higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

PROCESS CONTROL
NQF LEVEL 3

(6050403)

13 March 2018 (X-Paper)
09:00–12:00

This question paper consists of 5 pages.

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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 question on a NEW page.
5. Write neatly and legibly.

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QUESTION 1

Indicate whether the following statements are TRUE or FALSE. Choose the answer and write only 'true' or 'false' next to the question number (1.1–1.10) in the ANSWER BOOK.

1.1 Pneumatic actuators need no air supply for operation.

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

1.3 A remote instrument can take measurements without being in close proximity to the material or product being measured.

1.4 Normal control limit is the top line on the control chart.

1.5 Bourdon tubes are circular tubes with an oval cross section used to measure temperature.

1.6 Electrical measuring instruments are mostly used for measuring basic parameters such as current, voltage, resistance and speed of rotation.

1.7 A thermometer that relies on the expansion of a liquid in metal has inaccuracies due to the expansion of the container.

1.8 A trip is a safety device that lowers the risk of unwanted events happening by cutting off power to the device that causes potential damage.

1.9 An open-loop control system does not need a human operator to take corrective measures.

1.10 When using feedback control, a correction of the disturbance can be made before the disturbance is known.

(10 × 1) **[10]**

QUESTION 2

Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number (2.1–2.5) in the ANSWER BOOK.

2.1 When a measured variable moves away from a desired value

2.2 One common controller signal commands two or more control valves.

2.3 A safety device that stops machines, when tripping and thus preventing damage to the machine and injury to the operator

2.4 A control loop where a correction is made in the controller after an error has been detected

2.5 A control loop where a correction is made in the controller before the process has time to respond to the disturbance

(5 × 2) **[10]**

QUESTION 3

3.1 The dipstick is one of the simplest level measuring gauges.

Explain how a dipstick can be used to measure the level of oil in a car engine. (4)

3.2 Name FOUR types of expansion thermometers. (4)

3.3 Make a simple, labelled sketch of the operation of a solid-rod thermometer. (5)

3.4 Discuss the working principle of a bimetallic strip thermometer. (10)
[23]

QUESTION 4

4.1 Draw a block diagram of a feed-forward control system. (5)

4.2 An alarm is used to alert personnel of variable changes from normal operation.

4.2.1 What is *alarm management*? (2)

4.2.2 Name THREE things that can cause a nascence alarm to be seen or heard in a process plant. (3)

4.2.3 Name TWO primary events that may lead to alarm floods. (2)

4.2.4 Define a *trip*. (2)

4.3 Explain the following alarm elements:

4.3.1 Warning lights

4.3.2 Audible alarm

(2 × 2) (4)

4.4 Name FOUR types of safety sensors. (4)
[22]

QUESTION 5

5.1 Piping and connections are represented by several different symbols. Draw representation symbols for the following:

5.1.1 Main process

5.1.2 Minor process

5.1.3 Electrical line

5.1.4 Pneumatic signal

5.1.5 Software line/data link

5.1.6 Capillary line

(6 × 2) (12)

5.2 Name THREE types of differential flowmeters. (3)

5.3 Which type of area flowmeter is also known as a variable area flowmeter? (2)

5.4 Name FOUR types of open-channel meters. (4)
[21]

QUESTION 6

6.1 Explain the difference between *local display* and *remote display*. (4)

6.2 Make a sketch of a pitot tube flowmeter and explain its working principle. (10)
[14]

TOTAL: 100

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