*. (1)
[29]

QUESTION 5

5.1 Explain the use of the following controllers:

5.1.1 Flow controllers

5.1.2 Discrete controllers

5.1.3 Multistep controllers

5.1.4 Level controllers

5.1.5 Temperature controllers

(5 × 2) (10)

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5.2 Describe the operating principle of each of the following safety trips:

5.2.1 Firearm control panel

5.2.2 Electrical current sensors

5.2.3 Pressure switches

(3 × 2) (6)

5.3 On what conditions can a trip be downgraded to an alarm? (3)

5.4 What are the TWO uses of corrective interlocks? (2)
[21]

QUESTION 6

6.1 Define a *parameter.* (2)

6.2 Explain what a *set point* is. (2)

6.3 What does the acronym PLC stand for? (2)

6.4 Make a freehand drawing of a split-range control loop and explain how it works. (10)

6.5 Name the THREE basic control modes used in process control. (3)

6.6 Explain what proportional (P), integral (I) and derivative (D) actions are in a PID controller. (3 × 3) (9)
[28]

TOTAL SECTION B: 78
GRAND TOTAL: 100

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