



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE INDUSTRIAL ELECTRONICS N2

14 November 2022

This marking guideline consists of 8 pages.

QUESTION 1

1.1

$$R_{p1} = \frac{R_5 \times R_6}{R_5 + R_6}$$

$$R_{p1} = \frac{6 \times 4}{6 + 4}$$

$$R_{p1} = \frac{24}{10}$$

$$R_{p1} = 2.4 \Omega$$

$$R_{s1} = R_1 + R_{p1} + R_4$$

$$R_{s1} = 10 + 2.4 + 8$$

$$R_{s1} = 20.4 \Omega$$

$$R_{p2} = \frac{R_{s1} \times R_2}{R_{s1} + R_2}$$

$$R_{p2} = \frac{20.4 \times 24}{20.4 + 24}$$

$$R_{p2} = \frac{489.6}{44.4}$$

$$R_{p2} = 11.027 \Omega$$

$$R_T = R_1 + R_{p2}$$

$$R_T = 11.027 + 7$$

$$R_T = 18.027 \Omega \checkmark$$

(8)

1.2

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

$$I_T = \frac{48}{18.027}$$

$$I_T = 2.663 \text{ A} \checkmark$$

(2)

1.3

$$V_T = I_1 \times R_2$$

$$V_2 = 2.663 \times 24$$

$$V_2 = 29.365 \text{ V}$$

$$I_1 = \frac{V_2}{R_2}$$

$$I_1 = \frac{29.365}{24}$$

$$I_1 = 1.224 \text{ A}$$

$$I_2 = \frac{V}{R}$$

$$I_2 = \frac{29.365}{20.4}$$

$$I_2 = 1.439 \text{ A} \checkmark$$

OR

$$I_1 = \frac{R_{s1}}{R_2 + R_{s1}} I_T$$

$$= \left(\frac{20.4}{24 + 20.4} \right) (2.663)$$

$$= 1.224 \text{ A}$$

$$I_2 = \frac{R_2}{R_2 + R_{s1}} I_T$$

$$= \left(\frac{24}{24 + 20.4} \right) (2.663)$$

$$= 1.439 \text{ A}$$

OR

$$I_2 = I_T - I_1$$

$$= 2.663 - 1.224$$

$$= 1.439 \text{ A}$$

(6)

1.4 $V_{R5} = I_2 \times R_{p1} \checkmark$
 $V_{R5} = 1.439 \times 2.4 \checkmark$
 $V_{R5} = 3.454 \text{ V} \checkmark$ (3)

1.5 Volt is the potential difference which exists across a resistance of one ohm when a current of one ampere is passed through it. (1)
[20]

QUESTION 2

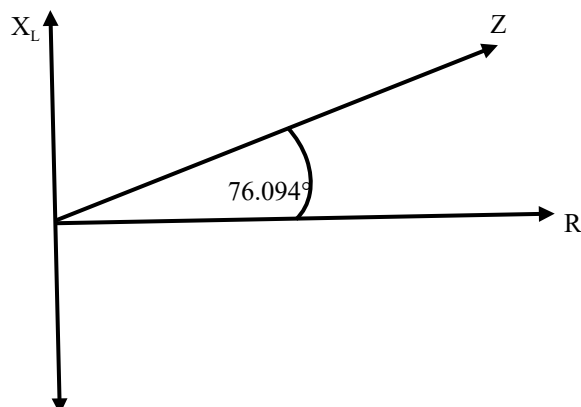
2.1 2.1.1 $X_L = 2\pi fL$
 $X_L = 2\pi(150)(3)$
 $X_L = 2827,433 \Omega$ (2)

2.1.2 $Z = \sqrt{R^2 + X_L^2} \checkmark$
 $Z = \sqrt{700^2 + X_L^2}$
 $Z = 2912,795 \Omega$ (3)

2.1.3 $I_T = \frac{V_T}{Z}$
 $I = \frac{200}{2912,795}$
 $I = 0.069 \text{ A} \checkmark$ (2)

2.1.4 $\cos \theta = \frac{R}{Z}$ OR $\sin \theta = \frac{X_L}{Z}$ OR $\tan \theta = \frac{X_L}{R}$
 $\theta = \cos^{-1}\left(\frac{700}{2912,795}\right)$ $\theta = \sin^{-1}\left(\frac{2827,433}{2912,795}\right)$ $\theta = \tan^{-1}\left(\frac{2822,433}{700}\right)$
 $\theta = 76.094^\circ$ $\theta = 76,094^\circ$ $\theta = 76,094^\circ$ (2)

2.1.5



(4)

2.2 • Circuit is resistive (4)

- Current and voltage in phase
- Current (I) is max
- $Z = R$ and is min

2.3

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

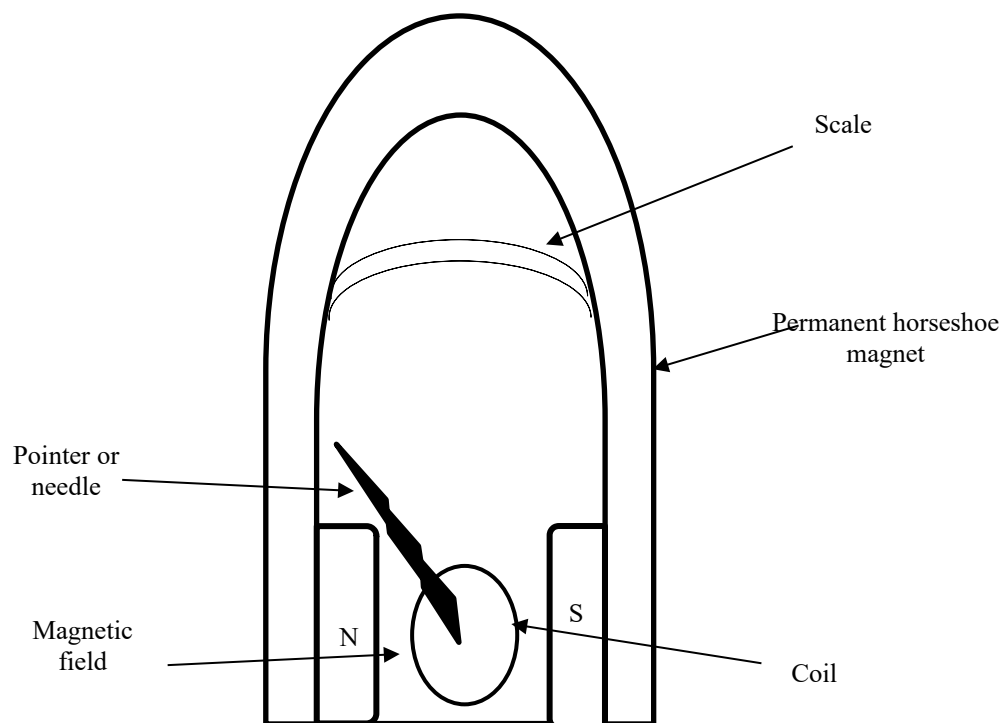
$$\hat{=} \frac{1}{2\pi\sqrt{10 \times 10^{-3} 10 \times 10^{-9}}}$$

$$\hat{=} 15915,494 \text{ Hz}$$

(3)

[20]**QUESTION 3**

3.1



(Any three correct labels 3 marks, correct drawing 2 marks)

(5)

3.2

- Mechanical damping
- Electro-magnetic damping
- Eddy current damping
- Air friction damping
- Spring damping

(Any 2 × 1)

(2)

3.3

3.3.1

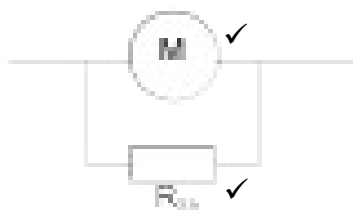
$$R_{sh} = \frac{I_M R_m}{I_{sh}}$$

$$\hat{=} \frac{1 \times 10^{-3} \times 100}{10 - 1 \times 10^{-3}}$$

$$\hat{=} 0,01 \Omega$$

(3)

3.3.2



..(2)

3.3.3



(electric circuit 1 mark, ammeter correctly shown 1 mark) (2)

3.4

$$P_i = \frac{V_i^2}{R_i}$$

$$P_i = 33,333 \mu W$$

$$P_i = 33,333 \times 10^{-6} W \text{ or}$$

$$P_i = 33,333 \mu W \checkmark$$

$$P_{out} = I^2 \times R$$

$$P_{out} = (1.5)^2 \times 8$$

$$P_{out} = 18 W \checkmark$$

$$N = 10 \log \frac{P_{out}}{P_i}$$

$$N = 10 \log \frac{18}{33,333 \times 10^{-6}}$$

$$N = 57,324 dB$$

(6)

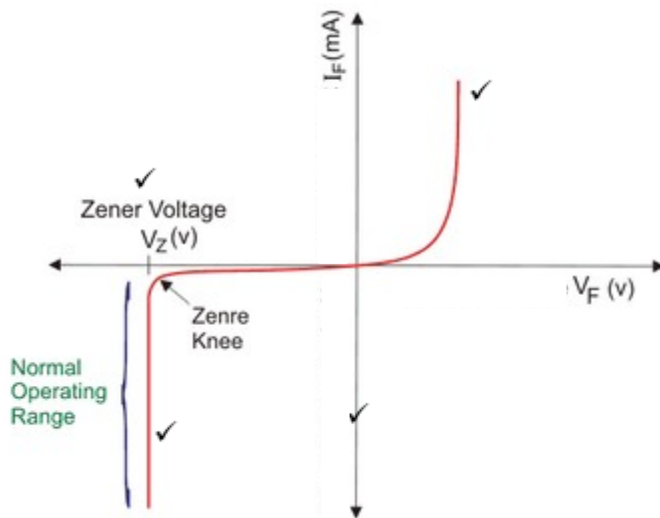
3.5 Decibel is one tenth of a bell.

(1)

[20]

QUESTION 4

4.1



Axis labelled correctly voltage and current 1 mark

Curve correctly drawn forward bias area 1 mark, reverse bias area 1 mark

Zener voltage V_Z indicated correctly 1 mark

(4)

4.2

- When used in the reverse bias mode✓ it has the ability to maintain a constant voltage across its terminals✓ and current to flow in the reverse direction, i.e. cathode to anode.
- When used in the forward bias mode,✓ it acts as a normal PN-junction diode and allows current to flow in the forward direction✓, i.e. anode to cathode.
- When reversed biased, the Zener diode does not allow current to flow initially until its Zener breakdown point is reached✓. At this point the voltage across the Zener diode remains constant.✓
(3 × 2)

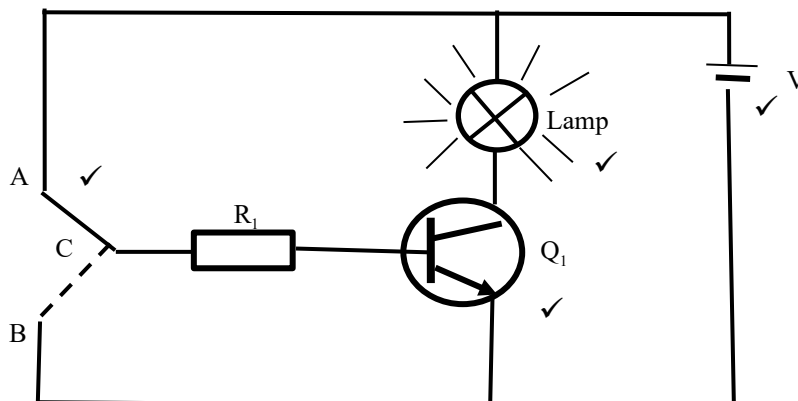
(6)

4.3

- The cut-off region✓ is when both the base-emitter and base-collector junctions are reverse biased.✓
- The active or linear region✓ – the base-emitter junction is forward biased and the base-collector junction is reverse biased. ✓
- The saturation region✓ is when both the base-emitter and base-collector junction are forward biased.✓
(3 × 2)

(6)

4.4

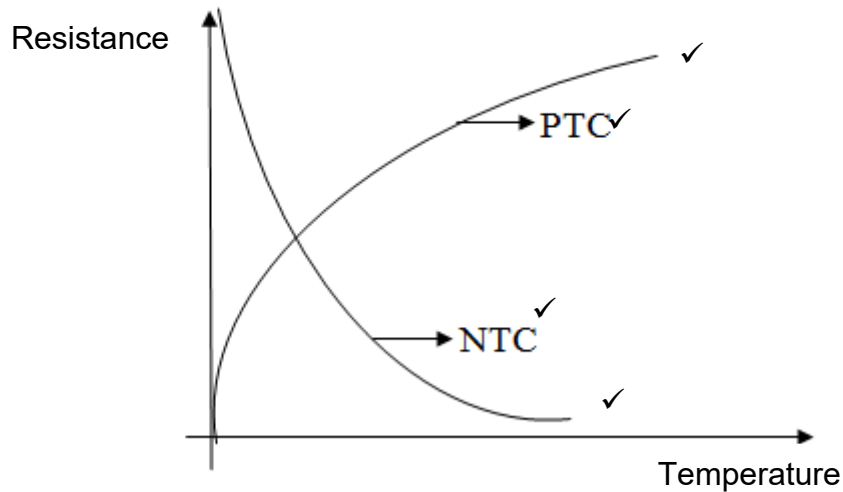


(4)

[20]

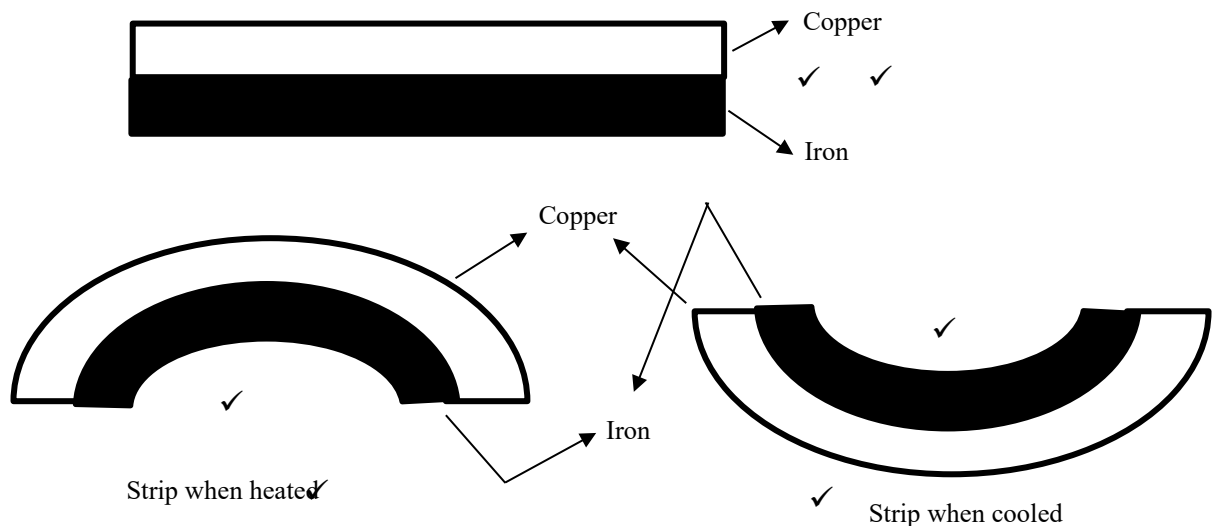
QUESTION 5

5.1



(4)

5.2



(6)

5.3

- Remote positioning of communication systems.
- Control positioning of gun turrets.
- Control of a ship's steering mechanism.
- Control of power tool.
- Remote control of model cars or model aeroplanes.
- Control of dam sluice gate.
- Controlling the course, speed, and range of missiles

(Any 5 × 1)

(5)

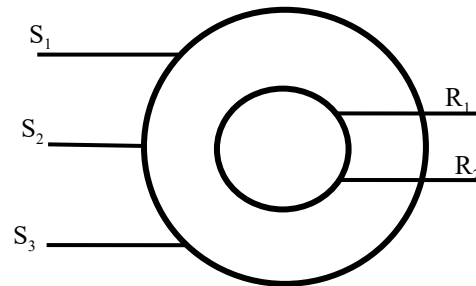
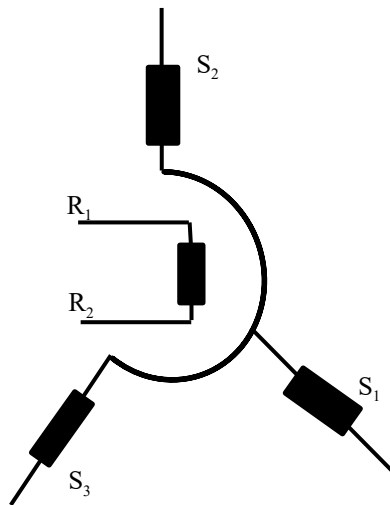
5.4

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.

(2)

5.5

Or



(3)
[20]

TOTAL: 100