



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE INDUSTRIAL ELECTRONICS N3

29 JULY 2019

This marking guideline consists of 7 pages.

SECTION A**QUESTION 1**

1.1	1.1.1	False
	1.1.2	True
	1.1.3	False
	1.1.4	False
	1.1.5	True
	1.1.6	False
	1.1.7	True
	1.1.8	True
	1.1.9	True
	1.1.10	False

(10 × 1) (10)

1.2	1.2.1	I
	1.2.2	G
	1.2.3	J
	1.2.4	H
	1.2.5	C
	1.2.6	A
	1.2.7	D
	1.2.8	F
	1.2.9	E
	1.2.10	B

(10 × 1) (10)
[20]**TOTAL SECTION A: 20**

SECTION B**QUESTION 2**

Minimise the currents in the circuit: $I_3 = (I_1 - I_2)$

Loop ABDFA

$$10 = 5I_1 + 6I_2 \dots\dots\dots (1) \checkmark$$

Loop ACEFA

$$10 = 4(I_1 - I_2) + 5I_1$$

$$10 = 4I_1 - 4I_2 + 5I_1$$

$$10 = 9I_1 - 4I_2 \dots\dots\dots (2) \checkmark$$

$$(1) \times 2: 20 = 10I_1 + 12I_2 \dots\dots\dots (3) \checkmark$$

$$(2) \times 3: 30 = 27I_1 - 12I_2 \dots\dots\dots (4) \checkmark$$

$$(3) + (4) : 50 = 37I_1$$

$$\underline{I_1 = 1,351 \text{ A}} \rightarrow \checkmark\checkmark$$

For I_2 , substitute $I_1 = 1,351 \text{ A}$ into..... (1)

$$10 = 5(1,351) + 6I_2$$

$$\frac{3,245}{6} = I_2$$

$$\underline{I_2 = 0,5 \text{ A}} \rightarrow$$

$\checkmark\checkmark$

$$\text{AND: } I_3 = (I_1 - I_2)$$

$$= 1,351 - 0,541$$

$$\underline{I_3 = 0,81 \text{ A}} \checkmark\checkmark \rightarrow$$

$$V_{R1} = I_3 \times R_1$$

$$= 0,81 \times 4$$

$$\underline{V_{R1} = 3,24 \text{ V}} \checkmark\checkmark \rightarrow$$

$$P_{R1} = (I_3)^2 \times R_1$$

$$= (0,81)^2 \times 4$$

$$\underline{P_{R1} = 2,624 \text{ W}} \checkmark\checkmark \rightarrow$$

[14]

QUESTION 3

3.1 3.1.1

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

$$= \sqrt{5^2 + 80^2}$$

therefore:

$$I_{RL} = \frac{V}{Z_{RL}}$$

$$= \frac{240}{80,156} \checkmark$$

$$Z_{RL} = 80,156 \Omega \checkmark$$

$$I_{RL} = 2,994 A \checkmark \quad (3)$$

3.1.2

$$I_C = \frac{V}{Z_C}$$

$$= \frac{240}{60} \checkmark$$

$$I_C = 4 A \checkmark$$

(2)

3.1.3

$$\theta = \tan^{-1} \frac{X_L}{R}$$

$$= \tan^{-1} \frac{80}{5} \checkmark$$

$$\theta = 86,424^\circ \checkmark$$

(2)

3.2 3.2.1

$$X_L = 2\pi fL$$

$$L = \frac{X_L}{2\pi f}$$

$$L = \frac{80}{2\pi \times 80}$$

$$L = 159,134 \text{ mH} \checkmark$$

$$\text{AND: } X_C = \frac{1}{2\pi fC}$$

$$C = \frac{1}{2\pi \times 80 \times 60}$$

$$C = 33,153 \mu\text{F} \checkmark$$

$$\text{THEREFORE: } Z_d = \frac{L}{RC}$$

$$= \frac{159,134 \times 10^{-3}}{5 \times 33,153 \times 10^{-6}} \checkmark$$

$$Z_d = 959,998 \Omega \checkmark \quad (4)$$

3.2.2

$$I_T = \frac{VT}{Z_d}$$

$$= \frac{240}{959,998} \checkmark$$

$$I_T = 0,25 A \checkmark$$

(2)

3.2.3

$$I_C (\text{at resonance}) = I_{RL} \sin \theta_L$$

$$= 2,994 \sin 86,424^\circ \checkmark$$

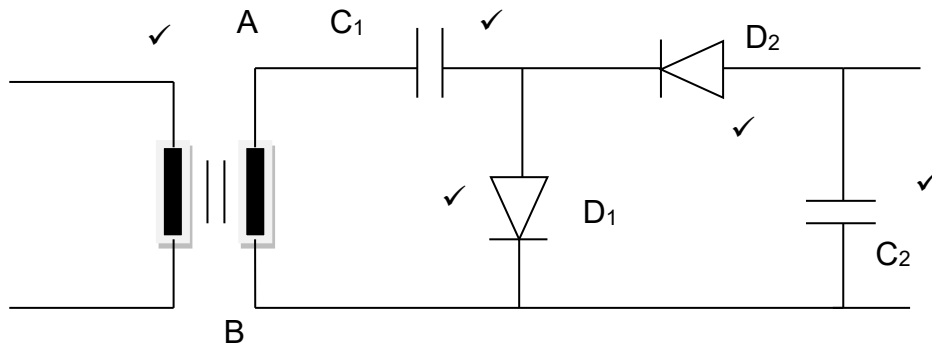
$$I_{C(\text{Res})} = 2,988 A \checkmark$$

(2)

[15]

QUESTION 4

4.1



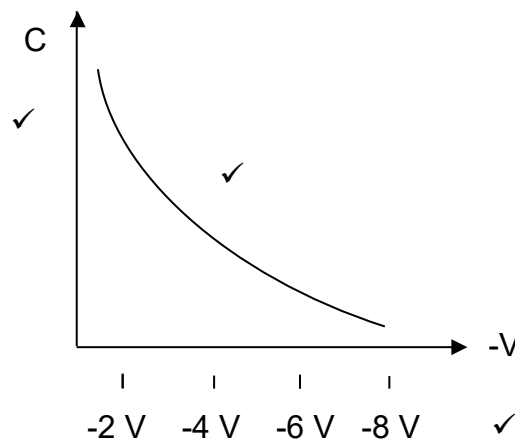
(5)

4.2

- During the positive half cycle of the input signal, point A is positive
- and diode D1 is forward biased
- and conducts charging up capacitor C1 to its maximum value.

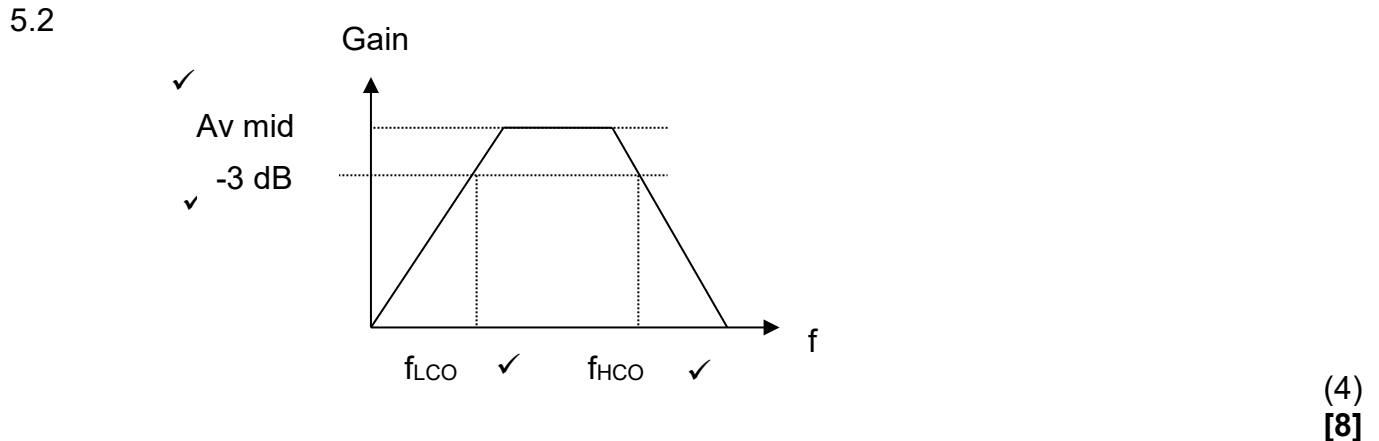
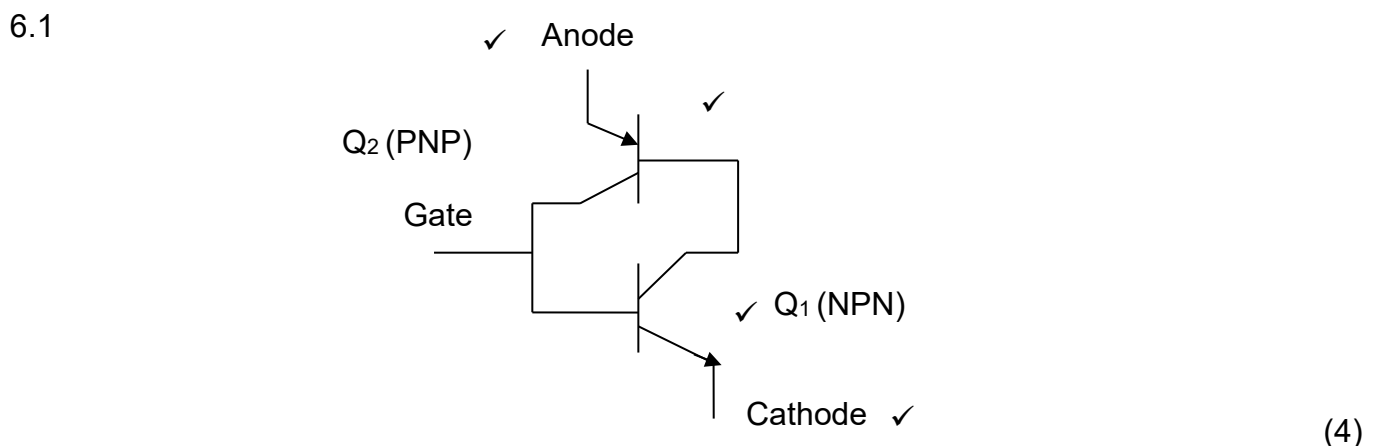
(3)

4.3

(3)
[11]

QUESTION 5

- 5.1
- No wear and tear on switch gears caused by arcing
 - Much faster switching times
 - Control over long distance
 - Small base-emitter current can switch the transistor on and off
- (4)

**QUESTION 6**

- 6.2
- When a positive signal is applied to the gate terminal, the NPN transistor Q_1 is forward biased
 - and conducts, producing a collector current.
 - This collector current forward biases the base-emitter of the PNP transistor Q_2 which produces the collector current on Q_2
 - and this current becomes the base current to transistor Q_1 .
- (4)
- 6.3
- Low 'On' resistance
 - High 'Off' resistance
 - Rapid switching
 - Low-control power
 - Long life
- (Any 3 × 1) (3)

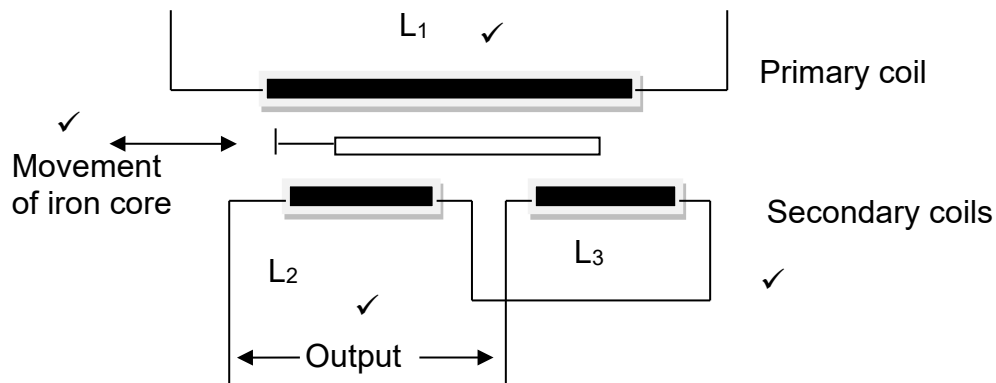
[11]

QUESTION 7

- 7.1 7.1.1 False
 7.1.2 False
 7.1.3 True

(3 × 1) (3)

7.2



(4)

- 7.3 • An external pressure applied to the core unbalances the voltages between the secondary coils.
 • The size of the difference is the magnitude of the force and its direction.

(4)
[11]**QUESTION 8**

- 8.1 a. Attenuator
 b. Vertical amplifier
 c. Delay line
 d. Trigger circuit
 e. Time-base generator
 f. Horizontal amplifier
 g. CRT
 h. Low voltage
 i. High voltage

(9)

- 8.2 It sets the gain of the vertical amplifier with the calibrated input volts/div.

(1)
[10]

TOTAL SECTION B: 80
GRAND TOTAL: 100