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.

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QUESTION 1

1.1

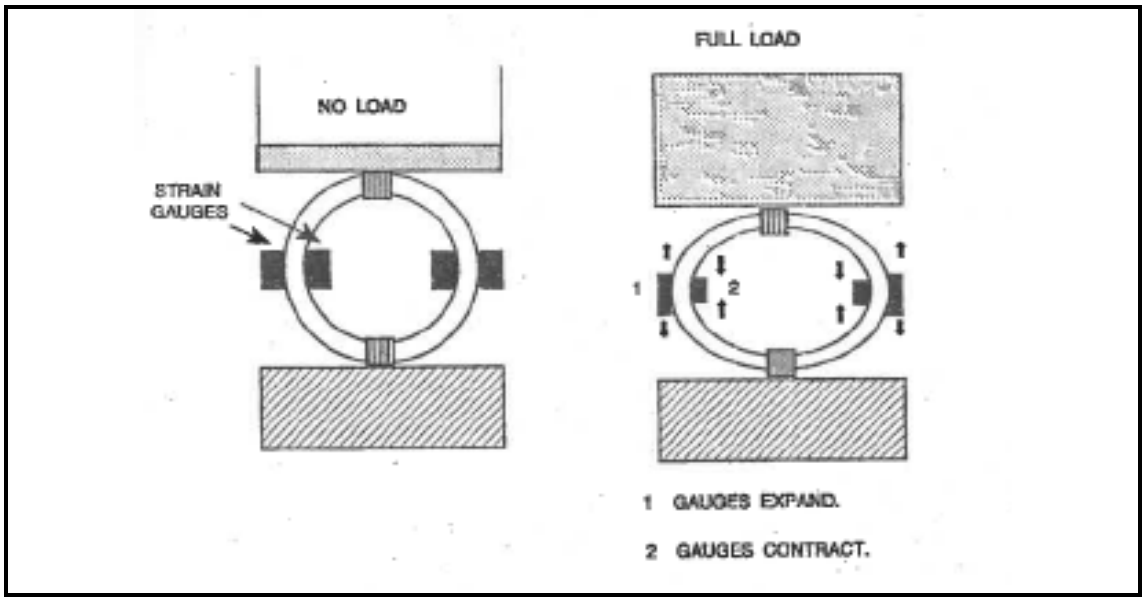
1.1.1	B
1.1.2	F
1.1.3	A
1.1.4	C
1.1.5	D

(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 I1 x R1 = I2 x R3.....1 ✓

and I1 x R2 = I2 x RT.....2 ✓

divide 1 by 2

$\frac{I1xR1}{I1xR2} = \frac{I2xR3}{I2xRT}$ ✓

therefore $\frac{R1}{R2} = \frac{R3}{RT}$ ✓

$RT = R3 \times \frac{R2}{R1}$ ✓ RT = R4

(6)

1.5
- Capacitive transducer
- Rare-earth transducer
- Piezoelectric transducer
- Magnetic pressure transducer (4)

[25]

QUESTION 2

2.1 2.1.1 $Vm = V_{CA} - V_{AD}$ V

$V_{CA} = \frac{R1}{R1+R2} \times V_T$ ✓

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

V_{CA} = 40 V ✓

$V_{AD=\frac{R_3}{R_3+R_4}V_T}$ ✓

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

V_{AD} = 75 V ✓

Vm = 40 – 75 ✓

Vm = -35 V ✓ The negative sign means polarity is reversed. ✓ (9)

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

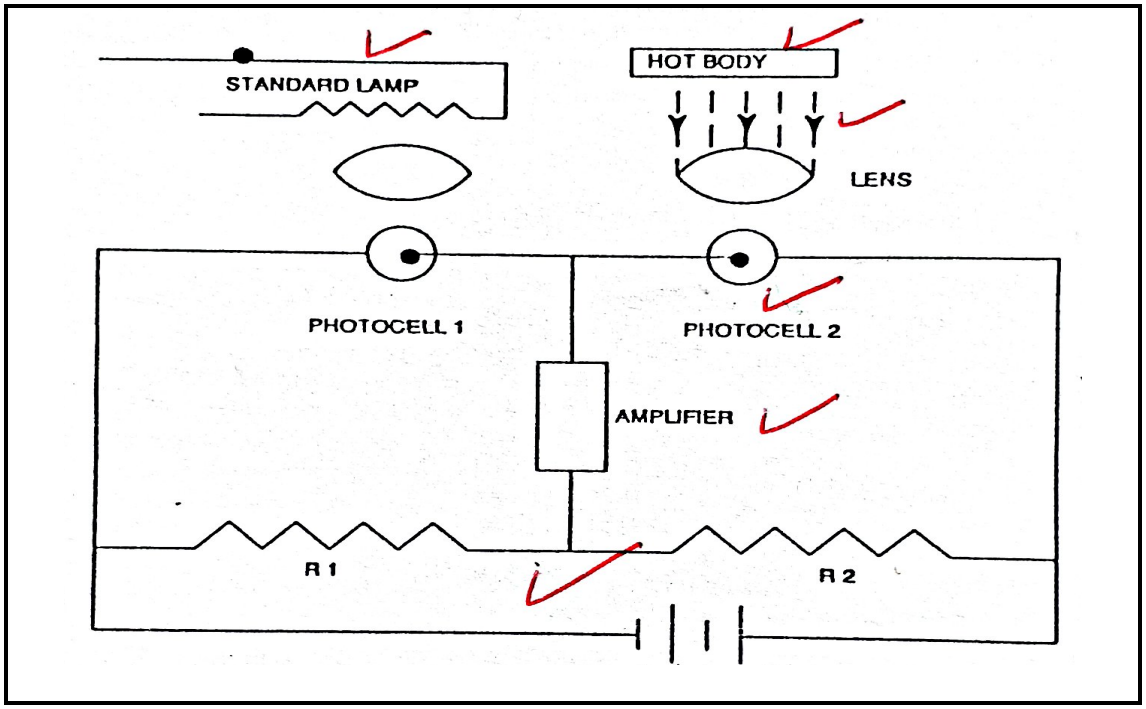
2.2 A potentiometer is a device for measuring an unknown potential difference ✓ by comparing it against a known potential difference ✓. (2)

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)

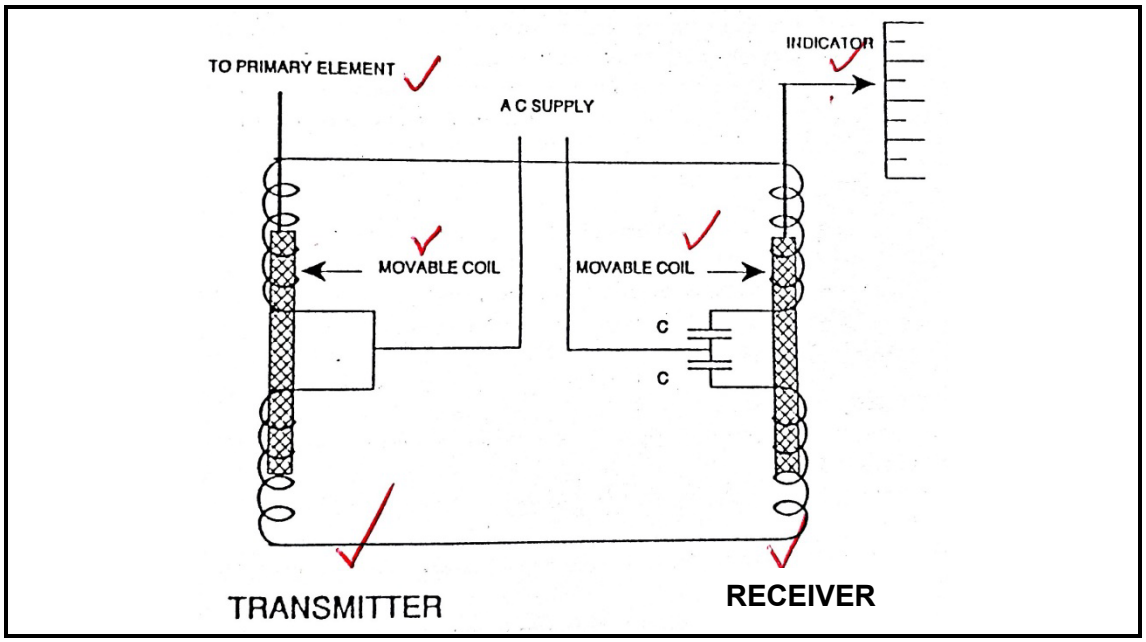
2.4



(6)
[25]

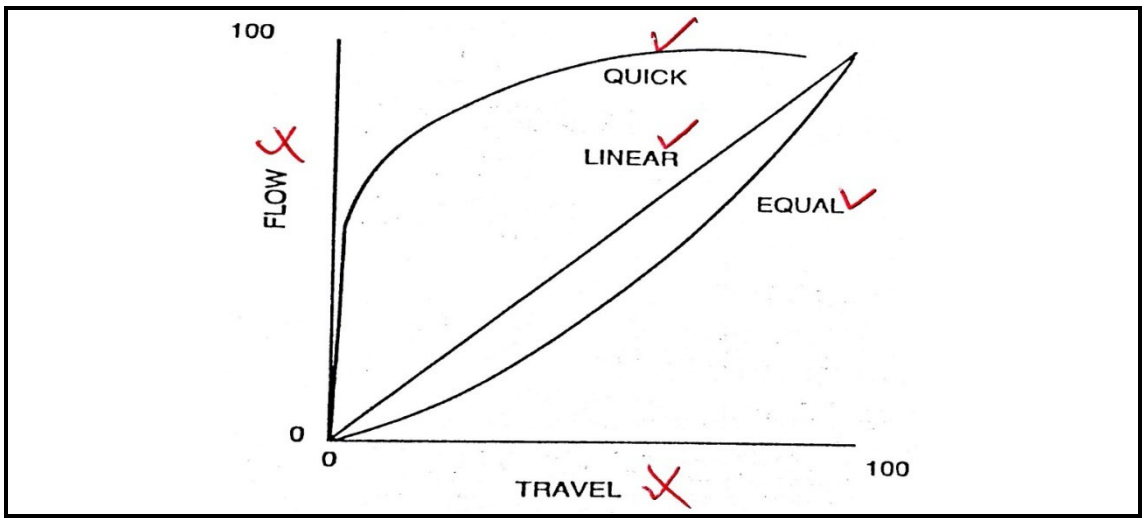
QUESTION 3

3.1



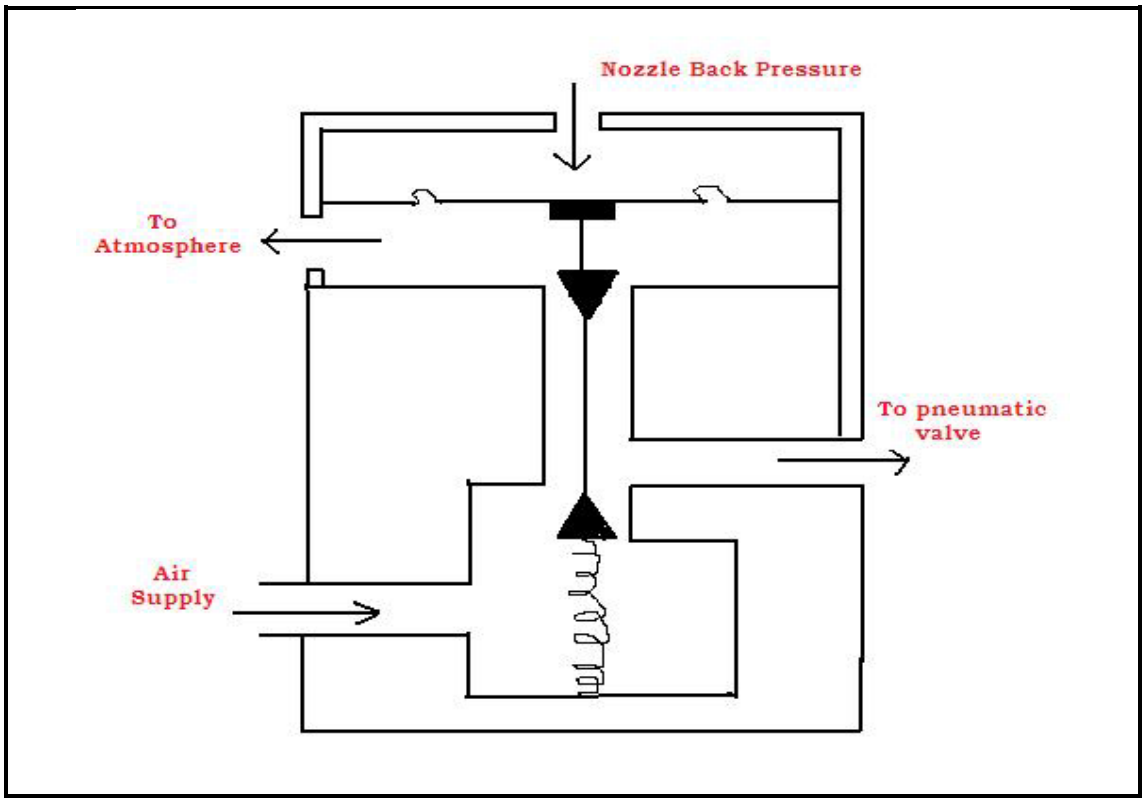
- Typical soft iron cores are placed between two similar coils in both the transmitter and indicator
- and when these iron cores are in the middle of the two coils
- the bridge will be in balance.
- If a change takes place, the iron core will be moved.
- This causes the circuit to be out of balance.
- 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 ✓

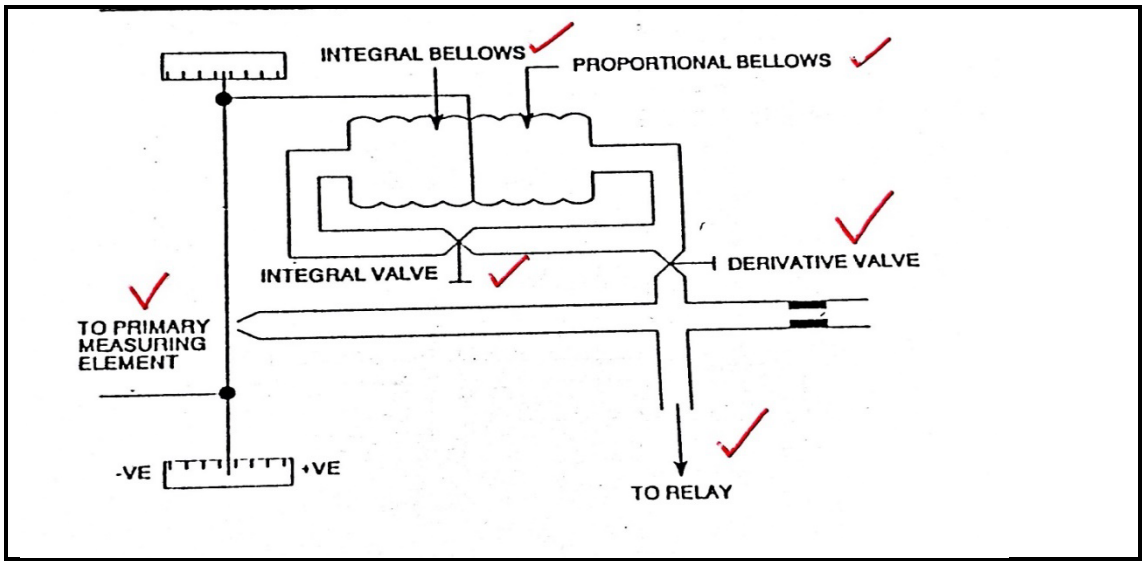
4.1.3 The difference between the value of the measured signal ✓ and the set point ✓

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

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