higher education & training

Department:
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REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)

INSTRUMENTATION TECHNOLOGY
NQF LEVEL 3

(6060463)

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE (VOCATIONAL)
INSTRUMENTATION TECHNOLOGY
NQF LEVEL 3
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. Use only a black or blue pen.
5. Write neatly and legibly.

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QUESTION 1

1.1 Indicate whether the following statements are TRUE or FALSE by writing only 'True' or 'False' next to the question number (1.1.1–1.1.10) in the ANSWER BOOK.

1.1.1 A convertor uses air pressure to send out signals.

1.1.2 A transmitter is designed to change the range, frequency or shape of air or gas pressure signals to a standardised electrical signal.

1.1.3 Piezo-resistive constant for the material is given in Ω.

1.1.4 Piezo is a Greek derived word that means to squeeze.

1.1.5 The higher the pressure difference between the high-pressure and low-pressure inlets, the smaller the gap between the force bar and the nozzle will be.

1.1.6 The process connection connects the transmitter onto the piping system.

1.1.7 Mechanical engineers use the capacitive transmitters in research to determine the strength of different types of material and alloy.

1.1.8 The transmitter signal output starts at 20 kPa and not at 0 kPa.

1.1.9 Inductive instruments work on a principle of capacitive induction.

1.1.10 Most convertors are calibrated in the factory or in a laboratory to the range specified by the customer.

(10 × 1) (10)

1.2 Installation of pneumatic transmitters and convertors.

Give FIVE basic tips that need to be considered when installing a pneumatic transmitter and convertor. (10)

1.3 What is the difference between *routine* and *preventative maintenance*? (4)

[24]

QUESTION 2

2.1 A bi-metallic thermometer consists of two metals with different physical properties joined together.

Answer the following questions in relation with the bi-metallic thermometer.

2.1.1 Make a neat labelled diagram of a bi-metallic thermometer. (5)

2.1.2 What is the only advantage of the bi-metallic thermometer? (2)

2.1.3 Name TWO uses of the bi-metallic thermometer. (2)

2.1.4 Why is it important for the two metals to have different coefficients? (3)

2.2 Thermistors:

2.2.1 Name TWO types of thermistors. (2)

2.2.2 In the same axis, make graphs of the two thermistors. (4)

2.2.3 What are FIVE limitations of thermistors? (5)

2.2.4 What is the general temperature range that you can measure with a thermistor? (2)

2.2.5 List THREE ways that can be used to connect a thermistor. (3)

2.2.6 How will you know if the thermistor is broken? (2)

2.3 Make a neat labelled diagram of an optical pyrometer. (6)
[36]

QUESTION 3

3.1 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 (3.1.1–3.1.10) in the ANSWER BOOK.

3.1.1 They use the ultrasound to measure the speed with which fluids flow through pipes.

A Electromagnetic flowmeter
B Ultrasonic flowmeter
C Vortex flowmeter
D Coriolis flowmeter

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3.1.2 The conductor used is in the form of electrically conductive fluids.

A Electromagnetic flowmeter
B Ultrasonic flowmeter
C Vortex flowmeter
D Coriolis flowmeter

3.1.3 The other name for this instrument is magmeter.

A Electromagnetic flowmeter
B Ultrasonic flowmeter
C Vortex flowmeter
D Coriolis flowmeter

3.1.4 With this instrument, the electrodes are insulated from the measuring tube and other piping.

A Electromagnetic flowmeter
B Ultrasonic flowmeter
C Vortex flowmeter
D Coriolis flowmeter

3.1.5 The meter measures the vibrations of vortices caused by an obstacle in the flow path of a liquid or a gas in a pipe.

A Electromagnetic flowmeter
B Ultrasonic flowmeter
C Vortex flowmeter
D Coriolis flowmeter

3.1.6 These meters are used where it is important to know the mass that flows through the system.

A Electromagnetic flowmeter
B Ultrasonic flowmeter
C Vortex flowmeter
D Coriolis flowmeter

3.1.7 It can be used where it is impossible to insert a meter directly into the fluid.

A Electromagnetic flowmeter
B Ultrasonic flowmeter
C Vortex flowmeter
D Coriolis flowmeter

3.1.8 Not suitable for plug flow or two-phase flow.

A Electromagnetic flowmeter
B Ultrasonic flowmeter
C Vortex flowmeter
D Coriolis flowmeter

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3.1.9 Can only be used when fluid is at high velocity.

A Electromagnetic flowmeter
B Ultrasonic flowmeter
C Vortex flowmeter
D Coriolis flowmeter

3.1.10 This meter has two designs which are; single tube and twin tube.

A Electromagnetic flowmeter
B Ultrasonic flowmeter
C Vortex flowmeter
D Coriolis flowmeter

(10 × 1) (10)

3.2 Open channel meters present few problems.

3.2.1 Name the TWO biggest problem/faults with open channel flow meters. (2)

3.2.2 Explain how these faults are detected? (6)

3.2.3 Explain how the faults are corrected? (4)

3.3 Make a neat labeled diagram of an electromagnetic flowmeter. (10)

3.4 Name FIVE main components of an ultrasonic flowmeter and explain the use of each component. (10)

3.5 Use a sketch to show how an ultrasonic flow device can be installed using a V-method. (3)

[45]

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QUESTION 4

4.1 Choose a/an term/item from COLUMN B that matches a description in COLUMN A. Write only the letter (A–L) next to the question number (4.1.1–4.1.10) in the ANSWER BOOK.

COLUMN A		COLUMN B	
4.1.1	Can measure levels within temperature ranges from 0 °C up to 200 °C	A	Hydrostatic level measurement
4.1.2	The instrument can handle temperatures from -50 °C to 400 °C and can withstand very high pressures	B	Discrete level measurement
4.1.3	This instrument can safely operate at temperatures ranging from -50 °C to 150 °C	C	Continuous level measurement
4.1.4	Instrument that measured the Nile's water level	D	capacitive
4.1.5	Level measurement can be taken at any time and an exact value can be read	E	vibrating
4.1.6	Level measurement that can be done by using a differential pressure measuring unit	F	Visual level measurements
4.1.7	This calculation should be done when the sensor is above the zero point	G	Parallax effect
4.1.8	Measures level of oil in the car	H	conductive
4.1.9	Looking at how high the level is	I	Zero suppression
4.1.10	If the reading of a level is not taken from the correct place	J	Zero elevation
		K	Nilometer
		L	dipstick

(10 × 1) (10)

4.2 Do the following calculations:

4.2.1 The liquid level of a rectangular tank is 0,6 m. The length of the tank is 2 m and the width is 1,5 m.

Calculate the volume of the tank in m^3. (3)

4.2.2 There is a cylindrical tank with a radius of 1,2 m. This tank can be filled to a maximum level of 3 m. The tank is 70% full.

Calculate the volume of the liquid. (6)

4.3 Explain how you will go about mounting the sensor of a conductive level instrument. (10)

4.4 List FIVE places where you can use the conductive level measuring instrument. (5)

4.5 List FOUR problems that can occur when using the capacitive level measuring instrument. (4)

4.6 Explain the installation procedure for vibrating level measuring instrument. (4)

4.7 How will you calibrate the vibrating level measuring instrument? (3)

[45]

TOTAL: 150

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