



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N2

28 July 2025

This marking guideline consists of 7 pages.

QUESTION 1

1.1	1.1.1	Voltmeter	(5 × 1)	(5)
	1.1.2	Zener diode		
	1.1.3	Light-emitting diode		
	1.1.4	Light-dependent resistor		
	1.1.5	Photodiode		
1.2	1.2.1	E	(5 × 1)	(5)
	1.2.2	B		
	1.2.3	D		
	1.2.4	G		
	1.2.5	A		

[10]

QUESTION 2

2.1	2.1.1	$R_{s1} = R_4 + R_6$ $R_{s1} = 3 + 12 = 15\Omega \checkmark$ $\frac{1}{R_p} = \frac{1}{R_3} + \frac{1}{R_5} + \frac{1}{R_s}$ $\frac{1}{R_p} = \frac{1}{10} + \frac{1}{15} + \frac{1}{15} \checkmark$ $R_p = \frac{1}{0.1 + 0.0667 + 0.0667}$ $R_p = 4.284\Omega \checkmark$ $R_T = R_1 + R_p + R_2$ $R_T = 3 + 4.284 + 4 \checkmark$ $R_T = 11.284\Omega \checkmark \checkmark$	(6)
2.1.2	The total current in the circuit.	$I_T = \frac{V_T}{R_T}$ $I_T = \frac{24}{11.284} \checkmark$ $I_T = 2.127A \checkmark$	(2)
2.1.3	Voltage across resistor R_3 .	$V_{R3} = I_T \times R_p$ $V_{R3} = 2.127 \times 4.284 \checkmark \checkmark$ $V_{R3} = 9.114V \checkmark$	(3)

2.1.4 The current flowing through R_5 .

$$I_{R5} = \frac{V}{R}$$

$$I_{R5} = \frac{9.114}{15} \checkmark$$

$$I_{R5} = 0.608A \checkmark$$

(2)

2.1.5 The total power consumed in the circuit.

$$P = V_T \times I_T$$

$$P = 24 \times 2.127 \checkmark$$

$$P = 51.048W \checkmark \checkmark$$

(3)

- 2.2
- The type of material
 - Length of the conductor
 - Cross-sectional area of the conductor
 - Temperature of the conductor
 - Resistivity

(Any 4 × 1)

(4)

[20]

QUESTION 3

3.1 3.1.1

$$Z = \sqrt{R^2 + (X_C - X_L)^2}$$

$$Z = \sqrt{(40)^2 + (60 - 40)^2} \checkmark$$

$$Z = \sqrt{1600 + 400}$$

$$Z = 44.721\Omega \checkmark \checkmark$$

(3)

3.1.2

$$I_T = \frac{V_T}{Z}$$

$$I_T = \frac{120}{44.721} \checkmark$$

$$I_T = 2.683A \checkmark$$

(2)

3.1.3

$$X_L = 2\pi fL$$

$$L = \frac{X_L}{2\pi f}$$

$$L = \frac{40}{2\pi(50)} \checkmark$$

$$L = 0.127H \checkmark$$

(2)

3.1.4

$$X_C = \frac{1}{2\pi fC}$$

$$C = \frac{1}{2\pi fX_C}$$

$$C = \frac{1}{2\pi(50)(60)} \checkmark$$

$$C = 53.052 \times 10^{-6}f / 53.052\mu f \checkmark$$

3.1.5 $\cos\theta = \frac{R}{Z}$
 $\theta = \cos^{-1}\left(\frac{40}{44.721}\right) \checkmark$
 $\theta = 26.564^\circ \checkmark \checkmark$ (3)

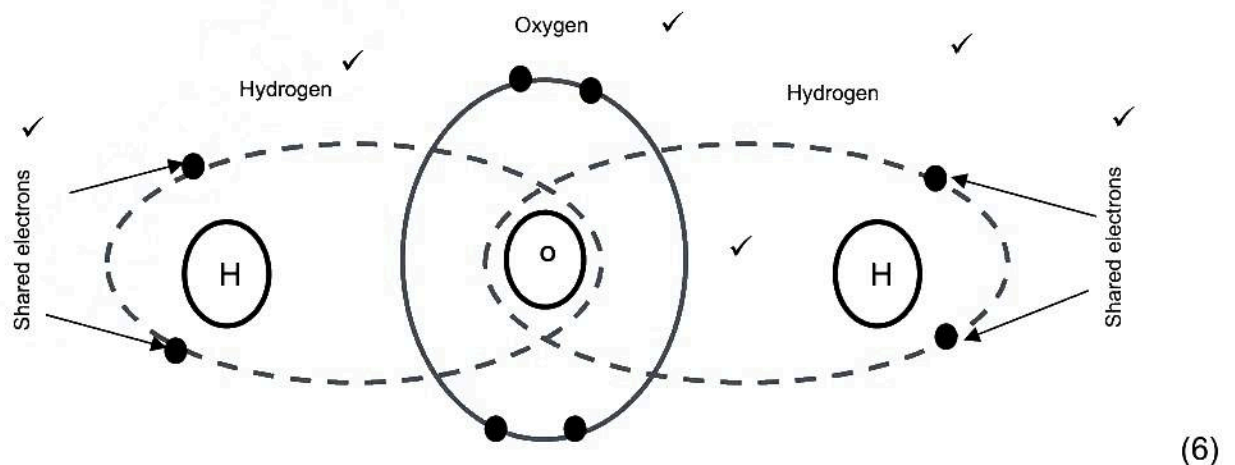
3.1.6 $f = \frac{1}{2\pi\sqrt{LC}}$
 $f = \frac{1}{2\pi\sqrt{0.127 \times 53.052 \times 10^{-6}}} \checkmark$
 $f = \frac{1}{0.01630919815}$
 $f = 61.315\text{Hz} \checkmark \checkmark$ (3)

3.2 3.2.1 $V_{(P-P)} = 24 \times 2 \checkmark$
 $V_{(P-P)} = 48\text{V} \checkmark$ (2)

3.2.2 $F = \frac{1}{t}$
 $F = \frac{1}{20 \times 10^{-3}} \checkmark$
 $F = 50\text{Hz} \checkmark \checkmark$ (3)
[20]

QUESTION 4

4.1



4.2 Semiconductor diode is a two-terminal PN-junction device. $\checkmark$ It has a low resistance when forward-biased, and a high resistance when reverse-biased. $\checkmark$ (2)

4.3.1 When the LDR is exposed to light, its resistance would decrease $\checkmark$ causing current to flow into the base circuit of the transistor $\checkmark$ and causing current to flow in the collector circuit causing the LED to turn ON. $\checkmark$

- 4.3.2 When the LDR is not exposed to light, its resistance would increase✓ and would not allow current to flow, there would be no current flowing in the base circuit,✓ the LED would be OFF.✓ (3)

4.4

$$A_v = 20 \log \frac{V_{out}}{V_{in}}$$

$$A_v = 20 \log \frac{140}{240^{-3}} \checkmark \checkmark$$

$$A_v = 20 \log(583.333)$$

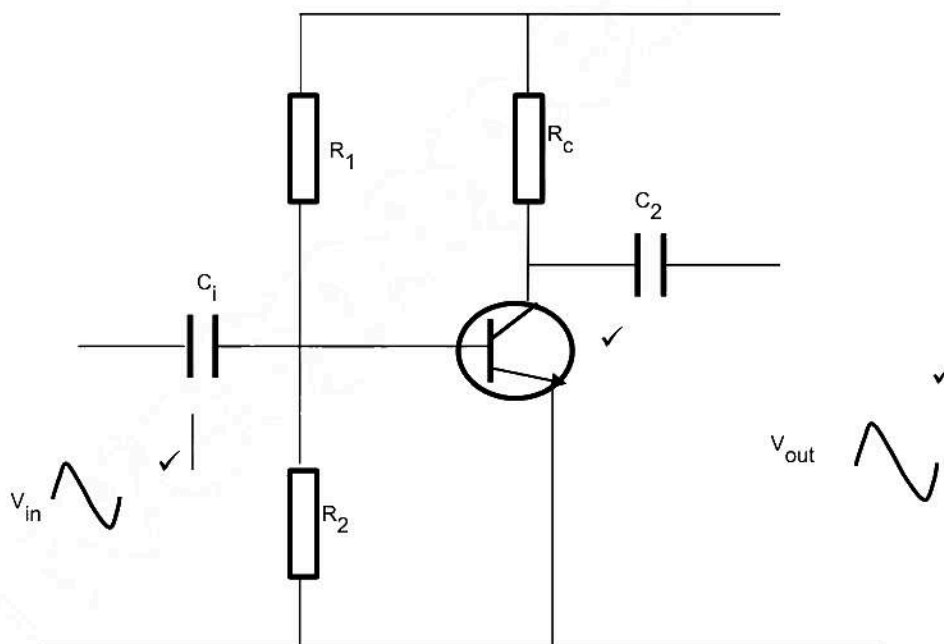
$$A_v = 55.318 \text{ dB} \checkmark \checkmark$$

(4)
[18]

QUESTION 5

- 5.1
- A small base-emitter current can switch the transistor ON or OFF.
 - There is no wear and tear on switchgear caused by arcing.
 - Control over a long distance.
 - Much faster switching time.
- (4)

5.2



1 Mark for Input, output and transistor. Half mark for resistors and

(6)

- 5.3.1 When a temperature difference exists between the hot and cold junction, a potential difference is produced that causes a current to flow. When a meter is connected to the terminals of the cold junction, the meter indication will be proportional to the difference in temperature between the hot and cold junctions. (4)

- 5.3.2 A bi-metallic strip is a temperature sensitive device. When the bi-metallic strip is heated, each metal begins to expand at its own rate of expansion. Copper has the larger coefficient of expansion, so the strip's copper layer expands faster when the strip is heated and shrinks faster when the strip is cooled. As the two layers of the bi-metallic strip expand or shrink, the strip curls to one side or the other.

(4)
[18]

QUESTION 6

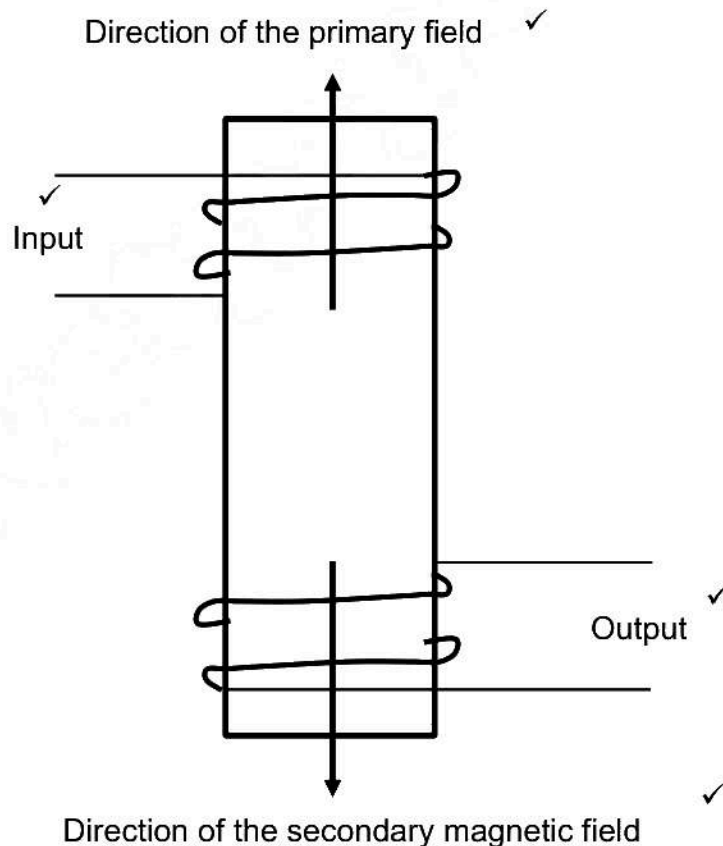
- 6.1 The EMF induced in an electric circuit always acts in such a direction that the current it drives around the circuit opposes ✓ the change in magnetic flux ✓ which produces the EMF. ✓

OR

When a magnetic field cuts through a coil and the voltage induced in the coil causes a current to flow, ✓ this induced current will produce a magnetic field which will be in opposition to the magnetic field ✓ which produced the induced current. ✓

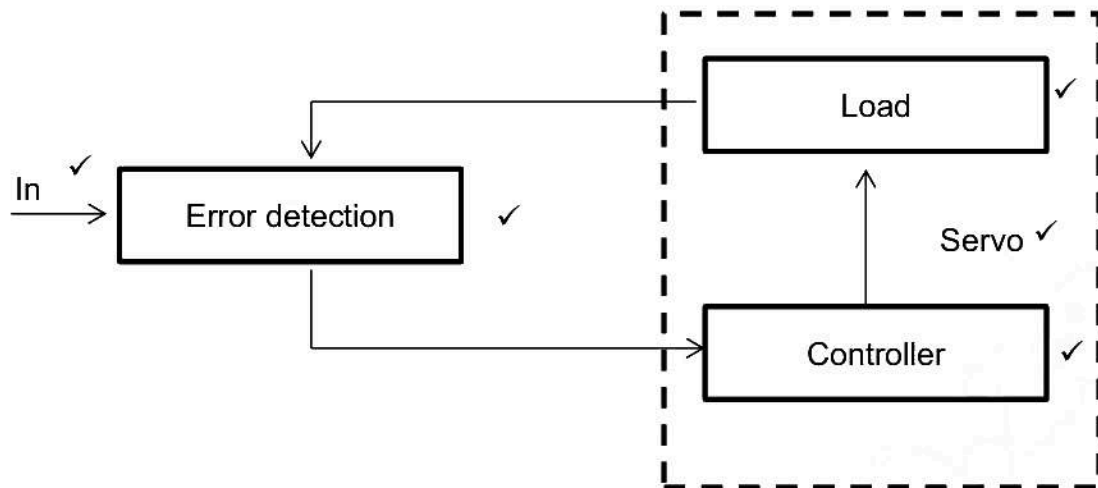
(3)

6.2



(4)

6.3



(5)

6.4

If an Iron bar or an electromagnet were placed in a magnetic field and allowed to turn freely, ✓ it would always tend to line up in the direction of that magnetic field. ✓

(2)
[14]

TOTAL: 100