GAUTENG DEPARTMENT OF EDUCATION
GAUTENGSE DEPARTEMENT VAN ONDERWYS

SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

ELECTRONICS / *ELEKTRONIKA* SG

POSSIBLE ANSWERS OCT / NOV 2006

PLEASE NOTE THIS MEMO SERVES ONLY AS A GUIDE TO MARKERS. ALTERNATIVE CALCULATION METHODS AND EXPLANATIONS MUST BE CONSIDERED.

NEEM ASSEBLIEF KENNIS DAT HIERDIE MEMO SLEGS AS 'N RIGLYN VIR NASIENERS DIEN. ALTERNATIEWE BEREKENINGSMETODES EN VERDUIDELIKINGS MOET IN AG GENEEM WORD.

QUESTION 1 / *VRAAG 1*
ELECTRIC CURRENT THEORY / *ELEKTRIESE STROOMTEORIE*

1.1.1

$$X_L = 2 \times \pi \times F \times L \, (\Omega)$$
$$X_L = 2 \times \pi \times 100 \times 0,1H$$
$$X_L = 62,83 \, \Omega = 62,8 \, \Omega$$

(3)

1.1.2

$$X_C = \frac{1}{2 \times \pi \times f \times c \, (\Omega)}$$
$$X_C = \frac{1}{2 \times \pi \times 100 \times 40 \times 10^{-6}}$$
$$X_C = 39,788 \, \Omega = 39,8 \, \Omega$$

(3)

1.1.3

$$Z = \sqrt{R^2 + X^2} \qquad\qquad X = X_L - X_C$$
$$Z = \sqrt{20^2 + 23^2} \qquad X = 62,83 - 39,788$$
$$Z = \sqrt{400 + 529} \qquad X = 23$$
$$Z = 30,479 = 30,5 \, \Omega$$

(4)

1.1.4

$$I = \frac{V}{Z} \, (A) = \frac{100 \, V}{30,5} = 3,28 \, A$$

(3)

1.1.5

(3)

$$\cos \phi = \frac{R}{Z} = \frac{20}{30,5} = 0,656$$

1.1.6

$$? = \cos^{-1}\frac{R}{Z} = \cos^{-1}0{,}656 = 49° \text{ leading.}$$

(3)

1.1.7

$$P = V \times I \times \cos\phi \,(W) \qquad\qquad Dw = V \times I \times \cos\phi \,(W)$$
$$P = 100 \times 3{,}28 \times 0{,}656 \qquad\qquad Dw = 100 \times 3{,}28 \times 0{,}656$$
$$P = 215{,}168 \qquad\qquad\qquad Dw = 215{,}168 \,W$$

(3)

1.1.8

$$P\,reac = VXI \times \sin\phi \,(VARS) \qquad Dreak = VXI \times \sin\phi \,(VARS)$$
$$= 100\,V \times 3{,}28\,A \sin 49° \,(VARS) \qquad Dreak = 100\,V \times 3{,}28\,A \sin 49° \,(VARS)$$
$$= 247{,}544 \ VARS \qquad\qquad = 247{,}544 \ VARS$$

(3)

1.1.9

$$Papp = V.I.\,(VA) \qquad\qquad Ds = V \times I \,(S.A.)$$
$$= 100\,V \times 3{,}28\,A\,(V.A.) \qquad Ds = 100\,V \times 3{,}28\,A\,(S.A.)$$
$$= 328\,(V.A.) \qquad\qquad\qquad Ds = 328\,(S.A.)$$

(3)

1.1.10

$$V_R = I \times R \,(V)$$
$$V_R = 3{,}28\,A \times 20\,\Omega$$
$$V_R = 65{,}6\,V$$

$$V_L = I \times X_L \,(V)$$
$$V_L = 3{,}28\,A \times 62{,}8\,\Omega$$
$$V_L = 205{,}98\,V$$

$$Vc = I \times Xc \,(V)$$
$$Vc = 3{,}28\,A \times 39{,}8\,\Omega$$
$$Vc = 130{,}43\,V$$

(9)

2.1

$$Q \text{ factor} = \frac{X_L}{R} = \frac{62{,}8}{20} = 3{,}14 \qquad Q\text{-faktor} = \frac{X_L}{R} = \frac{62{,}8}{20} = 3{,}14$$

(3)

[40]

QUESTION 2 / *VRAAG 2*
THREE-PHASE ALTERNATING CURRENT SYSTEMS /
DRIEFASIGE WISSELSTROOMSTELSELS

2.1.1

$Y = \dfrac{\text{output power}}{\text{Input power}}$ $Y = \text{efficiency}$ $Y = \dfrac{\text{uitsetdrywing}}{\text{insetdrywing}}$ $Y = \text{Rendement}$

$0,9 = \dfrac{50 \times 1000}{1,732 \ I_L \times 380 \times 0,85}$ $0,9 = \dfrac{50 \times 1000}{1,732 \ I_L \times 380 \times 0,85}$

$09 = \dfrac{50 \times 1000}{559,436 \times I_L}$ $09 = \dfrac{50 \times 1000}{559,436 \times I_L}$

$50 \times 10^3 = I_L \times 503,492$ $50 \times 10^3 = I_L \times 503,492$ (4)

$I_L = \dfrac{50 \times 10^3}{503,492}$

$I_L = 99,3 \ A$

2.1.2

$P_{app} = V \times I \ (VA)$ $D_s = V \times I \ (S.A.)$

$\quad = 380 \ V \times 99,3 \ A$ $D_s = 380 \ V \times 99,3 \ A$

$\quad = 37736,448 \ VA$ $D_s = 37736,448 \ (S.A.)$

$\quad = 37,736 \ kVA$ (3)

2.1.3

$V_{ph} = \dfrac{V_L}{\sqrt{3}}$

$V_{ph} = \dfrac{380 \ V}{1,732}$

$V_{ph} = 219,399 \ V$ (3)

QUESTION 2 / VRAAG 2

2.2

Rotation /
Rotasie

Degrees /
Grade   **120°**   **120°**

Degrees /
Grade

4

L₃   **L₂**

120°

D₁   **D₃**   **D₅**

D₂   **D₄**   **D₆**

$\overline{O}$

O^+

−V

(10)

V

D₁   **D₃**

D₂

120° 150° 180°   240° 270° 300°   **O**

[20]

4
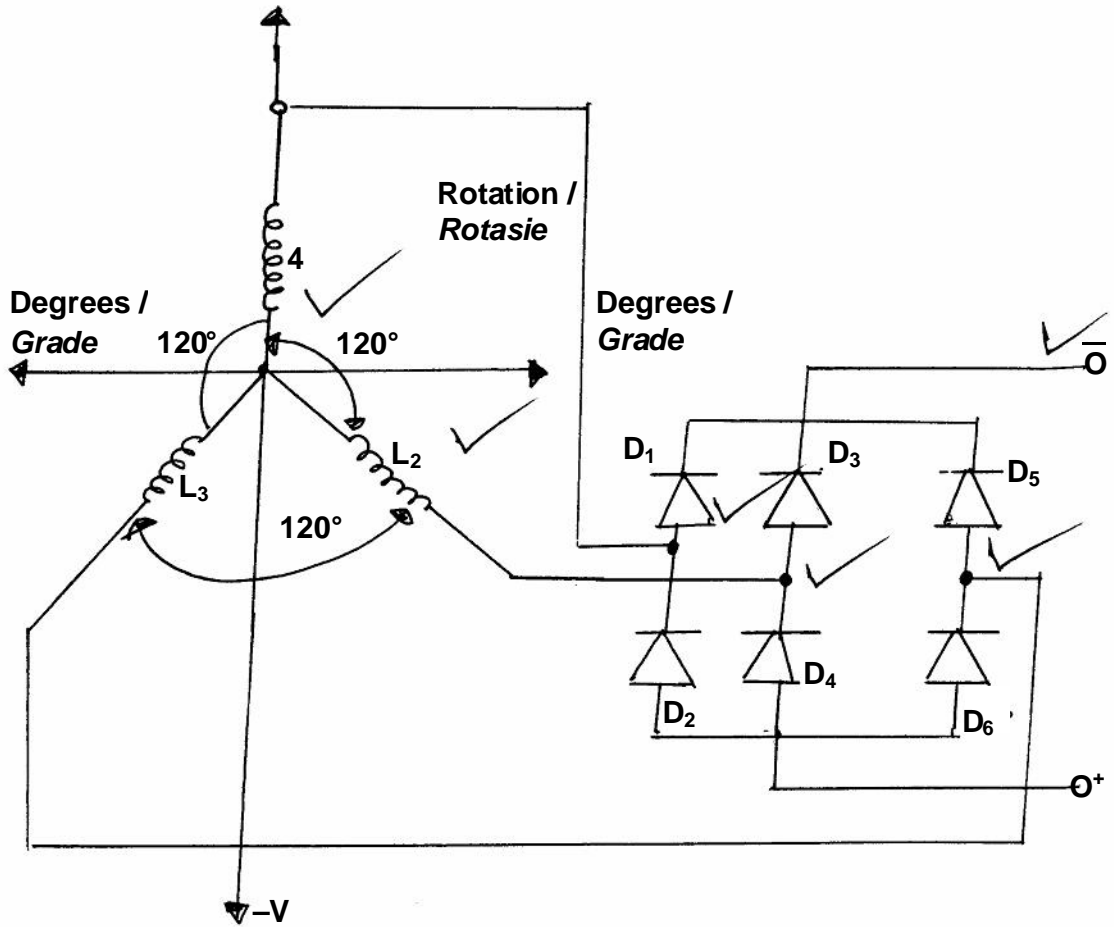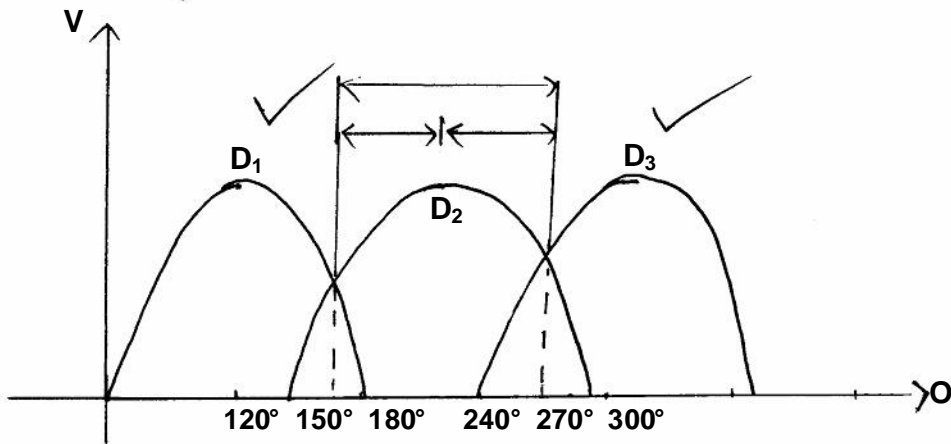
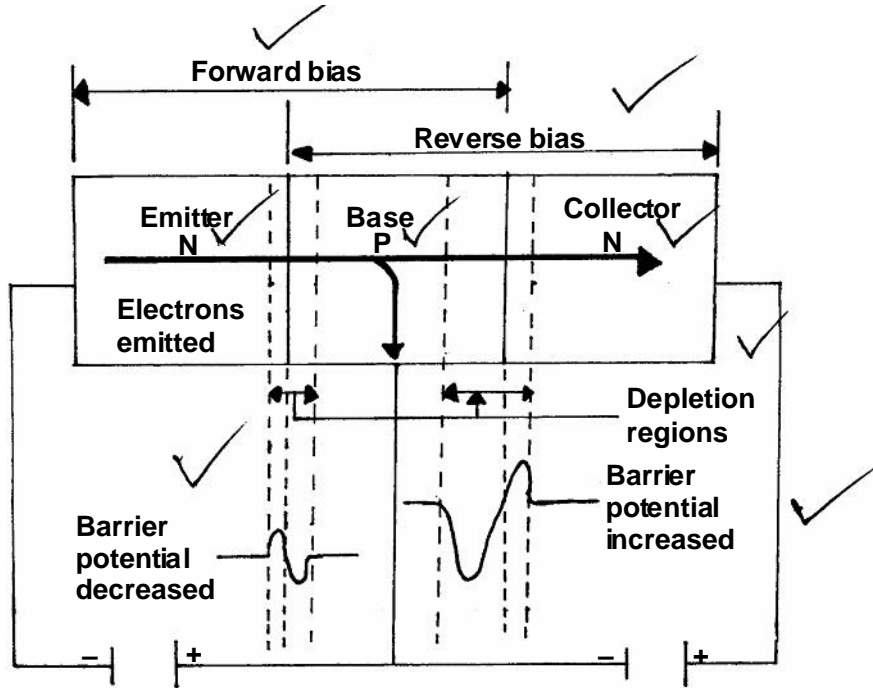## QUESTION 3 / VRAAG 3
SEMICONDUCTORS / HALFGELEIERS

3.1

$$I_E = I_C + I_B$$
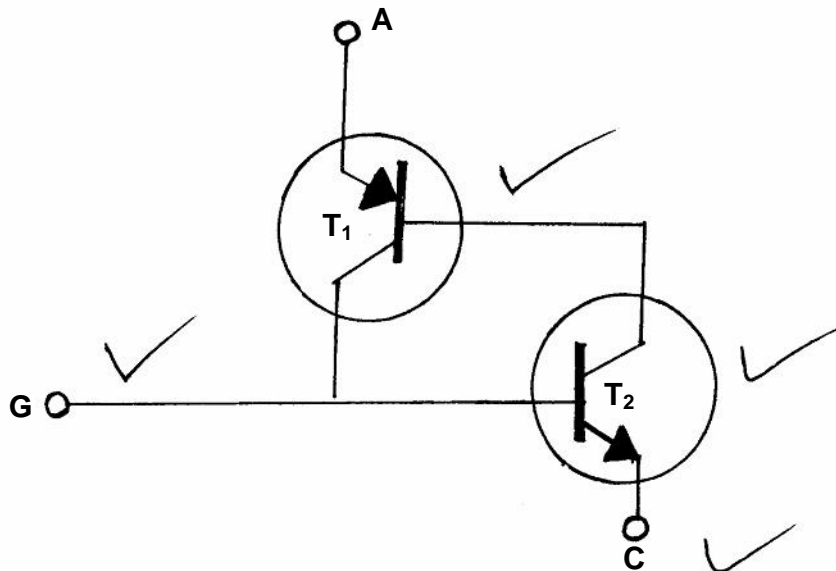$$I_C = I_E - I_B$$
$$I_C = 6,4\,mA - 20\,\mu A$$
$$I_C = 6,38\,mA$$

(3)

3.2   **NPN Biased Transistor / NPN Voorspanning-transistor**

Forward bias

Reverse bias

Emitter
N

Base
P

Collector
N

Electrons
emitted

Depletion
regions

Barrier
potential
increased

Barrier
potential
decreased

− |+ |− |+

(10)

3.3   **SCR Circuit (Two Transistors) / BSG-kring (Twee Transistors)**
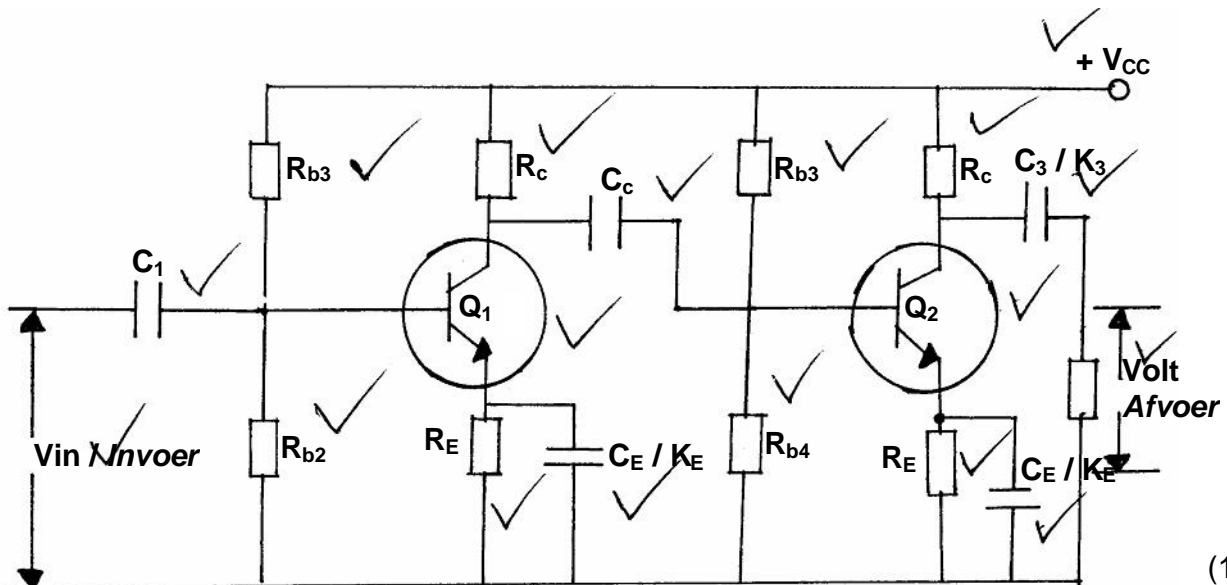
A

T₁

G

T₂

C

(5)
[18]

QUESTION 4 / *VRAAG* 4

RC- Coupled Amplifier / *RC-Koppelingversterker*

4.1

(18)

4.2.1 Coupling capacitors are placed in series with the amplifier, both at the input and output terminals to allow the ac-signal to pass through to the transistors without disturbing the next stage dc-circuit bias arrangements.

Koppelingskapasitors word in serie met die versterker gekoppel in beide die inset- en uitsetterminale sodat die ws-sein na die transistor deurgelaat kan word, sonder om die volgende kring se gs-voorspanning te beïnvloed.

4.2.2 The bypass capacitor across the emitter is necessary to give the transistor a good level of voltage gain.

Die omloopkapasitor oor die emittor-resistor is noodsaaklik om ? goeie spanningwins vir die transistorversterker te verseker.
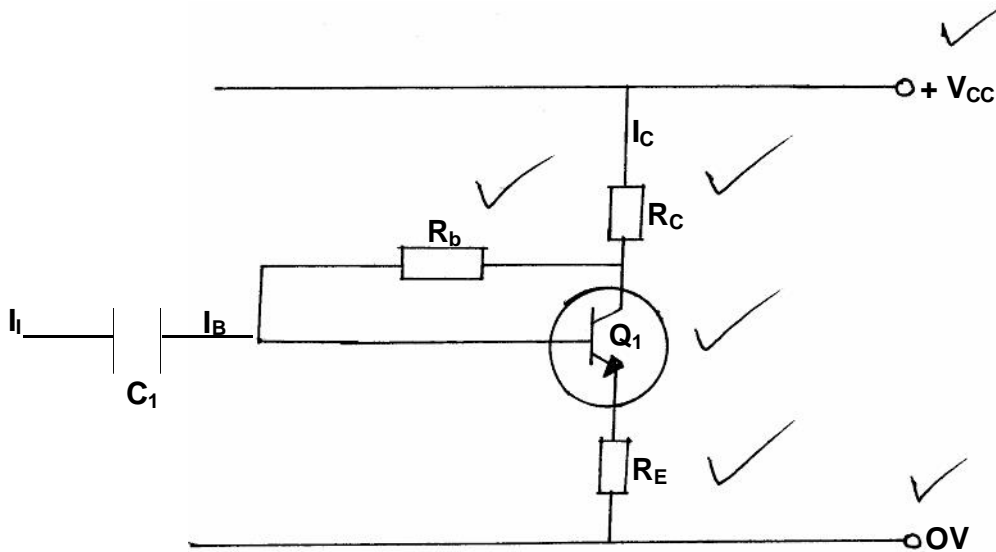
4.2.3 Emitter resistor provides a large deal of thermal stability to the amplifier.

Emittorresistor is verantwoordelik vir ? groot mate van termiese stabiliteit van die versterker. (6)

4.3 Biasing circuit with both collector and emitter feedback.

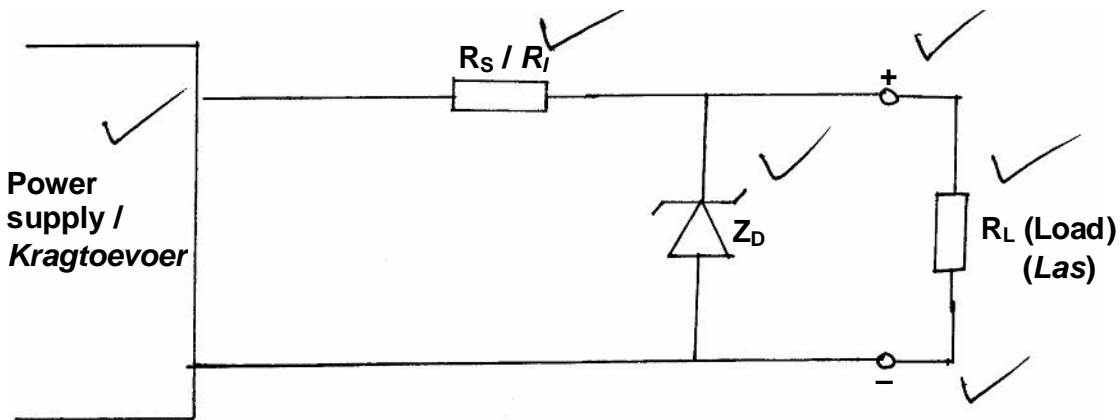*Voorspanningkring met beide kollektor- en emittor-terugvoer.*

(6)
[30]

QUESTION 5 / *VRAAG 5*
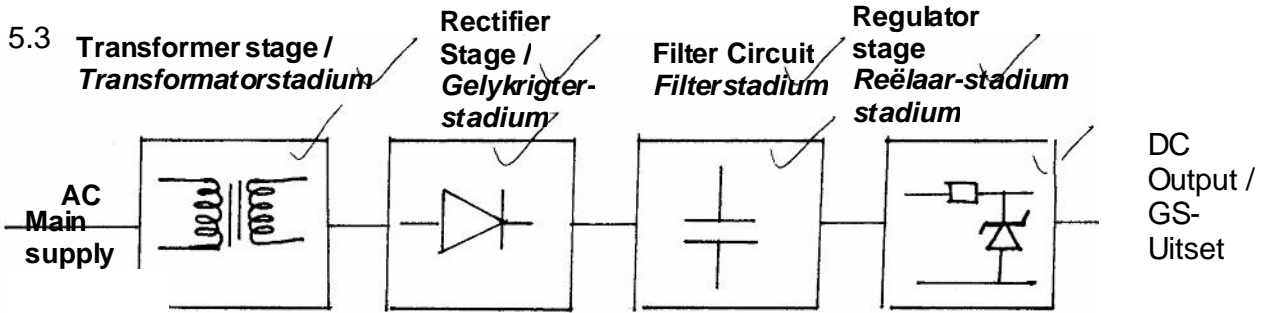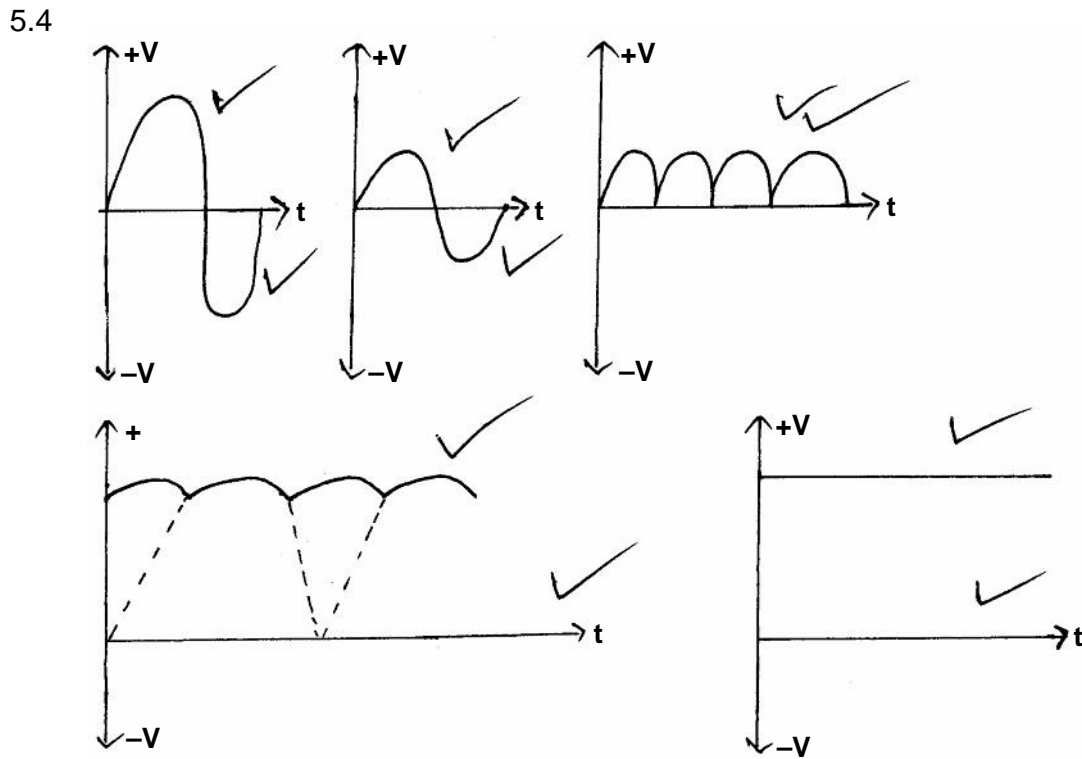
5.1 Series regulator
Shunt regulator

Seriereëlaar
Sjuntreëlaar (2)

5.2 Simple zener diode regulator / *Eenvoudige Zener-diode-reguleerder*

(6)

5.3 **Transformer stage /**
   Transformatorstadium

Rectifier Stage / *Gelykrigter-stadium*

Filter Circuit *Filterstadium*

Regulator stage *Reëlaar-stadium stadium*

AC Main supply

DC Output / GS-Uitset

(10)

5.4

(10)

5.5 Transformer – transforms a high mains ac voltage to a lower ac voltage

Rectifier – changes the ac-voltage wave into a pulsating voltage which exists only in the positive quadrant

Filter – smoothes out the pulsating voltage to remove all high pulse variations.

Regulator – eliminates any voltage variations still present and offers a smooth, unvarying dc voltage to the output terminals

Transformator – Verander die hoofspanning van die hoofleiding na ? laer ws-spanning

Gelykrigter – Verander die uitsetstroom-golf in ? pulserende spanning wat slegs in die positiewe kwadrant voorkom
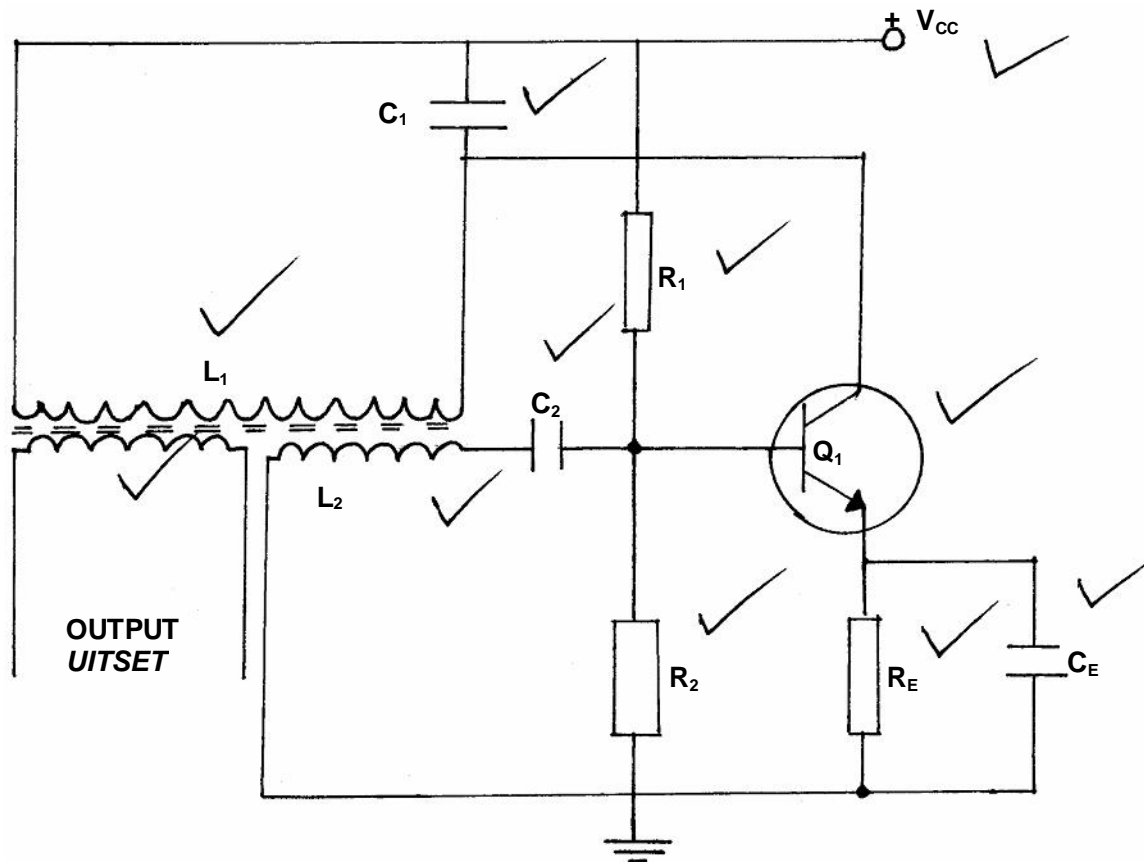
Filter – Vlak die pulserendespanning-golf af en stryk die hoë pulserende variasies uit

Reëlaar – Stryk enige verdere variasies in die spanning uit en lewer ? gladde gs-uitset.

(8)

[36]

QUESTION 6 / *VRAAG 6*
OSCILLATORS / *OSSILLATORS*

6.1 Inductive-coupled oscillator / *Induktief gekoppelde ossillator*

(12)

6.2 When pressure is applied to the crystal, it has the ability to develop a potential difference across it.

Wanneer drukking op die kristal toegepas word, veroorsaak dit ? potensiaal-verskil oor die kristal.

(2)

[14]

QUESTION 7 / *VRAAG 7*
COMPUTER PRINCIPLES / *REKENAARBEGINSELS*
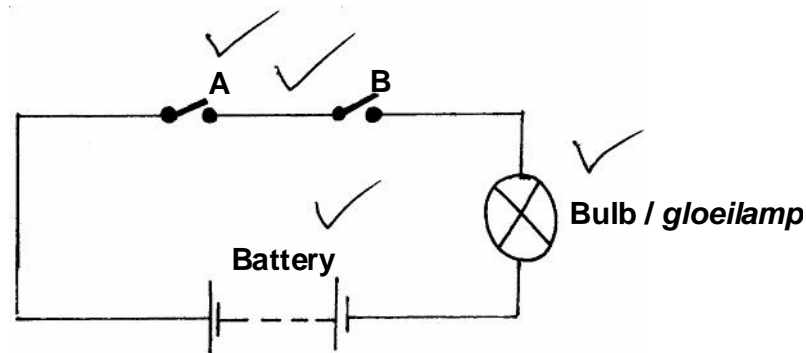
7.1 Boolean expression of an OR GATE

Boole-uitdrukking van die OF-HEK

$A + B = X$

TRUTH TABLE OF AN OR-GATE
WAARHEIDSTABEL VAN DIE OF-HEK

A	B	X
0	0	0
1	0	1
0	1	1
1	1	1

ELECTRICAL CIRCUIT OF AN OR-GATE
ELEKTRIESE KRING VAN DIE OF-HEK

Bulb / *gloeilamp*

Battery

(10)

7.2

$AB + BC + AC = BC + AC$

$AB + BC + AC = BC + AC$

$AB\,(C + C) + BC + AC = BC + AC$

$ABC + ABC + BC + AC = BC + AC$

$BC\,(A + 1) + AC\,(B + 1) = BC + AC$
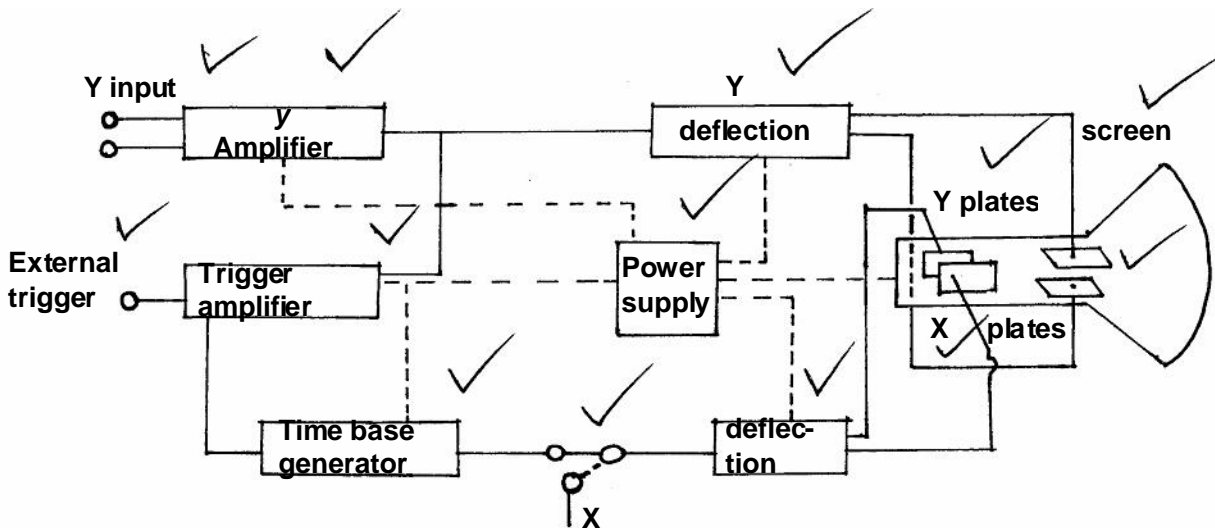
$BC.1 + AC.1 = BC + AC$

$BC + AC = BC + AC$ (7)

7.3

$(A + B)^{+}(A.B.C) = X$ (4)
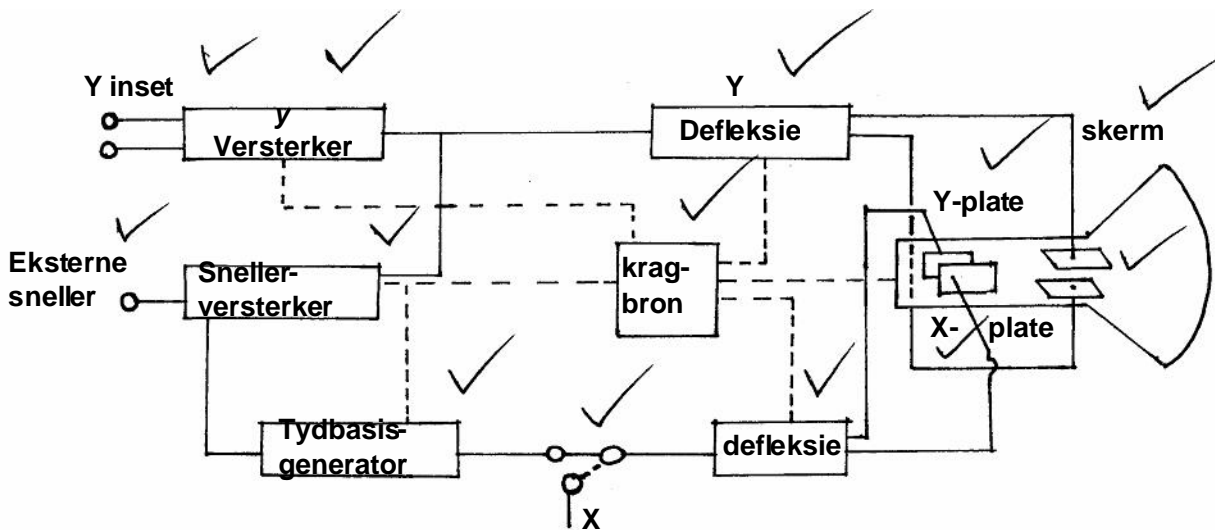
10

QUESTION 8 / *VRAAG 8*
ELECTRONIC APPARATUS / *ELEKTRONIESE APPARAAT*

8.1

8.1

(13)

8.2   Calibrate means to ensure that the figure displayed or indicated by a meter or pointer is accurate and true.

Kalibrasie beteken om te verseker dat die lesing van ? meetinstrument korrek is.   (3)

[16]

QUESTION 9 / *VRAAG 9*
OCCUPATIONAL SAFETY PRECAUTIONS /
BEROEPSVEILIGHEIDSMAATREËLS

9.1   *   Do not wear loose clothing.
         *   Don't work without permission.
         *   Workshop must be clean.
         *   Do not enter or leave the workshop without the educator's permission.
                               (3 marks only)

        N.B.   Any acceptable answer (3 marks only)

        *   *Moenie los klere dra nie.*
        *   *Moenie sonder toestemming werk nie.*
        *   *Werkswinkel moet altyd skoon wees.*
        *   *Moenie in die werkswinkel ingaan of dit verlaat sonder die opvoeder se toestemming nie.*
                               (Slegs 3 punte)   (3)

9.2   *   From infected mother to unborn child.
         *   Infected blood entering a cut or an open wound on the body.
         *   Sharing needles or syringes with an infected person.
         *   Having unprotected sex with a person with HIV without protection (condom).
                               (2 marks only)

        LW: Enige aanvaarbare antwoord (slegs 3 punte)

        *   *Van geïnfekteerde moeder na ongebore baba.*
        *   *Deur besmette bloed wat deur ? seerplek op die vel die liggaam binne-gaan.*
        *   *Deur ? naald (vir dwelms) met ? VIGS-lyer te deel.*
        *   *Deur seks te hê met ? VIGS-lyer sonder beskerming. (kondoom)*
                          (Slegs 2 punte)   (2)
                                            [5]

                         TOTAL / *TOTAAL:*   **200**