



**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

$$R_{p1} = \left(\frac{1}{R_4} + \frac{1}{R_5} + \frac{1}{R_6} \right)^{-1}$$

$$R_{p1} = \left(\frac{1}{4} + \frac{1}{5} + \frac{1}{20} \right)^{-1} \quad \checkmark$$

$$R_{p1} = \left(\frac{1}{0,5} \right)^{-1}$$

$$R_{p1} = 2 \, \Omega \quad \checkmark$$

$$R_{s1} = R_3 + R_{p1} \quad \checkmark$$

$$R_{s1} = 18 + 2 = 20 \, \Omega \quad \checkmark$$

$$R_{s2} = R_1 + R_2$$

$$R_{s2} = 10 + 20 = 30 \, \Omega \quad \checkmark$$

$$R_T = \frac{R_{s1} \times R_{s2}}{R_{s1} + R_{s2}} \quad \checkmark$$

$$R_T = \frac{20 \times 30}{20 + 30} \quad \checkmark$$

$$R_T = 12 \, \Omega \quad \checkmark$$

(8)

1.2

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

$$I_T = \frac{90}{12} \quad \checkmark$$

$$I_T = 7,5 \, A \quad \checkmark$$

(2)

1.3

$$I_1 = \frac{V}{R}$$

$$I_1 = \frac{90}{30} \quad \checkmark$$

$$I_1 = 3 \, A \quad \checkmark$$

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

$$I_2 = \frac{90}{20} \quad \checkmark$$

$$I_2 = 4,5 \, A \quad \checkmark$$

(4)

1.4

$$V_{R5} = I_2 \times R_{//}$$

$$V_{R5} = 4,5 \times 2 \quad \checkmark$$

$$V_{R5} = 9 \, V \quad \checkmark$$

(3)

$$1.5 \quad P_{R6} = \frac{V_2^2}{R_6} \quad \checkmark$$

$$P_{R6} = \frac{9^2}{20} \quad \checkmark$$

$$P_{R6} = 4,05 \text{ W} \quad \checkmark$$

(3)
[20]**QUESTION 2**

- 2.1
- The size or area of the plates
 - The distance between the plates
 - The type of material between the plates

(3)

2.2 2.2.1 $X_L = 2\pi fL$

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

$$L = \frac{39,25}{2\pi(50)} \quad \checkmark$$

$$L = 124,937 \text{ mH} \quad \checkmark$$

(2)

2.2.2 $X_C = \frac{1}{2\pi fC}$

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

$$C = \frac{1}{2\pi(50)(31,8)} \quad \checkmark$$

$$C = 100 \mu\text{f} \quad \checkmark$$

(2)

2.2.3 $Z = \sqrt{R^2 + (X_L \times X_C)^2} \quad \checkmark$

$$Z = \sqrt{8^2 + (39,25 - 31,8)^2} \quad \checkmark$$

$$Z = 10,932 \Omega \quad \checkmark$$

(3)

2.2.4 $I_T = \frac{V}{Z}$

$$I_T = \frac{250}{10,932} \quad \checkmark$$

$$I_T = 22,869 \text{ A} \quad \checkmark$$

(2)

2.2.5 $V_C = I \times X_C$

$$V_C = 22,869 \times 31,8 \quad \checkmark$$

$$V_C = 727,234 \text{ V} \quad \checkmark$$

$$V_L = I \times X_L$$

$$V_L = 22,869 \times 39,25 \quad \checkmark$$

$$V_L = 897,608 \text{ V} \quad \checkmark$$

(4)

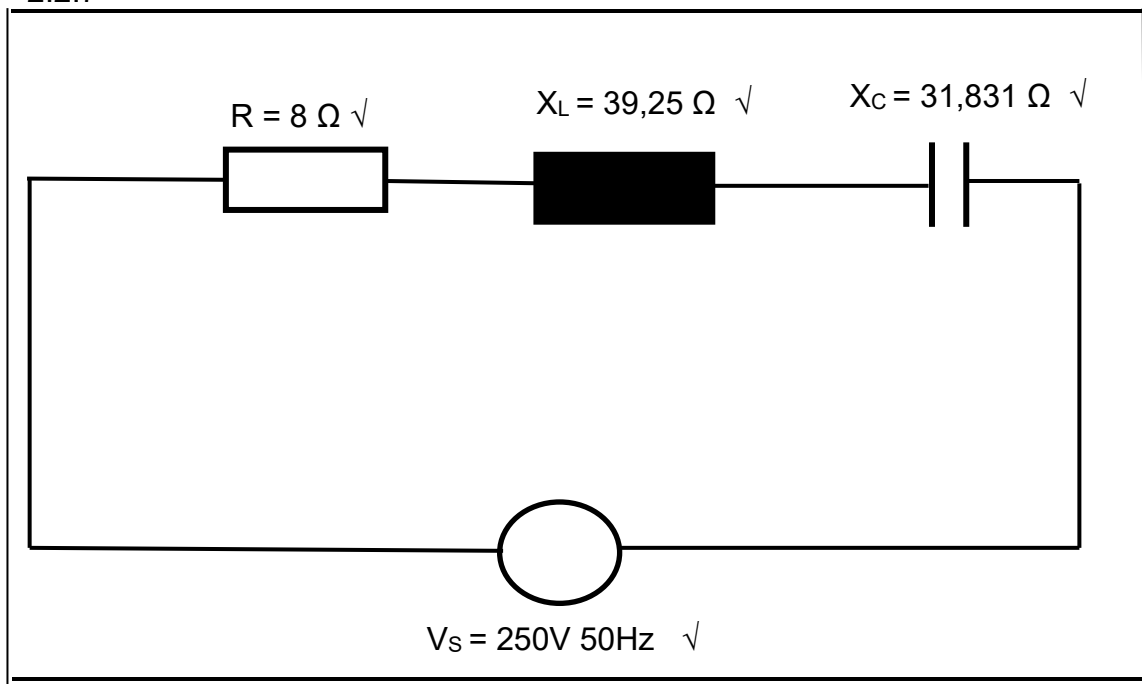
$$2.2.6 \quad \cos \theta = \frac{R}{Z}$$

$$\theta = \cos^{-1} \left(\frac{8}{10,932} \right) \checkmark$$

$$\theta = 42.862^\circ \checkmark$$

(2)

2.2.7

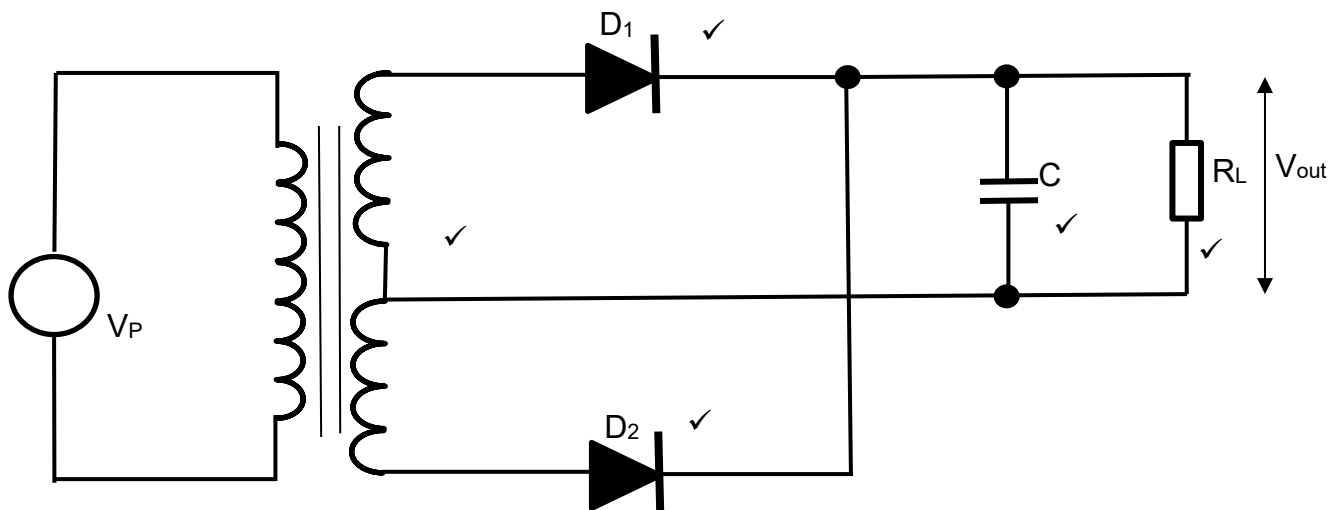


(2)

[20]**QUESTION 3**

- 3.1
- NO bias✓ means that there is no potential applied to the appliance and no electrical current flows.✓
 - Forward bias✓ means that when potential is applied, current flows freely. The electron flow is determined by the resistance of the conductor.✓
 - Reverse bias✓ is the opposite of the forward bias. The potential is applied in such a way that it opposes the flow of electrons.✓ (3 × 2) (6)
- 3.2 Peak-to-peak refers to the value measured between the positive ✓ and the negative peak ✓ values. (2)

3.3



V Output without smoothing capacitor

✓ both axis and labelling

✓ correct graph

t

V Output with smoothing capacitor

✓ both axis and labelling

✓ correct graph

t

(9)

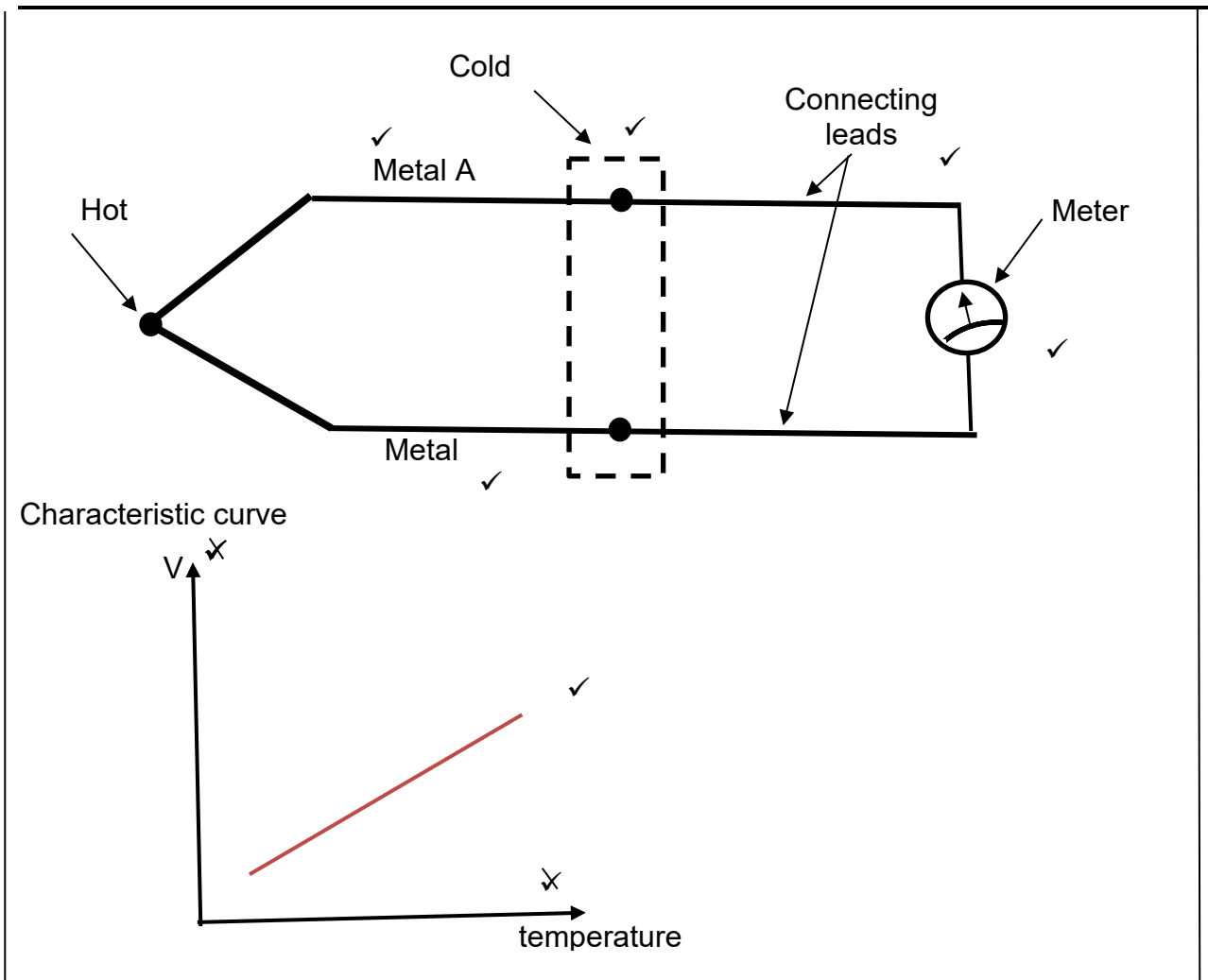
- 3.4
- Pulse frequency
 - Capacitor size
 - Size of the load

(3)
[20]

QUESTION 4

- 4.1 4.1.1 True
 4.1.2 True
(2 × 1) (2)
- 4.2 4.2.1 The cut-off region is when both the base-emitter and collector junctions ✓ are reverse biased. ✓
 4.2.2 A saturated region occurs when both base-emitter and base-collector junctions ✓ are forward biased ✓.
(2 × 2) (4)
- 4.3 • 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 times.
(4)

4.4



Drawing with no labels (2)

(8)

4.5

$$I_E = I_B + I_C$$

$$I_C = I_E - I_B$$

$$I_C = 50 \times 10^{-3} - 100 \times 10^{-6} \checkmark$$

$$I_C = 49,9 \times 10^{-3} A \text{ or } I_C = 49,9 \text{ mA} \checkmark$$

(2)
[20]

QUESTION 5

5.1 5.1.1

$$V = I \times R$$

$$V = (1 \times 10^{-3}) \times 20 \checkmark$$

$$V = 0,02 V \text{ or } 20 \text{ mV} \checkmark$$

$$V = 5 - 0,02 \checkmark$$

$$= 4,98 V \checkmark$$

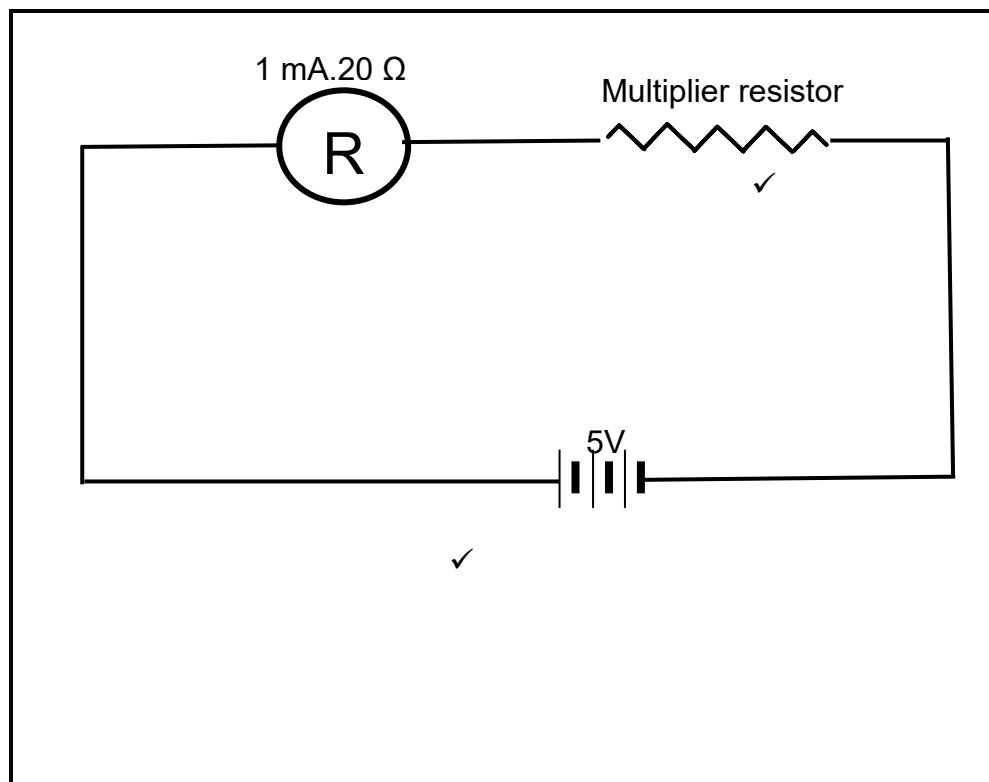
$$R = \frac{V}{I}$$

$$R = \frac{4,98}{1 \times 10^{-3}} \checkmark$$

$$R = 4\,980 \, \Omega \checkmark$$

(6)

5.1.2



(2)

5.2

$$P_o = I_o^2 \times R_o$$

$$P_o = 1^2 \times 8 \checkmark$$

$$\underline{P_o = 8 \text{ W} \checkmark}$$

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

$$P_i = \frac{(300 \times 10^{-3})^2}{100 \times 10^3} \checkmark$$

$$P_i = \frac{90 \times 10^{-3}}{100 \times 10^3}$$

$$\underline{P_i = 900 \times 10^{-9} \text{ W} \checkmark}$$

$$N = 10 \log \frac{P_o}{P_i}$$

$$N = 10 \log \frac{8}{900 \times 10^{-9}} \checkmark$$

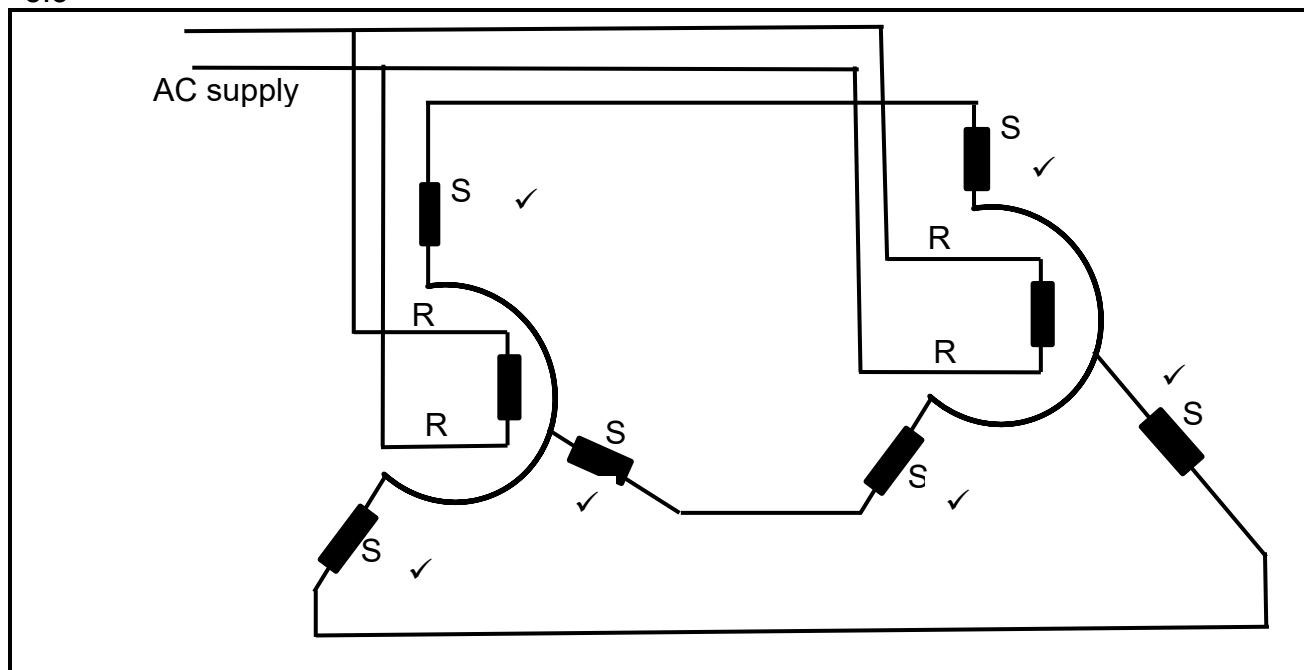
$$N = 10 \log(8,8889 \times 10^6)$$

$$N = 10 \times 6,9488$$

$$\underline{N = 69,488 \text{ dB} \checkmark}$$

(6)

5.3

(6)
[20]

TOTAL: 100