



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE INDUSTRIAL ELECTRONICS N3

25 JULY 2018

This marking guideline consists of 7 pages.

QUESTION 1

- 1.1 The direction of the current provided in the circuit is opposite✓ to the direction of the chosen loop.✓ (2)

1.2 **Loop ABDA**

$$0 = 0,7 \times 12 - 5 I_1 \checkmark$$

$$-8,4 = -5 I_1$$

$$I_1 = \frac{-8,4}{-5} \checkmark$$

$$I_1 = 1,68 \text{ A} \checkmark \rightarrow$$

LOOP DBCD

$$0 = 0,7 \times 12 - 5 I_2 \checkmark$$

$$-8,4 = -5 I_2$$

$$I_2 = \frac{-8,4}{-5} \checkmark$$

$$I_2 = 1,68 \text{ A} \checkmark \rightarrow$$

$$\text{Therefore: } (I_1 - I_2) = 0 \text{ A} \checkmark \checkmark$$

(8)
[10]**QUESTION 2**

2.1 $X_L = 2\pi fL$
 $= 2 \times 3,142 \times 50 \times 200 \times 10^{-3} \checkmark$
 $X_L = 62,84 \Omega \checkmark \rightarrow$

Therefore: $\theta = \cos^{-1} \frac{R}{Z_{RL}}$
 $\theta = \cos^{-1} \frac{75}{97,846} \checkmark$
 $\theta = 39,96^\circ \checkmark \rightarrow$

AND:

$$Z_{RL} = \sqrt{R^2 + X_L^2}$$

$$= \sqrt{(75)^2 + (62,84)^2} \checkmark$$

$$Z_{RL} = 97,846 \Omega \checkmark \rightarrow$$

or

$$\theta = \tan^{-1} (R/X_L)$$

$$= \tan^{-1} (75/62,84)$$

$$= 39,96^\circ$$

(6)

2.2 $I_{RL} = \frac{VT}{Z_{RL}}$
 $= \frac{180}{97,846} \checkmark$
 $= 1,839 \text{ A} \checkmark \rightarrow$

(2)

2.3 $I_C = \frac{VT}{X_C}$
 $= \frac{180}{21,218} \checkmark$

$$I_C = 8,483 \text{ A} \checkmark \rightarrow$$

BUT:

$$X_C = \frac{1}{2 \times \pi \times f \times C}$$

$$= \frac{1}{2 \times 3,142 \times 50 \times 150 \times 10^{-6}}$$

$$X_C = 21,218 \Omega \checkmark \rightarrow$$

(3)

2.4 $I_{RL(HORZ)} = I_{RL} \cos \theta$
 $= 1,839 \cos 39,96^\circ \checkmark$
 $I_{RL(HORZ)} = 1,409 \text{ A} \checkmark$
 (2)

2.5 $I_{RL(VERT)} = I_{RL} \sin \theta$
 $= 1,839 \sin 39,96^\circ \checkmark$
 $I_{RL(VERT)} = 1,18 \text{ A} \checkmark$ (2)

2.6 $I_{C(HORZ)} = I_C \cos \theta$
 $= 8,483 \cos 90^\circ \checkmark$
 $I_{C(HORZ)} = 0 \text{ A} \checkmark$
 (2)

$I_{C(VERT)} = I_C \sin \theta$
 $= 8,483 \sin 90^\circ \checkmark$
 $I_{C(VERT)} = 8,483 \text{ A} \checkmark$
 (2)

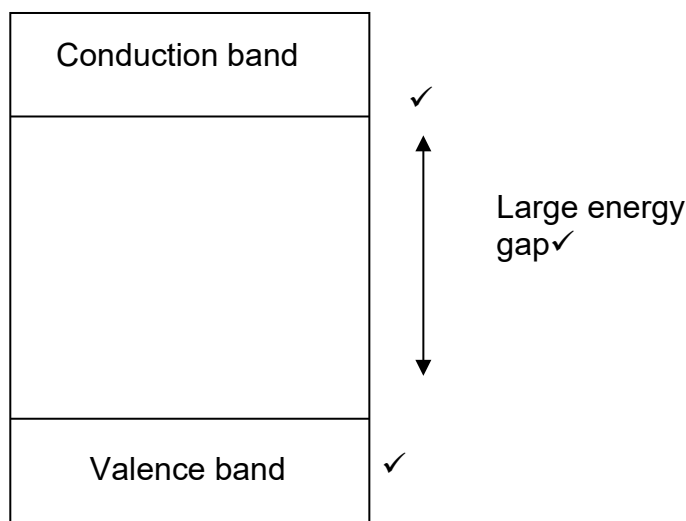
[19]

QUESTION 3

3.1 An atom is considered neutral because there is an equal number✓ of electrons and protons inside the nucleus.✓ (2)

3.2 Reverse current is the amount of current that leaks through✓ a diode at various reverse voltages.✓ (2)

3.3 With reference to the sketch below, the energy gap of an insulator is too big for the electrons to cross over from the valence band into the conduction band.✓ this makes it difficult for the insulator to conduct electricity.✓



(5)

- 3.4 A positive ion is an atom which has lost an electron✓ or an atom with more protons than electrons.✓ (2)
- 3.5 Series positive clipper (1)
- 3.6 The diode will only conduct during the negative✓ half of the input signal because it is forward-biased. The diode will block the positive half of the input signal✓ because it is reverse-biased at the time. Only the negative half of the input can be produced on the output as a DC signal.✓ (3)
- 3.7 Negative parallel clipper or negative shunt clipper (1)
- [16]**

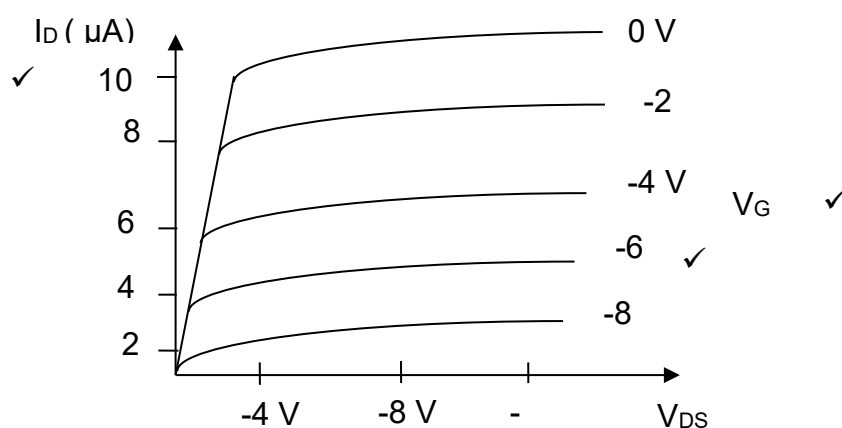
QUESTION 4

- 4.1 Forward
- 4.2 Reverse
- 4.3 PN-junction
- 4.4 Dark
- 4.5 PN-junction
- (5 × 1) **[5]**

QUESTION 5

- 5.1 Exposure of the photo diode to light (1)
- 5.2 As soon as the photo diode is exposed to light,✓ current flows through to the base of the transistor and this base current causes the collector✓ current to flow. This collector current produces a magnetic field around✓ the coil of the relay and this activates the relay contact in a closed✓ position. Once this contact closes, it activates the load.✓ (5)
- 5.3
- The output waveform is 180° out of phase with the input waveform
 - High current gain
 - High voltage gain
 - Average values for input and output impedances
- (4)

5.4



(4)

- 5.5 A class A amplifier has a low distortion level whereas a class B amplifier has a high efficiency; a compromise was made in order to combine these two advantages into a single amplifier and to form a class AB amplifier or push-pull amplifier.

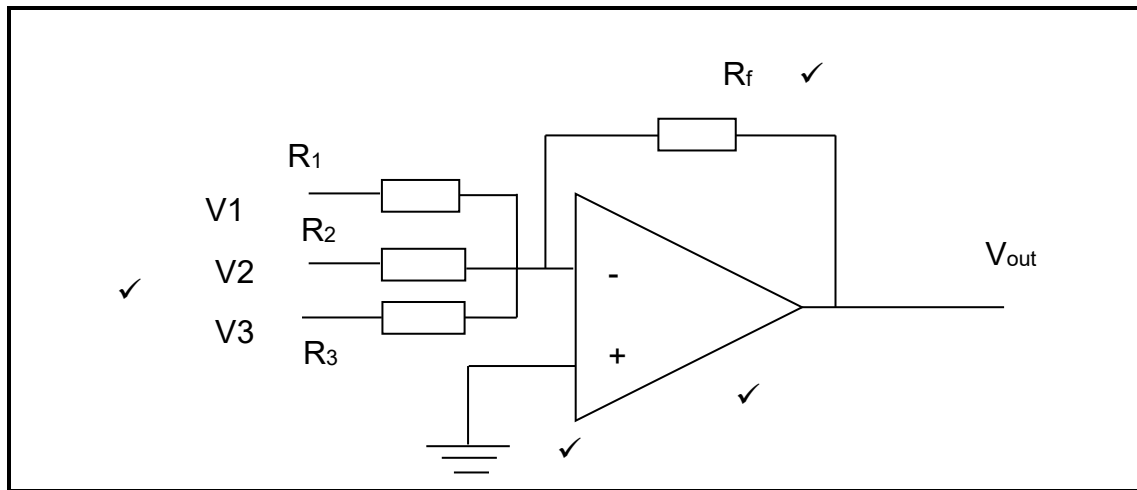
(4)
[18]**QUESTION 6**

- 6.1 Holding current is the minimum current required to keep an SCR in the conduction state. (2)
- 6.2 Cycle control is achieved by switching the control device on for a number of full cycles and then switching it off for a number of full cycles. The load current only flows for a number of on-times. (5)
- 6.3 The time that the SCR takes before it starts to conduct is termed the delay angle. (2)
- 6.4 The time that the SCR conducts is termed as conduction angle. This is the time that the output is produced. (2)

[11]

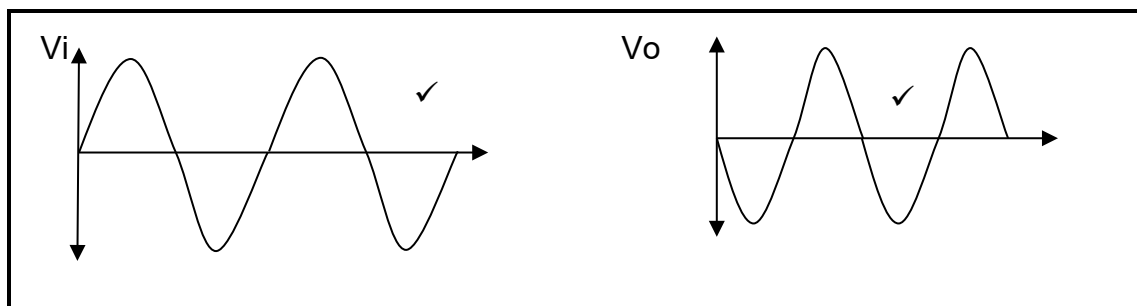
QUESTION 7

7.1



(4)

7.2



(2)

[6]**QUESTION 8**

8.1 An increase in the length will cause the resistance✓ of the strain gauge to increase✓ and the increase in the area of the strain gauge✓ will cause the resistance of the strain gauge to decrease.✓

(4)

8.2 An increase in the area✓ of the plates will cause the capacitance to increase,✓ and the change of the dielectric to a higher value✓ will also increase the capacitance✓ but an increase in the distance between the plates✓ will decrease the capacitance of the transducer.✓

(6)

[10]

QUESTION 9

9.1 $V_{av} = 0,637 \cdot V_M$

$$V_M = \frac{200 \times 10^{-3}}{0,637} \quad \checkmark$$

$$\underline{V_M = 0,314 \text{ V}} \quad \checkmark$$

THEREFORE:

$$V_{RMS} = 0,707 V_M$$

$$= 0,707 \times 0,314 \quad \checkmark$$

$$\underline{= 0,222 \text{ V}} \quad \checkmark$$

(4)

9.2 $V_{p-p} = 2 \cdot V_m$
 $= 2 \times 0,314$

$$\underline{V_{p-p} = 0,628 \text{ V}} \quad \checkmark$$

(1)

[5]**TOTAL: 100**