higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

INSTRUMENTATION TECHNOLOGY
NQF LEVEL 3

(6060463)

4 November 2022 (X-paper)
09:00–12:00

This question paper consists of 6 pages.

061Q1N2204

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TIME: 3 HOURS
MARKS: 150

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. Write neatly and legibly.

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QUESTION 1

1.1 Pneumatic transmitters use air pressure to send signals.

List FIVE problems or shortcomings of pneumatic transmitters. (5)

1.2 Make a neat, labelled diagram of a capacitive transmitter and explain its operation. (10)

1.3 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.3.1–1.3.5) in the ANSWER BOOK.

1.3.1 Capacitive transmitters and convertors change their capacitance value as their capacitor is compressed or released.

1.3.2 Preventative maintenance includes any task or inspection that must be carried out on a routine basis.

1.3.3 Piezo-resistive transmitters and convertors use the change in resistance of a material because of a change in length to determine pressure within a system.

1.3.4 Electronic transmitters and convertors are used to measure temperature, pressure, flow, and levels in processes and systems.

1.3.5 Routine maintenance is carried out when certain operating conditions have been met.

(5 × 1) (5)

1.4 List FIVE components found in a piezo-resistive transmitter. (5)

[25]

QUESTION 2

2.1 Make a freehand drawing of the following glass thermometers:

2.1.1 Medical thermometer (3)

2.1.2 Wall thermometer (3)

2.1.3 Industrial thermometer (3)

2.2 In your own words, explain how a thermometer works. (3)

2.3 Which TWO liquids are normally used in glass thermometers? (2)

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2.4 Make a labelled drawing that explains the broadband pyrometer. ☆ (6)

2.5 Name FOUR advantages and FOUR disadvantages of a pyrometer. (4 × 2) (8)

2.6 Choose a/an item/word from COLUMN B that matches a description in COLUMN A. Write only the letter (A–G) next to the question number (2.6.1–2.6.5) in the ANSWER BOOK.

☆

COLUMN A		COLUMN B
2.6.1	They are also called single-colour pyrometers	A broadband pyrometer
2.6.2	They are also known as two-colour pyrometers	B thermopile
2.6.3	Sensors that are used in pyrometers	C optical pyrometer
2.6.4	Also known as a disappearing-filament pyrometer	D ratio pyrometer
2.6.5	The simplest type of pyrometer using a large spectrum of wavelengths to measure temperature	E Boltzmann constant
		F narrow-band pyrometer
		G Pythagoras' theorem

(5 × 1) (5)

2.7 Name TWO types of thermistors. ☆ (2)
[35]

QUESTION 3

3.1 Make a drawing that shows the operating principle of an electromagnetic flow meter. (10)

3.2 Draw a table to list TWO advantages and TWO disadvantages of a flume. (2 × 2) (4)

3.3 Explain in your own words how a vortex flow meter is zero-checked. ☆ (5)

3.4 Open-channel flow measurement plays an important role in everyday life.

3.4.1 What is the use or purpose of open-flow measurement instruments? (3)

3.4.2 Name TWO places where open-flow measurement instruments are used. (2)

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3.4.3 What are/is the disadvantage(s) of open-flow measurement instruments? (2)

3.4.4 Name FOUR devices that are used to measure open-channel flow. (4)

3.4.5 Name TWO of the biggest problems of open-channel meters. (2)

3.4.6 What are the maintenance requirements of open-channel meters? (5)

3.5 The ultrasonic flow meter

3.5.1 What are the FIVE main components of an ultrasonic flow meter? (5)

3.5.2 Explain how calibration is performed in an ultrasonic flow meter. (3)

[45]

QUESTION 4

4.1 Use the table below and complete the conversions.

UNIT	METRE (M)	CENTIMETRES (CM)	FOOT (FT)	INCH (IN)
Metre	1	100	3,2808	39,3707
Centimetre	0,01	1	0,0328	0,39371
Foot	0,3048	30,48	1	12
Inch	0,0254	2,54	0,0833	1

4.1.1 You have a measurement of 2 metres.

What is the length in inches? (2)

4.1.2 You have a measurement of 12 feet. What is the length in centimetres? (2)

4.1.3 You have a level measurement of 2,6 m. The maximum level of a silo is 4 m.

What percentage of the silo is filled? (4)

4.2 Explain the difference between *continuous level measurements* and *discrete level measurements*. (2 × 2) (4)

4.3 Name FIVE ways to measure the level of liquids. (5)

4.4 Give THREE level measurement instruments that are found in a car. (3)

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4.5 Draw a neat, labelled diagram that shows a tank with an electrode sensor. (10)

4.6 Explain with the aid of a labelled drawing the installation of a vibrating level measuring instrument. (10)

4.7 Electromechanical level meters have two common problems: no output and incorrect output.

Both problems have a number of causes.

List FIVE possible causes of incorrect output. (5)

[45]

TOTAL: 150

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