

**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

$$\begin{aligned} X_L &= 2 \times \pi \times F \times L (\Omega) \\ X_L &= 2 \times \pi \times 100 \times 0,1 \text{H} \\ X_L &= 62,83 \Omega = 62,8 \Omega \end{aligned} \quad (3)$$

1.1.2

$$\begin{aligned} X_C &= \frac{1}{2 \times \pi \times f \times C} (\Omega) \\ X_C &= \frac{1}{2 \times \pi \times 100 \times 40 \times 10^{-6}} \\ X_C &= 39,788 \Omega = 39,8 \Omega \end{aligned} \quad (3)$$

1.1.3

$$\begin{aligned} Z &= \sqrt{R^2 + X^2} & X &= X_L - X_C \\ Z &= \sqrt{20^2 + 23^2} & X &= 62,83 - 39,788 \\ Z &= \sqrt{400 + 529} & X &= 23 \\ Z &= 30,479 = 30,5 \Omega \end{aligned} \quad (4)$$

1.1.4

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

1.1.5

$$\cos \phi = \frac{R}{Z} = \frac{20}{30,5} = 0,656 \quad (3)$$

1.1.6

$$\theta = \cos^{-1} \frac{R}{Z} = \cos^{-1} 0,656 = 49^\circ \text{ leading.} \quad (3)$$

1.1.7

$$\begin{aligned} P &= V \times I \times \cos \phi \text{ (W)} & D_w &= V \times I \times \cos \phi \text{ (W)} \\ P &= 100 \times 3,28 \times 0,656 & D_w &= 100 \times 3,28 \times 0,656 \\ P &= 215,168 & D_w &= 215,168 \text{ W} \end{aligned} \quad (3)$$

1.1.8

$$\begin{aligned} P_{\text{react}} &= V \times I \times \sin \phi \text{ (VAR)} & D_{\text{react}} &= V \times I \times \sin \phi \text{ (VAR)} \\ &= 100 \text{ V} \times 3,28 \text{ A} \sin 49^\circ \text{ (VAR)} & D_{\text{react}} &= 100 \text{ V} \times 3,28 \text{ A} \sin 49^\circ \text{ (VAR)} \\ &= 247,544 \text{ VAR} & &= 247,544 \text{ VAR} \end{aligned} \quad (3)$$

1.1.9

$$\begin{aligned} P_{\text{app}} &= V \cdot I \text{ (VA)} & D_s &= V \times I \text{ (S.A.)} \\ &= 100 \text{ V} \times 3,28 \text{ A (V.A.)} & D_s &= 100 \text{ V} \times 3,28 \text{ A (S.A.)} \\ &= 328 \text{ (V.A.)} & D_s &= 328 \text{ (S.A.)} \end{aligned} \quad (3)$$

1.1.10

$$\begin{aligned} V_R &= I \times R \text{ (V)} \\ V_R &= 3,28 \text{ A} \times 20 \Omega \\ V_R &= 65,6 \text{ V} \\ \\ V_L &= I \times X_L \text{ (V)} \\ V_L &= 3,28 \text{ A} \times 62,8 \Omega \\ V_L &= 205,98 \text{ V} \\ \\ V_C &= I \times X_C \text{ (V)} \\ V_C &= 3,28 \text{ A} \times 39,8 \Omega \\ V_C &= 130,43 \text{ V} \end{aligned} \quad (9)$$

2.1

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

[40]

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

2.1.1

$$Y = \frac{\text{output power}}{\text{Input power}} \quad Y = \text{efficiency}$$

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

$$0,9 = \frac{50 \times 1000}{559,436 \times I_L}$$

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

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

$$I_L = 99,3 \text{ A}$$

$$Y = \frac{\text{uitsetdrywing}}{\text{insetdrywing}} \quad Y = \text{Rendement}$$

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

$$0,9 = \frac{50 \times 1000}{559,436 \times I_L}$$

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

(4)

2.1.2

$$\begin{aligned} P_{app} &= V \times I \text{ (VA)} \\ &= 380 \text{ V} \times 99,3 \text{ A} \\ &= 37736,448 \text{ VA} \\ &= 37,736 \text{ kVA} \end{aligned}$$

$$\begin{aligned} D_s &= V \times I \text{ (S.A.)} \\ D_s &= 380 \text{ V} \times 99,3 \text{ A} \\ D_s &= 37736,448 \text{ (S.A.)} \end{aligned}$$

(3)

2.1.3

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

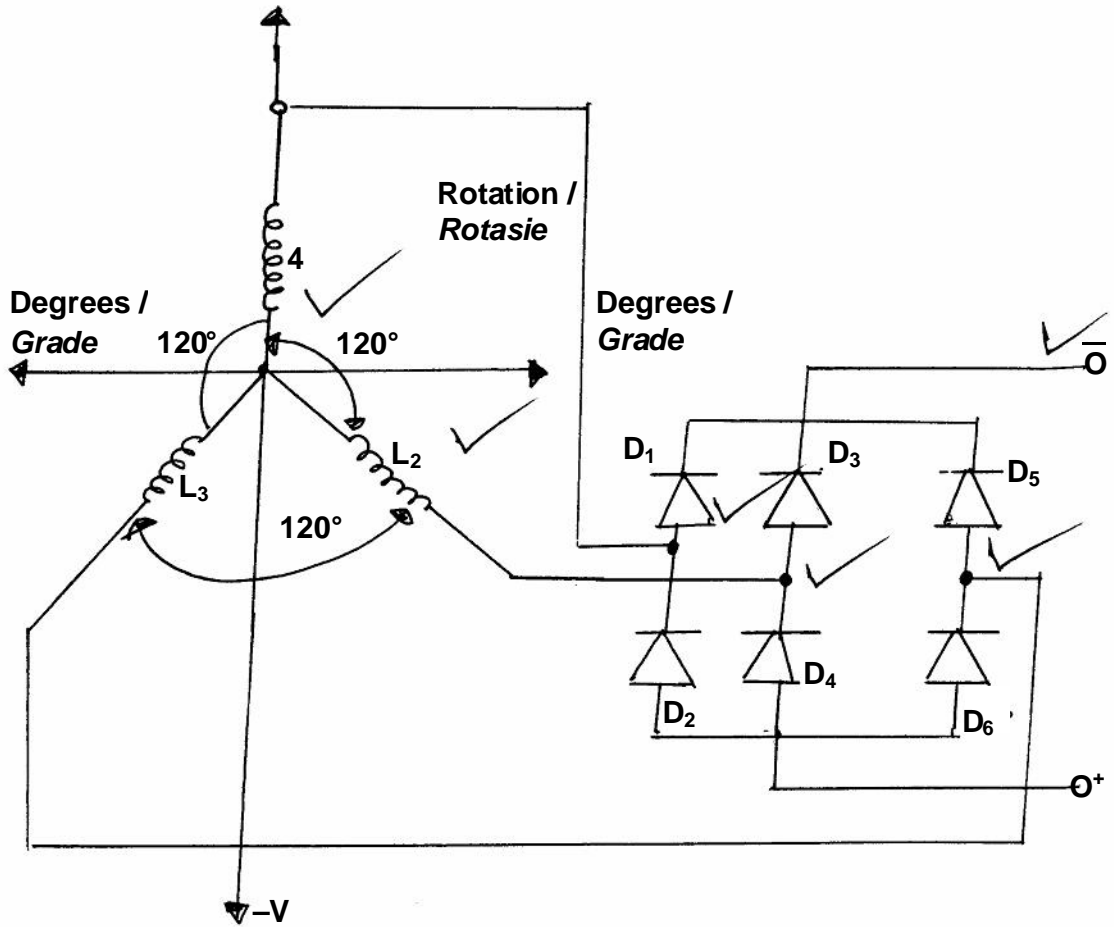
$$V_{ph} = \frac{380 \text{ V}}{1,732}$$

$$V_{ph} = 219,399 \text{ V}$$

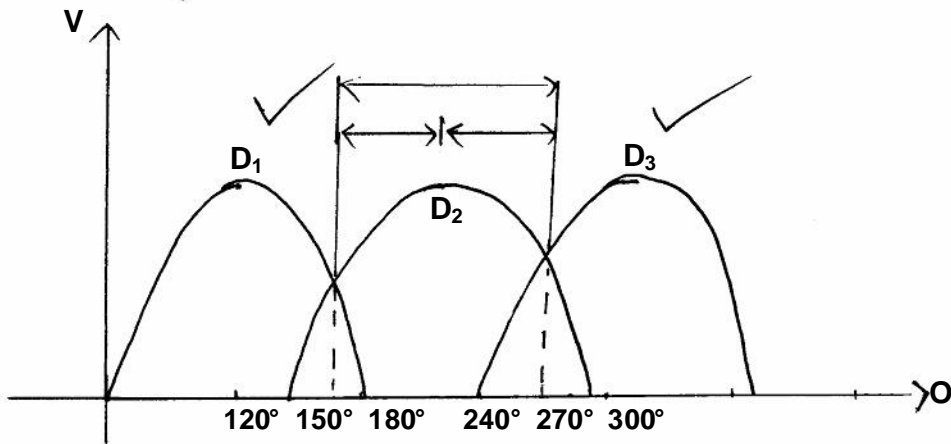
(3)

QUESTION 2 / VRAAG 2

2.2



(10)



[20]

QUESTION 3 / VRAAG 3
SEMICONDUCTORS / HALFGELEIERS

3.1

$$I_E = I_C + I_B$$

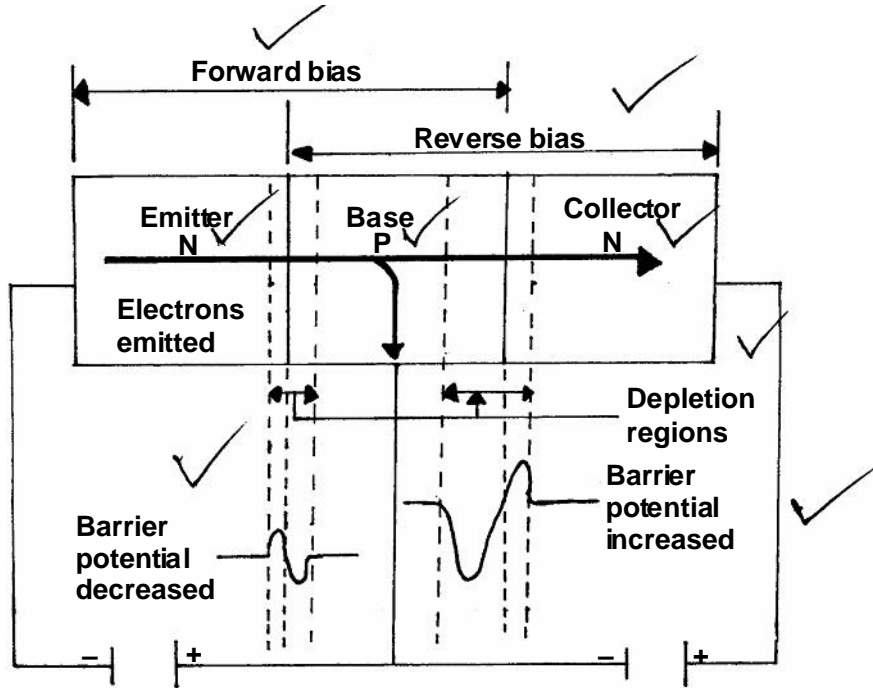
$$I_C = I_E - I_B$$

$$I_C = 6,4 \text{ mA} - 20 \mu\text{A}$$

(3)

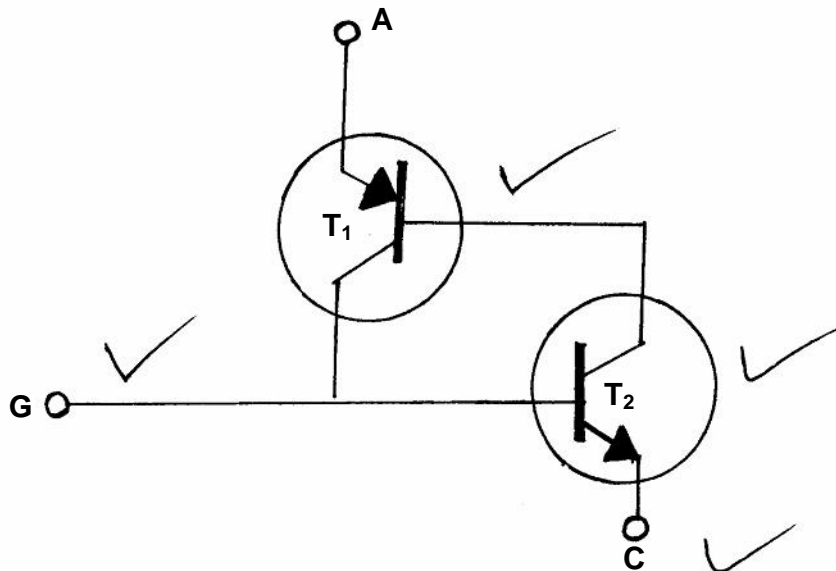
$$I_C = 6,38 \text{ mA}$$

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



(10)

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

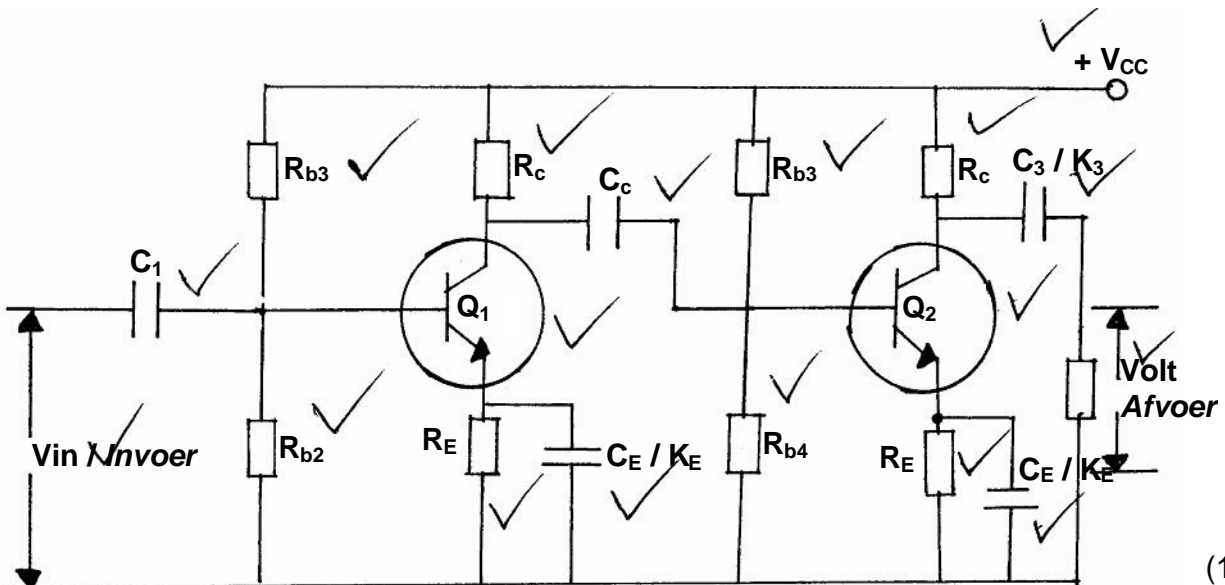


(5)
 [18]

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.

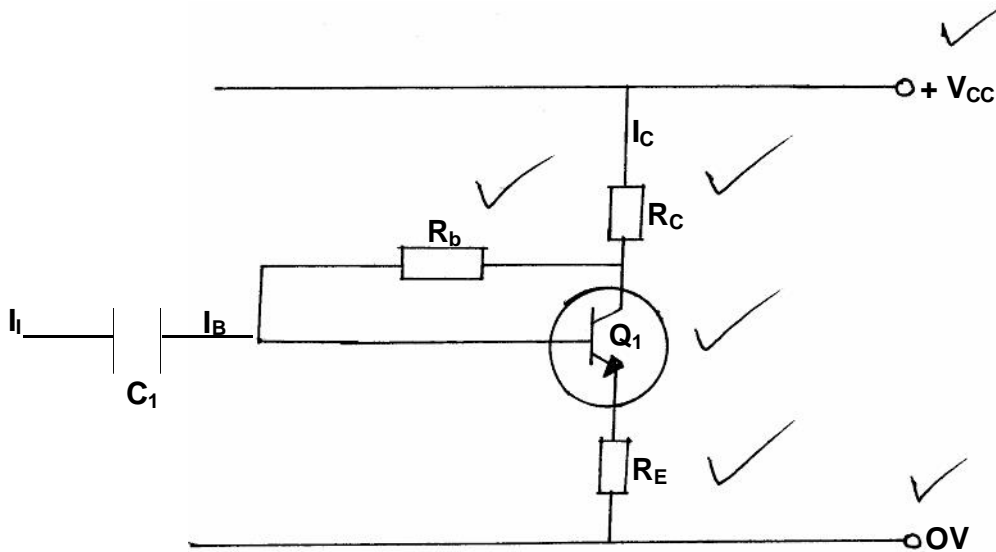
- 4.2.3 Emitter resistor provides a large deal of thermal stability to the amplifier.

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]

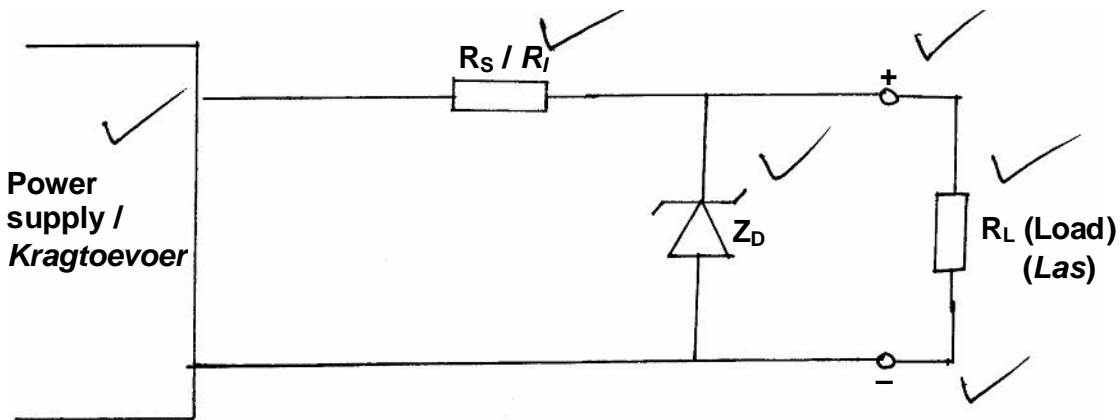
QUESTION 5 / VRAAG 5

5.1 Series regulator
Shunt regulator

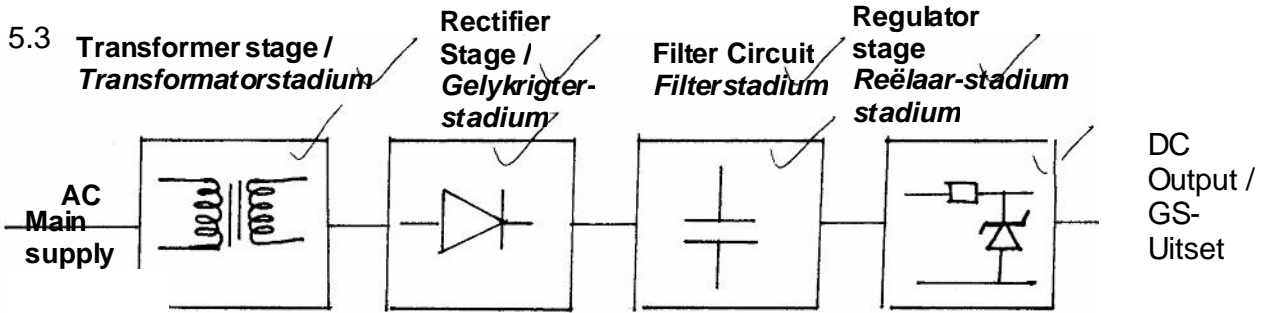
Seriëlelaar
Sjuntreëlaar

(2)

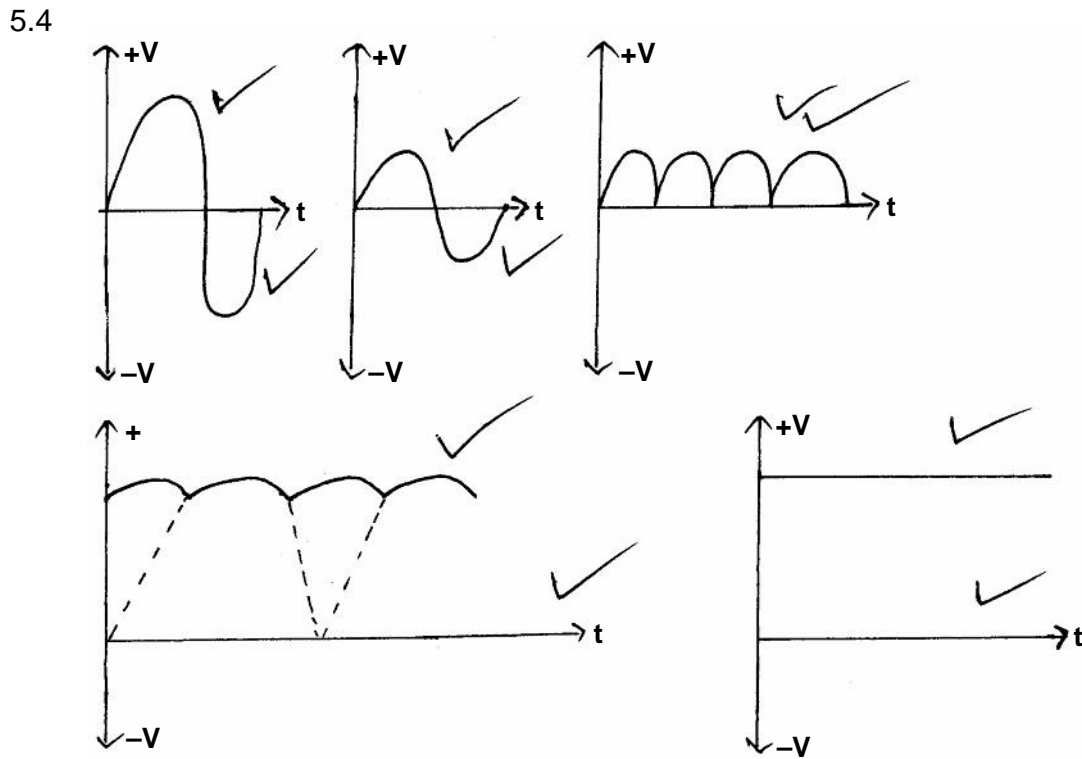
5.2 Simple zener diode regulator / Eenvoudige Zener-diode-reguleerder



(6)



(10)



(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*

*Gelykrichter – Verander die uitsetstroom-golf in ? pulserende spanning wat
slegs in die positiewe kwadrant voorkom*

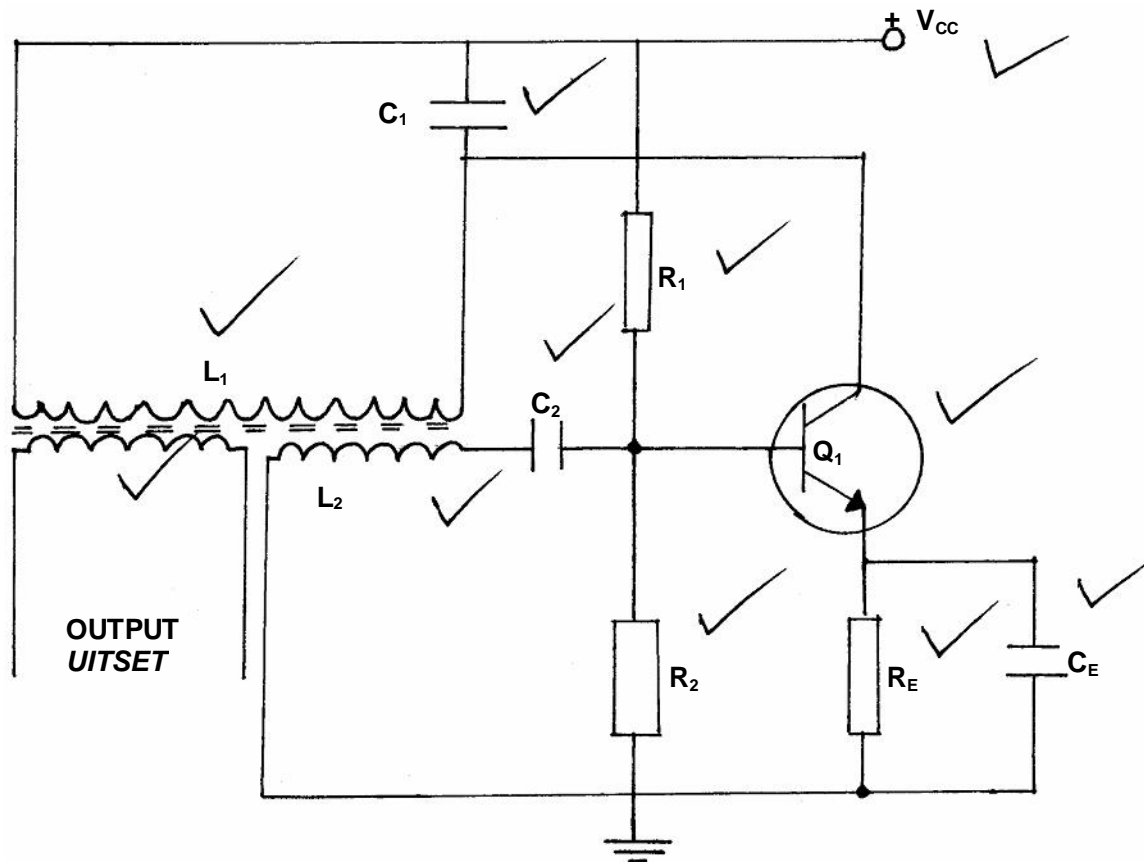
*Filter – Vlak die pulserendespanning-golf af en stryk die hoë pulserende
variasies uit*

*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

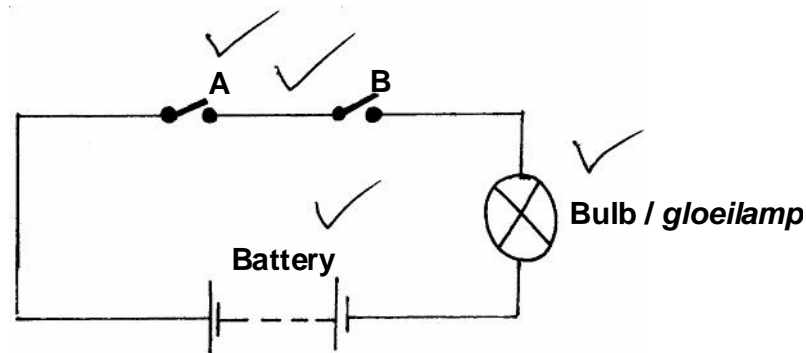
Boole-uitdrukking van die OF-HEK

$$A + B = X$$

TRUTH TABLE OF AN OR-GATE
WAARHEIDSTABEL VANDIE 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



(10)

7.2

$$AB + BC + AC = BC + AC$$

$$AB + BC + AC = BC + AC$$

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

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

$$BC(A + 1) + AC(B + 1) = BC + AC$$

$$BC \cdot 1 + AC \cdot 1 = BC + AC$$

$$BC + AC = BC + AC$$

(7)

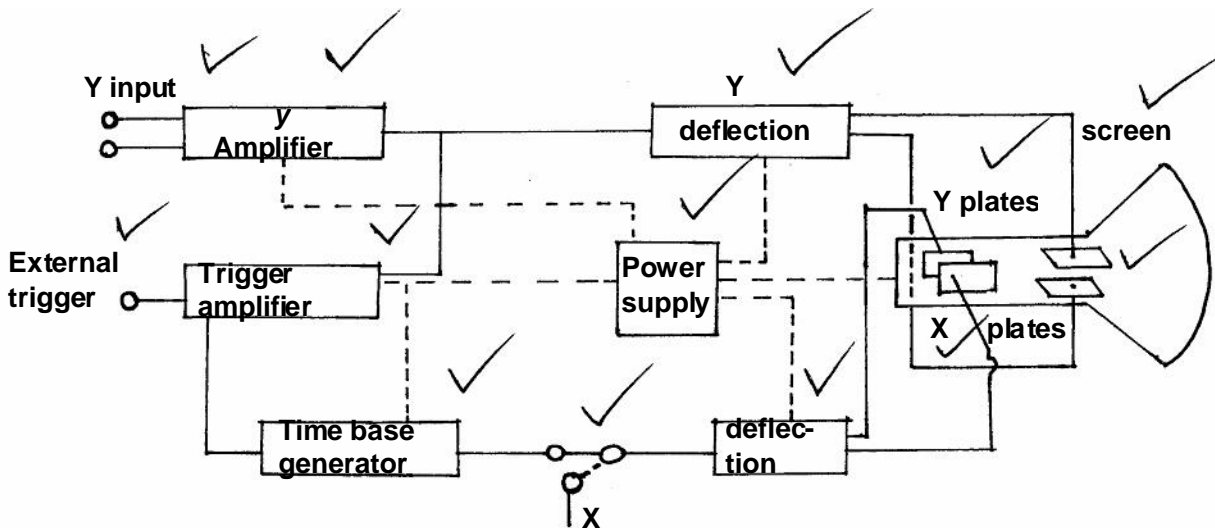
7.3

$$(A + B) + (A \cdot B \cdot C) = X$$

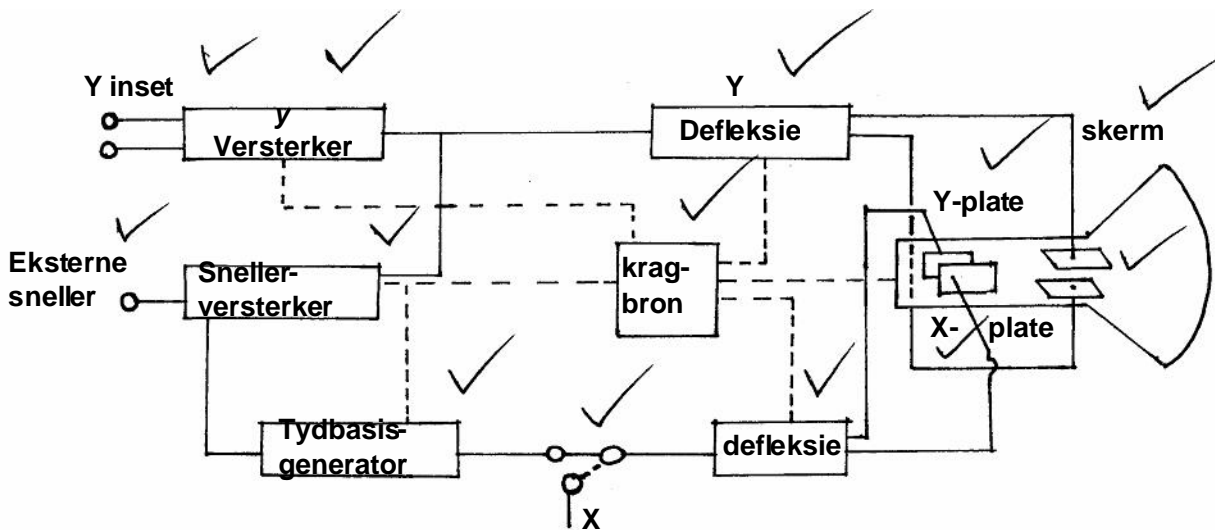
(4)

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 /
BEROEPSVEILIGHEIDSMATREËLS

- 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.*
- * *Werkwinkel moet altyd skoon wees.*
- * *Moenie in die werkwinkel 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 geïnfecteerde moeder na ongebore baba.*
- * *Deur besmette bloed wat deur ? seerplek op die vel die liggaam binnegaan.*
- * *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