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.

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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**

$0 = 0,7 \times 12 - 5\ I_1$✓

$-8,4 = -5I_1$

$I_1 = \frac{-8,4}{-5}$ ✓

$I_1 = 1,68\ A$ ✓

LOOP DBCD

$0 = 0,7 \times 12 - 5\ I_2$✓

$-8,4 = -5\ I_2$

$I_2 = \frac{-8,4}{-5}$✓

$I_2 = 1,68\ A$✓

Therefore: $(I_1 - I_2) = 0\ A$✓✓ (8)

[10]

QUESTION 2

2.1 $X_L = 2\pi fL$

$= 2 \times 3,142 \times 50 \times 200 \times 10^{-3}$ ✓

$X_L = 62,84\ \Omega$ ✓

Therefore: $\theta = \text{Cos}^{-1}\frac{R}{ZRL}$

$\theta = \text{Cos}^{-1}\frac{75}{97,846}$ ✓

$\theta = 39,96^\circ$✓

AND:

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

$= \sqrt{(75)^2 + (62,84)^2}$✓

$Z_{RL} = 97,846\ \Omega$✓

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

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

$= 39,96^\circ$

(6)

2.2 $I_{RL} = \frac{VT}{ZRL}$

$= \frac{180}{97,846}$✓

$= 1,839\ A$✓

(2)

2.3 $I_C = \frac{VT}{XC}$

$= \frac{180}{21,218}$ ✓

$I_C = 8,483\ A$ ✓

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

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

$X_C = 21,218\ \Omega$✓

(3)

2.4 $I_{RL(HORZ)} = I_{RL} \text{ Cos } \theta$
$= 1,839 \text{ Cos } 39,96$✓
$I_{RL(HORZ)} = 1,409 \text{ A}$✓ (2)

2.5 $I_{RL(VERT)} = I_{RL} \text{ Sin } \theta$
$= 1,839 \text{ Sin } 39,96$✓
$I_{RL(VERT)} = 1,18 \text{ A}$✓ (2)

2.6 $I_{C(HORZ)} = I_C \text{ Cos } \theta$
$= 8,483 \text{ Cos } 90$✓
$I_{C(HORZ)} = 0 \text{ A}$✓ (2)

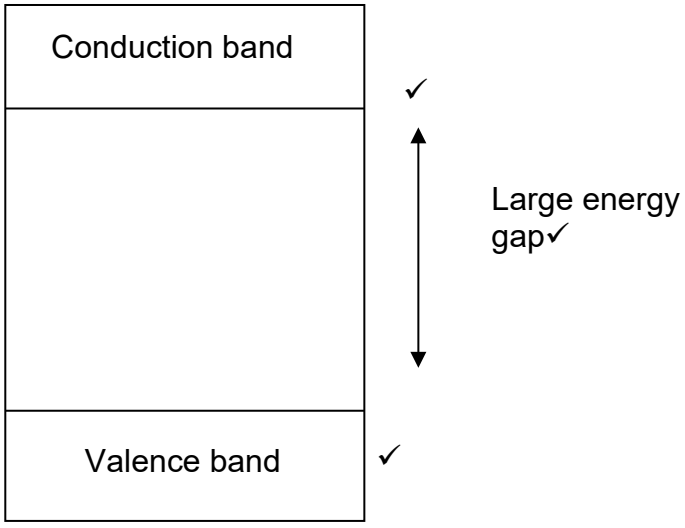
$I_{C(VERT)} = I_C \text{ Sin } \theta$
$= 8,483 \text{ Sin } 90$✓
$I_{C(VERT)} = 8,483 \text{ A}$✓ (2)
[19]

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]**

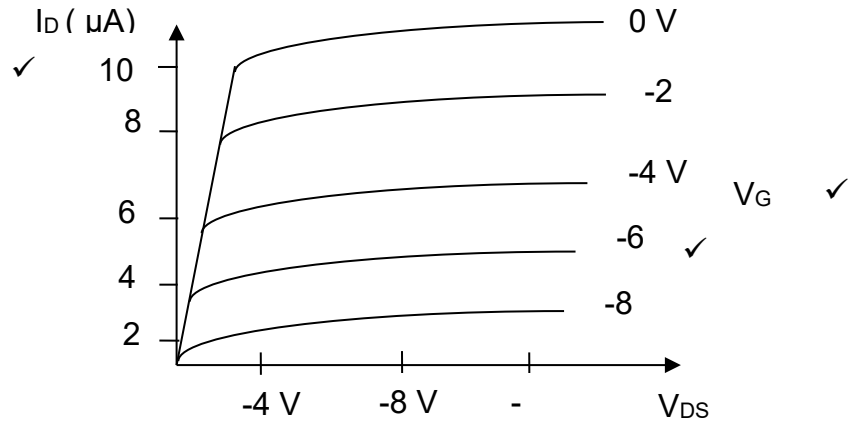
QUESTION 5

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)

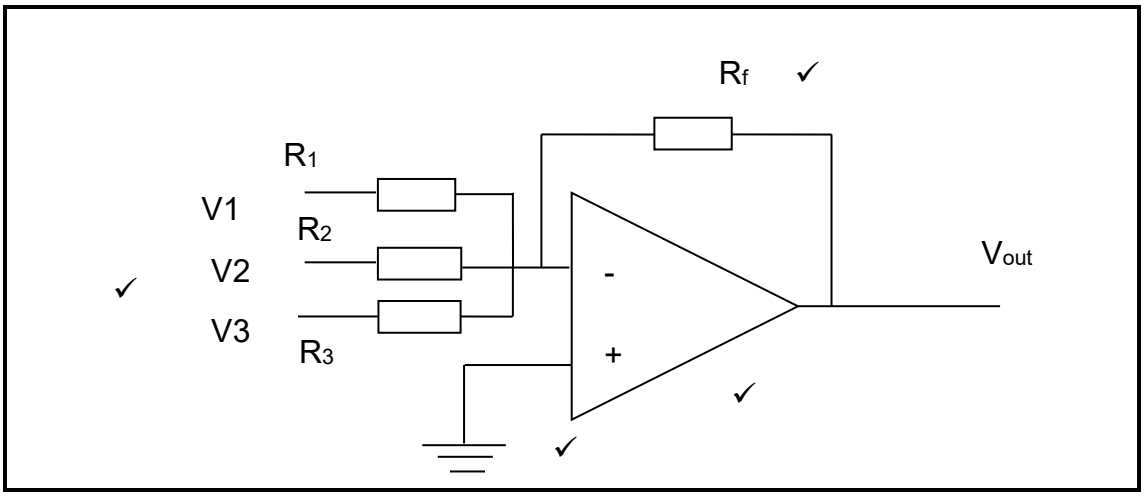
6.2 Cycle control is achieved by switching the control device✓ on for a number of full cycles✓ and then switching it off for a number of full cycles.✓ The load current only flows for a number of on-times.✓✓ (5)

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]

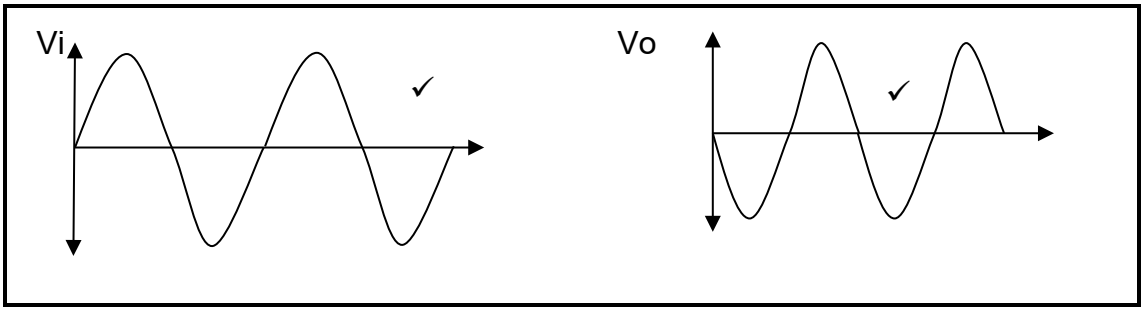
QUESTION 7

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 stain 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 $V_{av} = 0,637 . V_M$ **THEREFORE:** $V_{RMS} = 0,707\ V_M$

$V_M = \frac{200 \times 10^{-3}}{0,637}$ ✓ $= 0,707 \times 0,314$ ✓

$V_M = 0,314\ V$ ✓ $= 0,222\ V$ ✓ (4)

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

$V_{p-p} = 0,628\ V$ ✓ (1)
[5]

TOTAL: 100

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