



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N5

3 August 2026

This marking guideline consists of 7 pages.

QUESTION 1: AC THEORY

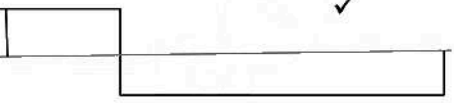
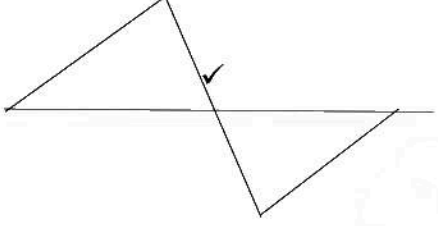
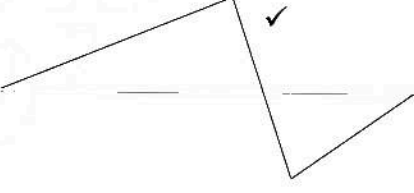
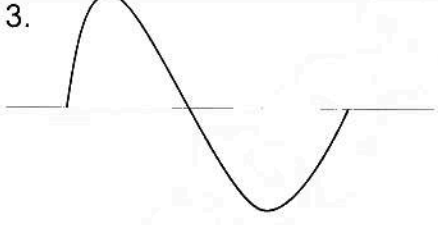
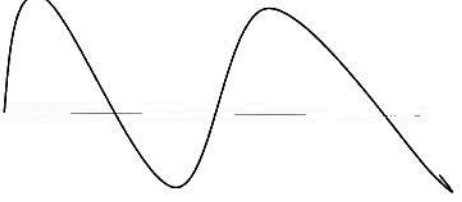
- 1.1 1.1.1 True
 1.1.2 False
 1.1.3 False

(3 × 1) (3)

- 1.2 Capacitive coupling: the transfer of energy within an electrical network✓ by means of the capacitance between circuit nodes.✓

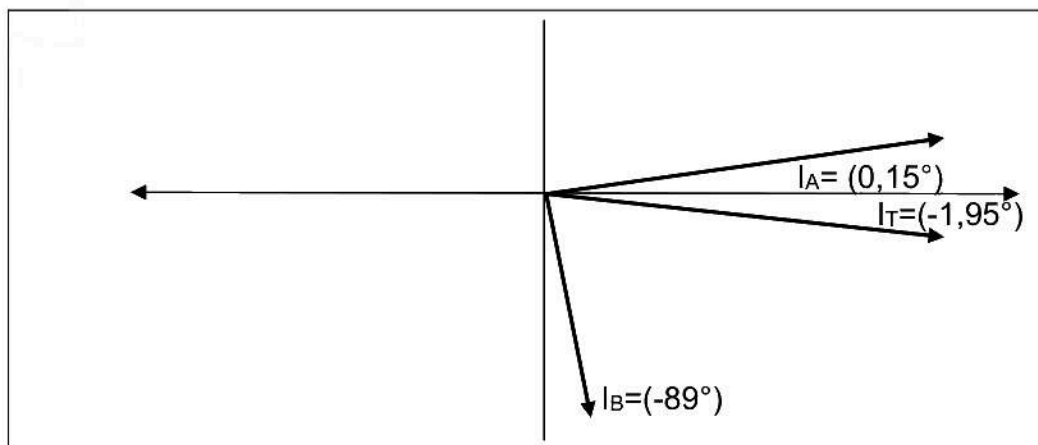
Disadvantage: they become noisy with age.✓

(3)

1.3	ODD HARMONICS	EVEN HARMONICS
1.		1. 
2.		2. 
3.		3. 

(4)

- 1.4 1.4.1



(Allocate ONE full mark for each current \

(3)

$$\begin{aligned}
 1.4.2 \quad Z_T &= \frac{V_T}{I_T} \\
 &= \frac{100 \angle 0^\circ}{0,83 \angle -1,95^\circ} \checkmark \\
 &= 120,48 \angle 1,95^\circ \Omega \checkmark
 \end{aligned}$$

(2)
[15]

QUESTION 2: POWER SUPPLIES

$$\begin{aligned}
 2.1 \quad 2.1.1 \quad V'_{DC} &= \frac{R_L}{R_L + R_S} V_{DC} \\
 &= \frac{10000}{10000+120} \checkmark \times 15 \checkmark \\
 &= 14,822 \checkmark
 \end{aligned}$$

(3)

$$\begin{aligned}
 2.1.2 \quad X_C &= (4\pi fC)^{-1} = (4\pi \times 150 \times 10^{-6} \times 50)^{-1} = 21,22 \Omega \checkmark \\
 V'_{R(RMS)} &= \frac{X_C}{\sqrt{R_S^2 + X_C^2}} V_{R(RMS)} \\
 &= \frac{21,22}{\sqrt{120^2 + (21,22)^2}} \times 1,5 \checkmark \\
 &= 0,261 V \checkmark
 \end{aligned}$$

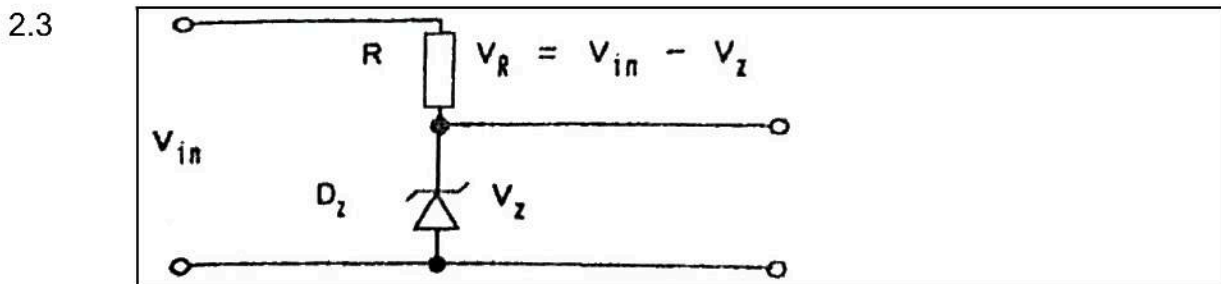
(3)

$$\begin{aligned}
 2.1.3 \quad \%r_{C1} &= \frac{V_{R(RMS)}}{V_{DC}} \times 100 \\
 &= \frac{1,5}{15} \times 100 \checkmark \\
 &= 10 \% \checkmark
 \end{aligned}$$

(2)

- 2.2 D_1 charges C_1 to V_m during positive half cycle ✓
 D_2 charges C_2 to $2 V_m$ during negative half cycle ✓
 D_3 charges C_3 to $2 V_m$ during positive half cycle ✓
 $V_T = V_m + 2 V_m = 3 V_m \checkmark$

(4)



(Allocate 1 full marks for D_z and R , and half mark for input and output.)

(3)

QUESTION 3: AMPLIFIERS

3.1 Fixed bias circuit produces a reasonable gain as amplifier, but experiences problems with the maintenance of bias stability. ✓ (1)

3.2 $Z_L = R_C // R_L$

$$= \frac{480 \times 6000}{480 + 6000} \checkmark$$

$$= 444,444 \Omega \checkmark$$

$$Z_1 = h_{ie} - \frac{h_{fe} h_{re} Z_L}{1 + h_{oe} Z_L}$$

$$= 13000 - \frac{300 \times 2,8 \times 10^{-4} \times 444,444}{1 + (30 \times 10^{-6} \times 444,444)} \checkmark$$

$$= 12,963 \text{ k}\Omega \checkmark$$

$$Z_{IN} = R_B // Z_1$$

$$\frac{1}{R_B} = \frac{1}{Z_{IN}} - \frac{1}{Z_1}$$

$$R_B = \frac{12963 \times 2500}{12963 - 2500} \checkmark$$

$$= 3,097 \text{ k}\Omega \checkmark$$

(6)

3.3 $t = \frac{I}{f} = \frac{1}{500} = \frac{0,00125}{2} \checkmark = 0,000625 \text{ Sec} \checkmark$

$$V_{t1} = -\frac{1}{RC} \int_{t0}^{t1} V(t1) + V(t0) dt$$

$$= -\frac{1}{10 \times 10^6 \times 0,01^{-6}} \checkmark \int_{t0}^{t1} 2(0,000625) + 0 \checkmark$$

$$= -0,0125 \text{ V} \checkmark$$

$$V_O = V_{t2} = -\frac{1}{RC} \int_{t1}^{t2} V(t2) + V(t1) dt \checkmark$$

$$= -\frac{1}{10 \times 10^6 \times 0,01^{-6}} \int_{t1}^{t2} -2(0,000625) \checkmark + (-0,0125) \checkmark$$

$$= 0 \text{ V} \checkmark$$

(2)

QUESTION 4: IC and TRANSDUCERS

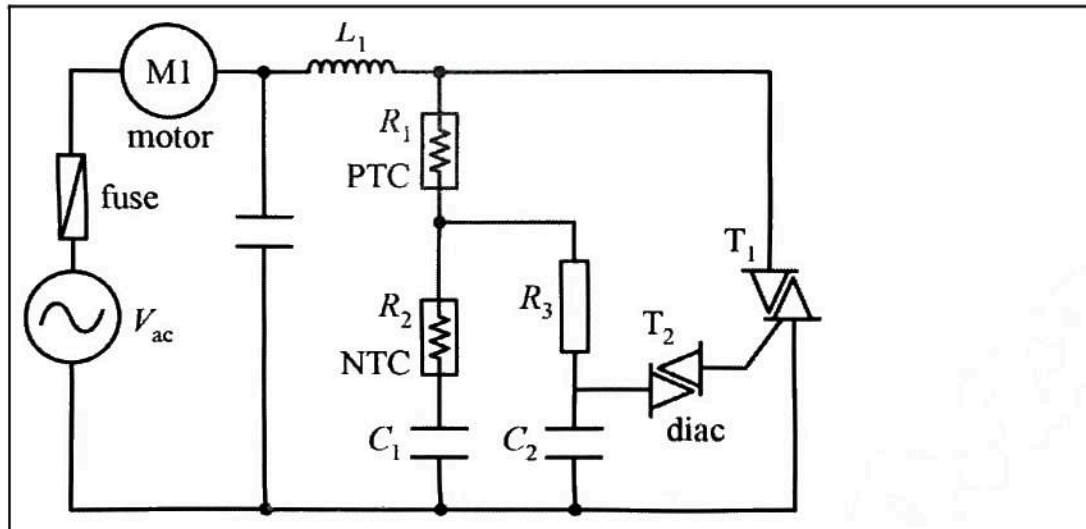
- 4.1 It is a small semiconductor based electronic device consisting of transistors, resistors and capacitors fabricated as a single component.✓✓ (2)
- 4.2 PIN 1 – positive input
PIN 2 – positive output
PIN 3 – ground/earth (3)
- 4.3
 - Low cost
 - Easy to use. (2)
- 4.4  (3)
- 4.5
 - Measures temperature
 - Controls temperature (2)
- 4.6
$$\%Resolution = \frac{1}{turns} \times 100$$
$$turns = \frac{1}{0,000125}✓$$
$$turns = 800✓$$
 (3)

[15]

QUESTION 5: ELECTRONIC PHASE CONTROL

- 5.1 5.1.1
 - A gate signal of suitable magnitude and short rise time must be produced.
 - A gate signal of suitable duration must be produced.
- 5.1.2
 - Reduction of anode to cathode current
 - Making use of commutation (2 × 2) (4)

5.2



(Allocate ONE full mark for QUADRAC and MOTOR, and half a mark for each correctly labelled electric component.)

(6)
[10]

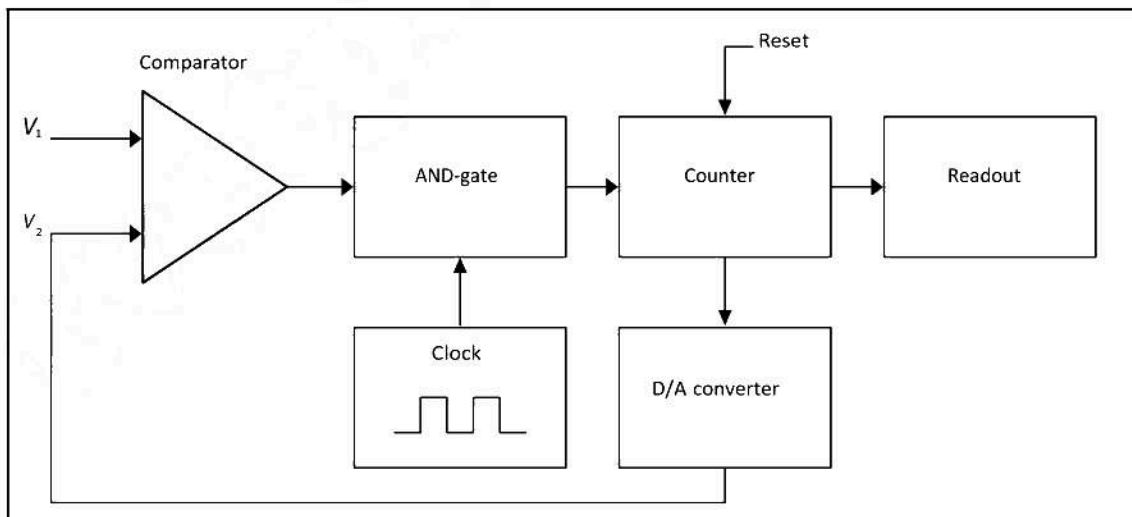
QUESTION 6: MEASURING INSTRUMENT

6.1

- It is a voltage sensitive switch
- Used for a wave shaper converting
- Produces a digital output
- It has two firing points
- Input

(5)

6.2

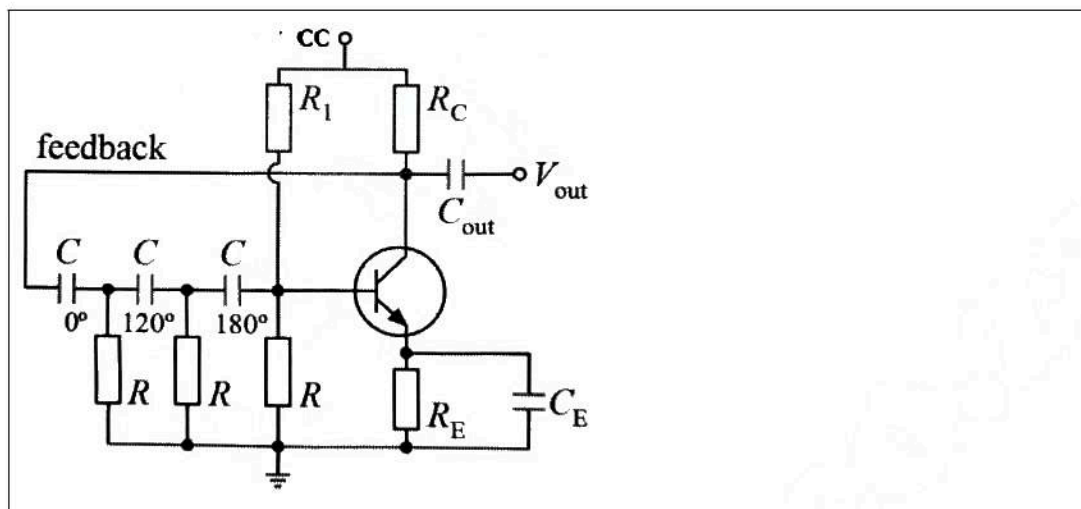


COMPARATOR✓
AND-GATE✓
CLOCK✓
D/A CONVERTER✓
DISPLAY✓

(5)
[10]

QUESTION 7: OSCILLATORS

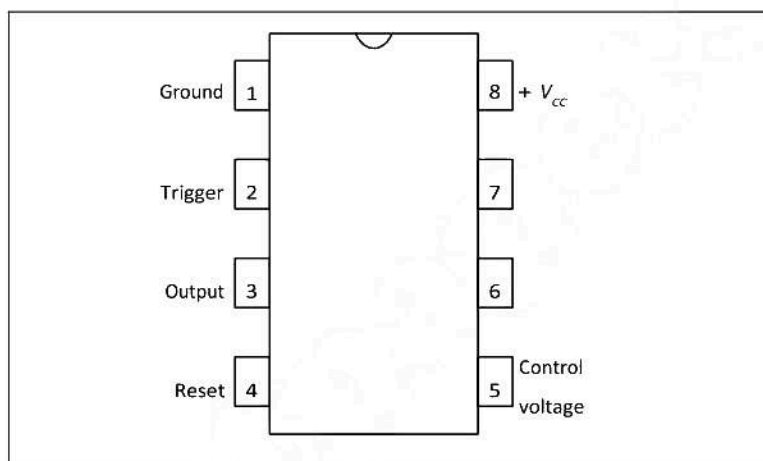
7.1



(Allocate ONE full mark for RC-PHASE SHIFT and TRANSISTOR, and a half mark for each correctly labelled electric component.)

(4)

7.2



(Allocate HALF a mark for each correctly labelled pin.)

(4)

7.3 7.3.1 Capacitor

7.3.2 High

(2 × 1)

(2)
[10]

QUESTION 8: LIQUID CRYSTAL DISPLAY

- 8.1 E
- 8.2 C
- 8.3 D
- 8.4 A
- 8.5 B

(5 × 2)

[10]

TOTAL: