



higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

INDUSTRIAL ELECTRONICS N2

27 July 2026

This marking guideline consists of 6 pages.

QUESTION 1

- 1.1 Electrons with enough energy to leave the valency shell.
- 1.2 Mutual sharing of electrons between atoms.
- 1.3 The total currents flowing towards a junction is equal to the total current flowing away from the junction.
- 1.4 The total opposition to the flow of AC in a circuit that comprised of resistors and reactants.
- 1.5 A thermistor is a temperature sensitive device that changes resistance with the change in temperature.

(2 × 5) [10]

QUESTION 2

- 2.1

$\begin{aligned} 1/R_{P1} &= 1/R_1 + 1/R_2 \\ &= 3/10 \\ R_{P1} &= 3,33 \, \Omega \checkmark \end{aligned}$	$\begin{aligned} 1/R_{P2} &= 1/R_3 + 1/R_4 + 1/R_5 \\ &= 0,07 + 0,05 + 0,04 \\ &= 0,16 \\ R_{P2} &= 6,25 \, \Omega \checkmark \end{aligned}$	$\begin{aligned} R_s &= R_{P1} + R_{P2} \\ &= 9,58 \, \Omega \checkmark \end{aligned}$
$\begin{aligned} 1/R_{P3} &= 1/R_s + 1/R_6 \\ &= 1/9,58 + 1/30 \\ R_{P3} &= 7,26 \, \Omega \checkmark \\ R_t &= 7,26 + 35 = 42,26 \, \Omega \checkmark \end{aligned}$		

(5)
- 2.2

$$\begin{aligned} I &= V/R \\ &= 100/42,26 \checkmark \\ &= 2,37 \, A \checkmark \end{aligned}$$

(2)
- 2.3

$$\begin{aligned} V_p &= I \cdot R_{P3} = 2,37 \times 7,26 = 17,21 \, V \checkmark \checkmark \\ I_{R6} &= V_p/R_6 \\ &= 17,21/30 \checkmark \\ &= 0,57 \, A \checkmark \end{aligned}$$

(4)
- 2.4

$$\begin{aligned} V_{R7} &= V_t - V_{R6} \\ &= 100 - 17,21 \checkmark \\ &= 82,79 \, V \checkmark \end{aligned}$$

(2)
- 2.5

$$\begin{aligned} P &= I^2 R_7 \\ &= (2,37)^2 \times 5 \checkmark \\ &= 196,59 \, W \checkmark \end{aligned}$$

(2)

[15]

QUESTION 3

- 3.1 $X_C = 1 / 2(3,142)F.C$
 $= \frac{1}{2} (3,142) (50) (200 \times 10^{-6}) \checkmark$
 $= 15,913 \Omega \checkmark$ (2)
- 3.2 $X_L = 2 (3,142) F. L$
 $= 2 (3,142) (50) (20 \times 10^{-3}) \checkmark$
 $= 6,284 \Omega \checkmark$ (2)
- 3.3 $Z = \sqrt{R^2 + (X_C \pm X_L)^2}$
 $= \sqrt{R^2 + (X_C \pm X_L)^2} \checkmark \checkmark$
 $= 22,197 \Omega \checkmark$ (3)
- 3.4 $I = V/Z$
 $= 100/22,197 \checkmark$
 $= 4,505 A \checkmark$ (2)
- 3.5 $\phi = \cos^{-1} R/Z$
 $= \cos^{-1} (20/22,197) \checkmark$
 $= 28,564^\circ \checkmark$ (2)
- 3.6 $V_C = I \cdot X_C$
 $= 4,505 \cdot 15,913 \checkmark$
 $= 71,688 V \checkmark$ (2)
- [13]

QUESTION 4

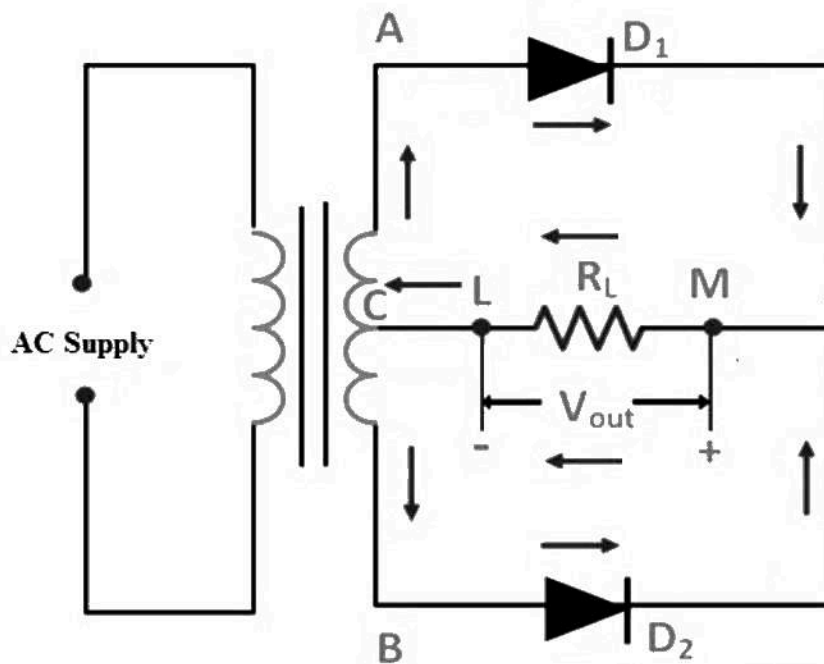
- 4.1 200 V (2)
- 4.2 $E_{AVE} = 0,637 \times 200 = 127,4 V \checkmark$
 $E_{RMS} = 0,707 \times 200 = 141,1 V \checkmark$ (2)
- 4.3 Form Factor = RMS/AVE $141/127,4 = 1,11 \checkmark$
 Crest Factor = $V_{max}/RMS = 200/141,1 = 1,414 \checkmark$
 Pure sine wave due to the above standard values. $\checkmark \checkmark$ (4)
- 4.4 $F = 31,41/2(3,142) = 50 Hz \checkmark \checkmark$ (2)
- 4.5 $E = 200 \sin (31,41 (6 \times 10^{-3} \times 57,3))$
 $= 190,158 V \checkmark \checkmark$ (2)
- [12]

QUESTION 5

- 5.1
- Security systems
 - Indicators
 - Optical encoders
 - Alphanumeric display
 - Remote controls

(Any 3 × 1) (3)

5.2



Elprocus.com ✓✓✓✓✓✓✓✓

Allocate ONE full mark for each correctly placed and labelled component and TWO marks for each correctly placed diode.

(7)
[10]

QUESTION 6

- 6.1 Eddy current and air friction

(2)

- 6.2
- Much more sensitive✓
 - Can handle negative quantities✓
 - More robust✓
 - High accuracy✓
 - No error of parallax✓
 - Some meters possess auto ranging

(Any 5) (5)

- 6.3
- $$R_{sh} = I_M R_M / I - I_M$$
- $$= 2 \times 600 / 600 - 2 \checkmark \checkmark$$
- $$= 2 \Omega \checkmark$$

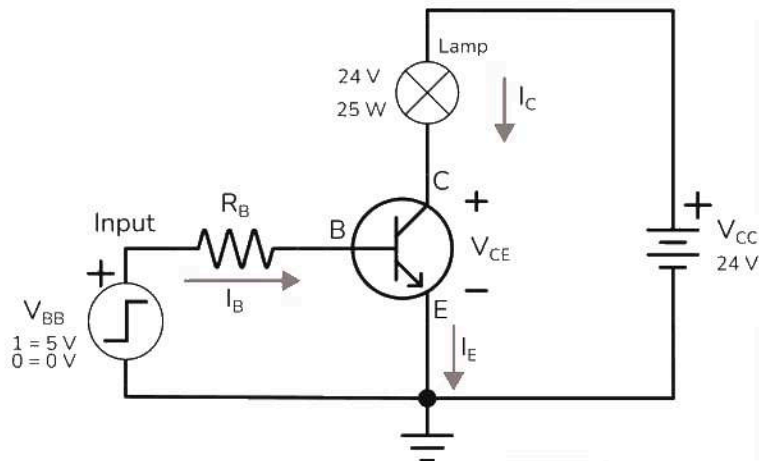
(3)
[10]

QUESTION 7

- 7.1
- Active region
 - Saturation region
 - Cut-off region

(3)

7.2



Allocate TWO marks for transistor and ONE mark for each correct component a ONE mark for the correctness of the circuit.

(7)
[10]

QUESTION 8

- 8.1
- Remote control of model cars
 - Remote positioning of communication systems
 - Control of power tools
 - Control of dam sluice gates

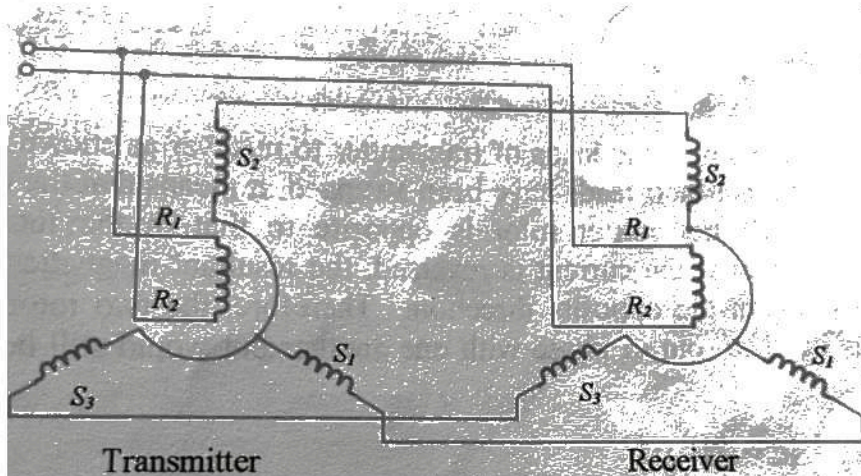
(Any 3 × 1)

(3)

- 8.2 The direction✓ of an induced EMF drives current round a circuit to always oppose the change in the magnetic flux that produces the EMF.✓

(2)

8.3



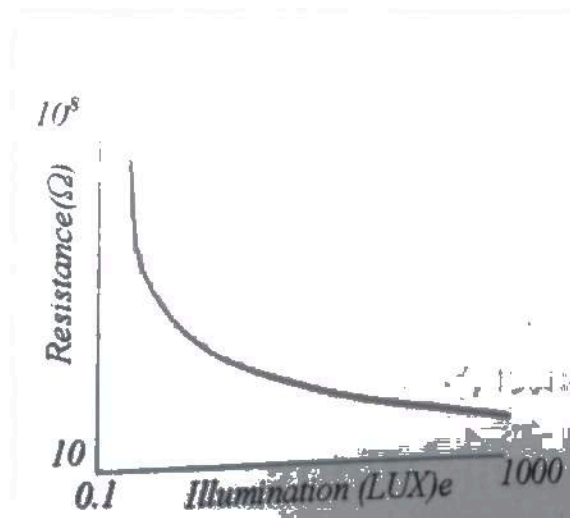
(Allocate TWO marks for transmitter and TWO marks for receiver, then ONE mark for the correct connection.)

(5)

QUESTION 9

- 9.1 9.1.1 When a temperature difference exists between the hot junction and the cold junction, ✓ a potential difference is produced that causes a current to flow. ✓ When a meter is connected to the terminals of the cold- junction, ✓ the meter indication will be proportional to the difference in temperature between the hot and cold junctions. ✓ (4)
- 9.1.2 A bimetal strip is a temperature sensitive device made of copper and iron strips. ✓ When the Bi-metal strip is heated, each metal expands at its own rate of expansion. ✓ Copper has a higher coefficient of expansion than iron and will therefore expand faster causing it to bend in a certain direction. ✓ (3)

9.2



(Allocate ONE mark for V, ONE mark for temperature and ONE mark for the graph)

(3)
[10]

TOTAL: 100