GAUTENG DEPARTMENT OF EDUCATION
GAUTENGSE DEPARTEMENT VAN ONDERWYS

SERNIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

ELECTRONICS SG
ELEKTRONIKA SG

QUESTION/*VRAAG 1*

ELECTRIC CURRENT THEORY/*ELEKTRIESE STROOMTEORIE*

1.1.1 $X_C = \frac{1}{2x\Pi xFxC}$

$X_C = \frac{1}{2x\Pi x50x200x10^{-6}}$

X_C = 15,915 Ω

$X_L = 2\Pi$ F.L (Ω)

X_L = $2x\Pi x50x100x10^{-3}$ Ω

X_L = 31,416 Ω (6)

1.1.2 $Z = \sqrt{R^2 + X^2}$

$Z = \sqrt{100^2 + (15,501)^2}$

$Z = \sqrt{10\,000 + 240,28}$

Z = 101,194 Ω

$X = X_L - X_C$

X = 31,416 – 15,915

X = 15,501 Ω (4)

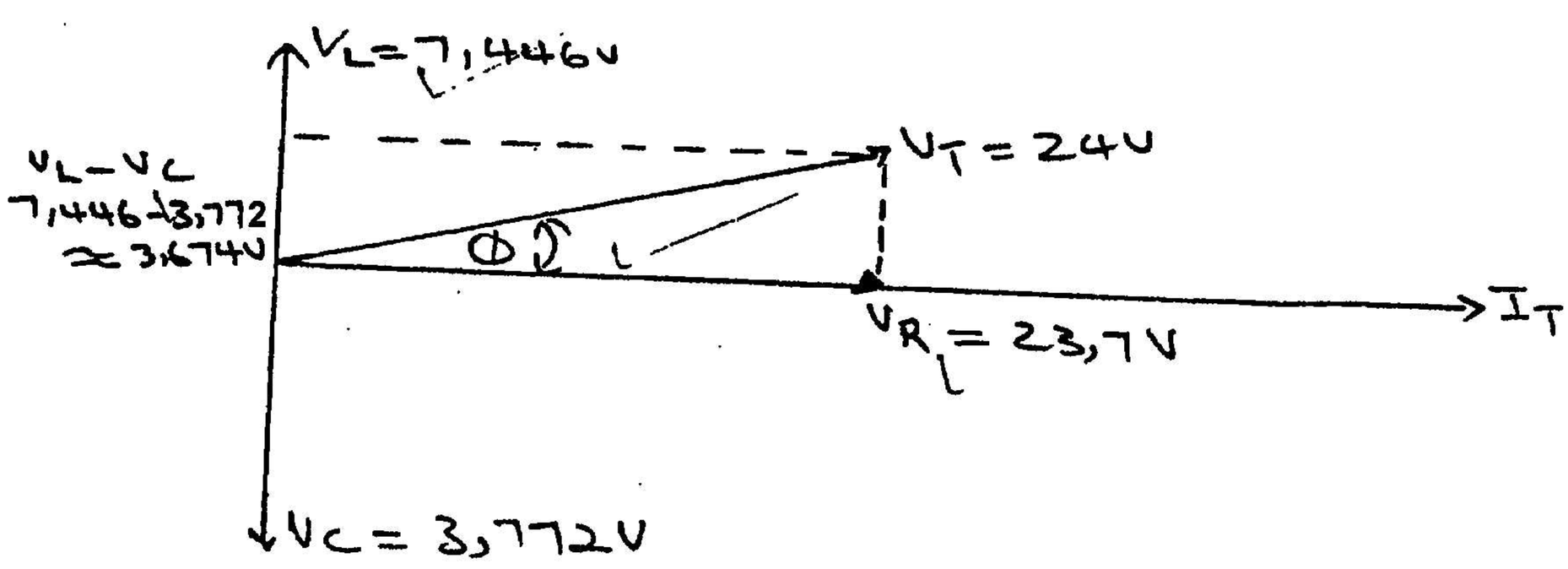
1.1.3 $I_T = \frac{V}{Z} = \frac{24\ V}{101,194\ \Omega} = 0,237$ A (3)

1.1.4 $V_R = I_T$ x R(v)
V_R = O,237x100 Ω
V_R = 23,7 V

$V_C = I_T$ x $X_{C(v)}$
V_C = 0,237 A x 15,915 Ω
V_C = 3,772 V

$V_L = I_T$ x X_L(V)
V_L = 0,237 x 31,416
V_L = 7,446 V (9)

1.2



1.3 $F_r = \frac{1}{2\Pi\sqrt{LC}}$

$F_r = \frac{1}{2\Pi\sqrt{5 \times 10^{-3} \times 10^{-6} \times 24}}$

$F_r = \frac{1}{2 \times 3,142\sqrt{120 \times 10^{-9}}}$

$F_r = 459,38$ Hz (6)

1.4 $X_L = X_C$ I = maximum
$Z = R$
$V_L = V_C$ (4)

1.5 Resonant circuits / Resonante kringe
Filter circuits / Filtreerkringe
Transmitting circuits/Senderkringe
Receiving circuits/Ontvangerkringe any two / enige twee (2)
[40]

QUESTION/*VRAAG 2*

THREE-PHASE ALTERNATING CURRENT SYSTEMS
DRIEFASIGE WISSELSTROOMSTELSELS

2.1 RYB (3)

2.2 Given data: Star-connected generator

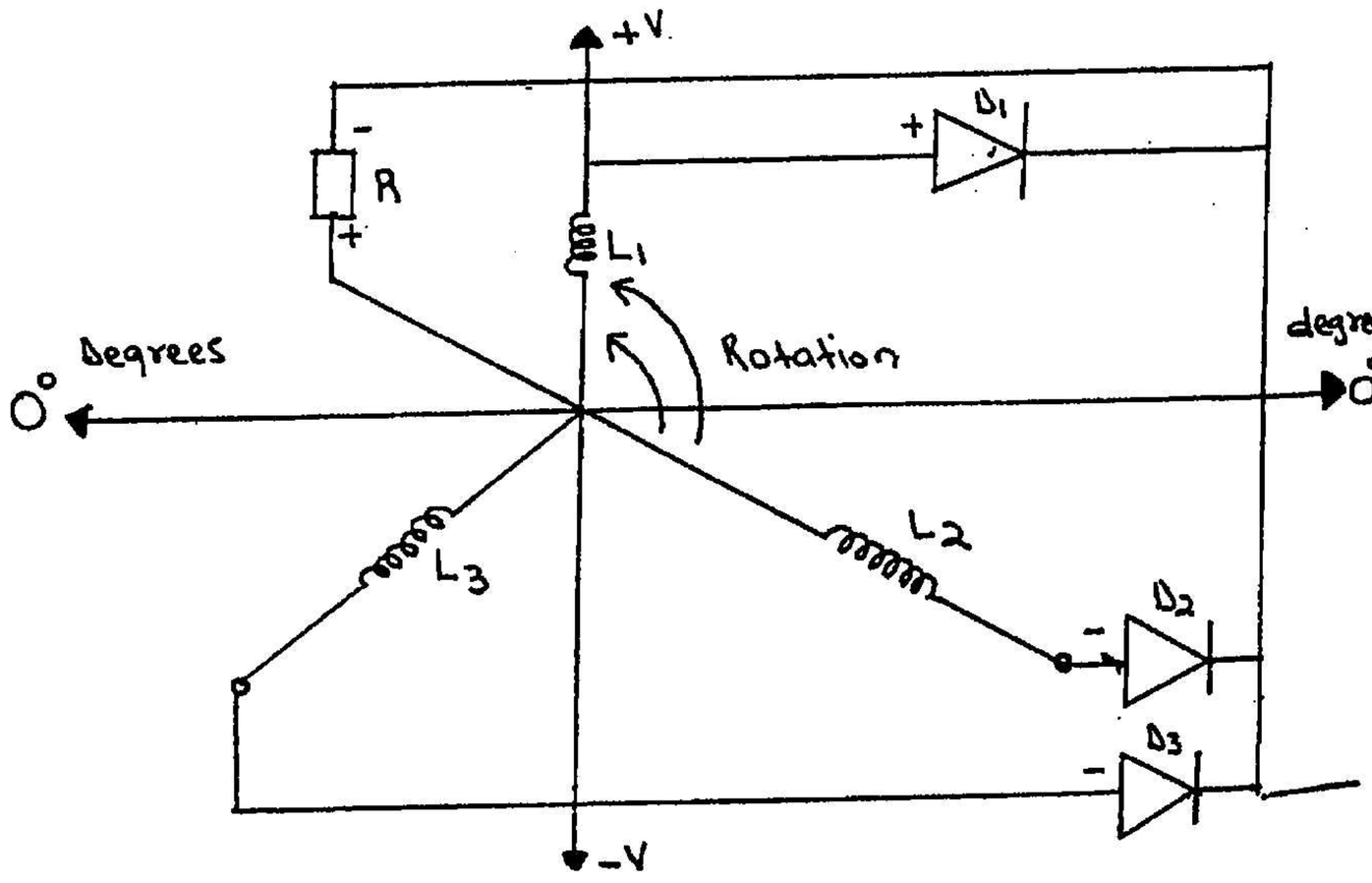
2.2.1 $V_L = \sqrt{3} \times V_p$

$\therefore Vph = \frac{V_L}{\sqrt{3}}$

$V_{ph} = \frac{400\ V}{1,732} = 230,946\ V$ (4)

2.2.2 $I_{ph} = I_L \quad \therefore I_{ph} = I_L = 30\ A$ (2)

2.3



(6)

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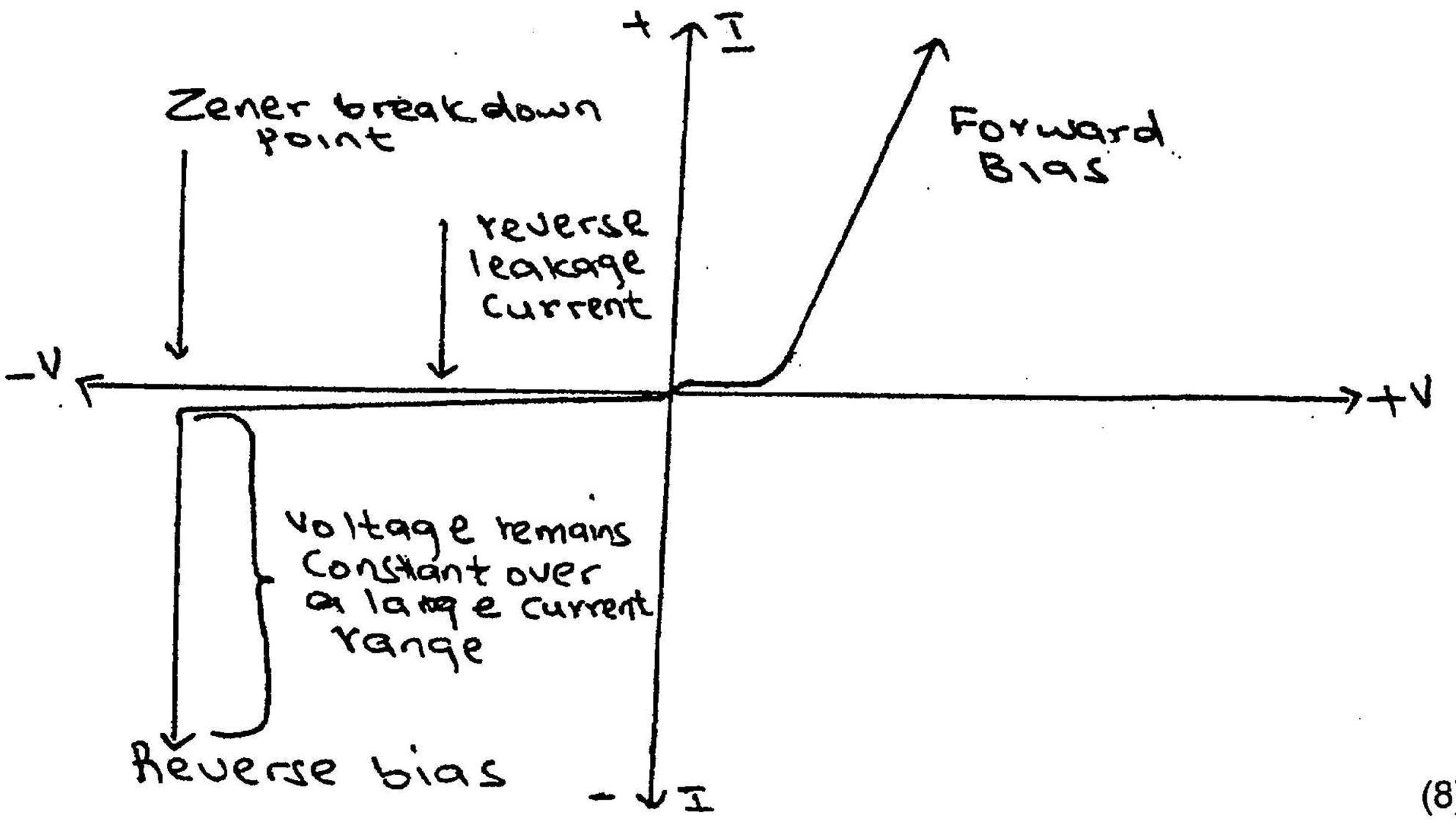
QUESTION/ *RAAG 3*
SEMICONDUCTORS / *HALFGELEIERS*

3.1 $I_E = I_B + I_C \therefore I_B = I_E - I_C = 12{,}45\ mA - 12{,}4\ mA$

$I_B = 0{,}05\ mA$

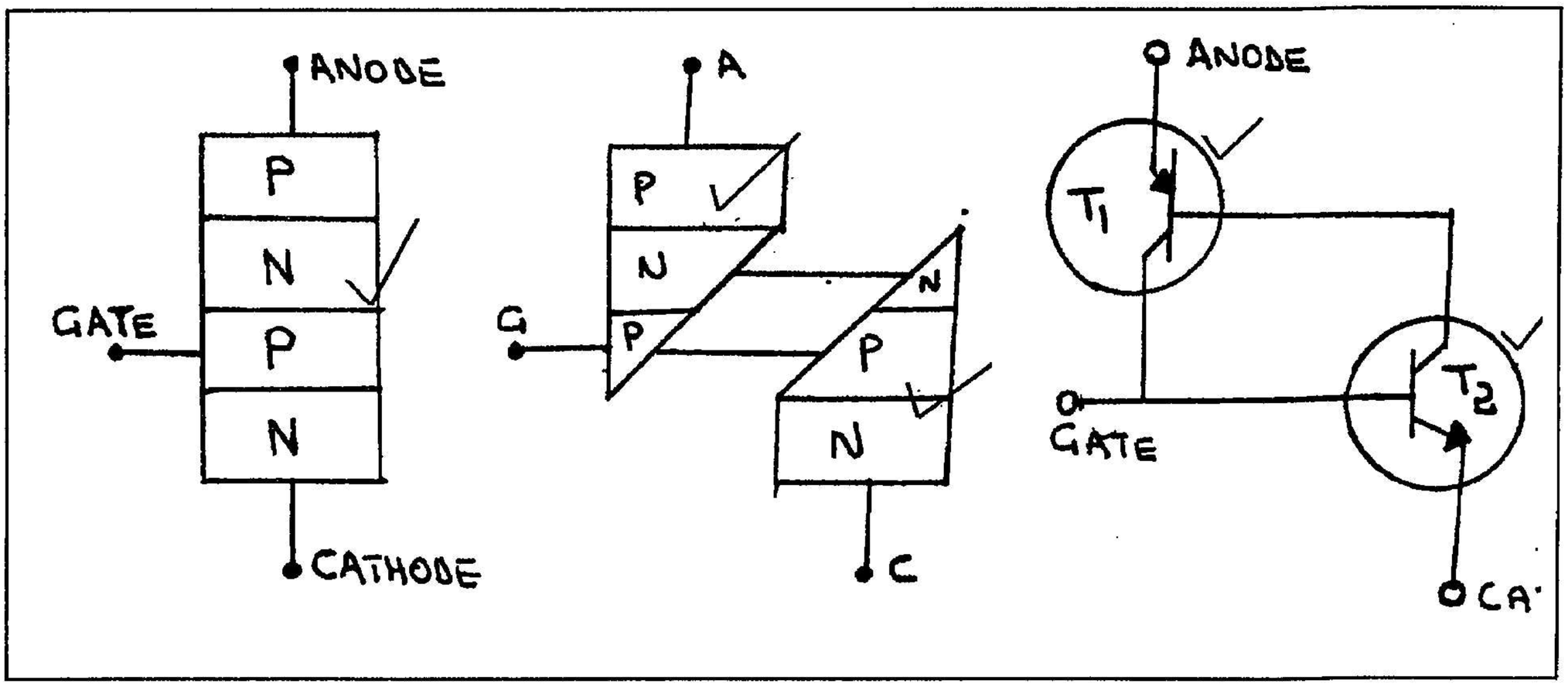
$\therefore I_B = 50\ \mu A$ (3)

3.2



(8)

3.3 SCR construction and its equivalent circuit.



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OPERATION OF THE SCR

To forward bias the SCR, a positive voltage must be applied to on the anode and a negative voltage to the cathode.✓
With no gate signal applied to the SCR, the SCR is off and will not conduct.✓
A positive gate signal will forward bias the emitter/ base junction of T2, switching it on and allowing electrons to flow from the emitter to collector of T2. ✓

The collectors of both transistors provide more than enough base current and therefore remain on with only a small anode-to-cathode voltage drop across the SCR , even if the gate pulse is removed. (6)

A small leakage current will flow when the reverse bias is applied across the SCR.✓

If the reverse bias is increased, the SCR will reach the reverse breakdown-voltage state, where the reverse current will increase sharply while the voltage stays relatively constant and this will destroy the SCR.✓

When a small forward bias is applied across the anode-to-cathode junction, a small leakage current flows, but it is not large enough to switch the SCR on. Once the positive gate signal is applied, the SCR will switch on and behave like an ordinary diode.✓

The SCR will stay on until the current through it is reduced to below the holding current. (12)

OR

TURN THE SCR ON.
By forward-biasing the anode-cathode terminal and applying a positive voltage to the gate terminals.✓✓

By raising the anode-cathode forward biasing voltage to a large positive level which will force the one reverse biased PN junction to break down.✓✓ (4)

TURN THE SCR OFF.
By reducing the SCR current below the holding current level, the SCR will reset and switch off. (2)

If the SCR terminal voltage is pulled lower than vac or even down to zero, it will in turn pull the current below the holding current and the SCR will reset and switch off.

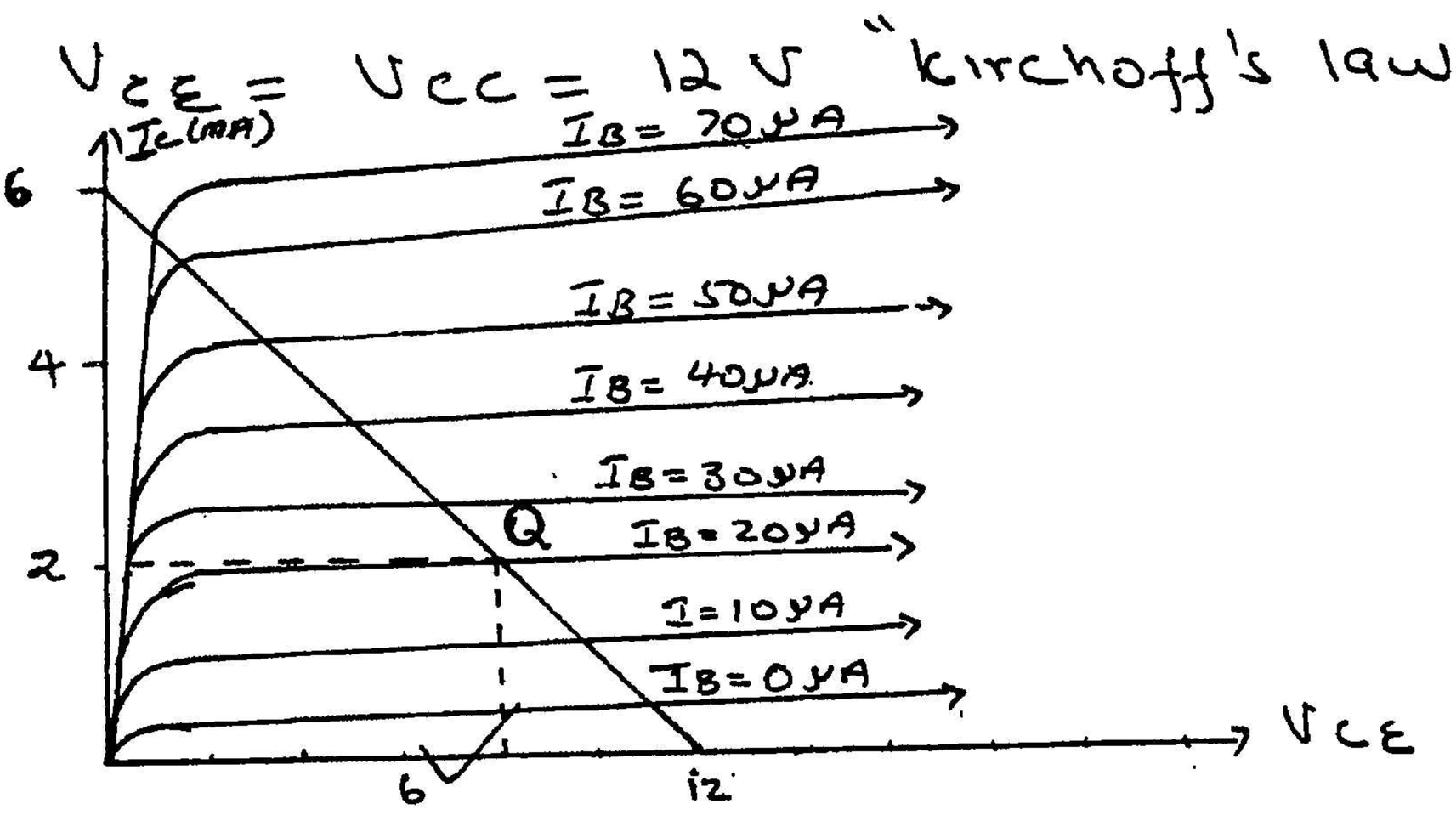
3.4 It is used as a switch to control the current flow to an AC load. (1)
[24]

QUESTION 4 / *VRAAG 4*
AMPLIFIERS */VERSTERKERS*

4.1.1 $I_C(max) = \frac{V_{CC}}{R_C} = \frac{12V}{2\,000\ \Omega} = 6\ mA$ (3)

$I_C = \beta I_B$
$= 100 \times 20\ \mu A$
$= 2\ mA$ (3)

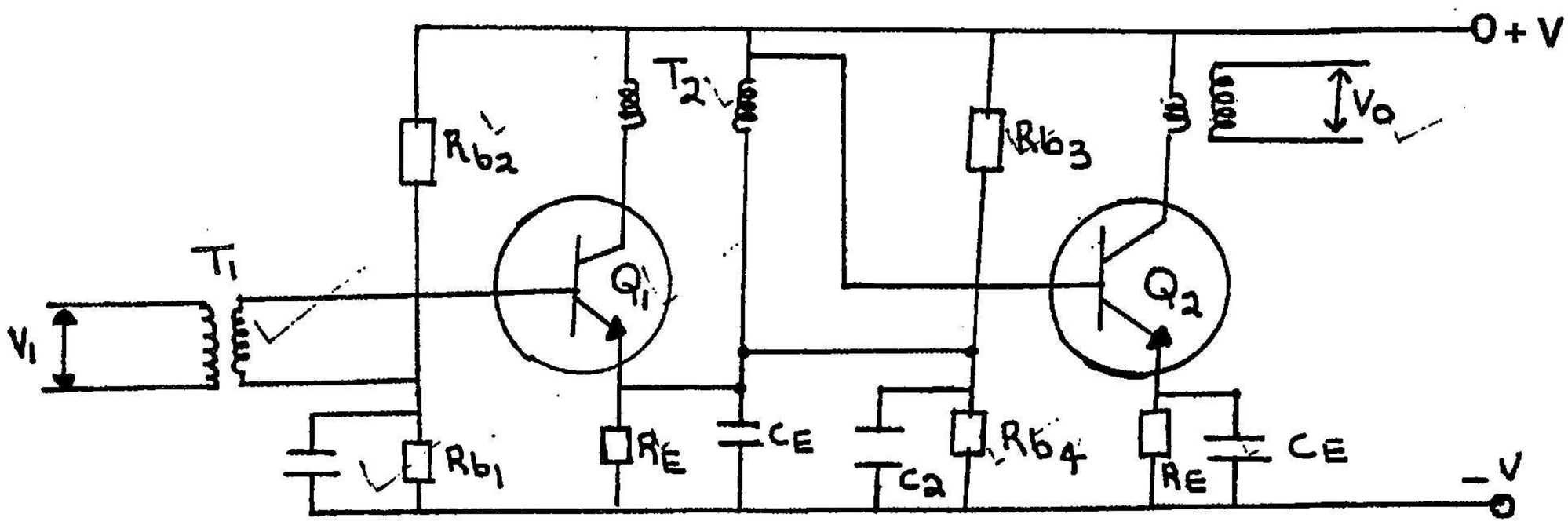
4.1.2



(7)

4.2
- Improving the amplifier's stability✓
- Increasing the amplifier's bandwidth✓ (any three / *enige drie*)
- Enhancing the amplifier's input and output impedances✓
- Reducing or suppressing any noise produced within the amplifier✓ (3)

4.3 TWO-STAGE TRANSFORMER-COUPLED NPN-TYPE TRANSISTOR AMPLIFIER



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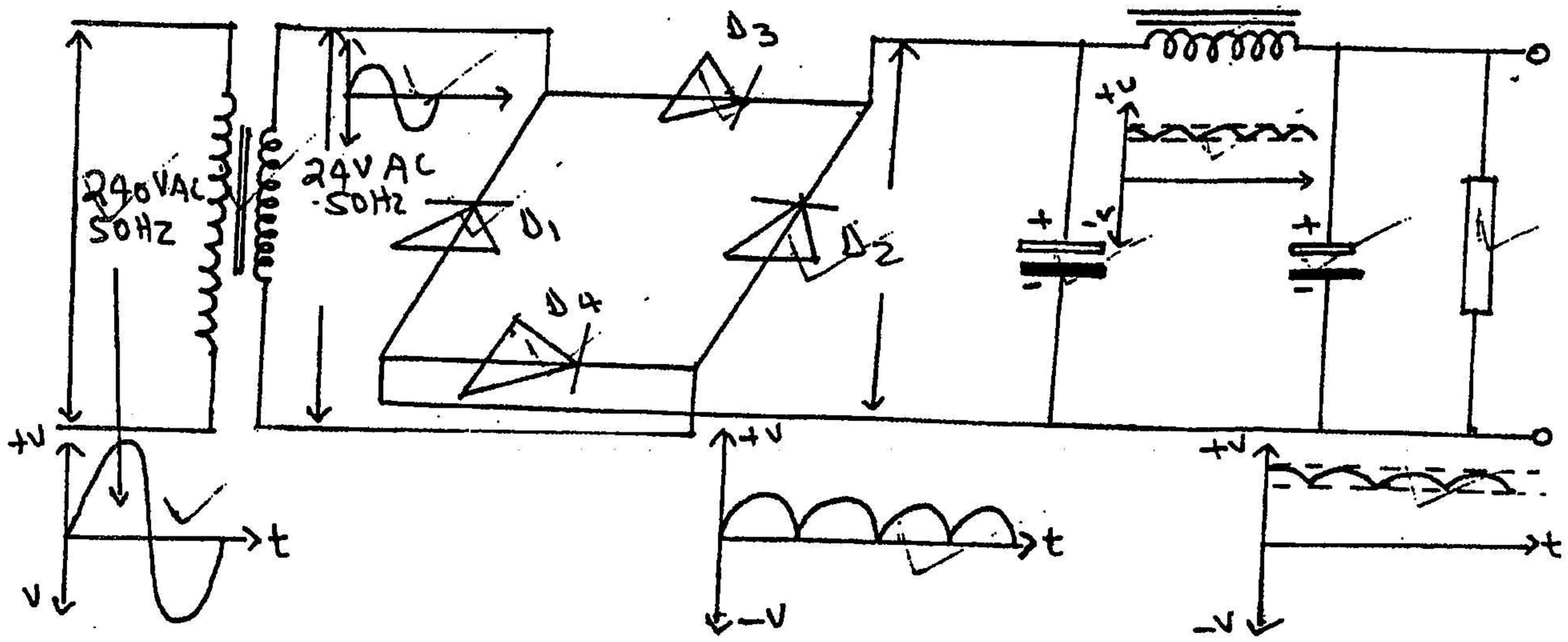
QUESTION 5 / *VRAAG 5*
SWITCHING AND CONTROL CIRCUITS / *SKAKEL- EN BEHEERKRINGE*

5.1



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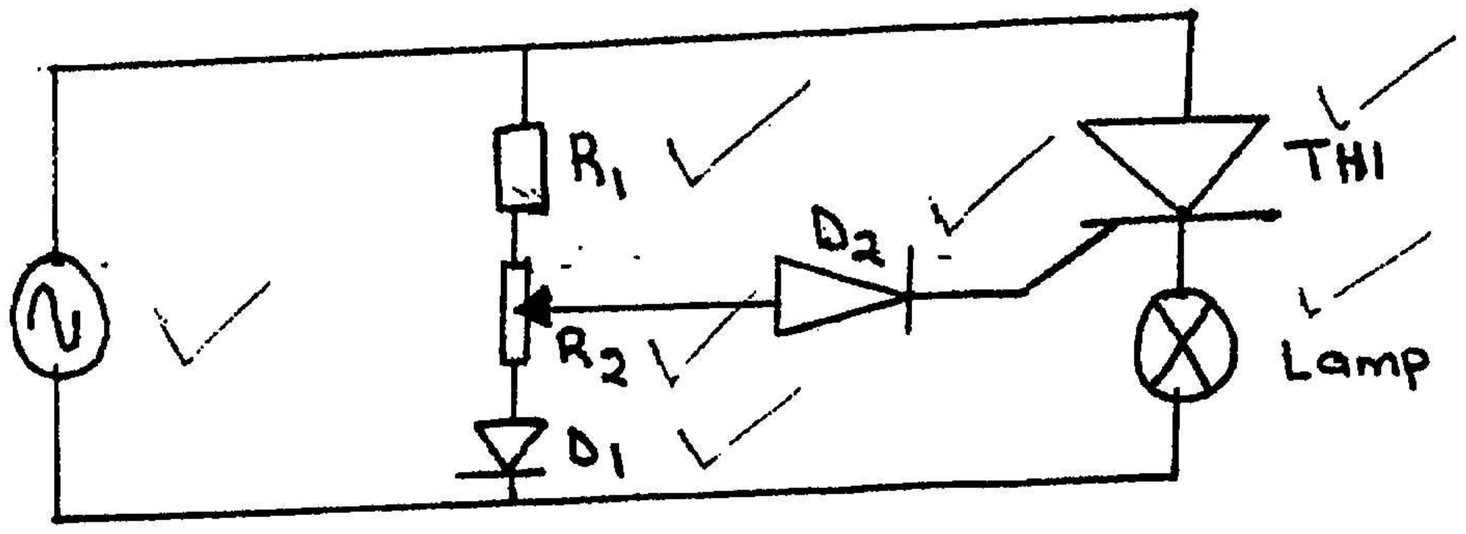
5.2



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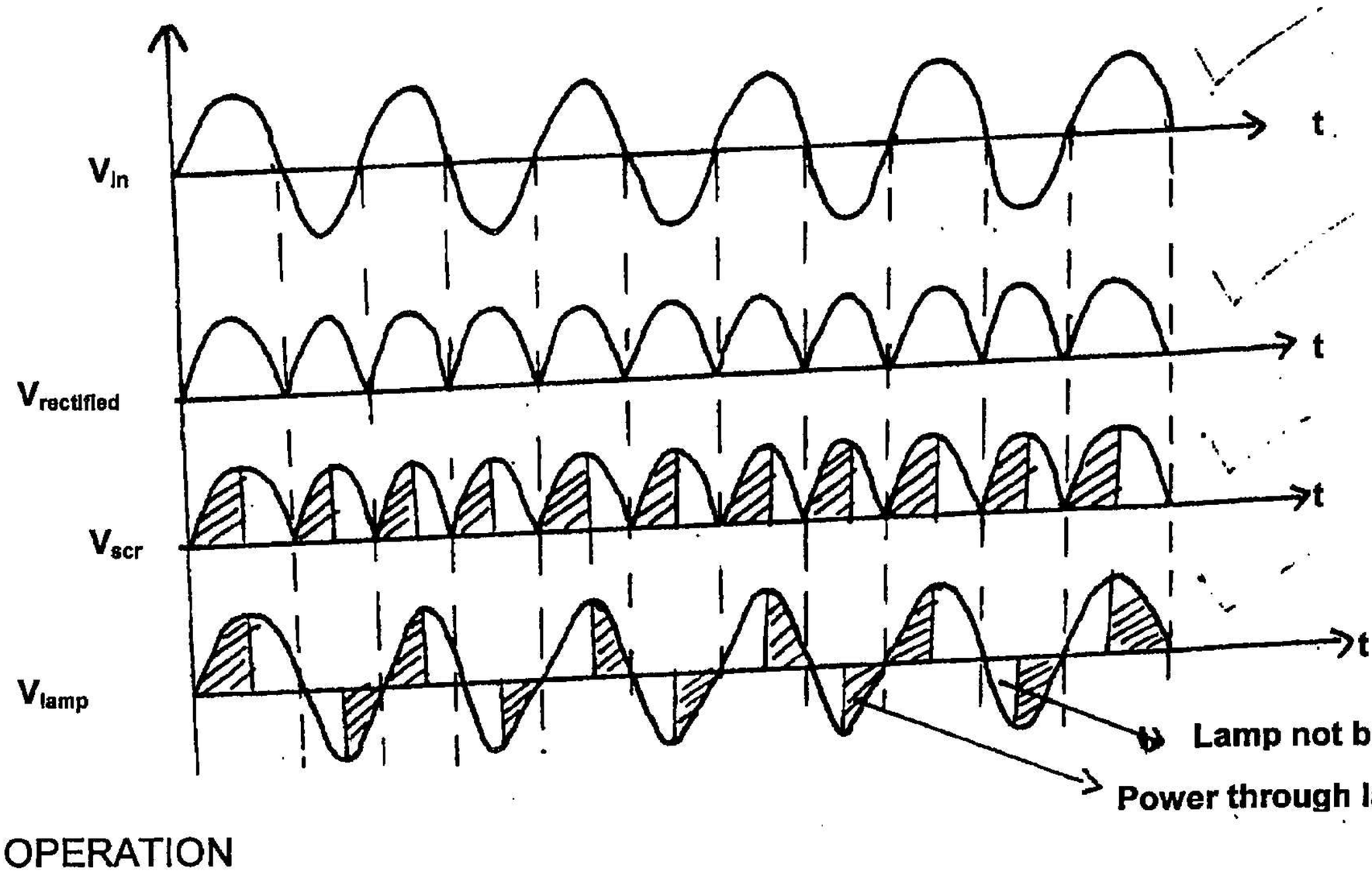


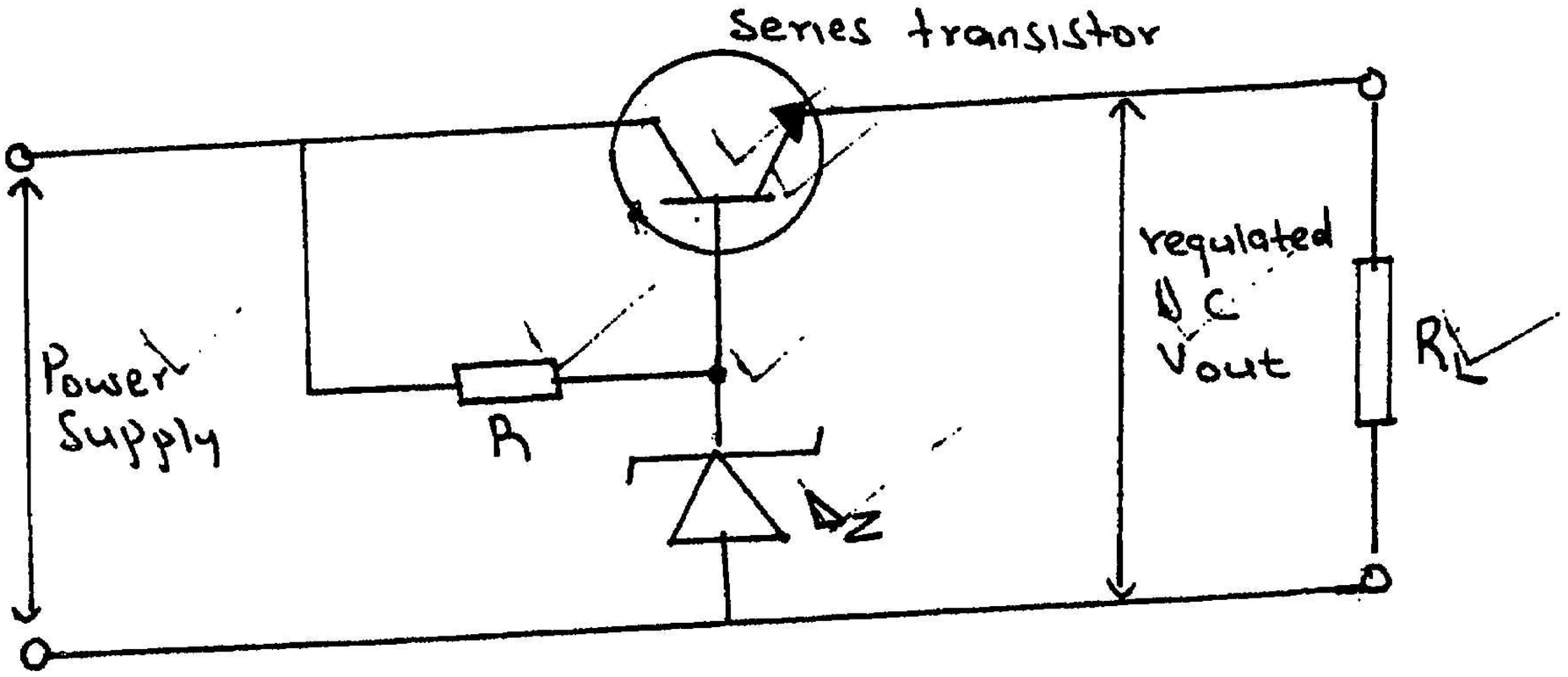
(4)

OPERATION

The. trigger angle is controlled by resistor R_2✓
Resistors R_1 and R_2 act as a voltage divider, while D_1 sets up the triggering potential. ✓
D_2 is the triggering device which conducts a positive voltage pulse to the gate only once its breakdown voltage of O,6 V is overcome. ✓
D_1 also prevents the negative half cycle of the mains waveform from appearing at the gate of the SCR. ✓
By varying R_2 the voltage level at the gate of the thyristor will vary, thus changing the trigger angle and therefore the power available to the load, giving full control over the lamp's brightness. ✓

(5)

5.3 Series regulator



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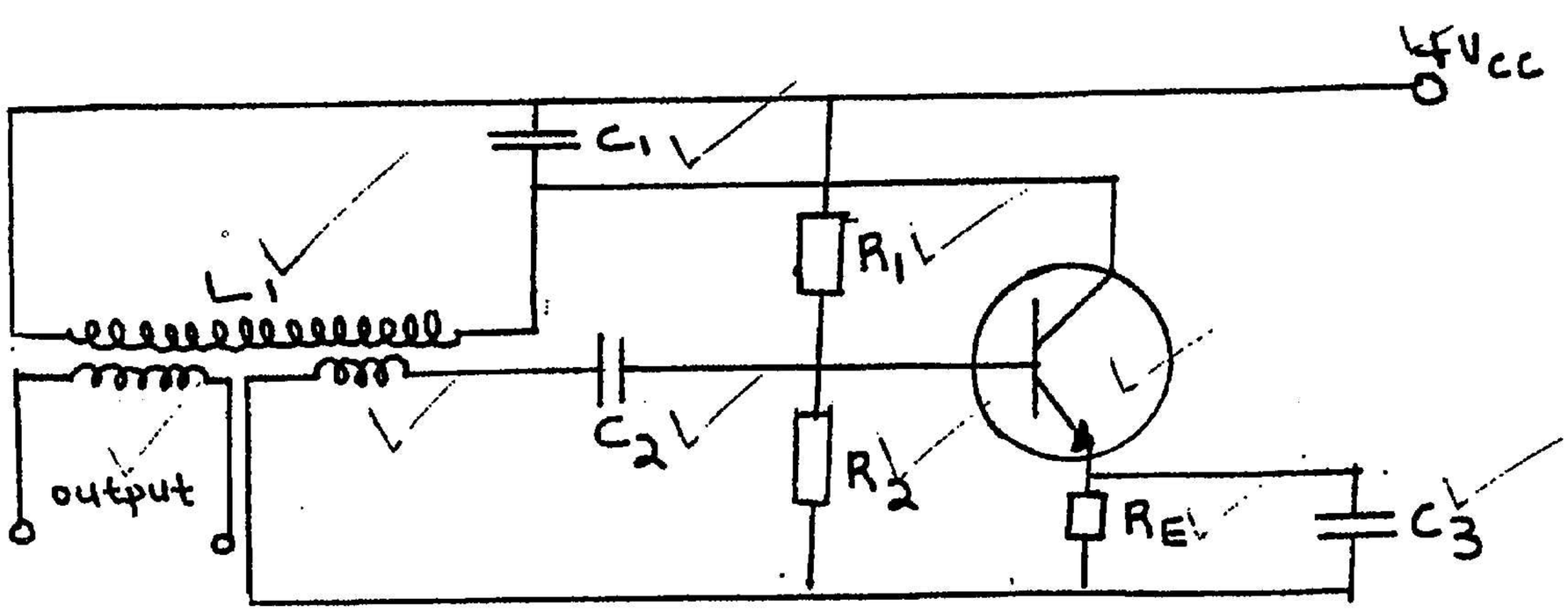
[39]

QUESTION/VRAAG 6
OSCILLATORS / *OSSILLATORS*

6.1



(11)

6.2 The ability of a crystal to develop a potential difference across its terminals when pressure is applied across it.

(2)
[13]

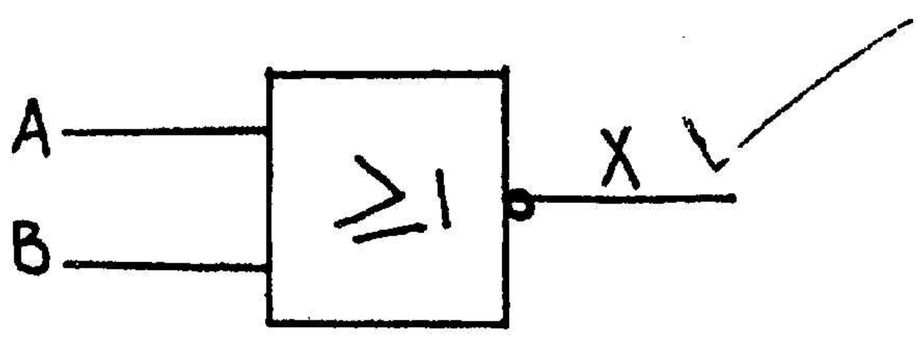
QUESTION/*VRAAG 7*
COMPUTER PRINCIPLES / *REKENAARBEGINSELS*

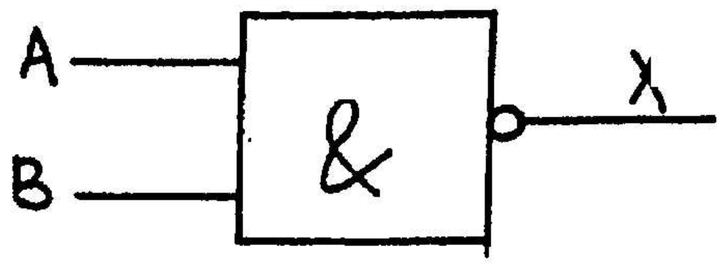
A	B	X
0	0	1
0	1	0
1	0	0
1	1	0

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

(4)

7.2





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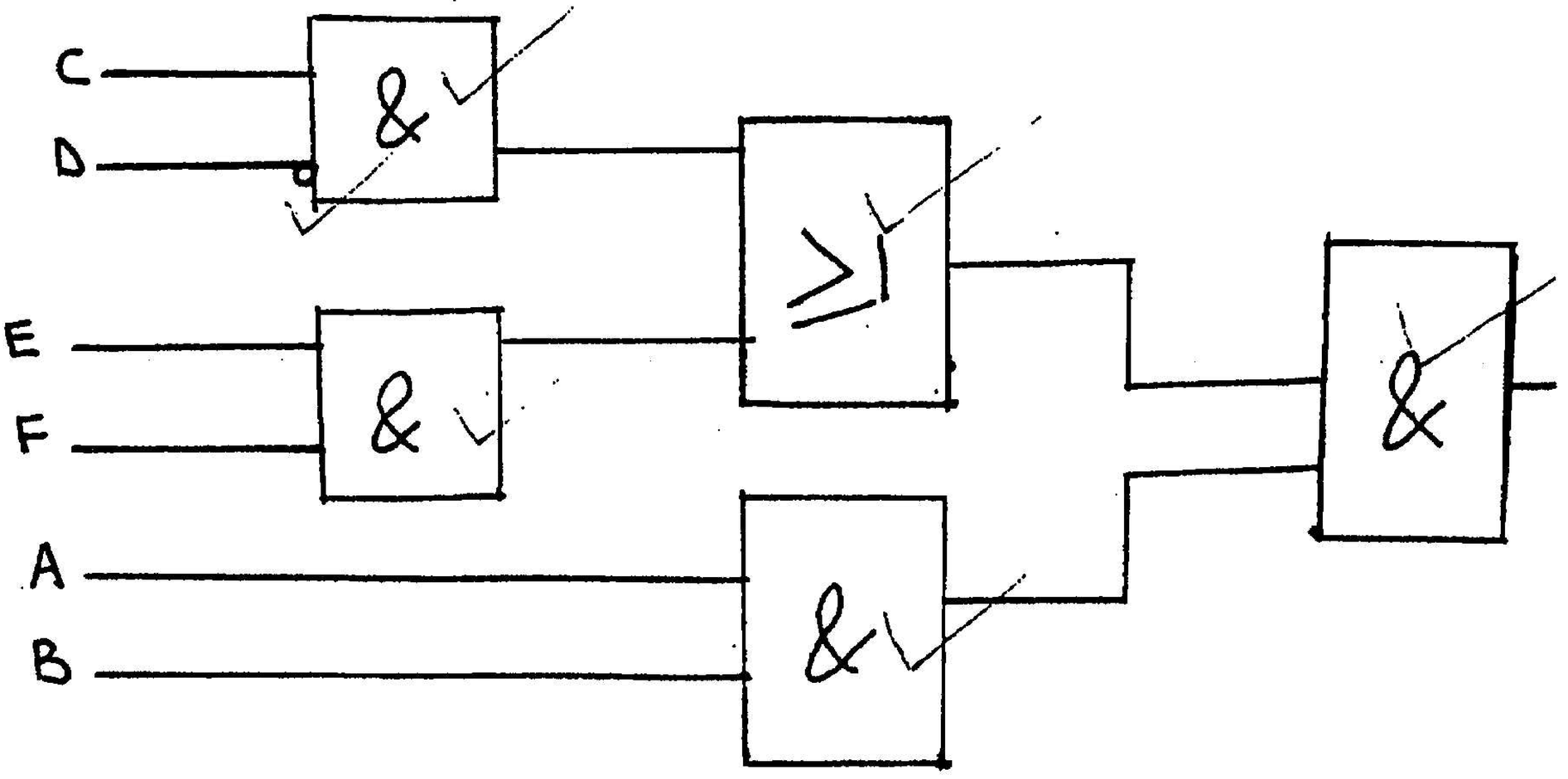

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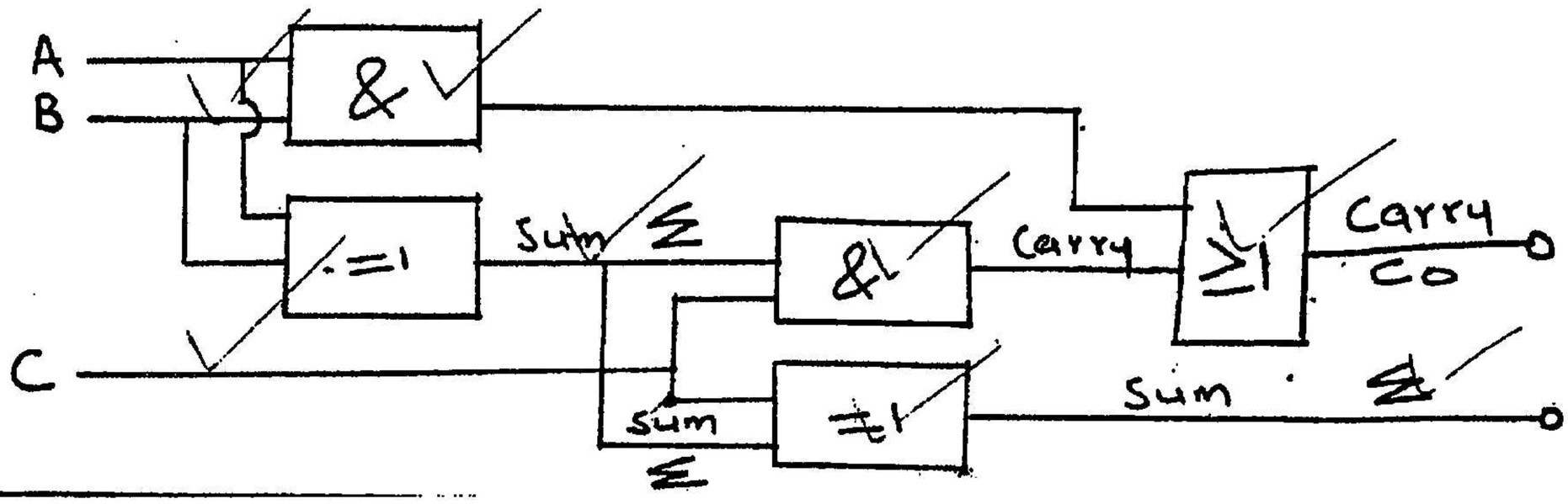
7.3 Full-Adder Circuit



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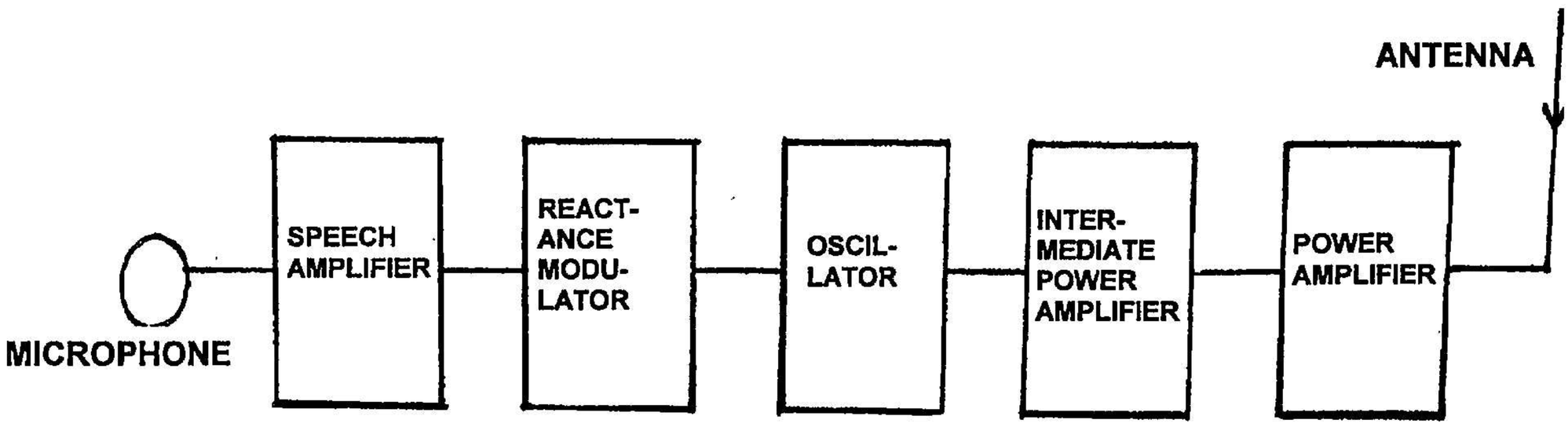
[24]

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

8.1



(7)

8.2 V = X number of divisions X Y volts/div
= 2 volts / div x 5 divisions
= 10 volts (4)

Vac(p-p)

[11]

QUESTION 9 / VRAAG 9
OCCUPATIONAL SAFETY / BEROEPSVEILIGHEID-MAATREËLS

9.1 Loose connections
Cracked broken insulations
Earth continuity
Faulty switches
Joints flexible cords
Correct polarity any two / *enige twee* (2)

9.2 Do not wear loose clothing.
Do not play In the workshop.
Check shadow board after each lesson.
Do not enter or leave the workshop without the teacher's / instructor's permission.
Keep the workshop clean and tidy.
Do not tamper with any electrical conductors, apparatus or machine in the workshop.

Protect your eyes by always wearing approved safety goggles when you are grinding or chipping. any two / *enige twee* (2)

9.3 Unprotected sex with an infected person
Sharing needles or syringes with an infected person
From infected mother to unborn child
Infected blood entering a cut or a wound on the body (2)
[6]

TOTAL: 200

END/*EINDE*