



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE INSTRUMENT TRADE THEORY N3

22 November 2022

This marking guideline consists of 6 pages.

QUESTION 1

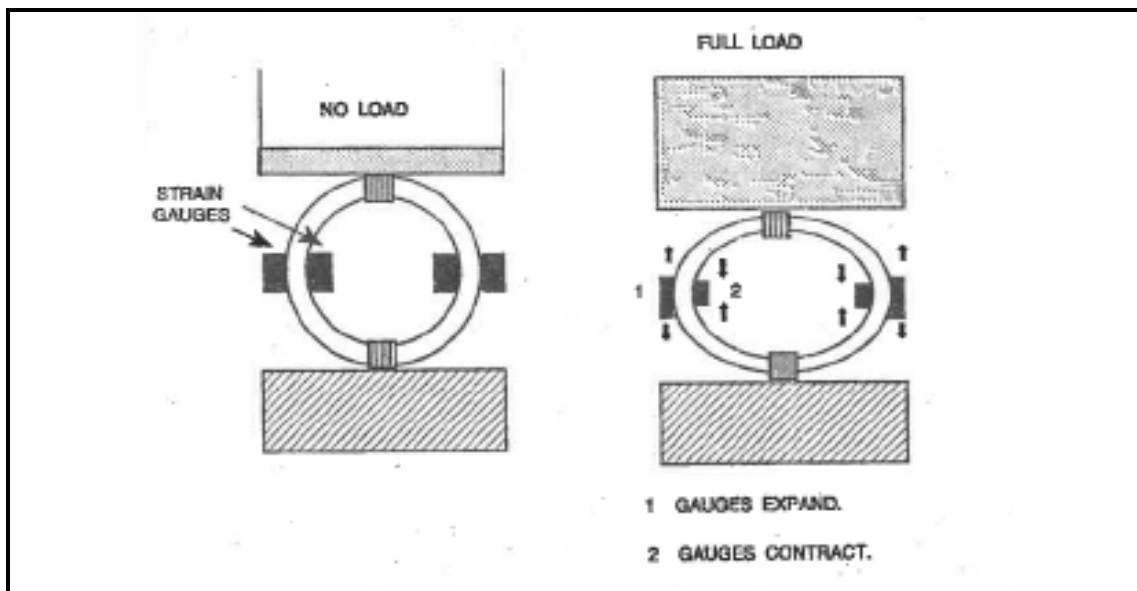
- 1.1 1.1.1 B
 1.1.2 F
 1.1.3 A
 1.1.4 C
 1.1.5 D

(5 × 1) (5)

- 1.2 • To compensate for these temperature changes, a dummy or second gauge is connected in the opposite arm of the bridge close to the measuring gauge
 • and oriented along its passive axis.
 • The dummy gauge will therefore experience the same temperature effects as the measuring gauge
 • and therefore the same change in resistance.
 • The unwanted resistance change in the measuring gauge is cancelled by the resistance of the dummy gauge.

(5)

1.3



3 marks for the sketches
 2 marks for correct strain gauges

(5)

1.4

Potential B = Potential at D ✓

therefore $I_1 \times R_1 = I_2 \times R_3$1 ✓and $I_1 \times R_2 = I_2 \times R_T$2 ✓

divide 1 by 2

$$\frac{I_1 \times R_1}{I_1 \times R_2} = \frac{I_2 \times R_3}{I_2 \times R_T} \quad \checkmark$$

$$\text{therefore } \frac{R_1}{R_2} = \frac{R_3}{R_T} \quad \checkmark$$

$$R_T = R_3 \times \frac{R_2}{R_1} \quad \checkmark \quad R_T = R_4$$

(6)

- 1.5
- Capacitive transducer
 - Rare-earth transducer
 - Piezoelectric transducer
 - Magnetic pressure transducer

(4)
[25]

QUESTION 2

2.1 2.1.1 $V_m = V_{CA} - V_{AD}$ ✓

$$V_{CA} = \frac{R_1}{R_1 + R_2} \times V_T \checkmark$$

$$V_{CA} = \frac{80}{80 + 120} \times 100 \checkmark$$

$$V_{CA} = 40 \text{ V} \checkmark$$

$$V_{AD} = \frac{R_3}{R_3 + R_4} V_T \checkmark$$

$$V_{AD} = \frac{480}{480 + 160} \times 100 \checkmark$$

$$V_{AD} = 75 \text{ V} \checkmark$$

$$V_m = 40 - 75 \checkmark$$

$$V_m = -35 \text{ V} \checkmark \quad \text{The negative sign means polarity is reversed.} \checkmark \quad (9)$$

- 2.1.2
- Need for standardisation
 - The lead-wire resistance is added to the thermometer giving false temperature readings.
- (2)

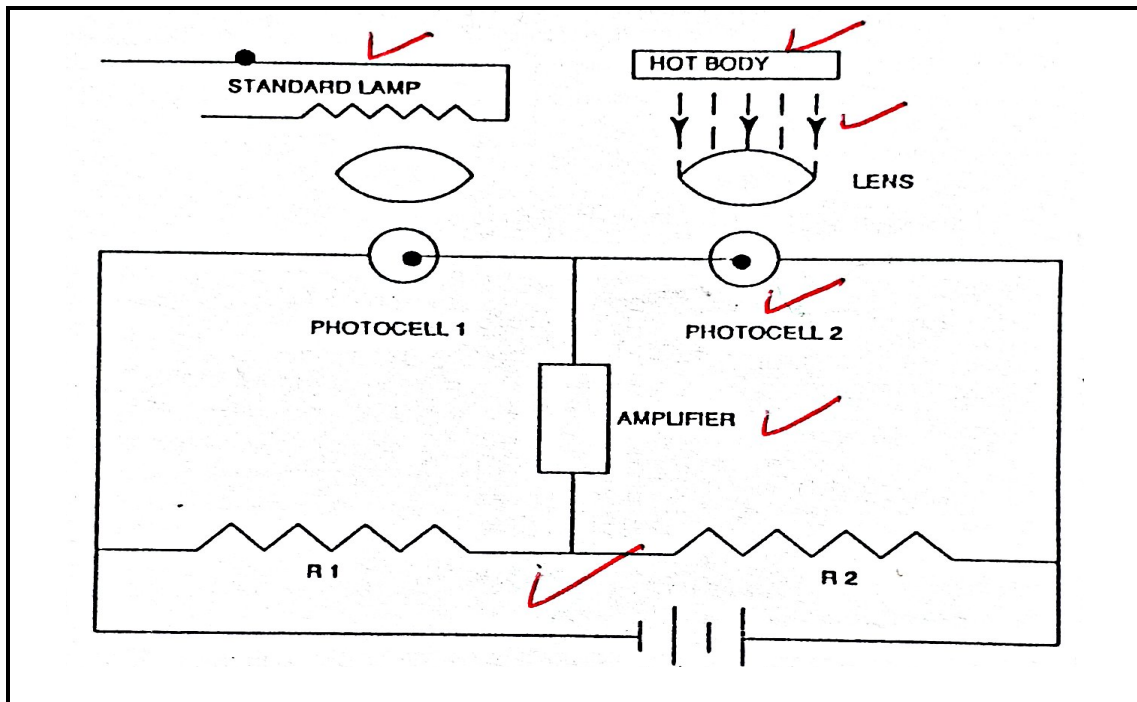
2.2 A potentiometer is a device for measuring an unknown potential difference ✓ by comparing it against a known potential difference ✓. (2)

- 2.3 2.3.1
- If there are two bodies, body A and body B, and body A is warmer than body B,
 - then body A will give off energy to body B.
 - Body A will keep on giving off energy until both body temperatures are the same.

- 2.3.2
- If two bodies of different temperatures are placed opposite each other, ✓
 - there is a transfer of heat energy from the hot body to the colder body, ✓
 - and the amount of radiated energy per time unit is roughly proportional to the fourth power of the absolute temperature difference between the two bodies. ✓

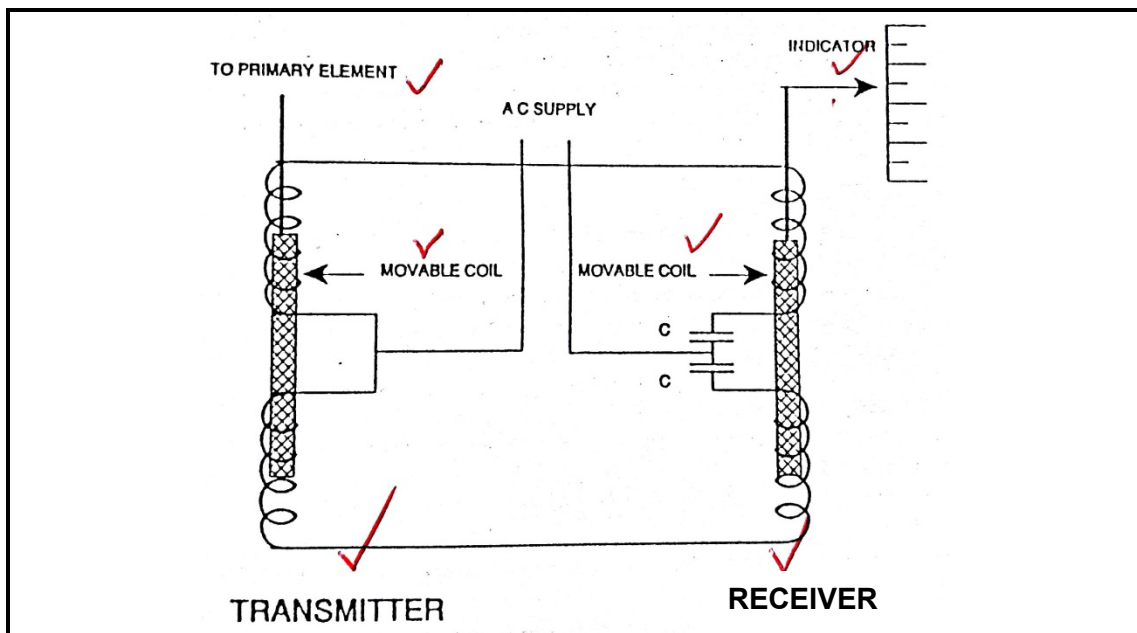
(2 × 3) (6)

2.4

(6)
[25]

QUESTION 3

3.1

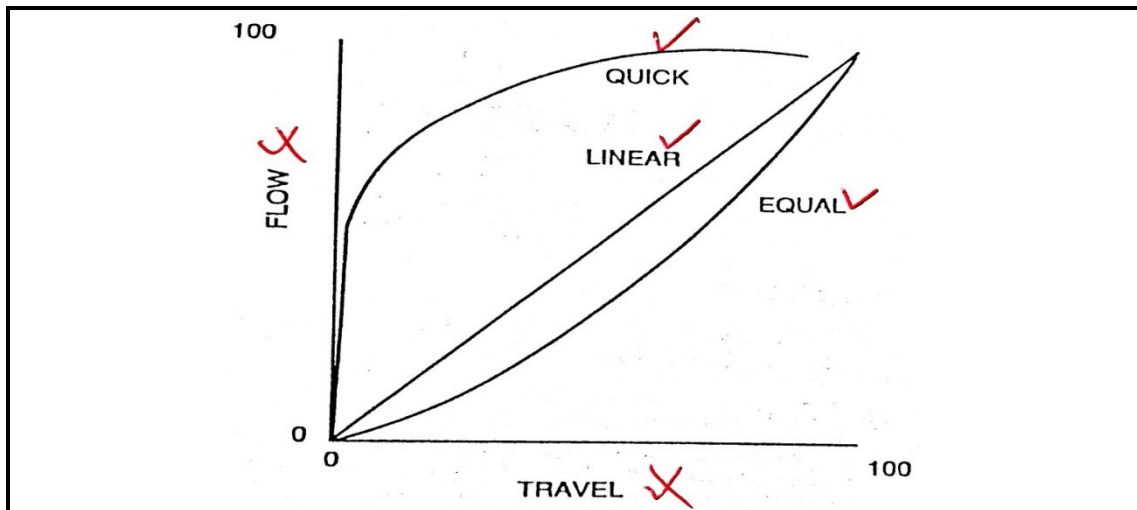


- Typical soft iron cores are placed between two similar coils in both the transmitter and indicator
- and when these iron cores are in the middle of the two coils
- the bridge will be in balance.
- If a change takes place, the iron core will be moved.
- This causes the circuit to be out of balance.
- The currents through the indicator's inductance coils will not be the same. A resulting force would then influence the indicator core.

(2 × 6)

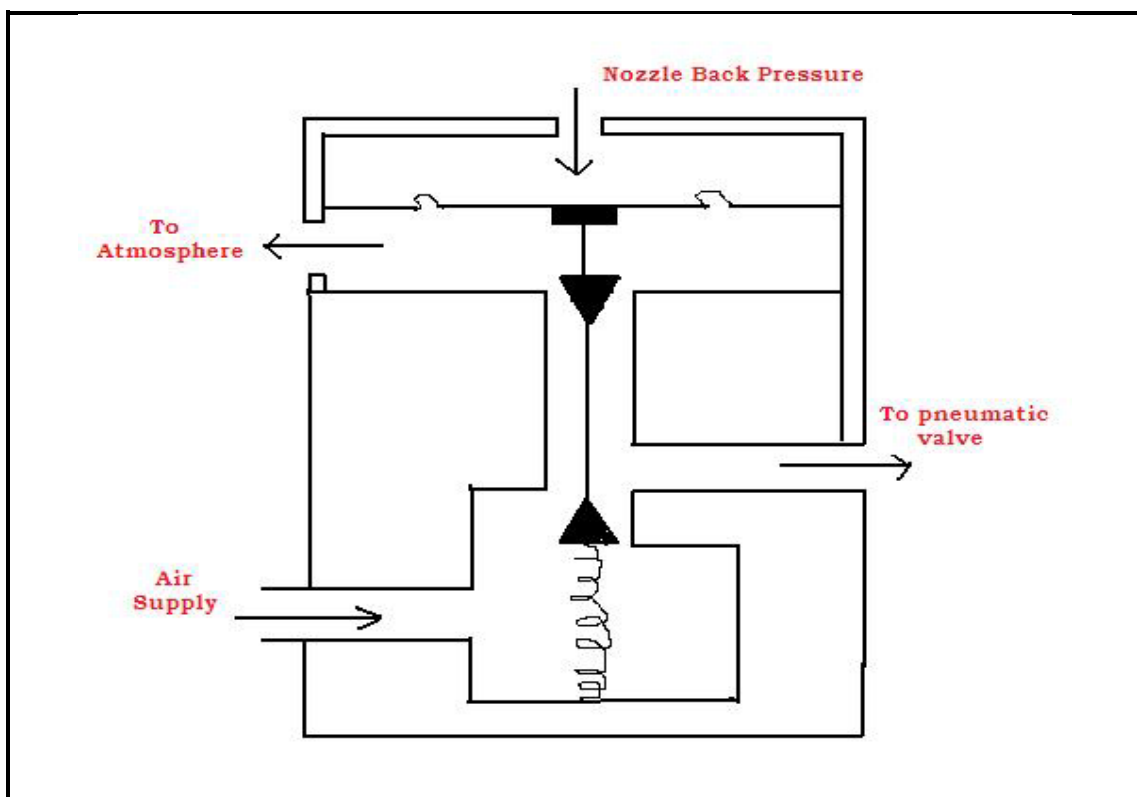
(12)

3.2



(4)

3.3



2 marks for the drawing

3 marks for any three correct labels

(5)

3.4

3.4.1

- Telemetry is the collection of measurements or other data at remote points
- and their automatic transmission to receiving equipment for monitoring.

(2 × 1)

(2)

3.4.2

- Missile launching
- Drones
- Remote gate control
- Spacecraft
- Oil rigs

(Any 2 × 1)

(2)

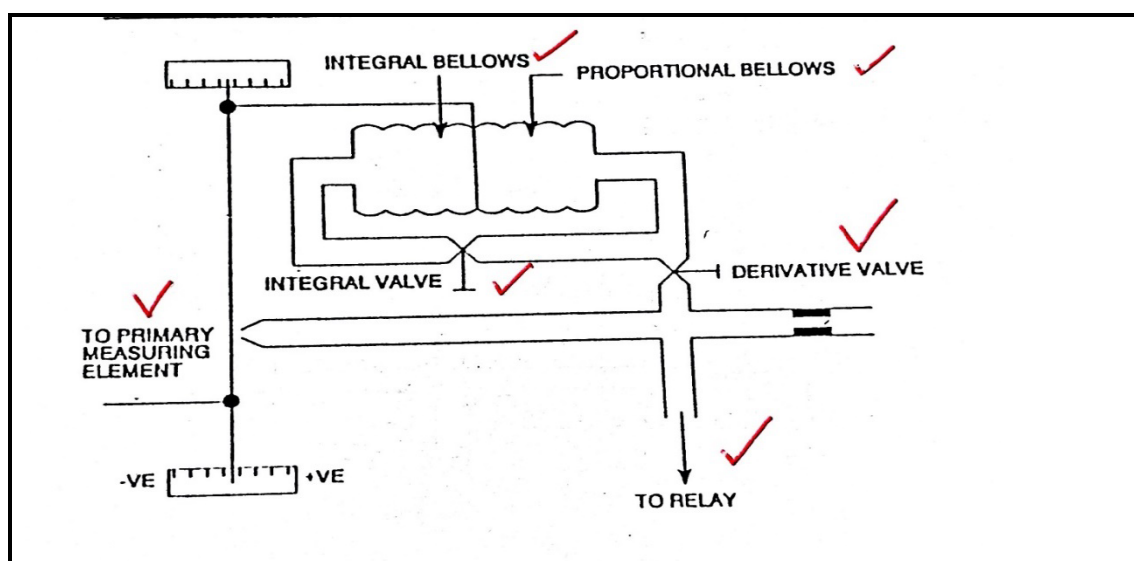
[25]

QUESTION 4

- 4.1 4.1.1 A change ✓ in the amount which must be processed ✓
- 4.1.2 The point at which the controller ✓ actually regulates the process ✓
- 4.1.3 The difference between the value of the measured signal ✓ and the set point ✓
- 4.1.4 This is a signal which deviates ✓ from the desired value ✓
- 4.1.5 This is the function ✓ to be controlled ✓

(5 × 2) (10)

4.2



(6)

- 4.3
- Basic forces
 - Pressure load
 - Weight load
 - Inertia load
 - Friction load

(5)

- 4.4 4.4.1 A valve plug is the movable part ✓ of a valve body assembly which provides a variable restriction to flow. ✓
- 4.4.2 A valve positioner is a device installed between the controller and the valve actuator ✓ in order to move the actuator stem in accordance with the value of the input signal. ✓

(2 × 2)

(4)

[25]**TOTAL: 100**