



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N4

4 August 2026

This marking guideline consists of 8 pages.

QUESTION 1

1.1

Short circuit V1	Short circuit V2
$R_{ser} = \frac{60 \times 30}{60 + 30} + 22$	$R_{ser} = \frac{25 \times 21}{25 + 21} + 22$
$R_{ser} = 42\Omega \checkmark$	$R_{ser} = 33,413\Omega \checkmark$
$R_T = \frac{R_{ser} \times 25}{R_{ser} + 25} + 21$	$R_T = \frac{R_{ser} \times 30}{R_{ser} + 30} + 60$
$R_T = \frac{42 \times 25}{42 + 25} + 21$	$R_T = \frac{33,413 \times 30}{33,413 + 30} + 60$
$R_T = 36,671\Omega \checkmark$	$R_T = 75,807\Omega \checkmark$
$I_T = \frac{9}{36,671}$	$I_T = \frac{11}{75,807}$
$I_T = 0,245A \checkmark$	$I_T = 0,145A \checkmark$
$I_{25A} = \frac{R_{ser}}{R_{ser} + 25} \times I_T$	$I_{ser} = \frac{30}{R_{ser} + 30} \times I_T$
$I_{25A} = \frac{42}{42 + 25} \times 0,245$	$I_{ser} = \frac{30}{33,413 + 30} \times 0,145$
$I_{25A} = 0,154A \checkmark$	$I_{ser} = 0,069A \checkmark$
	$I_{25B} = \frac{21}{21 + 25} \times I_{ser}$
	$I_{25B} = \frac{21}{21 + 25} \times 0,069$
	$I_{25B} = 0,032A \checkmark$
	$I_{25} = I_{25A} + I_{25B}$
	$I_{25} = 0,154 + 0,032 = 0,186A \checkmark$

(10)

1.2

$$V_{th1} = \frac{10}{10 + 30} \times 5$$

$$V_{th1} = 1,25V \checkmark \checkmark$$

$$V_{th2} = \frac{5}{35 + 5} \times 5$$

$$V_{th2} = 0,625V \checkmark \checkmark$$

$$V_{th} = V_{th1} - V_{th2}$$
$$V_{th} = 1,25 - 0,625$$

$$V_{th} = 0,625V \checkmark \checkmark$$

$$R_{th} = \frac{30 \times 10}{30 + 10} + \frac{35 \times 5}{35 + 5}$$

$$R_{th} = 11,875\Omega \checkmark \checkmark$$

$$I = \frac{V_{th}}{R_{th} + R_L}$$

$$I = \frac{0,625}{11,875 + 15}$$

$$I = 0,023A \checkmark \checkmark$$

(10)
[20]

QUESTION 2

2.1 2.1.1

$$I_R = \frac{V}{R}$$

$$I_R = \frac{200}{50} = 4A \checkmark$$

$$X_L = 2\pi FL$$

$$X_L = 2\pi \times 50 \times 0,3 = 94,248\Omega \checkmark$$

$$I_L = \frac{V}{X_L}$$

$$I_L = \frac{200}{94,248} \checkmark = 2,122A \checkmark$$

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

$$X_C = \frac{1}{2\pi \times 50 \times 60 \times 10^{-6}} = 53,052\Omega \checkmark$$

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

$$I_C = \frac{200}{53,052} \checkmark = 3,77A \checkmark$$

(7)

2.1.2

$$I_T = \sqrt{I_R^2 + (I_C - I_L)^2}$$

$$I_T = \sqrt{4^2 + (3,77 - 2,122)^2} \checkmark$$

$$I_T = 4,326A \checkmark$$

(2)

2.1.3

$$Z = \frac{V}{I_T}$$

$$Z = \frac{200}{4,326} = 46,323\Omega \checkmark$$

$$Z = 46,323\Omega \checkmark$$

(2)

2.1.4

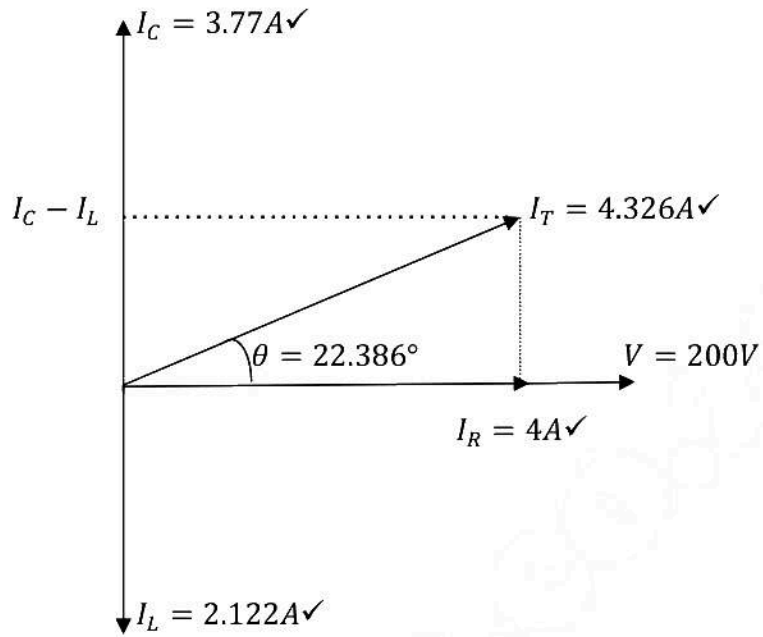
$$\cos\theta = \frac{I_R}{I_T}$$

$$\theta = \cos^{-1}\left(\frac{I_R}{I_T}\right)$$

$$\theta = \cos^{-1}\left(\frac{4}{4,326}\right) \checkmark = 22,386^\circ \checkmark$$

(2)

2.1.5



(4)

2.2

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

$$\therefore C = \frac{1}{(2\pi f_r)^2 L}$$

$$= \frac{1}{(2 \times \pi \times 1 \times 10^6)^2 \times 100 \times 10^{-6}}$$

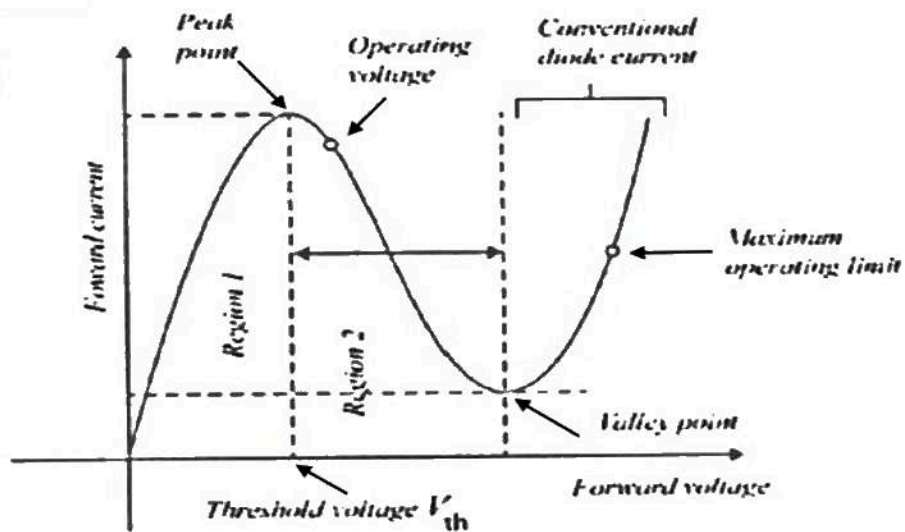
$$= 253,2 \rho f$$

(3)
[20]

QUESTION 3

3.1

3.1.1



✓✓✓✓

(A)

- 3.1.2
- Oscillators
 - Amplifiers
 - Radar systems
 - Electronic switching
- (Any 2 × 1) (2)

- 3.2
- 3.2.1 True
- 3.2.2 False
- 3.2.3 True
- 3.2.4 False
- 3.2.5 False
- (5 × 1) (5)

3.3

CLOSED LOOP	OPEN LOOP
Has feedback network	Has no feedback network
Has comparator that can compare the desired output to the actual output	Has no comparator that can compare the desired output to the actual output
The actual action/output is monitored (self-monitored)	The actual action/output is not monitored
Is controlled automatically	Is not controlled automatically

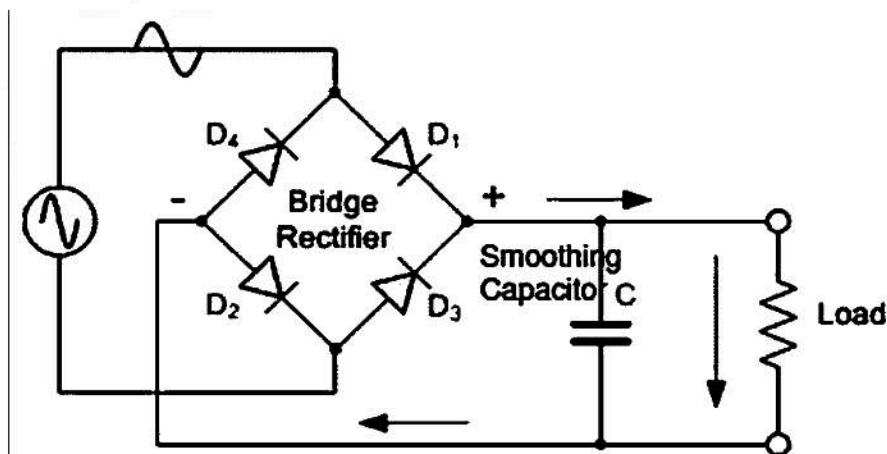
(4 × 1) (4)

[15]

QUESTION 4

- 4.1
- Voltage transformers: Are used for high-voltage monitoring and under- and overvoltage protection. ✓✓
 - Current transformers: Are used to reduce current levels and supply them to measurement equipment. ✓✓
- (4)

4.2



- (2 marks for bridge component)
 (1 mark for input supply)
 (1 mark for any component) (4)

4.3

$$\frac{V_1}{V_2} = \frac{N_1}{N_2} = 20$$

$$V_2 = \frac{230}{20} = 11.5V \checkmark$$

$$V_M = \sqrt{2} \times 11.5 = 16.263V \checkmark$$

$$V_{AVE} = 0.318 \times 16.263 \checkmark = 5.172V \checkmark \quad (4)$$

4.4

$$V_{DC} = V_M - \frac{I_{DC}}{2FC}$$

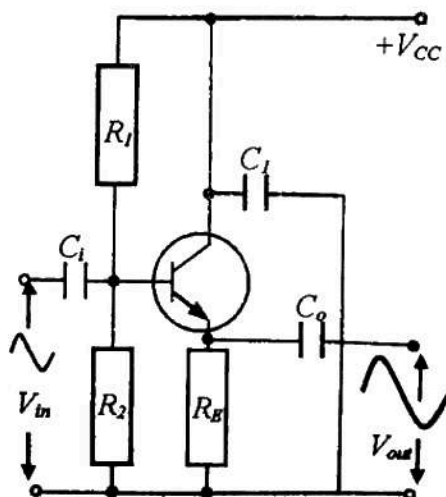
$$= 16,263 - \frac{15 \times 10^{-3}}{2 \times 50 \times 20 \times 10^{-6}} \checkmark \checkmark$$

$$= 8,763 V \checkmark \quad (3)$$

[15]

QUESTION 5

5.1



(1 mark for input waveform)
 (1 mark for output waveform)
 (1 mark for transistor)
 (1 mark for any 3 correct components) (6)

5.2 Under static conditions the AC signal is not connected ✓ and under dynamic conditions the AC signal is connected. ✓ (2)

- 5.3
- Non-complementary class B push-pull
 - Symmetrical class AB push-pull
 - Complementary-symmetry class B push-pull
 - Complementary-symmetry class AB push-pull
- (Any 3 × 1) (3)

- 5.4
- Infinite input impedance
 - Zero output impedance
 - Infinite voltage gain
 - Infinite bandwidth
 - Perfect balance or zero offset voltage
 - Common mode gain
 - Slew rate

(Any 4 × 1)

(4)

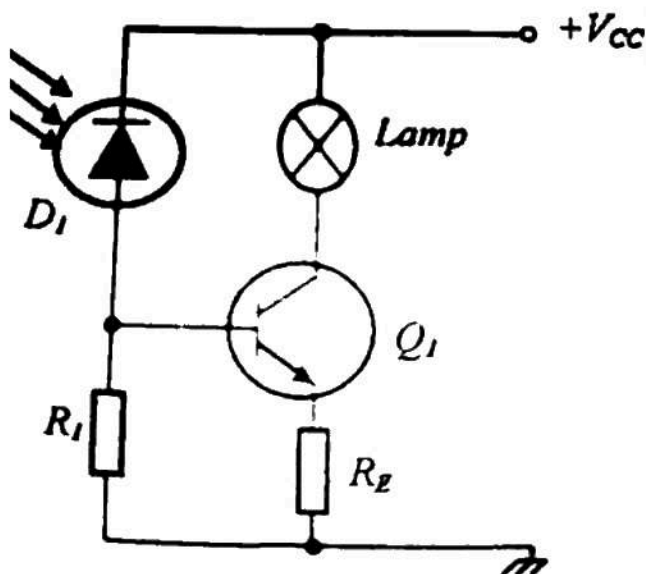
[15]

QUESTION 6

- 6.1
- Physical quantity to be measured
 - Accuracy required
 - Converting principle that is most suitable
 - The environment at which the transducer will be used
 - The type of supply that is available (AC or DC)

(5)

6.2



(1 mark for each correct component)

(1 mark for a supply terminal)

(6)

- 6.3
- Twisted nematic
 - In-plane switching
 - Advanced fringe-field switching
 - Vertical alignment

(4)

[15]

TOTAL:

100