higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

NOVEMBER EXAMINATION

INDUSTRIAL ELECTRONICS N2

21 NOVEMBER 2014

This marking guideline consists of 7 pages.

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SECTION A

QUESTION 1

1.1 False
1.2 True
1.3 True
1.4 False
1.5 True
1.6 False
1.7 False
1.8 False
1.9 False
1.10 False

(10 × 1) **[10]**

TOTAL SECTION A: 10

SECTION B

QUESTION 2

2.1 $V_{28\Omega} = I_T \times R_{28\Omega} = 1 \times 28 = 28\ V$ ✓✓

$V_{AB} = V_T - V_{28\Omega} = 40 - 28 = 12\ V$ ✓✓ (4)

2.2 $R_{AB} = \frac{60 \times 40}{60 + 40} = \frac{2400}{100} = 24\ \Omega$ ✓✓

$R_{CD} = \frac{4 \times 70}{4 + 70} = \frac{280}{74} = 3{,}784\ \Omega$ ✓ ✓ (4)

2.3 $I_1 = \frac{V_{AB}}{R_{P1}} = \frac{12}{24} = 0{,}5\ A$ ✓✓

$I_2 = I_T - I_{P1} = 0{,}5\ A$ ✓ (3)

2.4 $V_{CD} = I_2 \times R_{P2} = 0{,}5 \times 3{,}784 = 1{,}874\ V$ ✓✓ (2)

2.5 $V_R = V_P - V_{P1} = 12 - 1{,}874 = 10{,}126\ V$ ✓

$R = \frac{V_R}{I_{P2}} = \frac{10{,}126}{0{,}5} = 20{,}252\ \Omega$ ✓✓ (3)

✓

2.6 $P_{R70\Omega} = \frac{V_{P2}}{R_{70\Omega}} = \frac{1{,}874}{70} = 0{,}050\ W = 50\ mW$ ✓

(2)
[18]

In the event of a double tick, allocate one tick to the previous step.

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QUESTION 3

3.1 3.1.1

$$Z = \sqrt{R^2 + (X_L - X_L)^2} = \sqrt{40^2 + (40-60)^2} = 44{,}72\ \Omega \quad \checkmark\checkmark$$ (2)

3.1.2

$$I_T = \frac{V}{Z} = \frac{220}{44{,}72} = 4{,}92\ A \quad \checkmark\checkmark$$ (2)

3.1.3

$$X_L = 2\pi fL$$

$$L = \frac{X_L}{2\pi f} = \frac{40}{2\pi \times 50} = 0{,}127 H \quad \checkmark\checkmark$$ (2)

3.1.4

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

$$C = \frac{1}{2\pi f X_C} = \frac{1}{2\pi \times 50 \times 60} = 53{,}05 \mu F \quad \checkmark\checkmark$$ (2)

3.1.5

$$\theta = \text{Cos}^{-1}\frac{R}{Z} = \text{Cos}^{-1}\frac{40}{44{,}721} 26{,}56^{o} \quad \checkmark\checkmark$$ (2)

3.1.6

$$f_r = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{0{,}127 \times 53{,}05 \times 10^{-6}}} = 61{,}316\ Hz \quad \checkmark\checkmark$$ (2)

3.2

$$A_P = 20\log\frac{V_O}{V_I} + 10\log\frac{R_O}{R_I}$$

$$\therefore 25 = 20\log\frac{7{,}5}{V_I} + 0 \quad \checkmark\checkmark$$

$$\log\frac{7{,}5}{V_I} = \frac{25}{20}$$

$$\frac{7{,}5}{V_I} = 17{,}783 \quad \checkmark\checkmark$$

$$V_I = \frac{7{,}5}{17{,}783} = 0{,}422\ V \quad \checkmark\checkmark$$ (6)

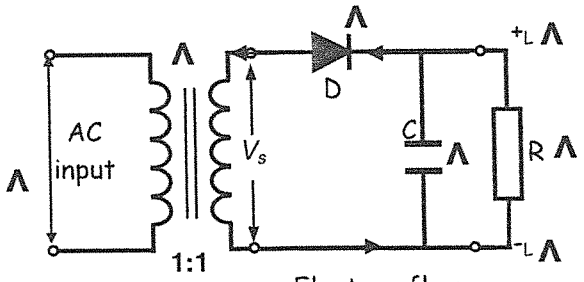
[18]

In the event of a double tick, allocate one tick to the previous step.

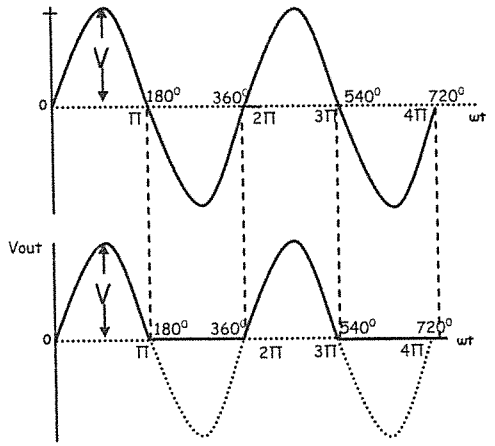
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QUESTION 4

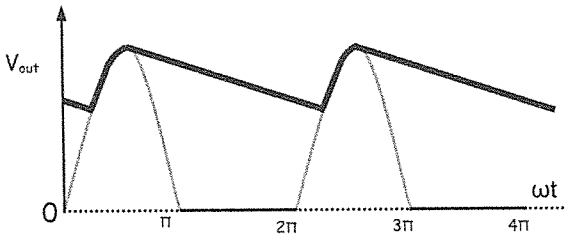
4.1



Before rectifier



After rectifier without C



Final output with C (10)

4.2

4.2.1	Pentavalent^
4.2.2	Electrons^
4.2.3	Donor^
4.2.4	N-type^
4.2.5	Electrons^
4.2.6	Trivalent^
4.2.7	Holes^
4.2.8	Acceptor^
4.2.9	P-type^
4.2.10	Holes^

(5)

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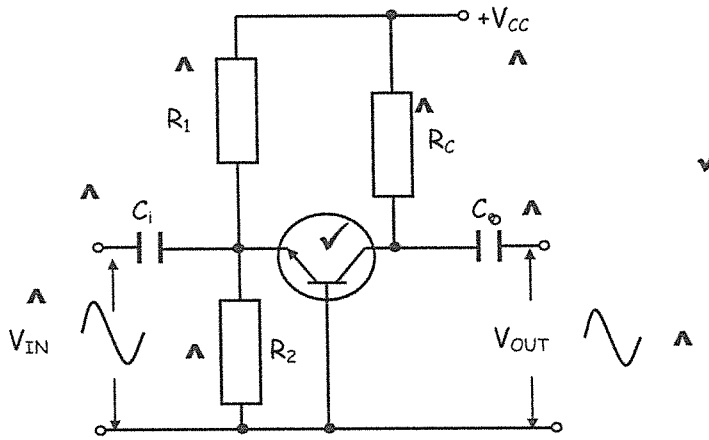
4.3 4.3.1 Should an atom lose an electron it becomes a positive ion ✓ (1)

4.3.2 Should an atom gain an electron, it becomes a negative ✓ (1)

4.4 The above process of losing or gaining electrons is referred to as ionization. ✓ (1)
[18]

QUESTION 5

5.1

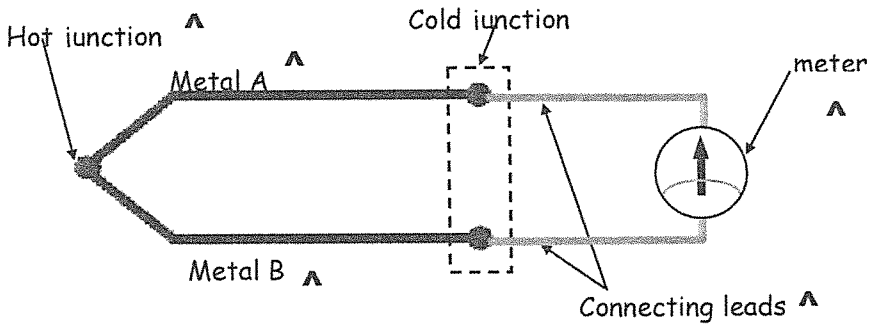


(6)

5.2 5.2.1 The cut-off region is when both base-emitter and base collector junctions are reverse-biased. ✓ (2)

5.2.2 Saturation occurs when both the base-emitter and the base-collector junctions are forward-biased. ✓ (2)

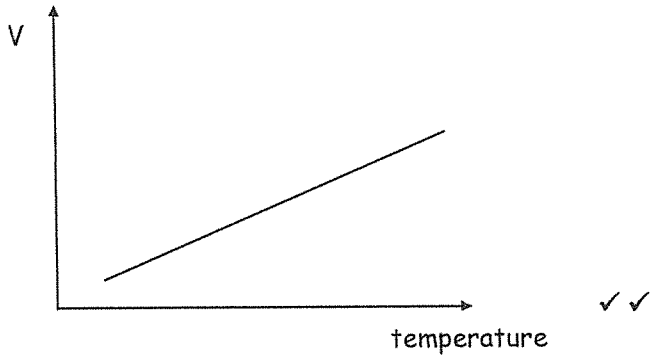
5.3 5.3.1



(4)

5.3.2

5.3.2 When a temperature difference exists between the hot junction and the 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. ✓✓ (2)



✓✓

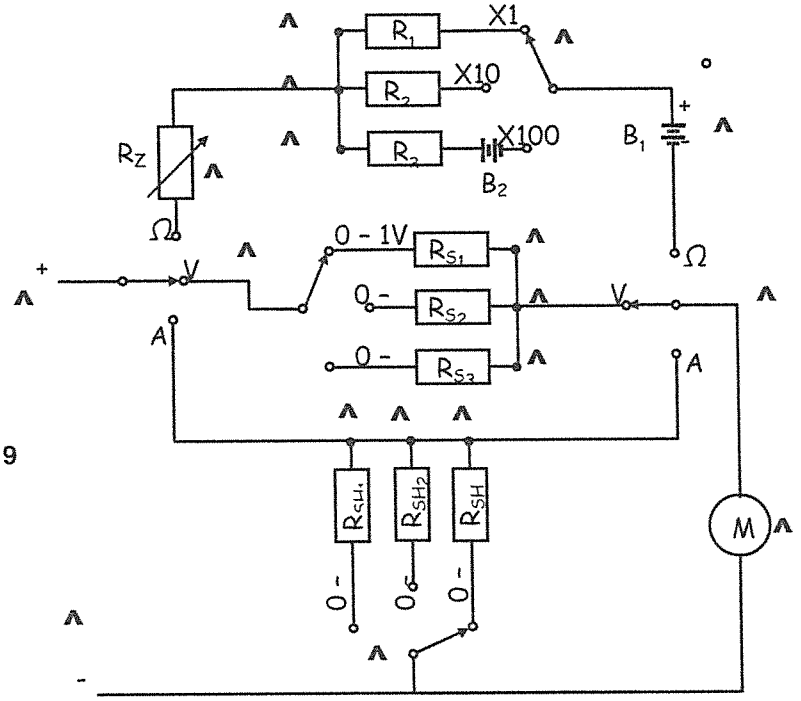
(2)

(a mark for the graph, a mark for the axis)

[18]

QUESTION 6

6.1



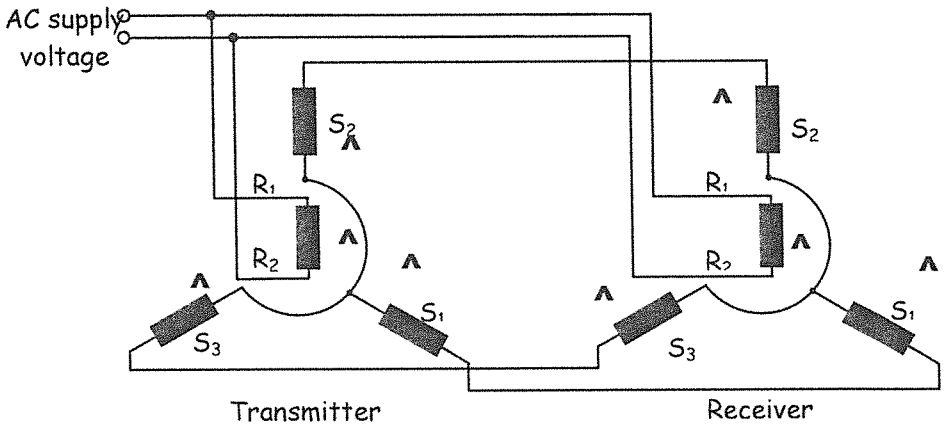
Labels = 18x/½ = 9
Correctness = 1

(10)

6.2 $$R_S = \frac{V}{I_m} - R_M = \frac{250}{25\times10^{-3}} - 5 = 9995\ \Omega$$ ✓ ✓

(2)

6.3



Labels=8x1/2=4
Drawing = 1
Correctness = 1

(6)
[18]

TOTAL SECTION B: 90
GRAND TOTAL: 100

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