higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N2

30 March 2020

This marking guideline consists of 7 pages.

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QUESTION 1

1.1 D
1.2 B
1.3 D
1.4 B
1.5 B

(5 × 2) **[10]**

QUESTION 2

2.1 $I_4 + I_3 = I_T + I_1 + I_2$✓
$I_4 = I_T + I_1 + I_2 - I_3$✓
$I_4 = 4 + 2 + 2 - 3$✓
$I_4 = 5\ \text{A}$✓ (4)

2.2 2.2.1 $R_{s1} = R + R$
$R = 14 + 6 = 20\ \Omega$ ✓✓

$V_T = I_1 \times R_{s1}$
$V_T = 1{,}2 \times 20$✓
$V_T = 24\ \text{V}$✓✓ (5)

2.2.2 $R_p = \dfrac{R \times R}{R + R}$
$R_P = \dfrac{12 \times 4}{12 + 4}$ ✓
$R_p = \dfrac{48}{16}$
$R_p = 3\ \Omega$ ✓

$R_s = 3 + 3 = 6\Omega$ ✓

$R_T = \dfrac{R \times R}{R + R}$
$R_T = \dfrac{20 \times 6}{20 + 6}$ ✓✓
$R_T = \dfrac{120}{26}$
$R_T = 4{,}615\ \Omega$✓ (6)

2.2.3 $I_2 = \dfrac{V_T}{R}$ ✓
$I_2 = \dfrac{24}{6}$ ✓
$I_2 = 4\ \text{A}$✓✓

Or $I_T = Vt/Rt = 24/4{,}615 = 5{,}2\text{A}$
$I_2 = I_T - I_1 = 5{,}2 - 1{,}2 = 4\text{A}$ (4)
[19]

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QUESTION 3

3.1 3.1.1

- A circuit containing a resistor; there is no effect on the current with the increase in frequency
- A circuit containing an inductor; the current decreases with the increase in frequency
- A circuit containing a capacitor; the current increases with the increase in frequency (3)

3.1.2

- A circuit containing a resistor; voltage and current are always in phase with each other
- A circuit containing an inductor; the voltage leads current by 90°
- A circuit containing a capacitor; the current leads voltage by 90° (3)

3.2 3.2.1 (a)

$$V_S = \sqrt{V_R^2 + (V_L - V_C)^2}$$
$$V_s = \sqrt{150^2 + (180 - 90)^2}\checkmark$$
$$V_s = 174{,}929\ \text{V}\checkmark \quad (2)$$

(b)

$$Z = \sqrt{R^2 + (X_L - X_c)^2}$$
$$Z = \sqrt{10^2 + (14 - 8)^2}\checkmark$$
$$Z = 11{,}662\ \Omega\checkmark \quad (2)$$

(c)

$$I = \frac{V_s}{Z}$$
$$I = \frac{174{,}929}{11{,}662}\checkmark$$
$$I = 15\ \text{A}\checkmark \quad (2)$$

(d)

$$X_c = \frac{1}{2\pi fC}$$
$$C = \frac{1}{2\pi(100)(8)}\checkmark$$
$$C = 198{,}944\ \mu\text{F}\checkmark \quad (2)$$

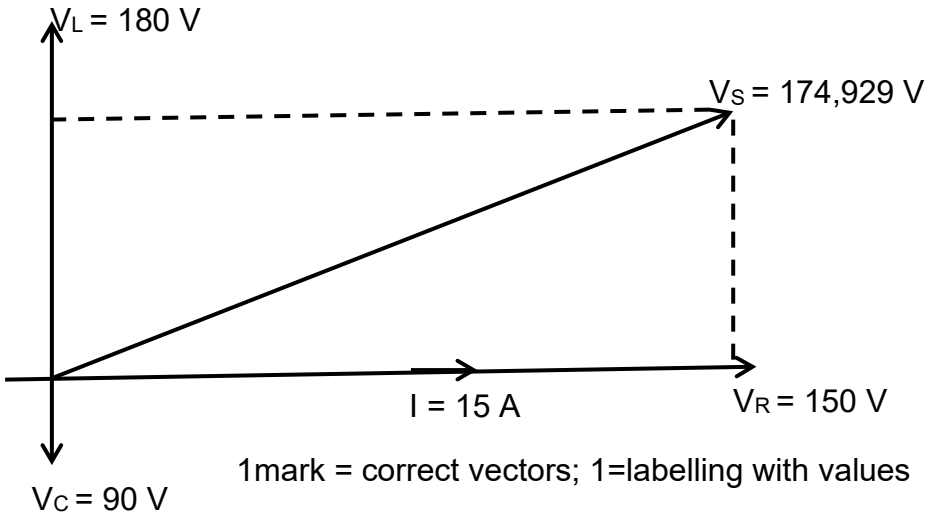
(e)

$$X_L = 2\pi fL$$
$$L = \frac{X_L}{2\pi f}$$
$$L = \frac{14}{2\pi(100)}\checkmark$$
$$L = 22{,}282\ \text{mH}\checkmark \quad (2)$$

(f)

$$\theta = cos^{-1}\frac{R}{Z}$$
$$\theta = cos^{-1}\frac{10}{11{,}662}\checkmark$$
$$\theta = 30{,}965°\checkmark \quad (2)$$

3.2.2



1mark = correct vectors; 1=labelling with values

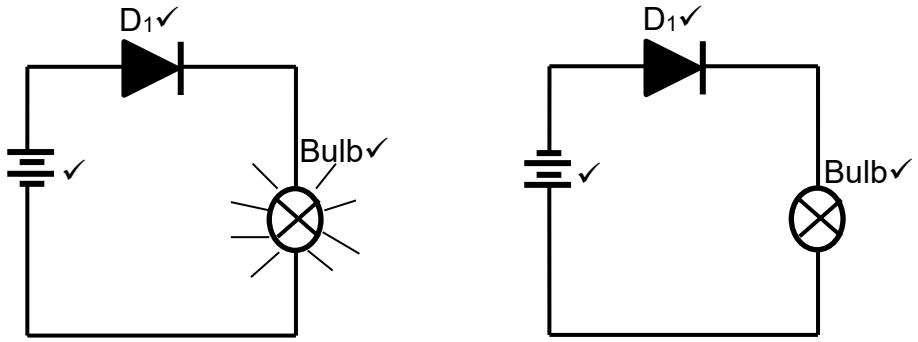
(2)
[20]

QUESTION 4

4.1
- Forward bias
- Reverse bias

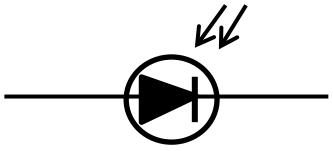
(2)

4.2



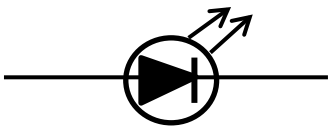
(3 + 3) (6)

4.3 4.3.1



- Used as a switch
- Under reverse bias

4.3.2



- Used as alphanumeric display
- Under forward bias

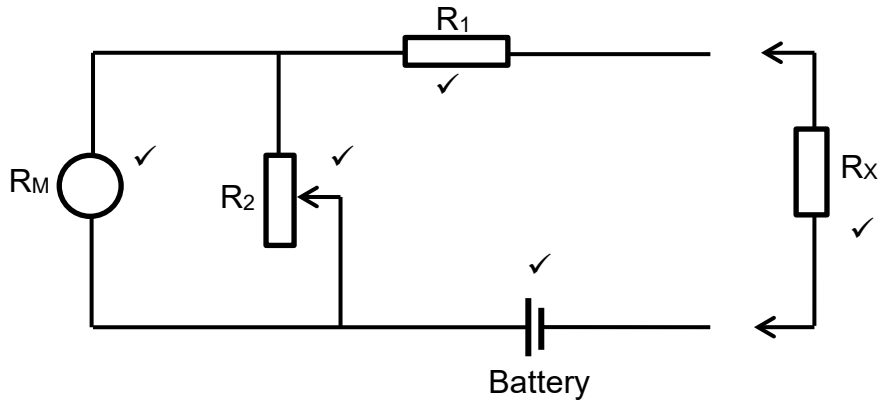
(2 × 3) (6)
[14]

QUESTION 5

5.1
5.1.1 Reverse biased
5.1.2 Amplifier
5.1.3 Forward biased
5.1.4 Switch
5.1.5 Reverse biased
5.1.6 Reverse biased

(6 × 1) (6)

5.2



(5)

5.3
- Eddy current
- Air friction

(2)

5.4
- Always select the highest scale first when starting measurements and decrease the scale if necessary.
- Never leave the meter on the ohm scale.
- Before any measurements are taken, the test leads should be shorted out and the meter set to zero.

(3)
[16]

QUESTION 6

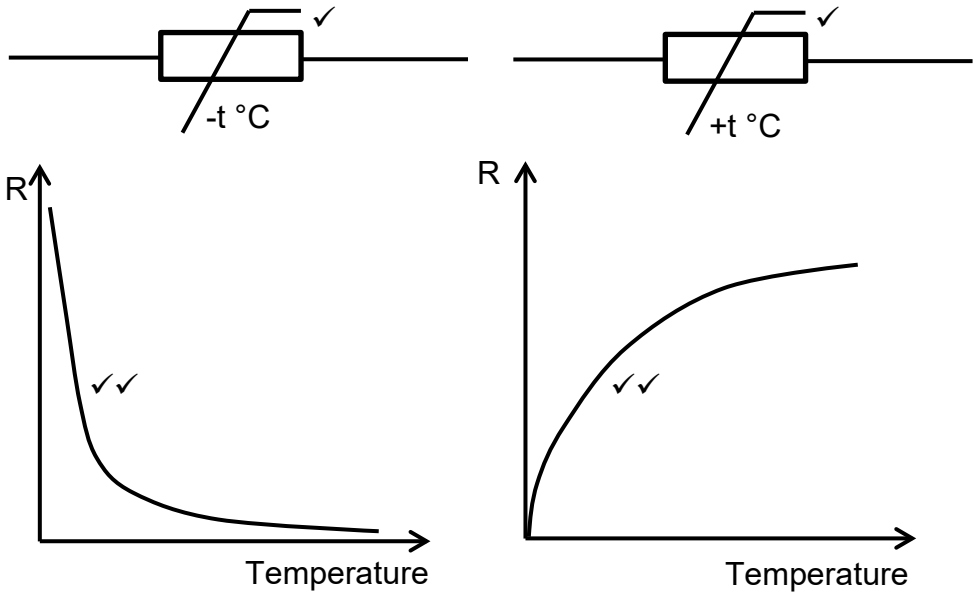
6.1
$P_{in} = I^2 \times R$
$P_{in} = (30 \times 10^{-3}) \times 400$
$P_{in} = 0{,}36$ W✓

$P_{out} = I^2 \times R$
$P_{out} = (300 \times 10^{-3}) \times 800$
$P_{out} = 240$ W✓

$N_p = 10log\frac{P_{out}}{P_{in}}$ ✓
$N_p = 10log\frac{240}{0{,}36}$ ✓
$N_p = 10\log(666{,}667)$
$N_p = 28{,}239$ dB✓

(5)

6.2
- Negative temperature coefficient (NTC)
- Positive temperature coefficient (PTC)

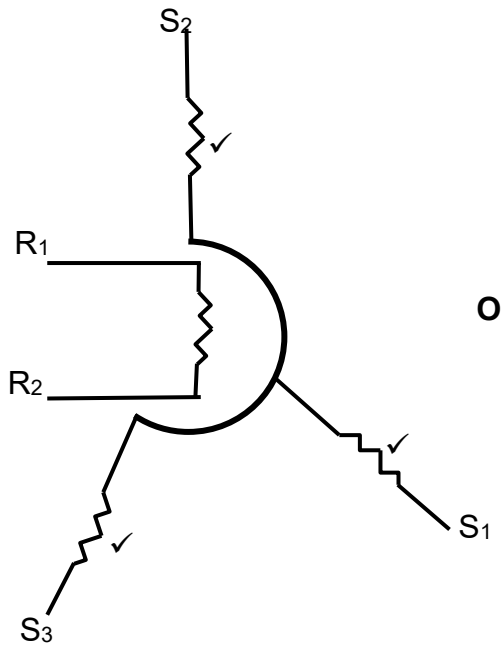


NTC: as temperature increases, the resistance decreases
PTC: as temperature increases, the resistance increases

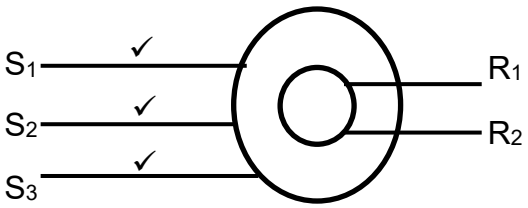
(4 + 4) (8)
[13]

QUESTION 7

7.1



OR



(4)

7.2
- Control of power tools
- Control of space ships
- Control positioning of gun turrets
- Remote control of model cars or model aeroplanes (4)

[8]

TOTAL: 100

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