

00000000



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

INDUSTRIAL ELECTRONICS N3

31 MARCH 2016

This marking guideline consists of 9 pages.

QUESTION 1

- 1.1 1.1.1 True
 1.1.2 True
 1.1.3 False
 1.1.4 False
 1.1.5 True
 1.1.6 True
 1.1.7 True
 1.1.8 False

(8 × 1) (8)

- 1.2 1.2.1 C
 1.2.2 A
 1.2.3 A
 1.2.4 A
 1.2.5 B
 1.2.6 C
 1.2.7 B

(7 × 1) (7)
[15]**QUESTION 2**

- 2.1 2.1.1 Loop ABCEFA

$$4 = 5(I_1 - 0,2) + 40I_2$$

$$= 5I_1 - 1 + 40I_2$$

$$5 = 5I_1 + 40I_2 \quad \checkmark$$

$$1 = I_1 + 8I_2 \dots \dots \dots [1] \quad \checkmark \quad (2)$$

- 2.1.2 Loop CDEC

$$0 = 5(I_1 - I_2 - 0,2) - 40I_2$$

$$= 5I_1 - 5I_2 - 1 - 40I_2 \quad \checkmark$$

$$1 = 5I_1 - 45I_2 \dots \dots \dots [2] \quad \checkmark \quad (2)$$

2.1.3 [1] × 5 : $5 = 5I_1 + 40I_2$

[2] × -1: $-1 = -5I_1 + 45I_2$

[1] + [2] : $4 = 85I_2 \quad \checkmark$

$$\therefore I_2 = 4/85 \\ = \underline{0,047 \text{ A}} \rightarrow \checkmark$$

Substitute I₂ in [1]

$$1 = I_1 + 8(0,047) \quad \checkmark$$

$$I_1 = 1 - 0,376 \\ = \underline{0,624 \text{ A}} \quad \checkmark$$

(4)

2.2

$$X_L = 2\pi fL$$

$$= 2 \times \pi \times 50 \times 32 \times 10^{-3} \\ = \underline{10,053 \Omega} \quad \checkmark$$

Alternate Solution:

$$f_r = \frac{1}{2\pi} \sqrt{1/(LC) - R^2/L^2}$$

Make C the subject and solve.

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

$$= 12^2 + 10,053^2$$

$$= \underline{15,564} \quad \checkmark$$

$$\Theta_L = \cos^{-1} R/Z_{RL}$$

$$= \cos^{-1} 12/15,564$$

$$= \underline{39,952^\circ} \quad \checkmark$$

$$I_{RL} = V/Z_{RL}$$

$$= 240/15,564$$

$$= \underline{15,332 \text{ A}} \quad \checkmark$$

I is at minimum $\therefore$ circuit is resonating

$$\therefore I_C = I_{RL} \sin \Theta$$

$$= 15,332 \times 0,642$$

$$= \underline{9,845 \text{ A}} \quad \checkmark$$

$$X_C = V/I_C$$

$$= 240/9,845$$

$$= \underline{24,378 \Omega} \quad \checkmark$$

$$X_C = 1/2\pi fC$$

$$\therefore C = 1/2\pi fX_C$$

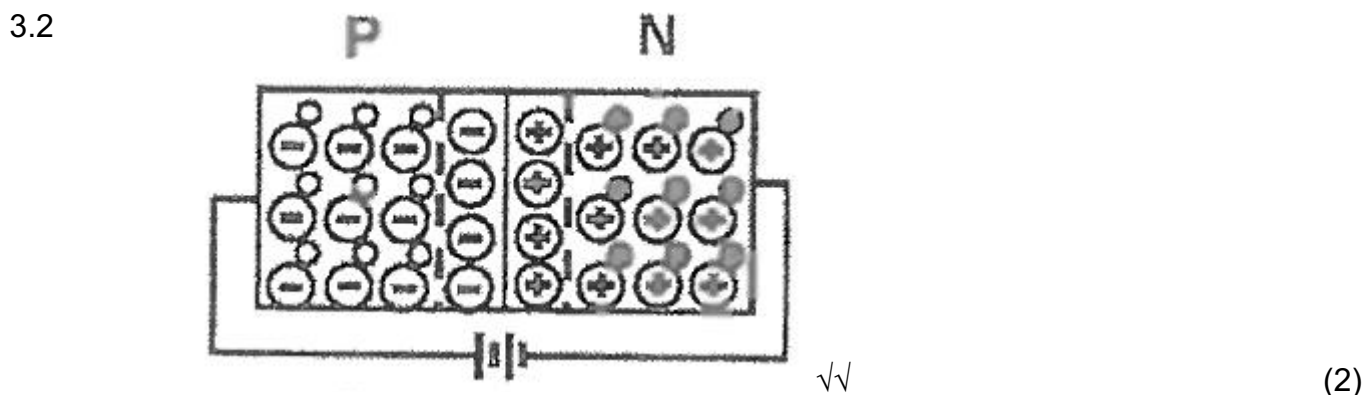
$$= 1/2 \times \pi \times 50 \times 24,378$$

$$= \underline{130,573 \mu\text{F}} \quad \checkmark$$

(7)
[15]

QUESTION 3

3.1 It is when an atom loses an electron. ✓ (1)

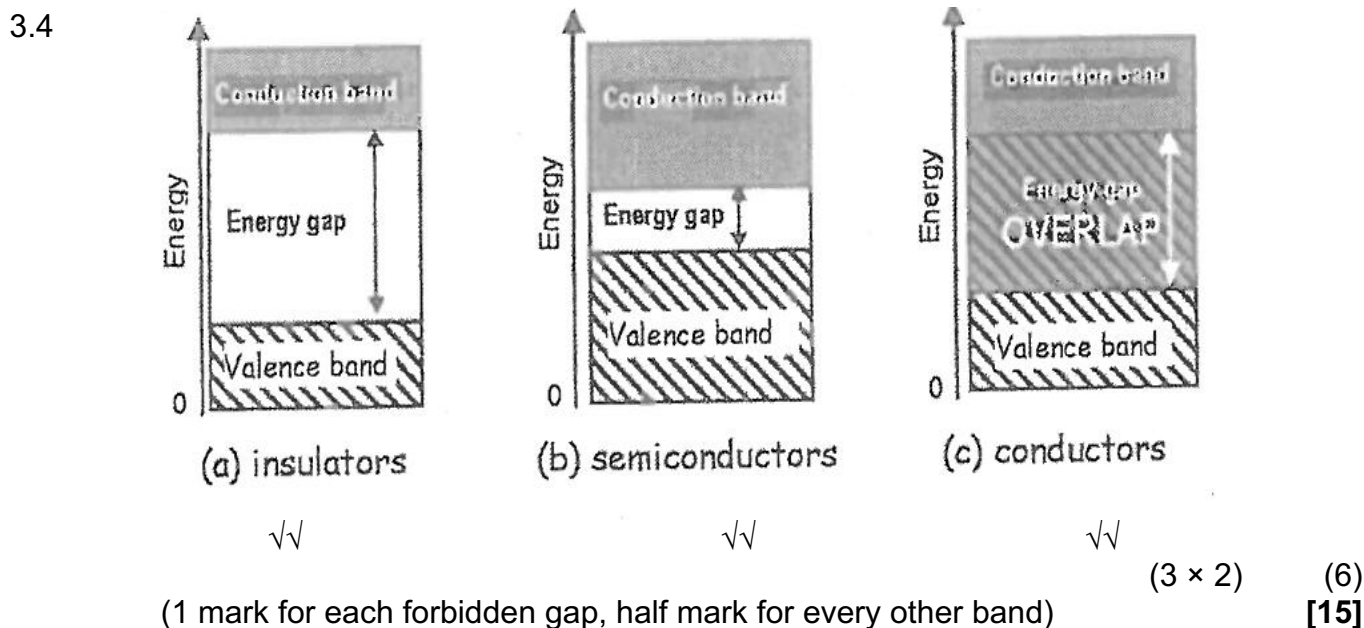


3.3 3.3.1 I_R – Reverse current or a leakage current ✓
The amount of current that will leak through the diode at various reverse voltages. ✓

3.3.2 V_{RRM} – The peak repetitive reverse voltage or peak inverse voltage ✓
The maximum reverse voltage applied repetitively. ✓

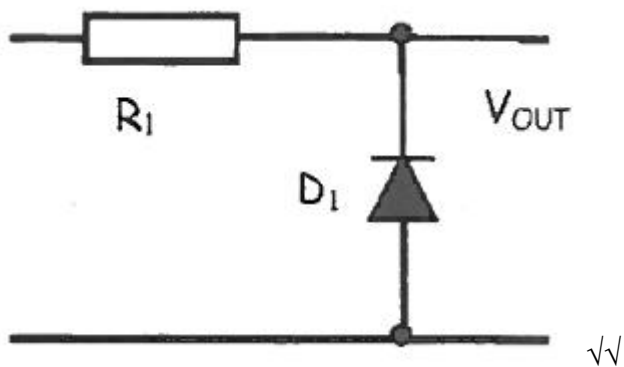
3.3.3 I_F – Forward current ✓
The maximum amount of current the diode can handle when forward-biased. ✓

(3 × 2) (6)



QUESTION 4

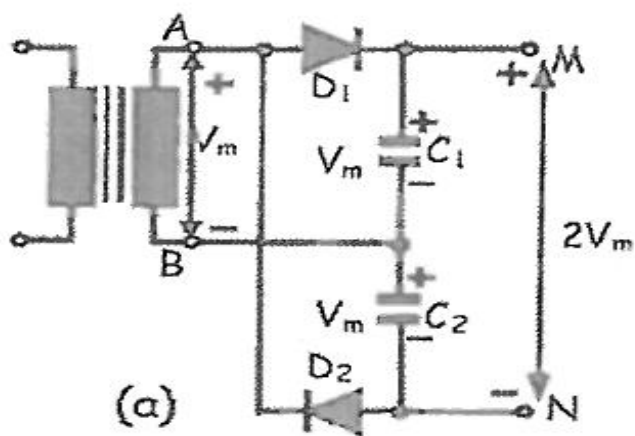
4.1



√√

(2)

4.2



(a)

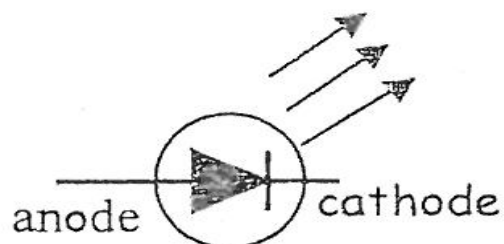
√√√√

(a mark for each component)

(4)

4.3

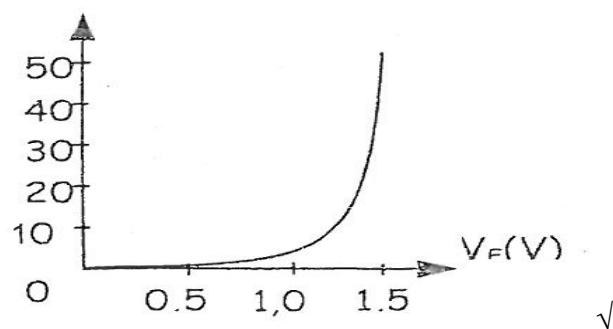
4.3.1



√

(1)

4.3.2



√

(1)

- 4.3.3 Seven segments
Dot matrix
Bar-graph displays
Security systems
Remote controls

(Any 2 x 1)

(2)

[10]**QUESTION 5**

5.1

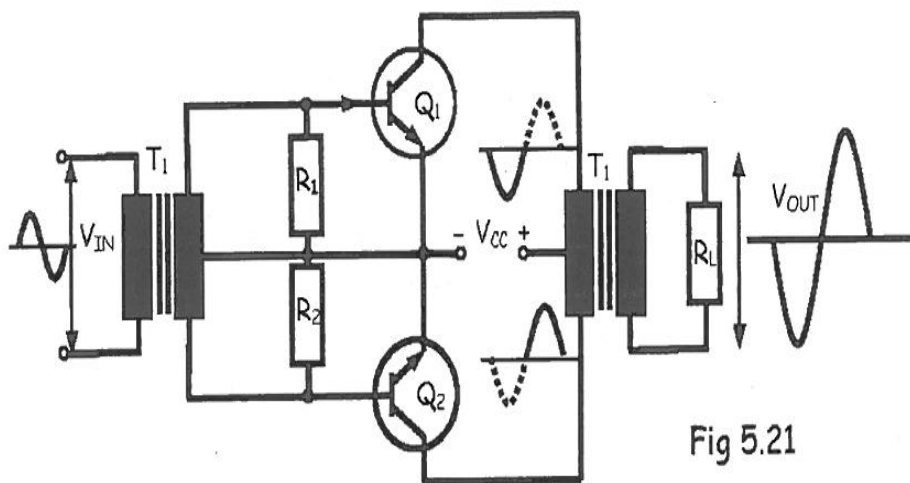
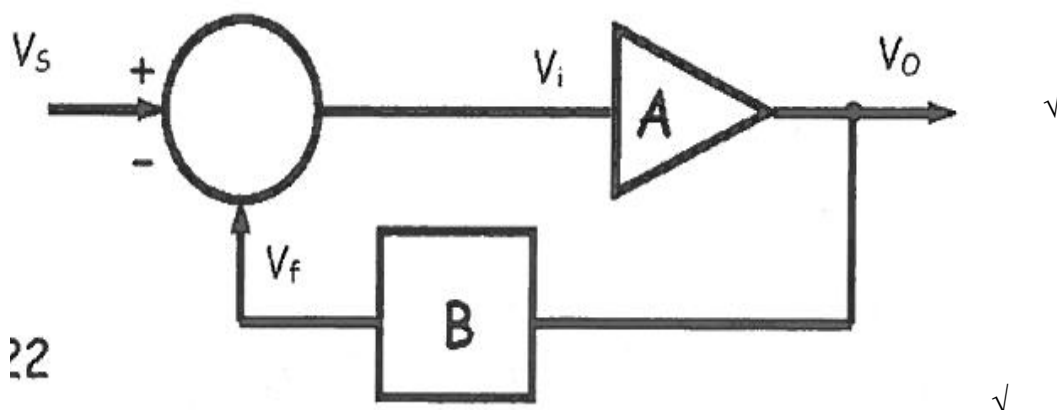


Fig 5.21

(7)

A mark for each component; the marks for the transformers will incl. input and output waveforms

5.2



This circuit diagram shows an amplifier A with a feedback network B. The feedback voltage V_f is taken from the output V_o and is fed back in anti-phase with the input voltage V_s . ✓✓

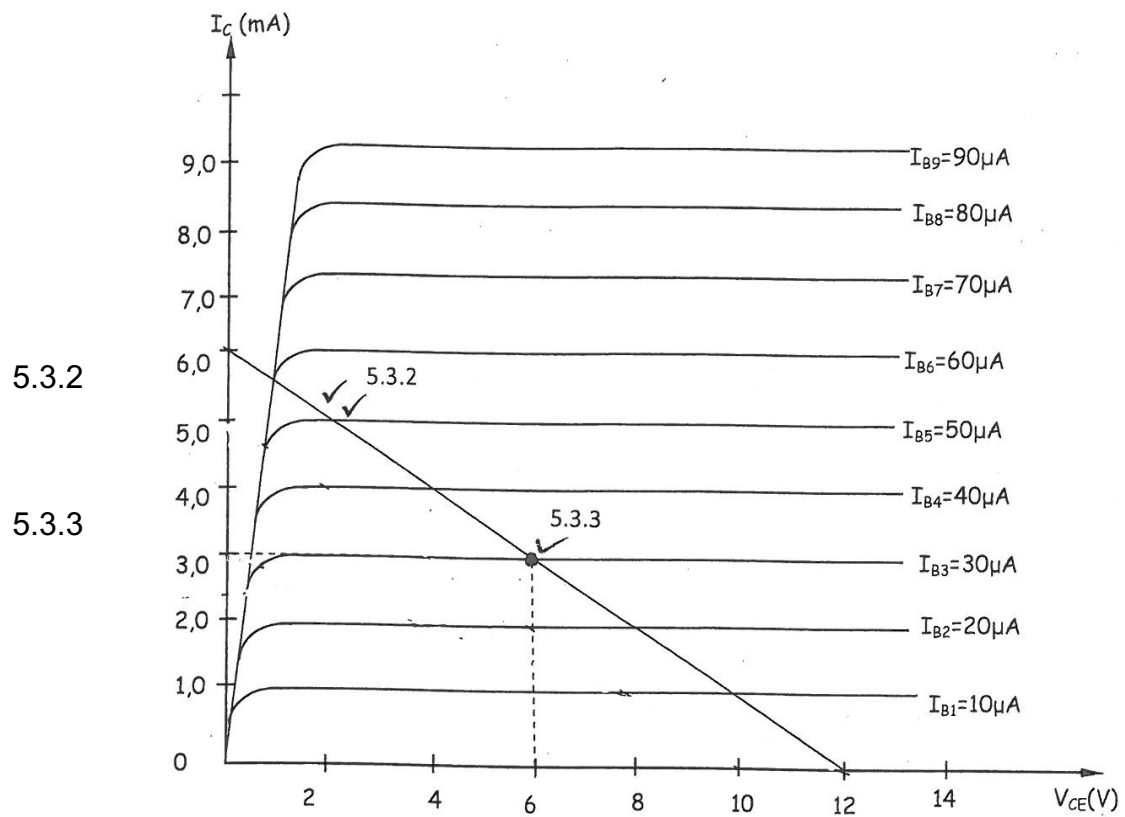
In this way the input voltage is reduced in that $V_i = V_s - V_f$. ✓

(5)

5.3

5.3.1 $I_c = V_{cc}/R_c$
 $= 12/2000$ ✓
 $= 6 \text{ mA}$ ✓

(2)



(3)

5.3.4 $I_{BQ} = 30\mu A$
 $I_{CQ} = 3\text{ mA}$
 $V_{CEQ} = 6\text{ V}$

(3)
[20]

QUESTION 6

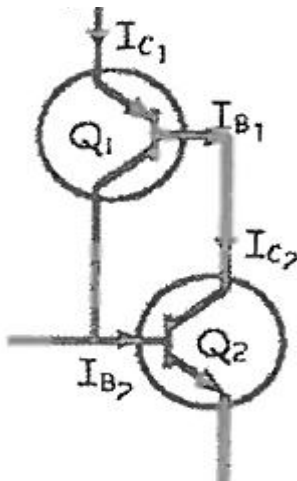
- 6.1
 - 6.1.1 Cyclotronic control
 - 6.1.2 Static switching
 - 6.1.3 Cycle control
 - 6.1.4 Phase control

$$(4 \times 1) \quad (4)$$

- 6.2 Holding current is defined as the minimum current required to hold the SCR in its conducting state.

(2)

- ## 6.3



(4)

- 6.4
- High input impedance
 - Low output impedance
 - High voltage gain
 - Wide bandwidth
 - Its parameters are matched and track well with temperature changes.
 - Can handle both AC and DC signals.
- (Any 3 x 1) (3)

- 6.5 When exposed to light energy it generates a voltage across the cell. (2)
- [15]

QUESTION 7

7.1	• Random errors • Gross errors • Systematic errors	(Any 2 x 1)	(2)
7.2	7.2.1 LVDT/ (Linear Variable Differential Transducer)		(1)
	7.2.2 (a) supply (b) movement (c) core (d) output	(4 x ½)	(2)
	7.2.3 Positioning the magnetic core through✓ an externally applied force varies the difference in voltage✓ of two secondary windings of a transformer. The magnitude of this difference is an indication of the direction and magnitude of the applied force.✓		(3)
7.3	• Measure DC volts • Measure AC volts • Measure frequency • Indicate phase difference between signals • Analyse waveforms • Indicate wave distortion	(Any 2 x 1)	(2)
			[10]
TOTAL:			100