higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL INSTRUMENTS N4

1 April 2021

This marking guideline consists of 7 pages.

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SECTION A

QUESTION 1

1.1	(1.1.1)	Displacement	
	(1.1.2)	Measured variable	
	(1.1.3)	Electrical signal	(3)
1.2	(1.2.1)	Inlet cone	
	(1.2.2)	Velocity	
	(1.2.3)	Pressure	(3)
1.3	(1.3.1)	Area	
	(1.3.2)	Distance	
	(1.3.3)	Dielectric	(3)
1.4	(1.4.1)	Kirchhoff's law	
	(1.4.2)	Current	
	(1.4.3)	Potential drops	
	(1.4.4)	Applied voltage	(4)
1.5	(1.5.1)	Gauge	
	(1.5.2)	Less than	(2)
			[15]

QUESTION 2

2.1 Telemetering
2.2 Non-bounded strain gauge
2.3 Proportional action
2.4 Density
2.5 Vena contracta

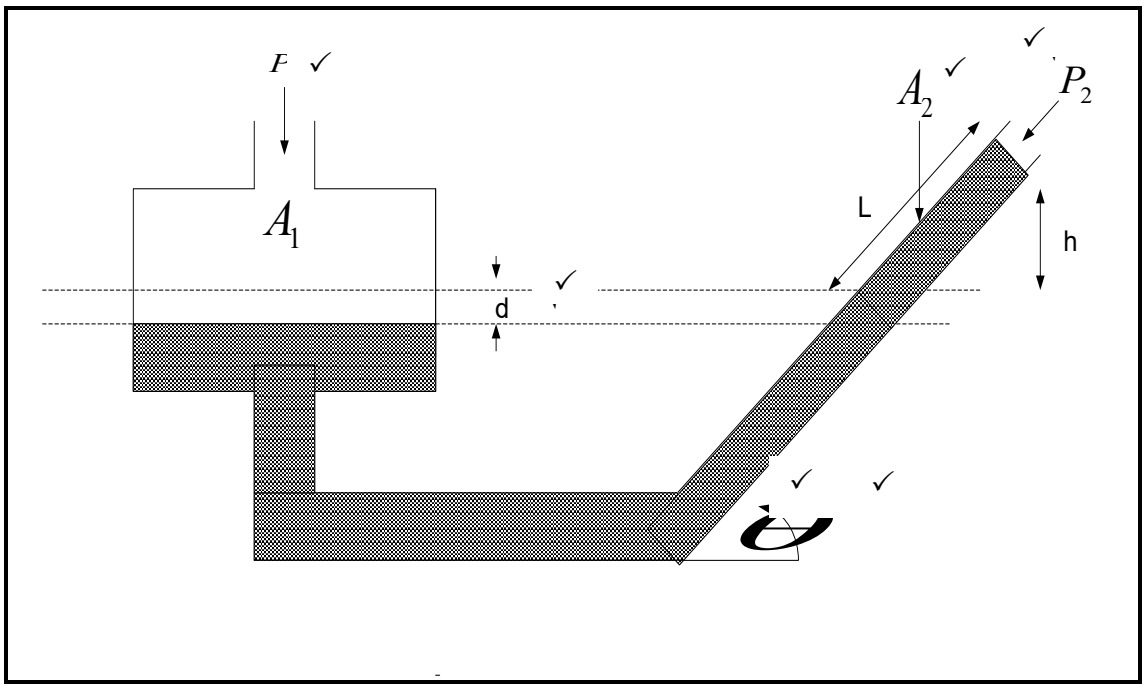
(5 × 1) **[5]**

TOTAL SECTION A: 20

SECTION B

QUESTION 3

3.1

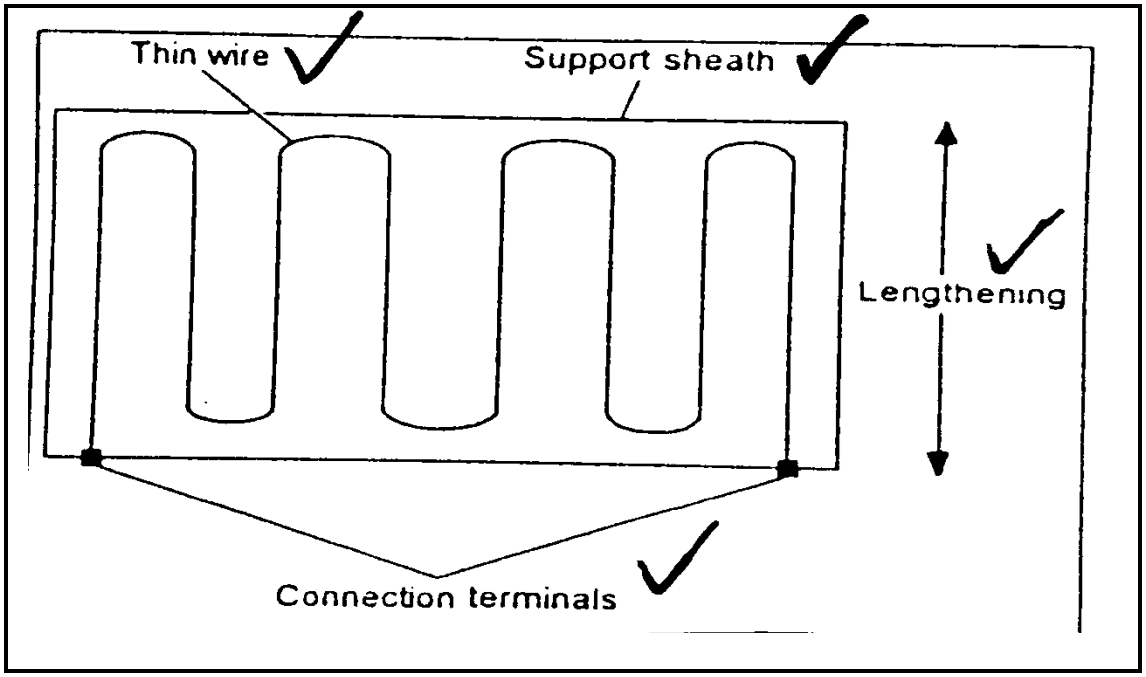


(6)

3.2

- Dry calibration is when a manometer-type instrument is calibrated with air.✓ Air fills the space above the sealing liquid in the dynamic area.✓
- In wet calibration air is used as calibration medium,✓ while the density of the measuring liquid in the dynamic area is calculated.✓ (2 × 2) (4)

3.3



(4 × 1 Labelling)
(1 × 1Diagram) (5)

3.4 $Stress = Young\ modulus \times strain$

$$\Rightarrow Strain = \frac{stress}{Young's modulus} = \frac{25\times10^{6}}{90\times10^{9}} = 277{,}8 \times 10^{-6}\checkmark$$

$$\text{Also,} \quad GF = \frac{\Delta R/R}{\Delta L/L}$$

$$1{,}9 = \frac{\Delta R/R}{277{,}8\times10^{-6}}\ \checkmark$$

$$\Rightarrow \Delta R = 527{,}82 \times 10^{-6} \times R\checkmark$$
$$= 527{,}82 \times 10^{-6} \times 200\checkmark$$
$$= 0{,}106\ \Omega\checkmark$$

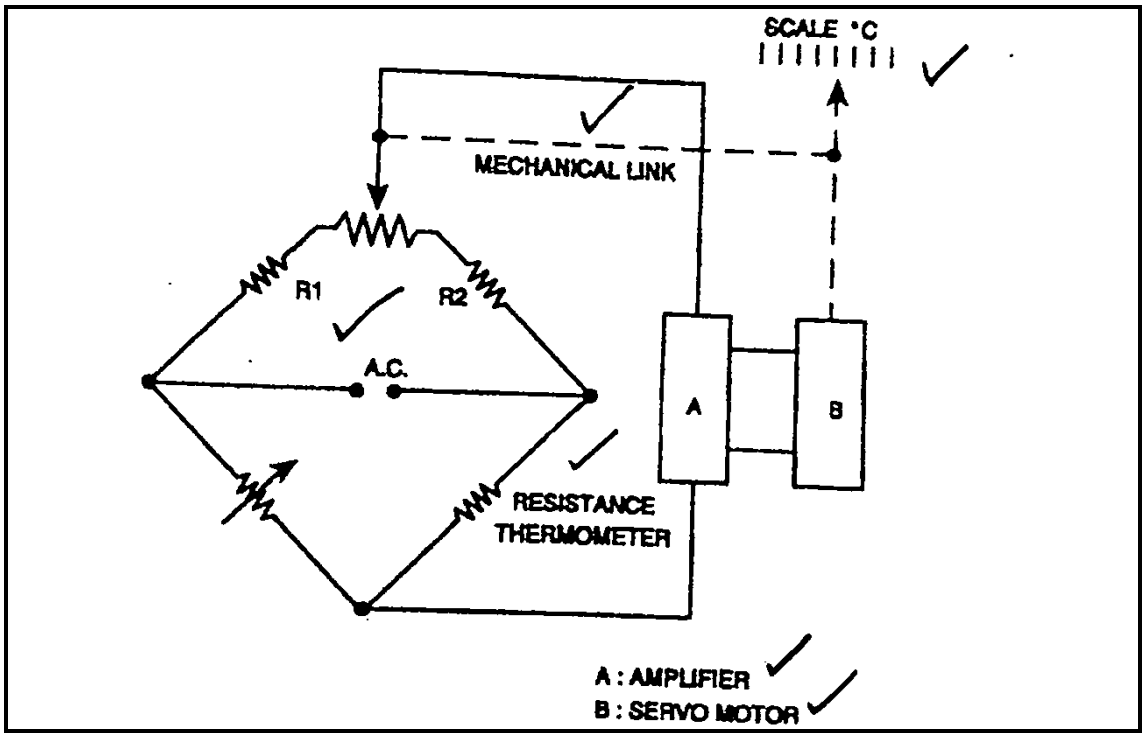
(5)
[20]

QUESTION 4

4.1
- The Celsius scale has two fixed points, namely the lower fixed point (0 ºC)✓ and the upper fixed point (100 ºC).✓
- The Kelvin scale has the same unit intervals as the Celsius scale, however, the starting point, i.e. 273,15 Kelvin is equal to 0 ºC.✓
- This means that the upper fixed point will be 373,15 K which is equal to 100 ^{0}C.✓

(4)

4.2

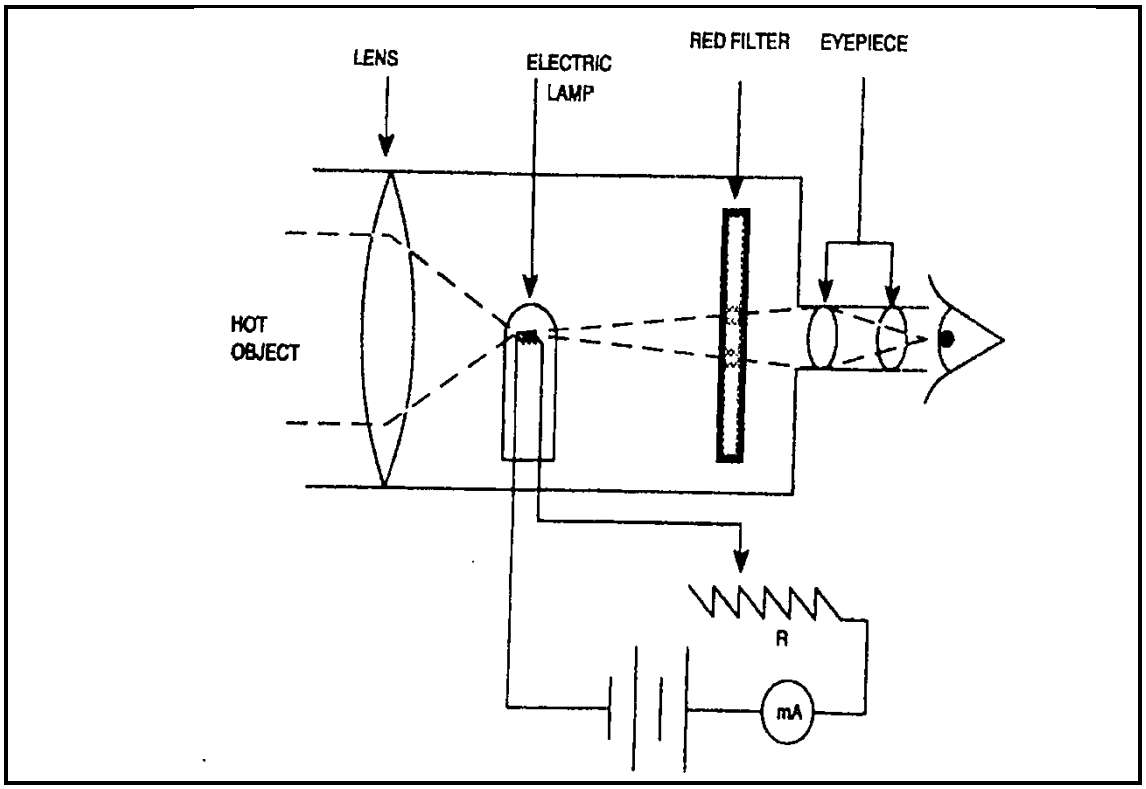


(6)

4.3
- The method of measuring the temperature of an object
- by means of the quantity of energy which it radiates, is called radiation pyrometry.
- These instruments measure the rate of energy given off per unit area of the body to be measured
- over a relatively broad range of wavelengths.

(4)

4.4



(5 × 1 Labelling)
(1 × 1 Diagram) (6)

[20]

QUESTION 5

5.1 5.1.1
- On-off control can be defined as a form of control where the output of a controller resumes one of two extreme positions,
- open or closed, high or low, on or off.
- There is no in-between value or position. (3)

5.1.2
- The amount of the measured value of the controlled condition must change
- for the valve to be moved from the fully closed to the fully opened position. (2)

5.1.3
- The valve positioner is a device installed between the controller and the valve actuator
- to move the actuator stem according to the value of the input signal. (2)

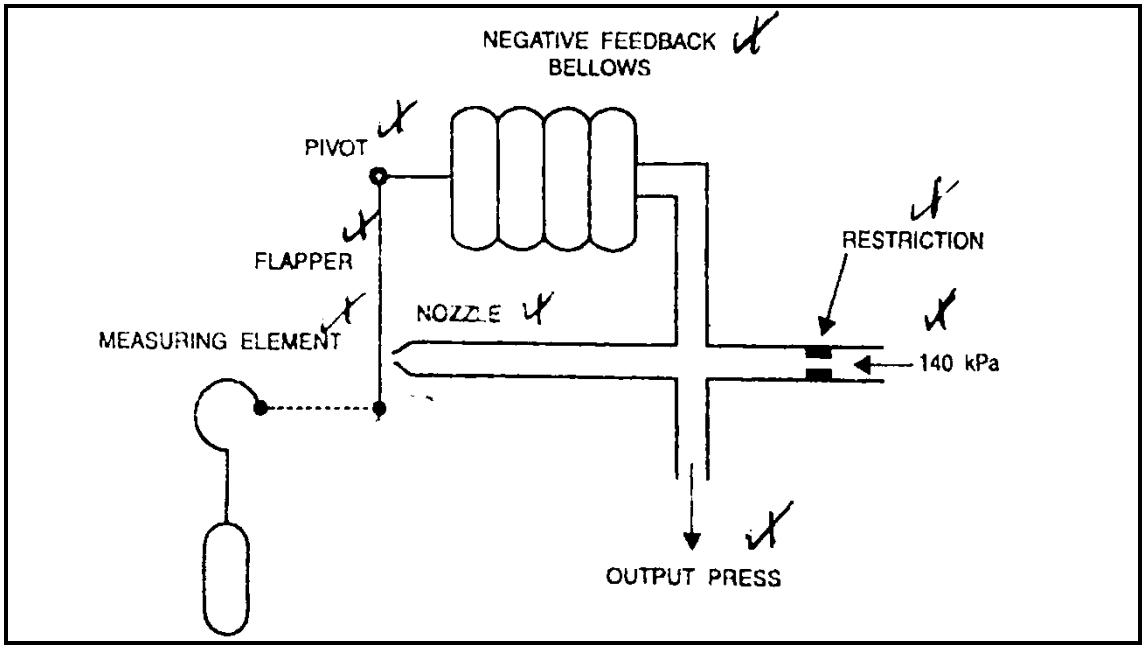
5.2 5.2.1 Proportional electronic controller (1)

5.2.2
- Current signal ranging from 4 mA to 20 mA for control purposes
- Voltage signal of ± 4 volts for feedback purposes (2)

5.2.3
- With no input signal, the feedback voltage is zero
- and the potential at point A relative to ground is zero.
- There is an output signal halfway between 4 mA and 20 mA. (3)

5.3
- A measuring element or primary element
- A transducer or conversion element
- Pressure line or telemetering channels or connecting wires (3)

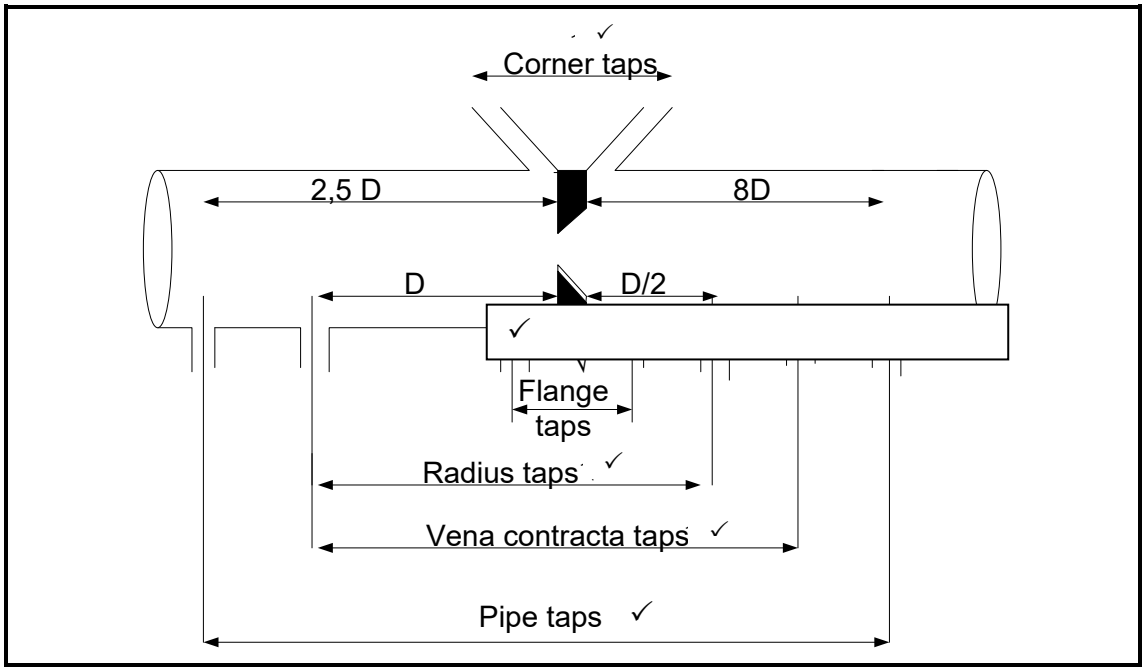
5.4



(4)
[20]

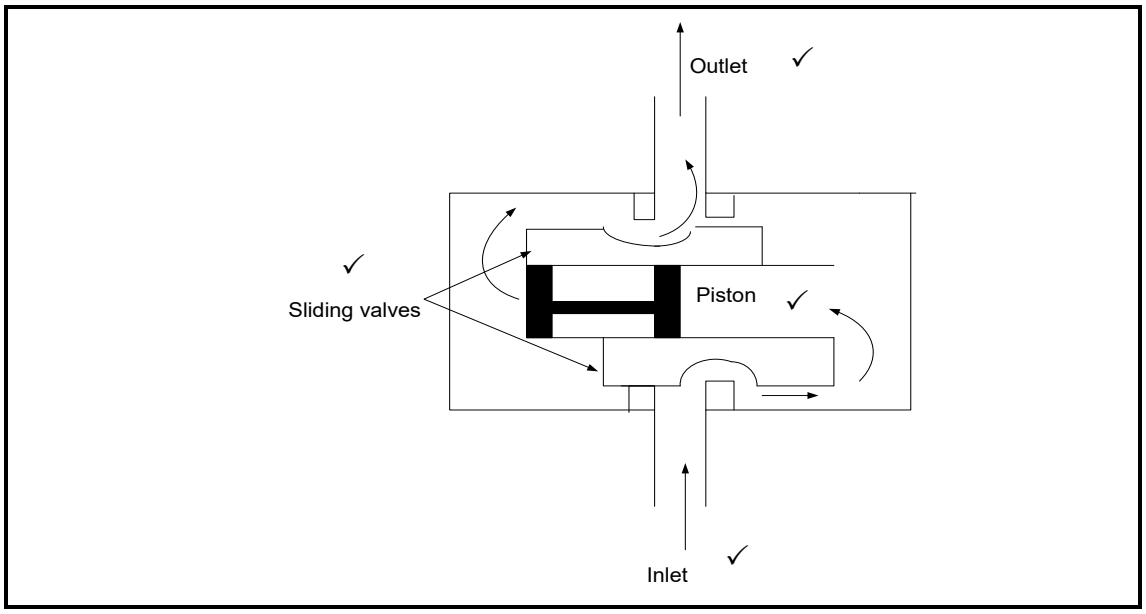
QUESTION 6

6.1



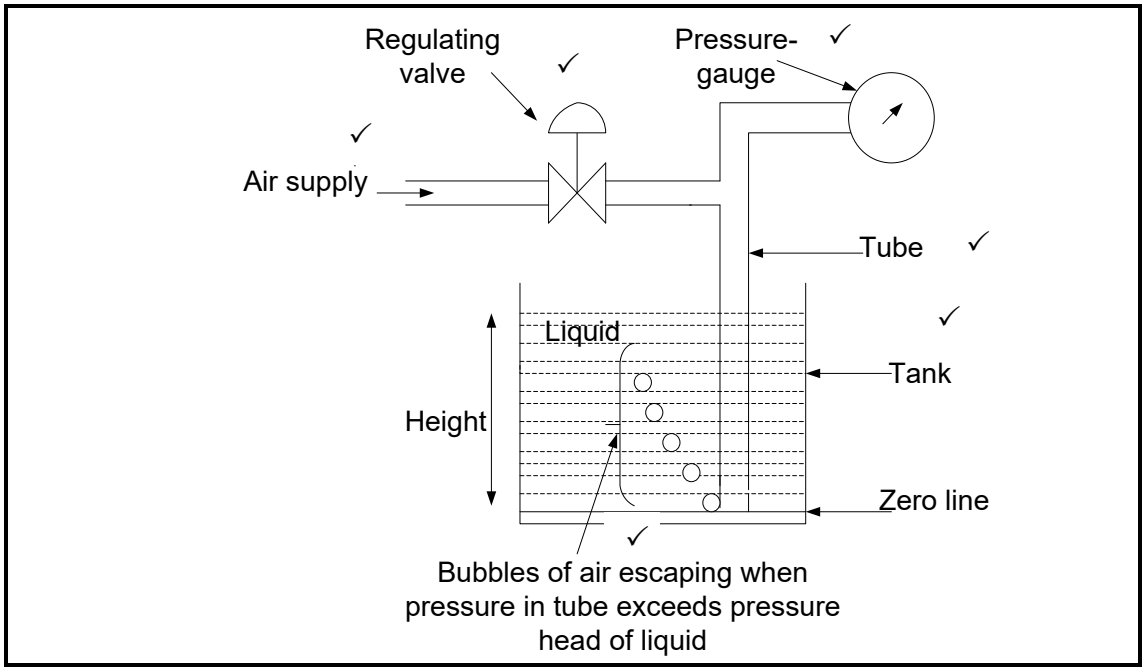
(5)

6.2



(4 × 1 Labelling)
(1 × 1 Diagram) (5)

6.3



(6)

6.4

$$\Delta P = \rho g h$$

$$50\,000 = 1\,000 \times 10 \times h \checkmark$$

$$\Longrightarrow h = 5\ m \checkmark$$

$$h_{\ total} = 5 + 0{,}05 \checkmark$$

$$= 5{,}05\ m \checkmark$$

(4)
[20]

TOTAL SECTION B: 80
GRAND TOTAL: 100

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