higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N1

28 JULY 2021

This marking guideline consists of 6 pages.

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QUESTION 1

1.1 1.1.1 D
1.1.2 D
1.1.3 C
1.1.4 D
1.1.5 B

(5 × 1) (5)

1.2 1.2.1 Two; dielectric (2)

1.2.2 Amplifiers; switches (2)

1.2.3 Four (1)

1.2.4 Recharged; primary (2)

1.2.5 Length; cross-sectional area; type of material (3)

1.3 $R_t = R_o(1+\alpha\Delta t)$

$R_0 = \frac{Rt}{1+\alpha\Delta t}$ ✓ ✓

$= \frac{48,6}{1+0,00428\times 50}$ ✓

$= 40\ \Omega$ ✓ (4)

1.4 1.4.1 True

1.4.2 False

1.4.3 True

1.4.4 False

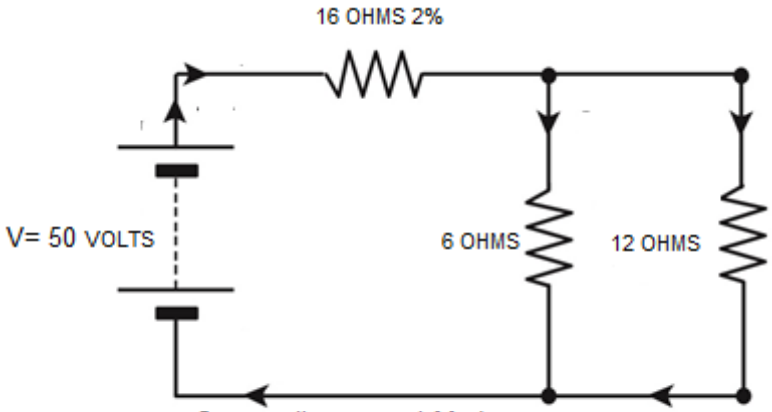
1.4.5 False

1.4.6 False

(6 × 1) (6)
[25]

QUESTION 2

2.1 2.1.1



Correct diagram = 1 Mark
Each resistor correctly labelled = 1 mark (3)
Supply voltage = 1 mark (5)

2.1.2

$$R_{//} = \frac{R_{6\Omega} \times R_{12\Omega}}{R_{6\Omega} + R_{12\Omega}} \checkmark$$
$$= \frac{6 \times 12}{6 + 12} \checkmark$$
$$= \frac{72}{18}$$
$$= 4\Omega \checkmark$$

$$R_T = R_S + R_{//} \checkmark$$
$$= 16 + 4 \checkmark$$
$$= 20\Omega \checkmark$$

(6)

2.1.3

$$I = \frac{V}{R} \checkmark$$
$$= \frac{50}{20} \checkmark$$
$$= 2,5A \checkmark$$

(3)

2.1.4 Brown; blue; black; red (4)

2.2 2.2.1

$$a = \frac{\pi d^2}{4} \checkmark$$
$$= \frac{3,142(6 \times 10^{-3})^2}{4} \checkmark \checkmark$$
$$= 28,278 \times 10^{-6} m^2 \checkmark$$

(4)

2.2.2

$$R = \frac{\rho l}{a}$$
$$= \frac{(1,728 \times 10^{-6}) \times 25}{(28,278 \times 10^{-6})} \checkmark \checkmark$$
$$= 1,5277\Omega \checkmark$$

(3)
[25]

QUESTION 3

3.1 3.1.1

$$\frac{1}{C_T}=\frac{1}{C_1}+\frac{1}{C_2}+\frac{1}{C_3}$$

$$\frac{1}{C_T}=\frac{1}{5}+\frac{1}{15}+\frac{1}{25}\ \checkmark$$

$$\frac{1}{C_T}=0,2+0,067+0,04\ \checkmark$$

$$\frac{1}{C_T}=0,307$$

$$C_T=\frac{1}{0,307}=3,257\mu F\ \checkmark\ \checkmark \quad \text{(unit = 1 mark)}$$

(4)

3.1.2

$$Q=C\times V$$

$$=3,257\times 50\ \checkmark$$

$$=162,85\mu C\ \checkmark\ \checkmark \quad \text{(unit = 1 mark)}$$

or

$$Q=1,6285\times 10^{-4}C$$

(3)

3.2 3.2.1

$$\frac{V_p}{V_s}=\frac{N_p}{N_s}$$

$$V_s=\frac{V_p\times N_s}{N_p}\ \checkmark$$

$$=\frac{240\times 1}{5}\ \checkmark$$

$$=48V\ \checkmark$$

(3)

3.2.2

$$\frac{I_s}{I_p}=\frac{N_p}{N_s}$$

$$I_p=\frac{I_s\times N_s}{N_p}\ \checkmark$$

$$=\frac{1,5\times 1}{5}\ \checkmark$$

$$=0,3A\ \checkmark$$

(3)

3.2.3 $$\frac{V_p}{V_s} = \frac{N_p}{N_s}$$

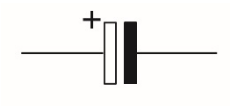
$$N_p = \frac{V_p \times N_s}{V_s} \checkmark$$

$$= \frac{240 \times 100}{48} \checkmark$$

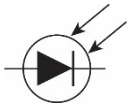
$$= 500 Turns \checkmark$$ (3)

3.2.4
- Excessive current results in too much heat dissipation
- Insulation breakdown can cause windings to short out and overheat (Any reasonable answer) (3)

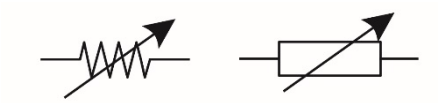
3.3 3.3.1



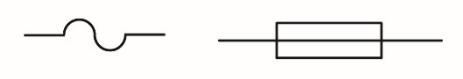
3.3.2



3.3.3



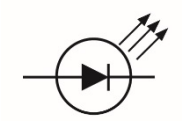
3.3.4



3.3.5



3.3.6



(6 × 1) (6)

QUESTION 4

4.1 4.1.1 The formation of hydrogen bubbles around the copper electrode preventing a chemical reaction from taking place

4.1.2 A semiconductor material, e.g., silicon, that has no impurities added

4.1.3 The difference of electrical potential between two points

4.1.4 A bond formed when electrons are shared between two atoms

4.1.5 The addition of impurities to pure silicon material

4.1.6 The process by which an atom or molecule acquires a negative or positive charge by gaining or losing electrons

(Any relevant 6 × 2) (12)

4.2 4.2.1 $Emf = 4 \times 2,1 = 8,4\ volts$ (1)

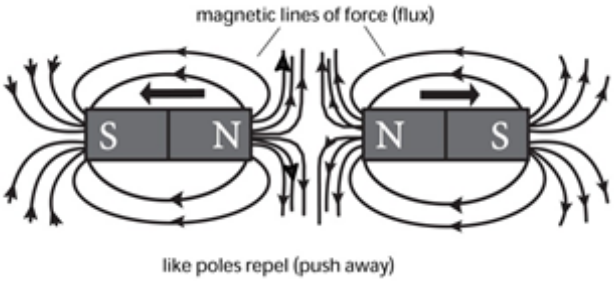
4.2.2 $R_T = R_{\text{int}} + R$ ✓

$= (0,5 \times 4) + 20$ ✓

$= 22\ \Omega$ ✓ (3)

4.2.3 $R_{\text{int}} = 0,5 \times 4 = 2\Omega$ (1)

4.3



FIVE marks for correct diagram
THREE marks for labels

(8)
[25]

TOTAL: 100

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