



# higher education & training

Department:  
Higher Education and Training  
**REPUBLIC OF SOUTH AFRICA**

## **MARKING GUIDELINE**

**NATIONAL CERTIFICATE**  
**AUGUST EXAMINATION**  
**INDUSTRIAL ELECTRONICS N3**  
**25 JULY 2014**

**This marking guideline consists of 7 pages.**

**SECTION A****QUESTION 1**

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

(10 x 1) (10)

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

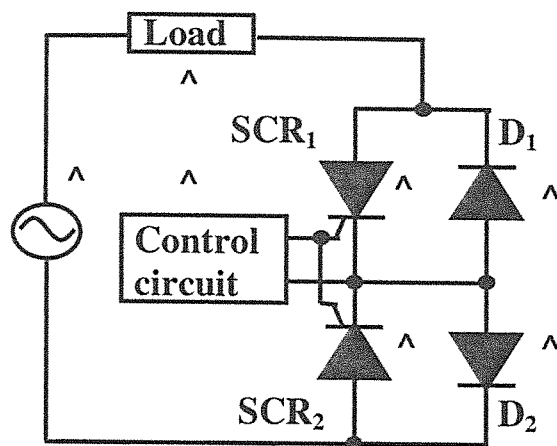
(10 x 1) (10)  
[20]**TOTAL SECTION A: 20**

## SECTION B

## QUESTION 2

- 2.1 2.1.1 **Loop\_ABCDA**  
For loop we have:  
 $12 = 3I_1 + 3I_2$  ✓✓ (2)
- 2.1.2 **Loop\_CDEFABC**  
 $12 = (2+7)(I_1 - I_2) + 3I_1$  ✓ OR  $12 = 2(I_1 - I_2) + 7(I_1 - I_2) + 3I_1$   
 $= 9I_1 - 9I_2 + 3I_1$   $12 = 2I_1 - 2I_2 + 7I_1 - 7I_2 + 3I_1$   
 $\therefore 12 = 12I_1 - 9I_2$   $12 = 12I_1 - 9I_2$   
 $4 = 4I_1 - 3I_2$  ..... [2] ✓ (2)
- 2.1.3 [1] - [2]:  $16 = 7I_1$  ✓ OR  $1 \times 4 : 48 = 12I_1 + 12I_2$   
 $\therefore I_1 = 2,2 \text{ A}$  ✓  $1 - 2 : 36 = 21I_2$   
 $\therefore I_2 = 1,714 \text{ A}$   
 Substitute  $I_1 = 2,2 \text{ A}$  in [1]  
 $12 = 3 \times 2,2 + 3I_2$  ✓  
 $3I_2 = 12 - 6,6$   
 $I_2 = 1,8 \text{ A}$  ✓  
 $12 = 3I_1 + 3(1,714)$   
 $6,858 = 3I_1$   
 $\therefore I_1 = 2,286 \text{ A}$  (4)
- 2.2 2.2.1 Static control ✓  
 2.2.2 Cyclotronic control ✓  
 2.2.3 Phase control ✓  
 2.2.4 Cycle control ✓ (4)

2.3



^ correctness

(ONE mark for diagram and THREE marks for correctness)

(4)  
[16]

## QUESTION 3

3.1

3.1.1

$$\begin{aligned}
 X_L &= 2\pi fL \\
 &= 2 \times \pi \times 50 \times 0,5 \\
 &= 157,080\Omega
 \end{aligned}$$

$$\begin{aligned}
 X_C &= \frac{1}{2\pi fC} \\
 &= \frac{1}{2 \times \pi \times 50 \times 100 \times 10^{-6}} \\
 &= 31,831\Omega
 \end{aligned}$$

$$\begin{aligned}
 Z &= \sqrt{R^2 + (X_L - X_C)^2} \\
 &= \sqrt{12^2 + (157,080 - 31,831)^2} \\
 &= 125,823\Omega
 \end{aligned}$$

(3)

3.1.2

$$I = \frac{V}{Z} = \frac{220}{125,823} = 1,748A$$

(2)

3.1.3

$$V_R = I \times R = 1,748 \times 12 = 20,976V$$

(1)

3.1.4

$$V_L = I \times X_L = 1,748 \times 157,080 = 274,576V$$

(1)

3.1.5

$$V_C = I \times X_C = 1,748 \times 31,831 = 55,641V$$

(1)

3.1.6

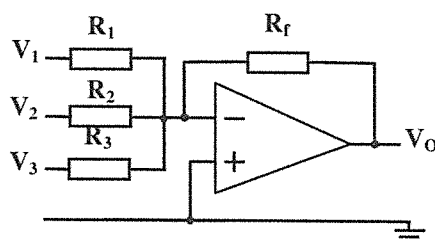
$$\theta = \cos^{-1}\left(\frac{V_R}{V_T}\right) = \cos^{-1}\left(\frac{20,976}{220}\right) = 84,523^\circ \quad \text{OR } \theta = \cos^{-1} \frac{R}{Z}$$

$$\begin{aligned}
 &= \cos^{-1} \frac{12}{125,847} \\
 &= 84,5490
 \end{aligned}$$

(2)

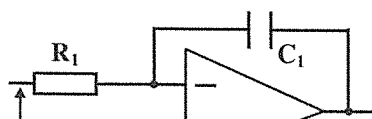
3.2

3.2.1



$R_1, R_2, R_3$  and  $R_f = 1$  ✓  
 Correct connections = 1 ✓  
 Correctness = 1 ✓

(3)



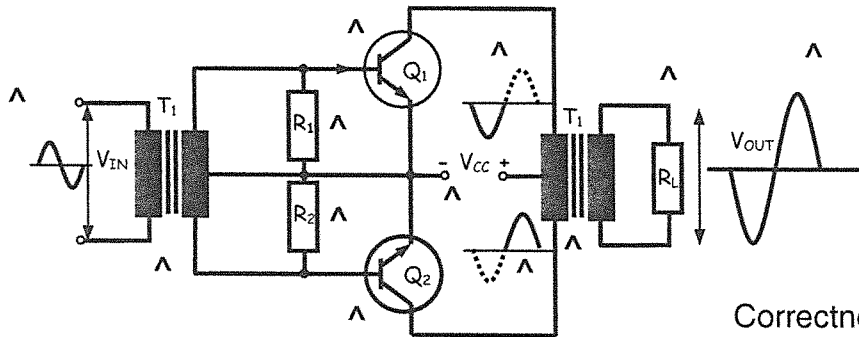
## 3.2.2

R1 and C1 = 1 ✓  
 Correct connections ✓  
 Correctness ✓

(3)  
 [16]

## QUESTION 4

4.1



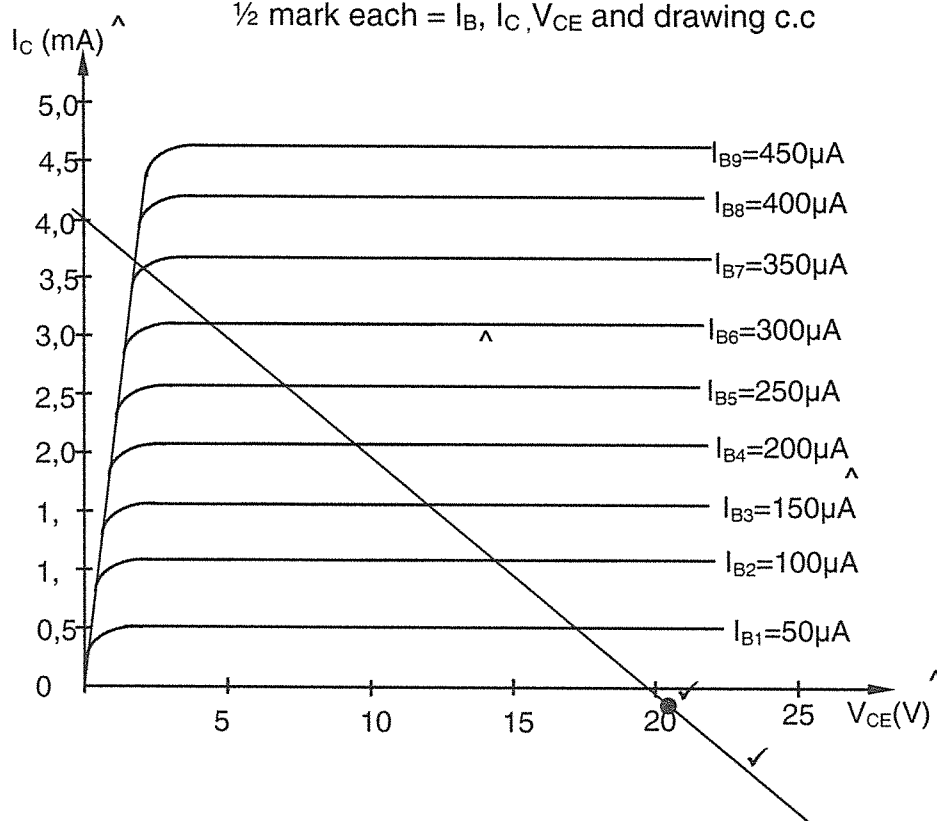
Correctness = 1 mark

(7)

4.2

Placing Q point = 1 mark

Drawing load line = 1 mark

½ mark each =  $I_B$ ,  $I_C$ ,  $V_{CE}$  and drawing c.c

(4)

- |     |       |                |     |
|-----|-------|----------------|-----|
| 4.3 | 4.3.1 | collector-base |     |
|     | 4.3.2 | reverse        |     |
|     | 4.3.3 | electrons      |     |
|     | 4.3.4 | increase       |     |
|     | 4.3.5 | increase       | (5) |
- [16]

### QUESTION 5

- 5.1

5.1.1 LVDT ✓ (1)

5.1.2 (a) supply ^  
 (b) movement ^  
 (c) core ^  
 (d) output ^ (2)

5.1.3 Positioning the magnetic core through an externally applied force varies the difference in voltage of two secondary windings of a transformer. The magnitude of this difference is an indication of the direction and magnitude of the applied force. (3)

5.1.4 Pressure - force measurements ✓  
 Displacement – linear motion-magnitude of movements  
 Position - to indicate direction of applied pressure or motion  
 (Any 2 x 1) (2)

5.2

5.2.1 (a) less ✓  
 (b) give up ✓

5.2.2 (a) more ✓  
 (b) tend to acquire (gain) ✓

5.2.3 (a) eight ✓  
 (b) neither lose nor gain ✓

5.2.4 (a) four ✓  
 (b) share ✓  
 (4 x 2) (8)

**QUESTION 6**

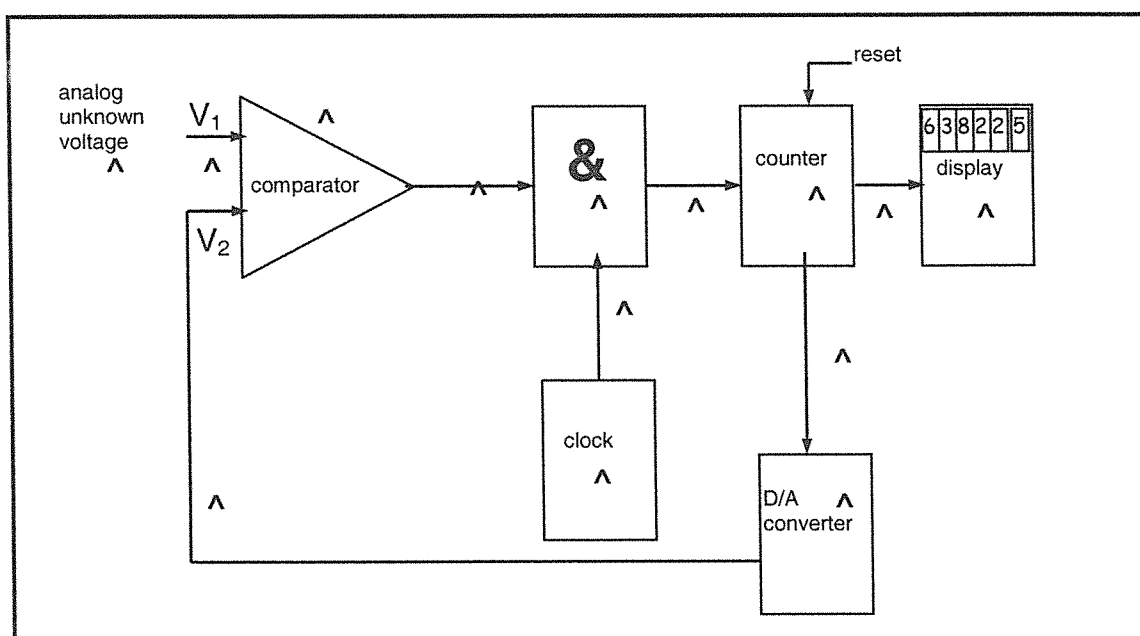
6.1 6.1.1 Deflection plates position the CRT spot anywhere on the screen by simultaneous application of appropriate vertical and horizontal voltage inputs. ✓

6.1.2 Delay line delays the arrival of the input waveform at the vertical deflection plates until the TRIGGER and TIME BASE circuits have had a chance to start the sweep of the beam. ✓

(2 × 2)

(4)

6.2



(7)

6.3

High input impedance ✓

Low output impedance ✓

High voltage gain ✓

Wide bandwidth ✓

Its parameters are matched and track well with temperature changes ✓

Can handle both AC and DC signals

(5)

[16]

**TOTAL SECTION B: 80**  
**GRAND TOTAL: 100**