higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE

NOVEMBER EXAMINATION

INDUSTRIAL ELECTRONICS N3

17 NOVEMBER 2014

This marking guideline consists of 7 pages.

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SECTION A

QUESTION 1

1.1	1.1.1	True
	1.1.2	False
	1.1.3	False
	1.1.4	True
	1.1.5	False
	1.1.6	False
	1.1.7	False
	1.1.8	True
	1.1.9	False
	1.1.10	False

(10 × 1) (10)

1.2	1.2.1	C
	1.2.2	C
	1.2.3	B
	1.2.4	B
	1.2.5	C
	1.2.6	B
	1.2.7	A
	1.2.8	C
	1.2.9	A
	1.2.10	A

(10 × 1) (10)
[20]

TOTAL SECTION A: 20

SECTION B

QUESTION 2

2.1 2.1.1 Loop AFEDCBA

$0 = 15(I_1 - I_2) - 15I_2$ ✓

$= 15I_1 - 15I_2 - 15I_2$

$= 15I_1 - 30I_2$ .....[1] ✓

OR

$O = -5(I_1 - I_2) - 10(I_1 - I_2) + 5I_2 + 10I_2$

$= -5I_1 + 5I_2 - 10I_1 + 10I_2 + 5I_2 + 10I_2$

$= -15I_1 + 30I_2$

$= 15I_1 - 30I_2$ .....(1)

(2)

2.1.2 Loop ADEFA

$-10 = -15(I_1 - I_2) - 10I_1$

$10 = 15I_1 - 15I_2 + 10I_1$ ✓

$= 25I_1 - 15I_2$ .....[2] ✓

OR

$-10 = -10I_1 - 5(I_1 - I_2) - 10(I_1 - I_2)$

$-10 = -10I_1 - 5I_1 + 5I_2 - 10I_1 + 10I_2$

$-10 = -25I_1 + 15I_2$

$10 = 25I_1 - 15I_2$ .....(1) (2)

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2.1.3 $[2]\times 2: \quad 20 = 50I_1 - 30I_2 \ldots\ldots\ldots\ldots\ldots\ldots\ldots [3]$

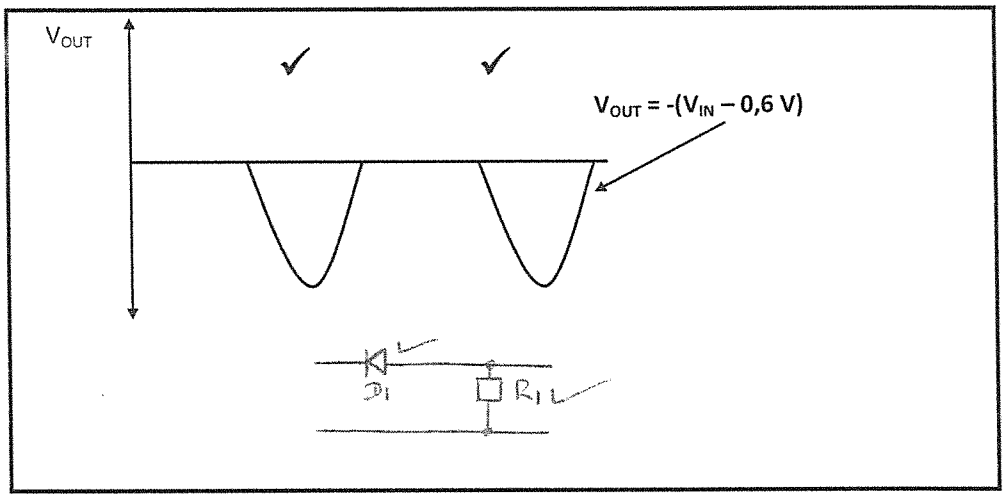
$[3]-[1]: \quad 20 = 35I_1$ ✓

$I_1 = 0{,}571\ \text{A}$ ✓

Substitute $I_1 = 0{,}571\ \text{A}$ in $[2]$:

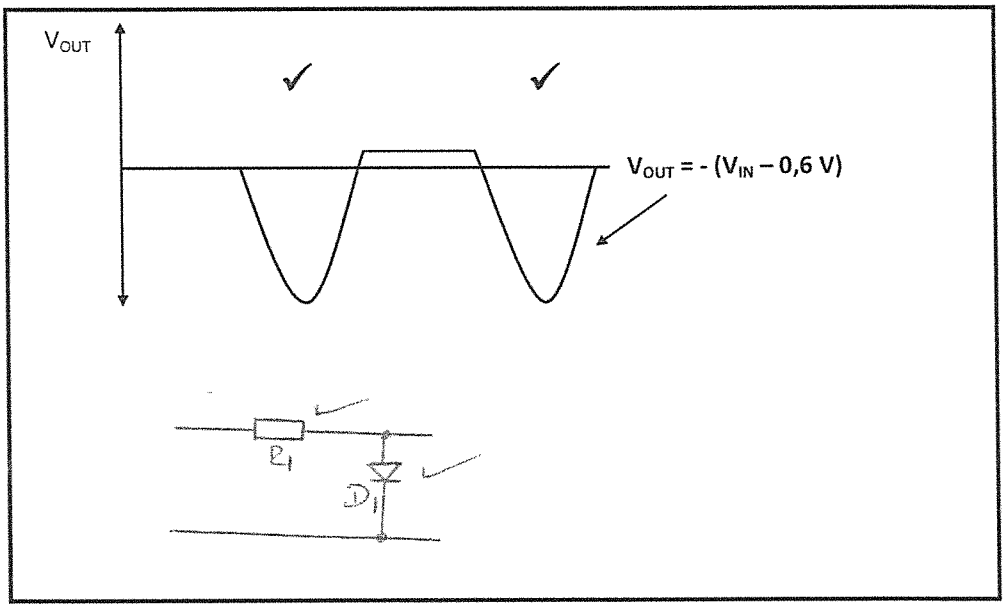
$$10 = 25(0{,}571) - 15I_2$$
$$= 14{,}275 - 15I_2$$
$$-4{,}275 = -15I_2$$ ✓
$$I_2 = 0{,}285\ \text{A}$$ ✓ (4)

2.2 2.2.1



(4)

2.2.2



(4)
[16]

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QUESTION 3

3.1 3.1.1 *At resonance*:

$$X_L = X_C$$

$$2\pi fL = \frac{1}{2\pi fC} \quad ✓$$

$$C = \frac{1}{(2\times\pi\times 60)^2 \times 0{,}15} \quad ✓✓$$

$$= 46{,}907\ \mu F \quad ✓$$

(4)

3.1.2 *Voltage*:

$$I = \frac{V}{R} = \frac{220}{4} = 55A \quad ✓$$

$$\therefore V_L = 2\pi fLI$$

$$= 2\times\pi\times 60\times 0{,}15\times 55 \quad ✓$$

$$= 3110{,}177\ V \quad ✓$$

$$= V_C \quad ✓$$

(4)

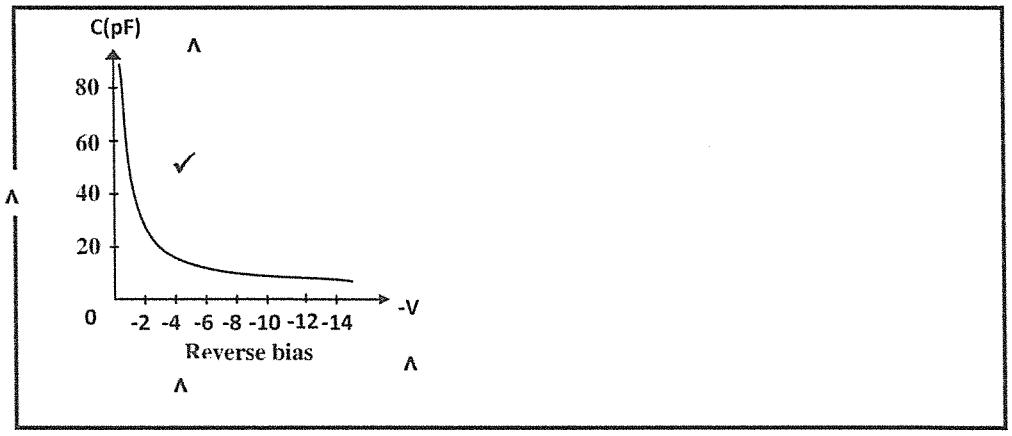
3.2 3.2.1



✓

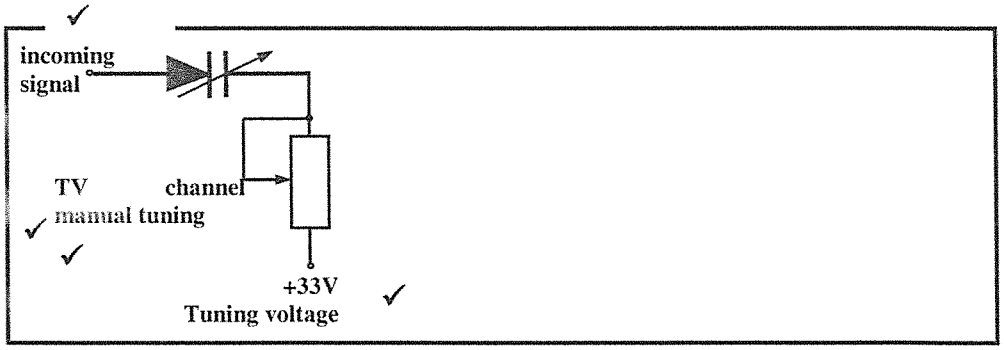
(1)

3.2.2



(3)

3.2.3



(4)

[16]

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QUESTION 4

4.1 4.1.1 Constant current regulator✓ (1)

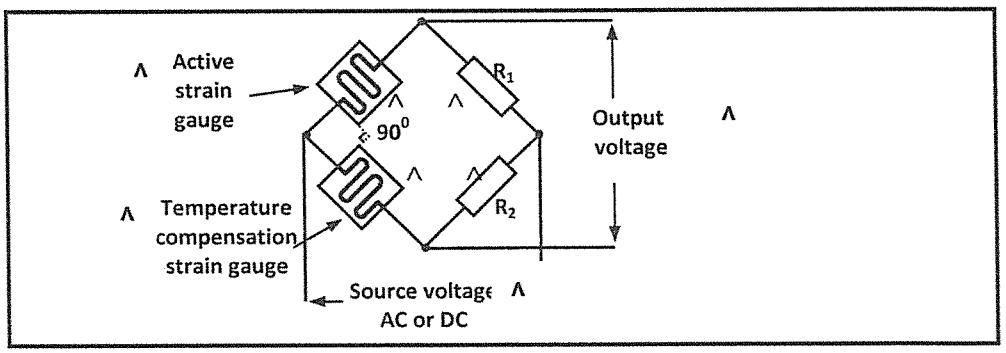
4.1.2
(a) decreases✓
(b) drop✓
(c) decrease✓
(d) decreases✓
(e) increase✓
(f) increases✓ (6)

4.2 Class A✓, Class B✓, Class C✓, Class AB (Any 3 × 1) (3)

4.3 Relatively unaffected by radiation✓
No offset voltage when used as a switch✓
Very high input resistance✓
Considerable thermal stability✓
Less noisy than bipolar transistors✓
Small-gain bandwidth✓ (6)
[16]

QUESTION 5

5.1 5.1.1



(4)

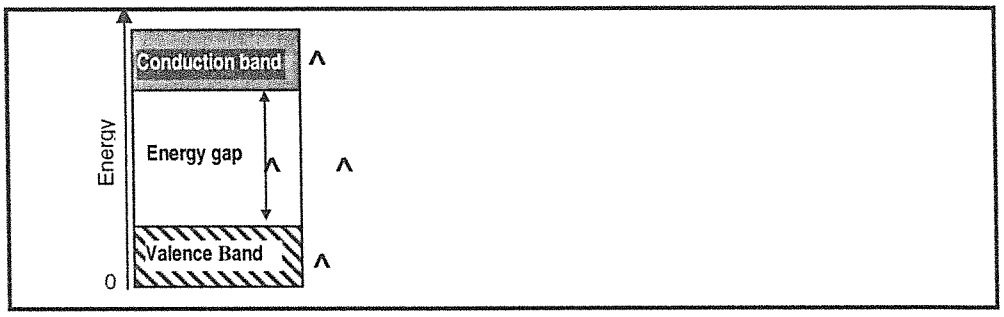
5.1.2 The resistance of a wire is changed✓ by expansion and contraction due to an externally applied stress. ✓ (2)

5.1.3 Force/pressure – aircraft wings, concrete pylons, compression✓
Displacement – bridges, tall buildings✓
Torque – cylindrical or torque bars (Any 2 × 1) (2)

5.2
- High input impedance✓
- Low output impedance✓
- High voltage gain✓
- Wide bandwidth✓
- Its parameters are matched and track well with temperature changes✓
- Ability to handle AC and DC signals✓ (Any 4 × 1) (4)

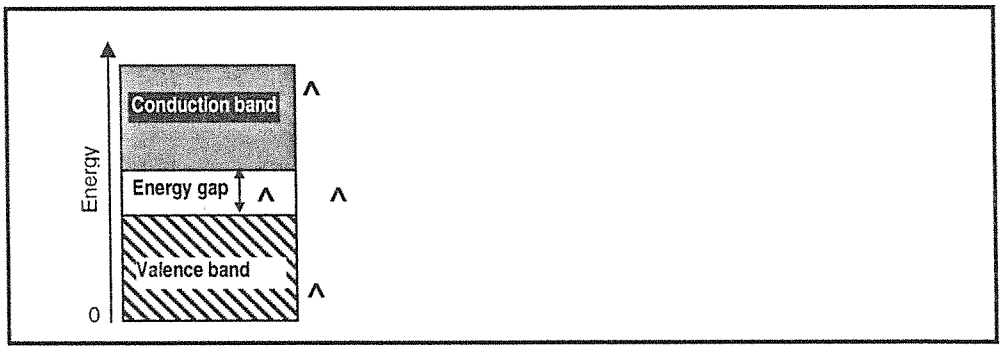
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5.3 5.3.1



(2)

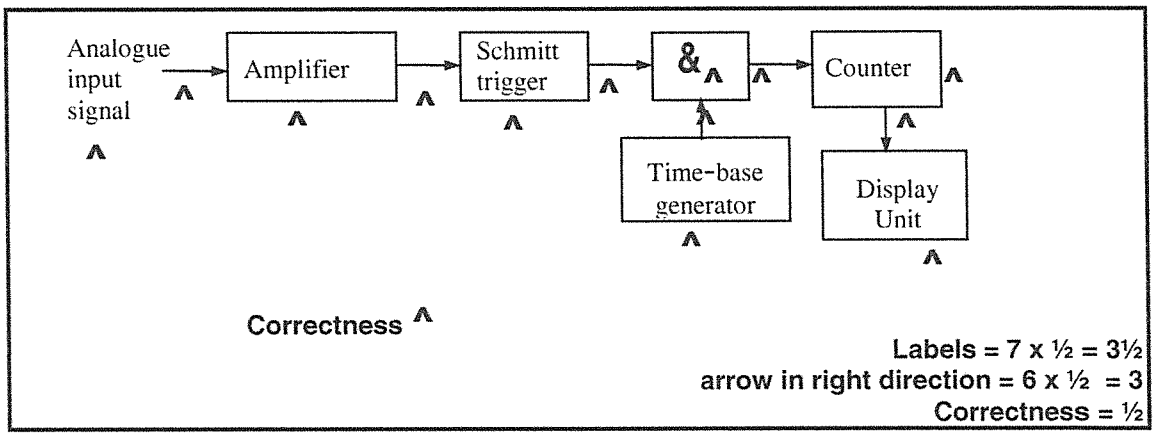
5.3.2



(2)
[16]

QUESTION 6

6.1



Labels = 7 x ½ = 3½
arrow in right direction = 6 x ½ = 3
Correctness = ½ (7)

6.2 Gross human errors ✓
made in reading and/or using a measuring instrument✓

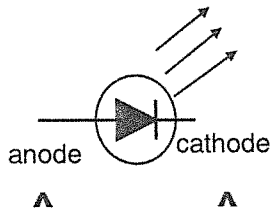
Systematic errors ✓
Instrument errors are due to the shortcomings of the instrument such as friction in bearings, irregular spring tension and stretching of the spring. ✓

Environmental errors✓
are due to external conditions affecting the instrument such as variations in temperature, humidity and barometric pressure and also magnetic or electrostatic field effects. ✓

Random errors✓
caused by unknown factors✓ (Any 2 × 2) (4)

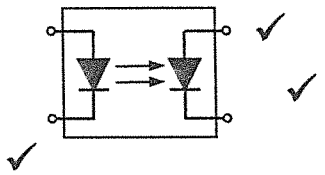
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6.3 6.3.1



½ mark for anode
½ mark for cathode
1 mark for LED symbol (2)

6.3.2



1 mark for LED symbol
1 mark for photodiode symbol
1 mark for correctness (3)

[16]

TOTAL SECTION B: 80
GRAND TOTAL: 100

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