

higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

APRIL EXAMINATION

INDUSTRIAL ELECTRONICS N4

4 APRIL 2014

This marking guideline consists of 7 pages.

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QUESTION 1

Consider loop ABCA
$0 = 10I_1 + 5I_2 - 5I_3 - 20I_2$
$0 = 15I_1 - 20I_2 - 5I_3$ ----------(1)√√ (2)

Consider loop BDCB
$0 = 30I_3 - 15[(I_1 - I_3) + I_2] - (I_1 - I_3)$
$0 = 30I_3 - 15I_1 + 15I_3 - 15I_2 - 5I_1 + 5I_3$
$0 = 20I_1 + 15I_2 - 50I_3$ ----------(2)√√ (2)

Consider loop ABDA
$5 = 10I_1 + 30I_3$
$10I_1 = 5 - 30I_3$
$I_1 = 0,5 - 3I_3$ ----------(3)√ (1)
(1) x 15: $0 = 225I_1 - 300I_2 - 75I_3$----------(4)√ (1)
(2) x 20: $0 = 400I_1 + 300I_2 - 1000I_3$---------- (5)√ (1)
(4) + (5): $0 = 625I_1 - 1075I_3$----------(6) (1)
Subst. I_1 in (6): $0 = 625(0,5 - 3I_3)$ (1)
$I_3 = 0,106$ A√
$I_1 = 0,5 - 3(0,106)$
$I_1 = 0,182$ A√
$I_4 = I_1 - I_3$
$= 0,182 - 0,106$
$= 0,076$ A√ (1)
[10]

QUESTION 2

2.1 $X_L = 2\pi fL$
$= 2 \times \pi \times 50 \times 0,2$
$= 62,84\ \Omega$√ (1)

$$Xc = \frac{1}{2\pi fC} = \frac{1}{2 \times \pi \times 50 \times 100 \times 10^{-6}}$$

$= 31,827\ \Omega$ √ (1)

$Z = R + j(X_L - X_C)$
$= 20 + j(62,84 - 31,827)$
$= 36,903\ \ 57,2^0\ \ \Omega$√√ (2)

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2.2 $I_T = \frac{V_T}{Z_T}$

$= \frac{220\ 0°}{36,903\ 57,2°}$

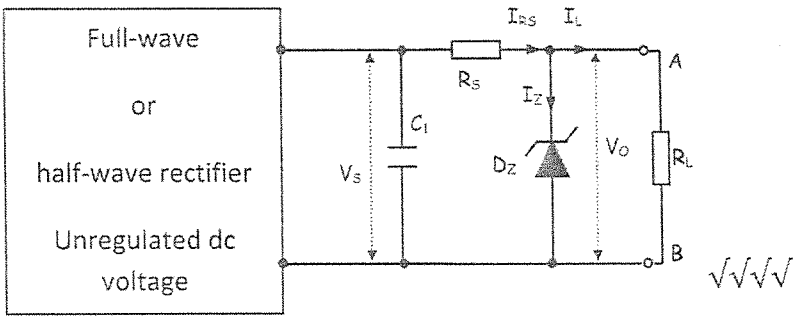
$= 5,962 - 57,2°$ A√√ (2)

2.3 $V_L = I_T \times X_L$
$= 5,962\ -57,2^0 \times 62,84\ 90°$
$= 374,652\ 32,8^0$ V√√ (2)

2.4 $V_C = I_T \times X_C$
$= 5,962\ -57,2^0 \times 31,827 - 90°$
$= 189,753 - 147,2°$ V√√ (2)
[10]

QUESTION 3

3.1



√√√√ (4)

If the load current through R_L increases, the Zener current will fall with the corresponding amount.√ (1)
If the load current through R_L decreases, the Zener current will increase with the corresponding amount.√ (1)

3.2 3.2.1 $I_P = \frac{P}{V_P} = \frac{100 \times 10^3}{2\ 000}$

$= 50$ A√√ (2)

3.2.2 $P\ I_S = \frac{100}{V_S} \times \frac{10^3}{500}$

$= 200$ A√√ (2)

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3.2.3 $N_P = \frac{N_S V_P}{V_S} = \frac{110 \times 2\,000}{500}$

$= 440$ turns√√ (2)

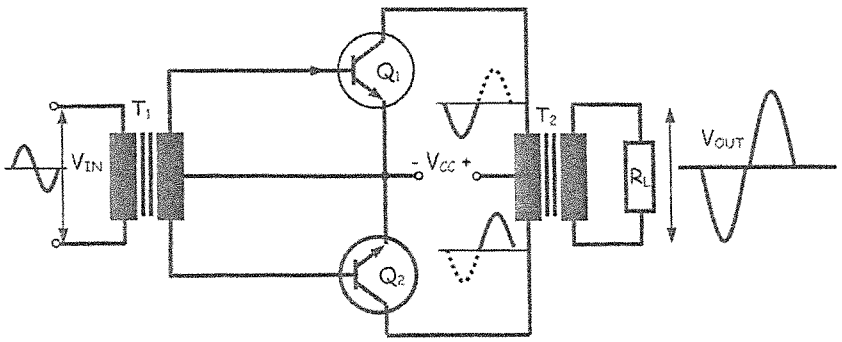
3.3 $Vdc = V_m - \frac{I_{dc}}{4fC}$

$= 12 - \frac{15 \times 10^{-3}}{4 \times 50 \times 100 \times 10^{-6}}$

$= 11{,}25$ V√√√ (3)
[15]

QUESTION 4

4.1



√√√√√ (5)

4.2
4.2.1 B
4.2.2 D
4.2.3 A
4.2.4 C

(4 × 1) (4)

4.3 $V_{CC} = V_{RC} + V_{CE}$
$= (1000 \times 3 \times 10^{-3}) + 15$
$= 18$ V√√ (2)

$R_{in} = \frac{V_{be}}{I_b} = \frac{0{,}68}{20 \times 10^{-6}}$
$= 34$ kΩ√√ (2)

$R_{out} = \frac{V_{ce}}{I_C} = \frac{15}{3 \times 10^{-3}}$
$= 5$ kΩ√√ (2)
[15]

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QUESTION 5

5.1
- Cheap
- Highly reliable
- Small size
- Highly stable
- Low power consumption

(5 × 1) (5)

5.2

$$\text{Gain} = 1 + \frac{R_f}{R_{in}}$$

$$= \frac{1 + 20 \times 10^3}{2\,000}$$

$$= 11\surd\surd$$

(2)

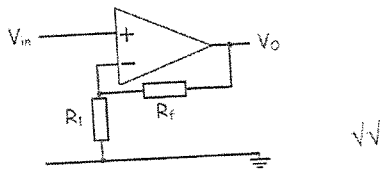
$$V_o = \text{gain} \times V_{in}$$

$$= 11 \times 0{,}5$$

$$= 5{,}5\ V\surd\surd$$

(2)

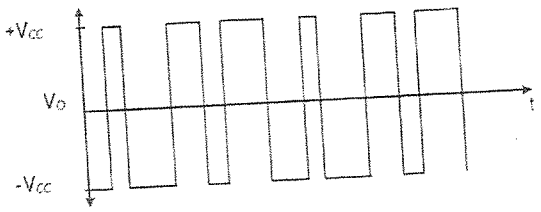
5.3



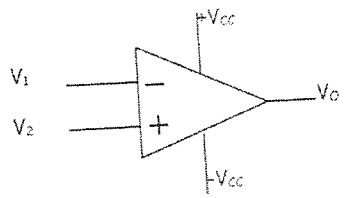
√√

(2)

5.4



√√ (2)



√√ (2)

[15]

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QUESTION 6

6.1

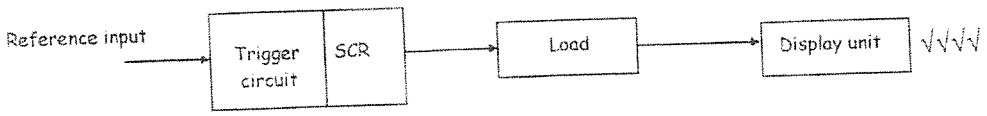
6.1.1	C
6.1.2	A
6.1.3	A
6.1.4	C
6.1.5	B

(5 × 1) (5)

6.2

- When no light is present, the LASCR is off, no current flows through the load.
- When the light activates the LASCR, it turns on, allowing current to flow through load.
- The resistor is used to set the triggering level of the LASCR. (3)

6.3



- The desired value is set at the reference input.
- The SCR will be triggered by the triggering circuit
- The output from the load will be measured and displayed in the display unit. (7)

[15]

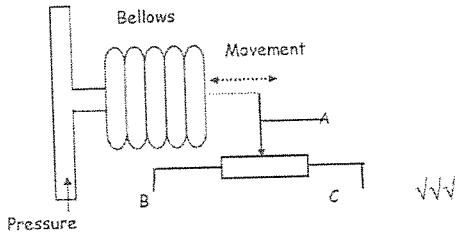
QUESTION 7

7.1

- Resistive
- Capacitive√
- Inductive
- Photo sensitive

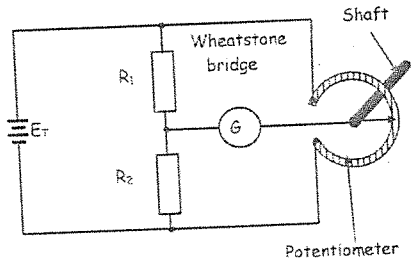
(4 × 1) (4)

7.2 7.2.1



(3)

7.2.2



√√√

(3)
[10]

QUESTION 8

A	Input signal
B	Attenuator
C	Vertical amplifier
D	Delay line
E	Cathode-ray tube
F	Horizontal amplifier
G	Sweep generator (time base)
H	Synchronise pulse generator
I	Trigger circuit
J	Power supply

(10 × 1) **[10]**

TOTAL: 100

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