GAUTENG DEPARTMENT OF EDUCATION
GAUTENGSE DEPARTEMENT VAN ONDERWYS

SENIOR CERTIFICATE EXAMINATION
SENIORSERTIFIKAAT-EKSAMEN

TECHNIKA (ELECTRONICS / *ELEKTRONIES*) HG

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

1.1.1 $Xl = 2\Pi fl$

$2\Pi x50x20x10^{-3}$
$= 6{,}283\Omega$ (3)

$$Xc = \frac{1}{2\Pi fC} \quad (3)$$

$$= \frac{1}{2\Pi \times 100 \times 10^{-6} x\, 50}$$

$= 31{,}831\Omega \rightarrow$

$$Ir = \frac{V}{R}$$

$$Ir = \frac{10}{5}$$

$= 2A$

$$Il = \frac{V}{Xl}$$

$$= \frac{10}{6{,}283}$$

$= 1{,}592 Amp \rightarrow$

$$Ic = \frac{V}{Xc}$$

$$= \frac{10}{31{,}831}$$

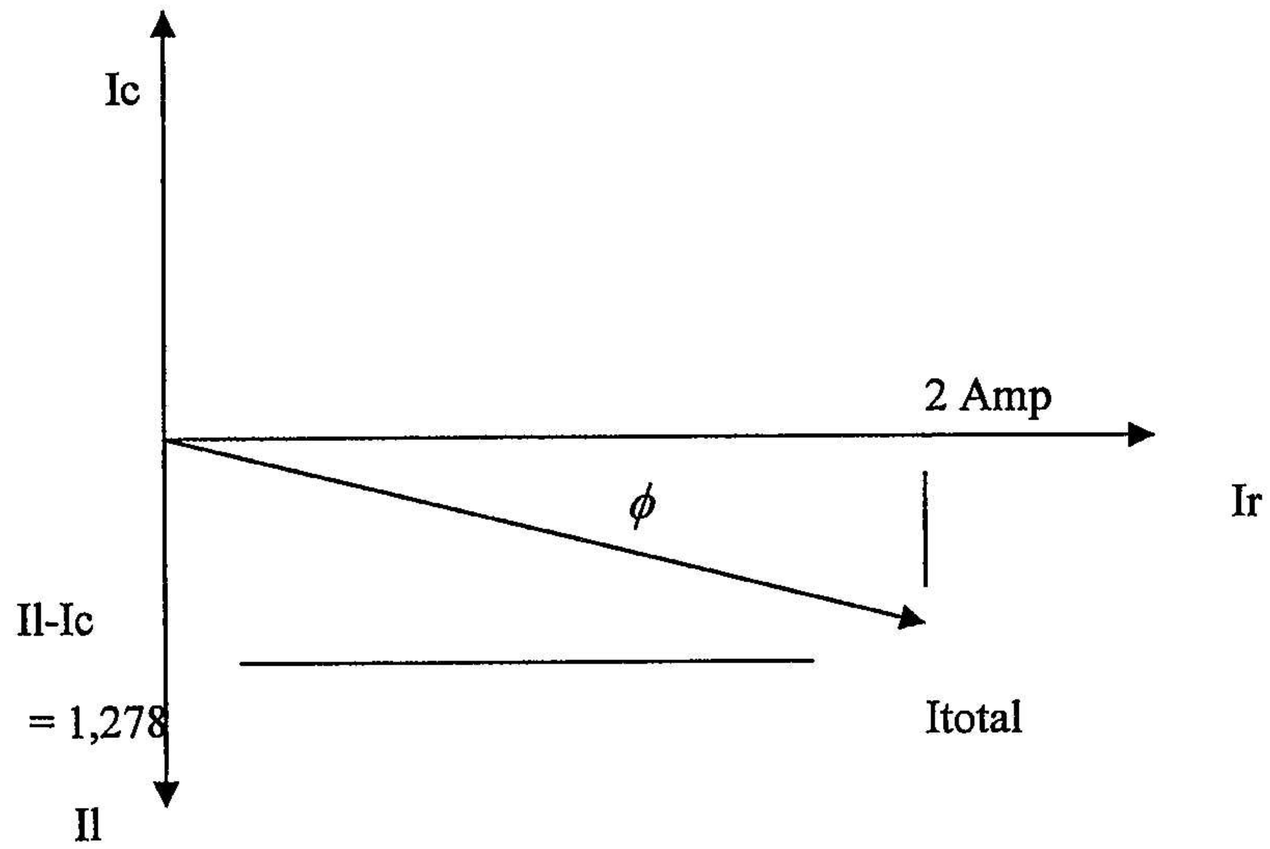
$0{,}314 Amp \rightarrow$

(9)

1.1.2 $Itotal = \sqrt{I + (Il - Ic)}$

$= \sqrt{4 + (1{,}592 - 0{,}314)}$ (3)

$= 2{,}373 Amp \rightarrow$



(6)

$$Cos\phi = \frac{Vt}{It} \qquad (3)$$

$$= \frac{2}{2,273}$$

$$\phi = 30,15$$

1.1.3 $$Z = \frac{Vt}{It} \qquad (3)$$

$$= \frac{10}{2,373}$$

$$= 4,213 \rightarrow \Omega$$

$$T = RC$$

1.2 $$C = \frac{1\times10^{-3}}{100\times10^{3}} \qquad (4)$$

$$= 0,01\mu Farad$$

1.3 $$\frac{Np}{Ns} = \sqrt{\frac{Zp}{Zs}}$$

$$\left(\frac{Np}{Ns}\right)^2 = \frac{Zp}{Zs}$$

$$Zp = Zs\left(\frac{Np}{Ns}\right)^2 \qquad (5)$$

$$= 8\left(\frac{15}{1}\right)^2$$

$$= 1{,}8K\Omega \rightarrow$$

[39]

QUESTION / *VRAAG* 2

SEMICONDUCTOR DEVICES / *HALFGELEIER-TOESTELLE*

2.1.1 LED / *Liguitstralende Diode* (2)

2.1.2 NPN Transistor (2)

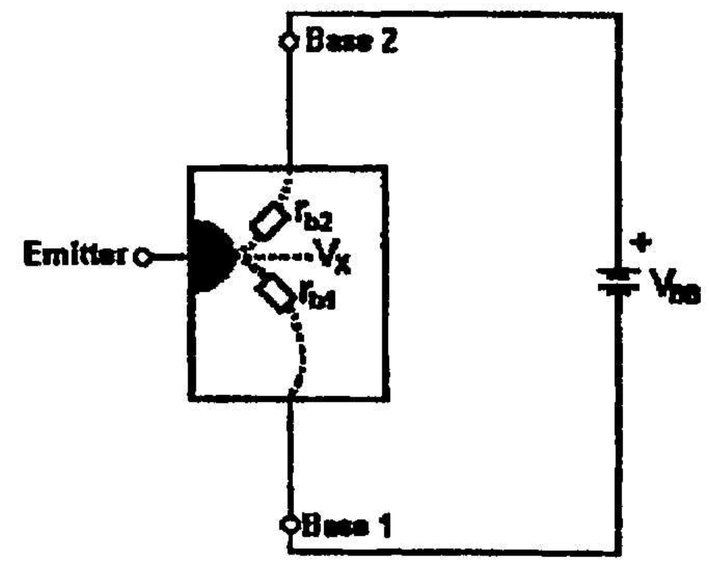
2.1.3 5pF – 140pF Variable Capacitor / *Verstelbare Kapasitor* (4)

2.1.4 Diode (1)

2.1.5 Inductor with pre-set adjustment / *Spoel met 'n voorafbepaalde verstelling* (3)

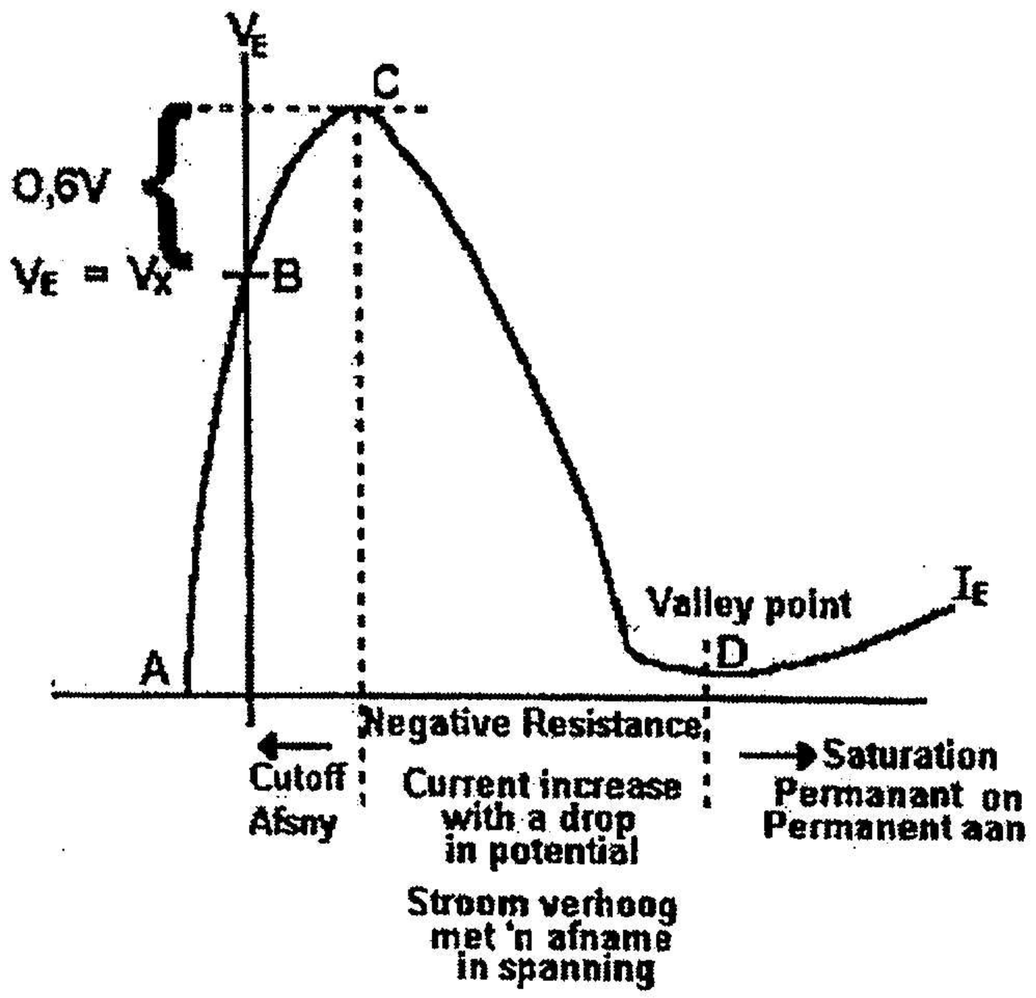
- Three terminal device. / *Drie terminaal komponent.*
- Only one junction between P- and N type material. / *Een aansluitingsvorm tussen die P- en N - tipe materiaal.*
- Consist of P- and N – type material / *Bestaan uit N – en P tipe materiaal*

Operation / Werking



Once a supply voltage is coupled to terminals B_1 and B_2 of the doped bar, this forms a resistance with a volt drop down the length of the bar. The bar naturally divides into two resistance between its ends and the central heavily doped p emitter region. These resistance, r_{b1} and r_{b2} lie from this point down to B_1 and the other up to B_2. When an external voltage is applied these two resistors form a potential divider within the bar which sets up an exact voltage V_x at the emitter pn junction. / *Sodra 'n toevoerspanning aan terminale B_1 en B_2 van die gebalanseerde staaf gekoppel word, vorm dit 'n spanningsval langs die lengte van die staaf. Die staaf verdeel die spanning natuurlik in twee weerstande op sy twee punte en die middel is swaar gebalansseerd in emittorstreek p. Die weerstande r_{b2} en r_{b2} is voorheen B_1 en B_2. Wanneer 'n uitwendige spanning op die twee weerstande toegepas word vanaf 'n potensiaal verdeler in die staaf, sal 'n presiese spanning V_x by die emitter se onskakeling vorm.*

- Emitter – Base 1 = Forward bias. / Emitter – 1 – Voorgespan.
- Emitter – Base 2 = Reverse bias. / Emitter – Basis 2 = Teenvoorgespan.
- Positive puls on Emitter. / Positiewe pulse op Emitter.



(15)

2.3

- Transport in anti-static containers / *Vervoer in anti-statiese houers.*
- Store unutilized units in conductive sponge / *Ongebruikte eenhede moet in geleide spons gestoor word.*
- Use earthed points soldering irons / *Soldeerboute moet geaard wees.*
- Use specially earthed wristbands / *Gebruik geaarde gewrigsbande.*
- Connect all test equipment to earth / *Aard alle toetstoerusting.*
- All unutilised inputs must be connected to Vdd or Vss / *Ongebruikte insette moet verbind word aan Vdd of Vss.*

Any Four / *Enige Vier* (4)

2.4.1 SCR enters into conduction / *BSG begin om te gelei.* (2)

2.4.2 The minimum current required to keep the SCR on / *Die minimum stroom wat benodig word om die BSG aan te hou.* (2)

2.4.3 The open circuit condition of the SCR / *Die oopbaan-toestand van die BSG.* (2)

2.4.4 If the specific voltage is exceeded, then the SCR will be destroyed. / *Wanneer hierdie spanning oorskry word, word die BSG vernietig.* (2)

[39]

QUESTION / VRAAG 3

AMPLIFIERS / VERSTERKERS

3.1

$$Ve \cong \frac{1}{10} \times (Vcc)$$

$$\cong \frac{1}{10} \times (20)$$

$$\cong 2\,Volt \rightarrow$$

(3)

$$\text{Re} = \frac{Ve}{Ic}$$

$$= \frac{2}{5 \times 10^{-3}}$$

$$= 400\,\Omega \rightarrow$$

Note / neem kennis: Ic = Ie

(4)

$$\text{Rc} = \frac{Vc}{Ic}$$

$$= \frac{8}{5 \times 10^{-3}}$$

$$= 1{,}6\ K\Omega \rightarrow$$

Vcc = Vc + Vce + Ve

Vc = Vcc – (Vce + Ve)

= 20 – (10 + 2)

= 8 Volt $\longrightarrow$

(7)

$$Rc = \frac{Vb}{Ib}$$

$$= \frac{17{,}3}{55{,}56 \times 10^{-6}}$$

$$= 311 K\Omega \rightarrow$$

Vb = Vcc – (Ve + Vbe)

= 20 – (2 + 0,7)

= 17,3 Volt $\longrightarrow$

$$\text{B} = \frac{Ic}{Ib}$$

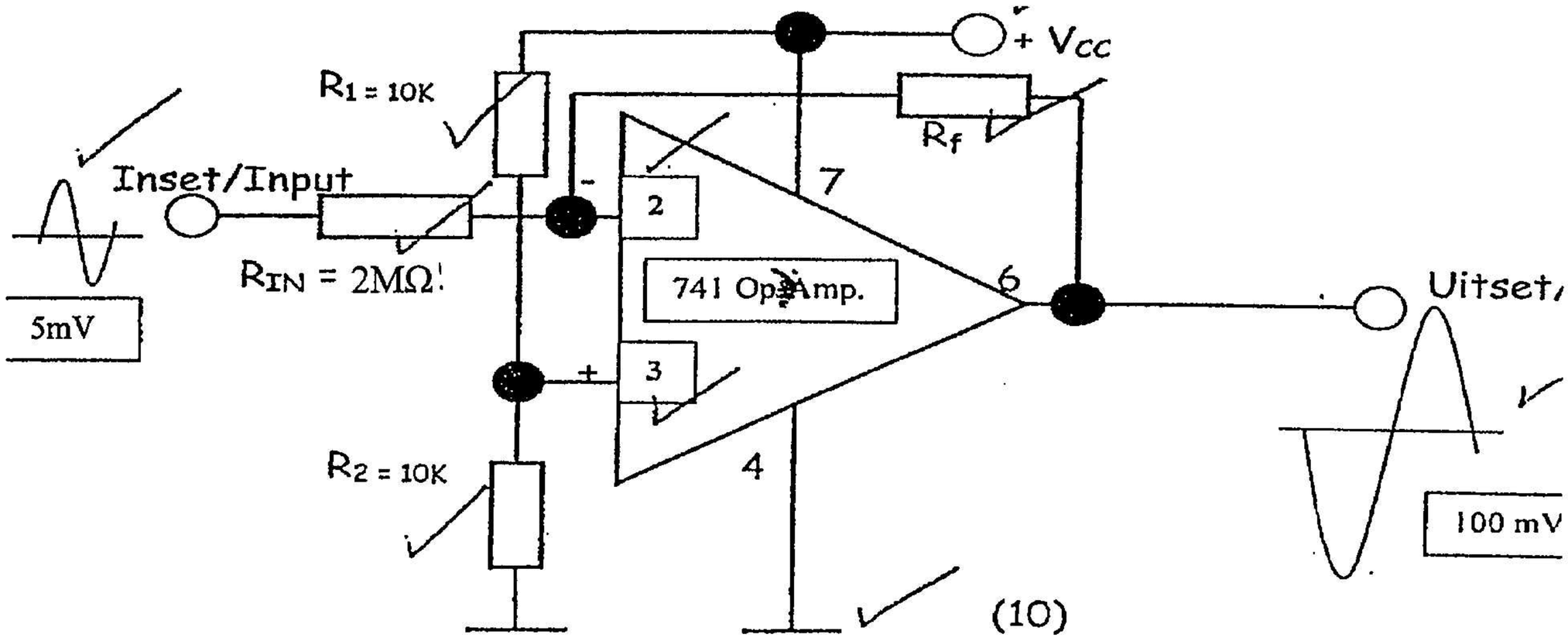
$$Ib = \frac{Ic}{\text{B}}$$

$$= \frac{5 \times 10^{-3}}{90}$$

$$= 55{,}56\,\mu Amp \rightarrow$$

(9)

3.2.



(10)

$$A = \frac{Rf}{Rin}$$

$$Rf = A \times Rin$$

$$= 200 \times 10^{6}\, x2$$

$$= 400M\Omega \rightarrow$$

$$Av = \frac{Vout}{Vin}$$

$$= \frac{1}{5 \times 10^{-3}}$$

$$= 200 \rightarrow$$

(7)

[40]

QUESTION / VRAAG 4

SWITCHING AND CONTROL CIRCUITS / SKAKEL EN BEHEERKRINGE

4.1

- R2 adjusts the speed and has a direct influence on the time constant. T = C1 x R2.
  R2 verstel die spoed en het 'n direkte invloed op die tydkonstante.

- Diode A14B ensures a positive pulse to the gate terminal of the SCR to switch the SCR on. / *Diode A14B verseker dat 'n positiewe puls na die BSG se hekterminaal gestuur word, om die BSG aan te skakel.*

- The 2 micro-farad capacitor prevents any circuit transients that could switch the SCR accidentally on. */Die kapasitor van 2 mikrofarad, voorkom dat enige transiente die BSG per ongeluk kan aanskakel.*

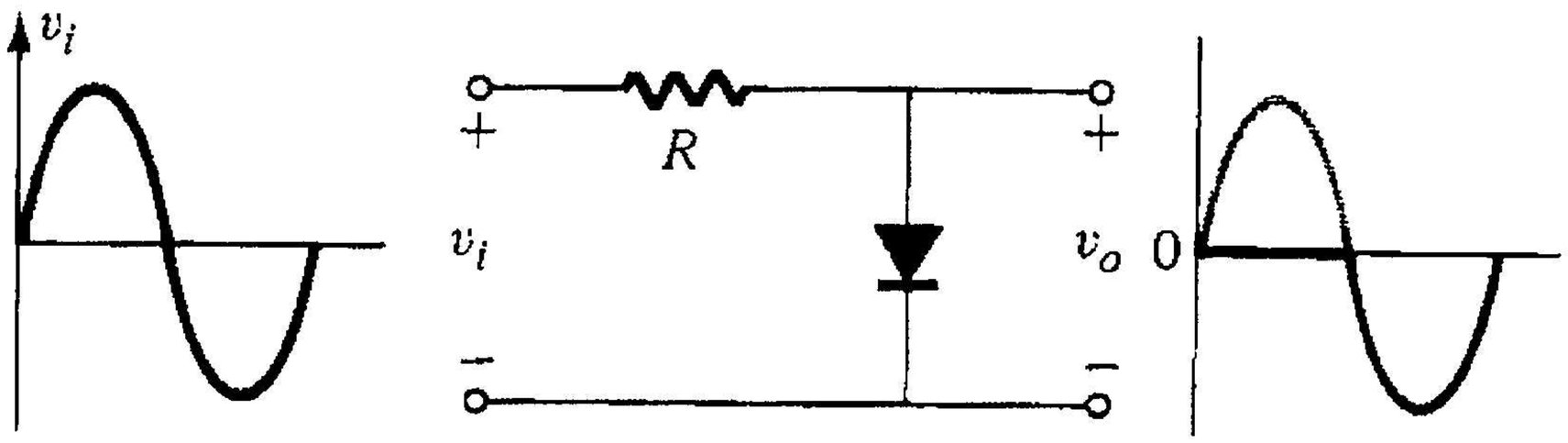
- Full speed may be achieved by closing switch S1, thus bypassing the SCR.
  Volspoed kan bereik word deur skakelaar S1 te sluit en sodoende die BSG te omtak

4.2 As long as the receiver is on the hook, the phone line voltage will be high, causing the optocoupler to conduct and the relay to remain off. Via the relay contacts, the radio is then connected to the loudspeakers in the normal fashion.
Once the receiver is lifted, the situation reverses with R2 pro-viding enough base current for T1 to start conducting. With the relay energized, the contacts connect 22-Ω resistors in series with the loudspeakers lines, causing much reduced volume and allowing you to complete the phone call without yelling.
Switch S1 when closed defeats the action of the optocoupler and so acts as a 'bypass' control.
The relay may be 12-volt type with two change-over (c/o) contacts or just two make contacts. Preset P1 is adjusted until the relay comes on reliably when the receiver is lifted.
Finally, of the two alternatives shown in the circuit diagram, only the CNY17-2 optocoupler will provide an isolation voltage specification compliant with Class 2 equipment. The 4N35 will still satisfy Class 1, however.
The circuit is conveniently and safely powered from a batery eliminator (a.k.a. mains adaptor) with a (loaded) output voltage of about 12 VDC.

Terwyl die gehoorstuk op die mikkie is, sal die lynspanning van die telefoon hoog wees, wat die optiese koppelstuk laat gelei en die relê af laat bly.
Deur middel van die relêkontakte word die radio nou op gewone manier met die luidsprekers verbind.
Sodra die gehoorstuk gelig word, keer die situasie om met R2 wat genoeg basisstroom voorsien dat T1 kan begin gelei. Met die relê bekrag, verbind die kontakte 22 Ω – resistors in serie met die luidsprekerkabels, wat die volume baie versag en jou toelaat om jou oproep af te handel sonder om te skreeu.
Skakelaar S1 maak die werking van die optiese koppelstuk tot niet en dien as 'n omleibeheer.
Die relê kan die 12-volt-tipe wees met twee oorskakelkontakte of net twee sluitkontakte. Voorafstelling P1 word verstel totdat die relê betroubaar inskakel sodra die gehoorstuk gelig word.
Ten slotte, van die twee alternatiewe wat in die kringdiagram getoon word, sal slegs die CNY17-2 koppelstuk 'n isolasiespanningsspesifikasie bied wat voldoen aan Klas 2-toerusting. Die 4N35 sal egter aan Klas 1 voldoen.
Die kring is gerieflik en word veilig bekrag vanaf 'n battery-eliminator (m.a.w. hoofkragbron) met 'n gelaaide uitsetspanning van nagenoeg 12 VDC.

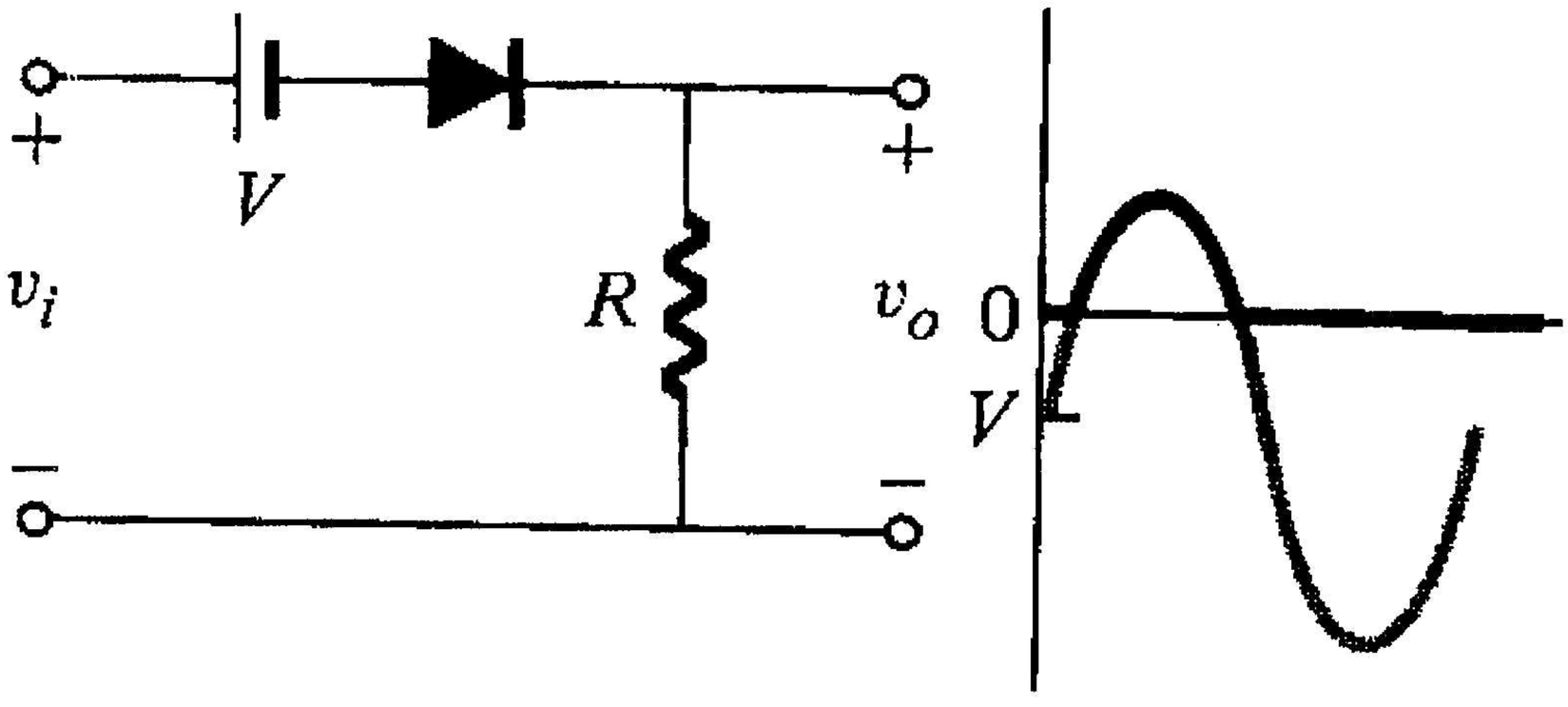
(12)

4.3.1



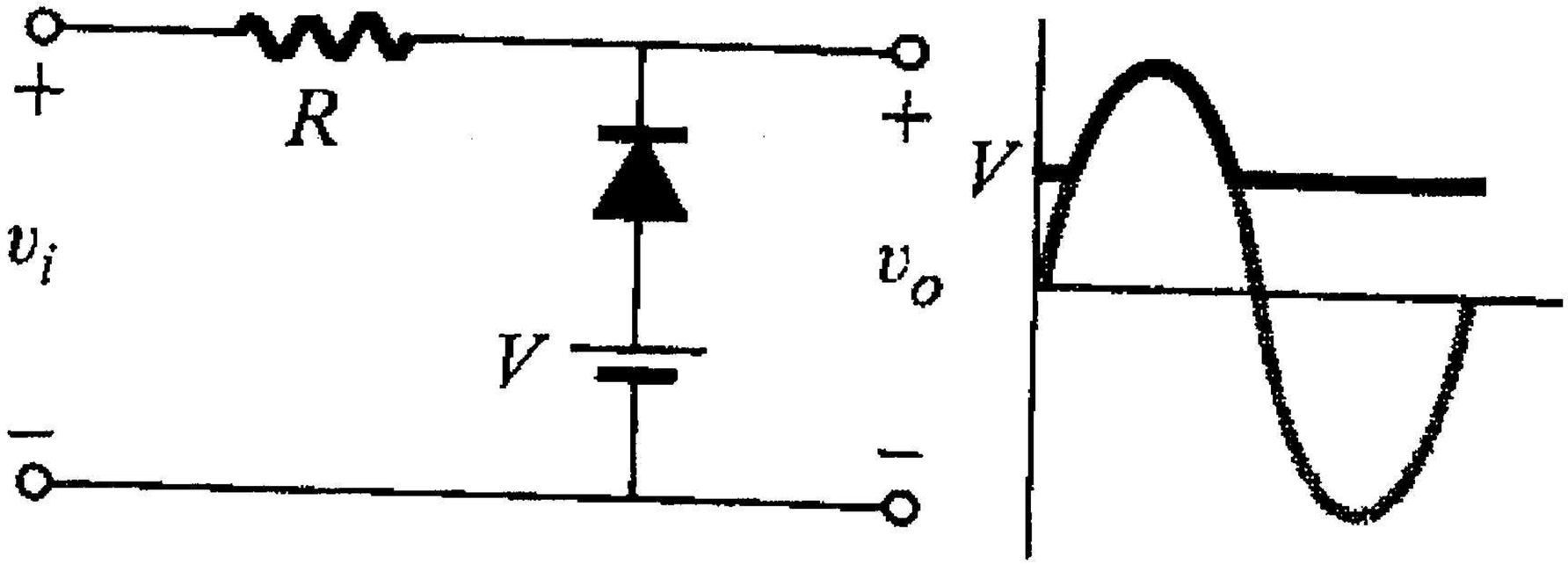
(2)

4.3.2



(3)

4.3.3



(3)

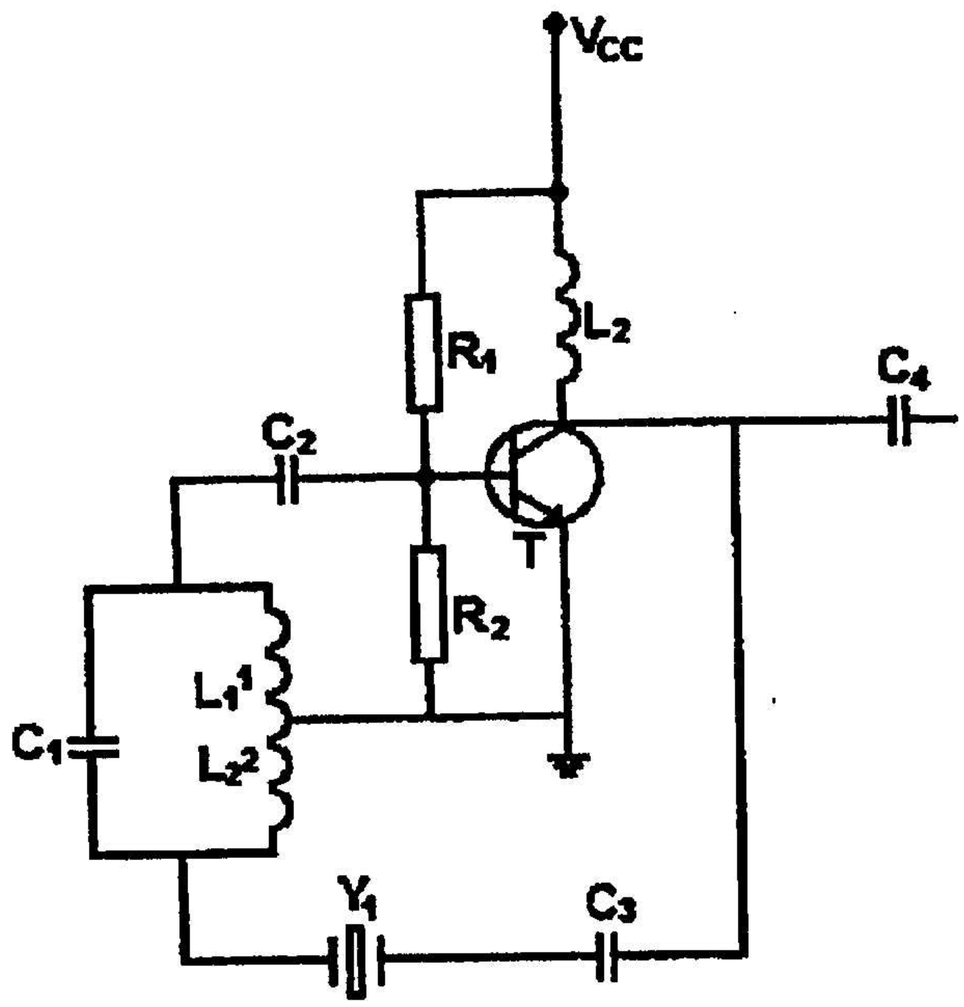
4.4 Any logical explanation / *Enige logiese verduideliking*

One mark for each correct fact / *Een punt vir elke korrekte feit.* (15)

[44]

QUESTION / VRAAG 5
OSCILLATORS / OSSILLATORS

5.1



CRYSTAL-CONTROLLED OSCILLATOR OR WITHOUT CRYSTAL

OPERATION

Make use of a crystal to control the frequency of the oscillator.

When crystal is used to block low and high frequencies when its impedance is high.

When the frequency of the oscillator is equal to the natural frequency of the crystal, the impedance of the crystal is a minimum resulting in maximum feedback.

KRISTALBEHEERDE-OSSILATOR OF SONDER KRISTAL

WERKING

Maak gebruik van 'n kristal om die frekwensie van die ossilator te beheer.

Die kristal word gebruik om lae en hoë frekwensie te blok wanneer die impedansie van die kristal verhoog word.

Wanneer die frekwensie van die ossilator gelyk is aan die natuurlike frekwensie van die kristal, sal die impedansie van die kristal 'n minimum wees, wat veroorsaak dat maksimum terugvoer na die versterker plaasvind.

(12)

5.2 $L = L1 + L2 + 2M$

$L = 2(750 \times 10^{-6}) + 2(150 \times 10^{-6})$

$L = 1{,}8mH \rightarrow$ (3)

$$Fo = \frac{1}{2\Pi\sqrt{LC}}$$

$$Fo = \frac{1}{2\Pi\sqrt{1{,}8 \times 10^{-3} \times 150 \times 10^{-12}}}$$

$Fo = 306{,}293KHz \rightarrow$ (3)

[18]

QUESTION / VRAAG 6

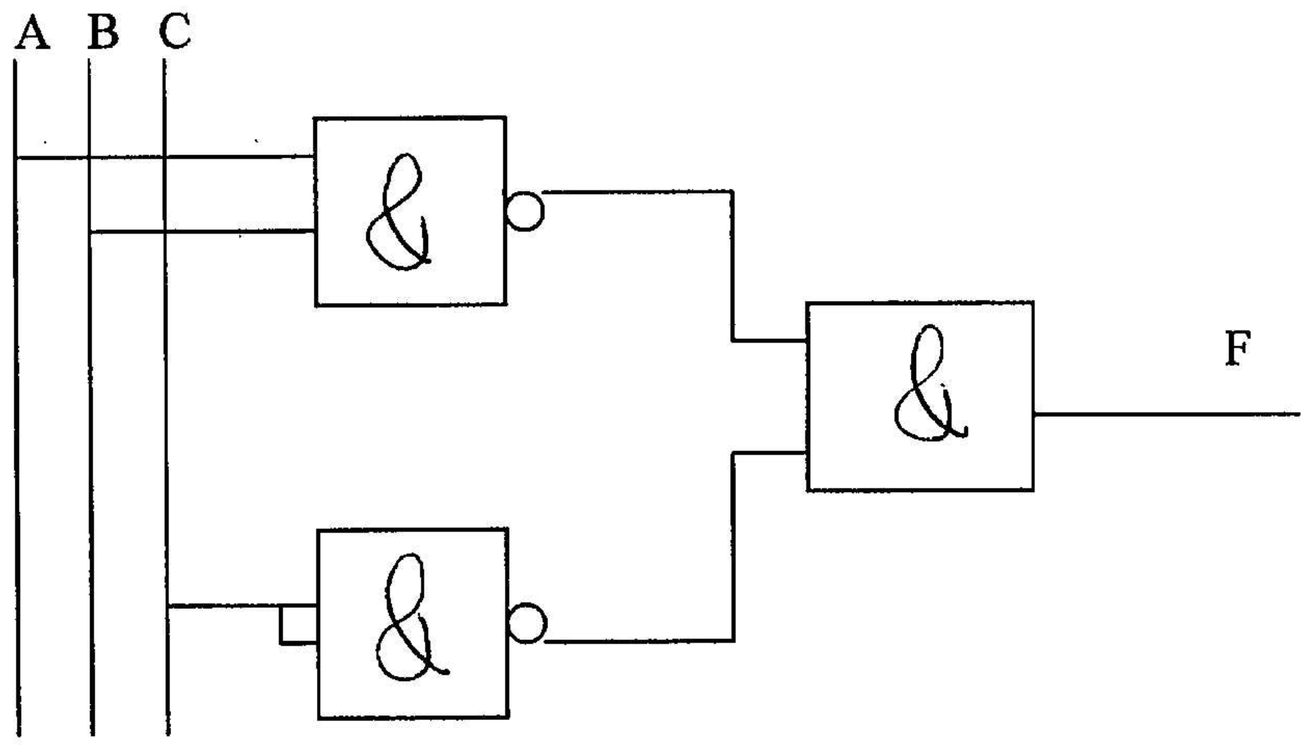
COMPUTER PRINCIPLES / REKENAARBEGINSELS

6.1 $F = ABC + AB + C$

$F = \overline{AB(C + 1)} + C$

$F = \overline{AB + C}$

$F = \overline{AB}.\ \overline{C}$ (3)



(3)

$F = \overline{A}\,B + \overline{A} + \overline{B}$

$F = \overline{A} + \overline{B} + A.\overline{B}$

$F = \overline{A} + \overline{B}(1 + A)$

$F = \overline{A.B}$ (5)

6.3.1

A	B	C	ALARM
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	1
1	0	0	0
1	0	1	1
1	1	0	0
1	1	1	1

Legend: A = Pas. 1

B = Pas. 2

C = Ignition / Aansitter (5)

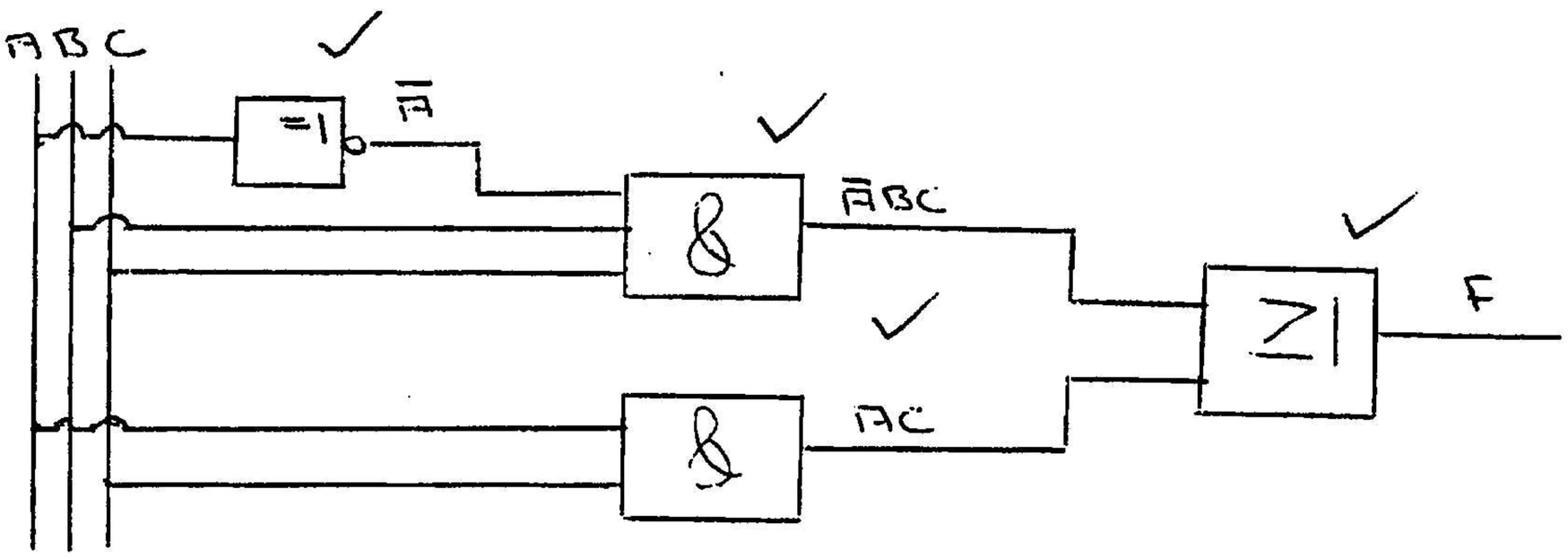
Positive logic is used to solve this problem / *Positiewe logika word gebruik om hierdie probleem op te los.* (*Leerders mag gebruik maak van enige aanvaarbare tegniek* / Learners are allowed to use any acceptable method to solve the problem)

6.3.2 $F = \overline{A}.B.C + A.\overline{B}.C + A.B.C$ (3)

6.3.3 $F = \overline{A}.B.C + A.\overline{B}.C + A.B.C$

$F = \overline{A}.B.C + A.C\,(\overline{B} + B)$

$F = \overline{A}.B.C + A.C$ (2)



(4)

6.4

2 | 28	0	MSB
2 | 14	0	↑
2 | 7	1	↑
2 | 3	1	↑
2 | 1	1	↑
0		LSB

0,375 x 2 = 0,75 carry / oordrag	0	LSB
0,75 x 2 = 1,5 carry / oordrag	1	↓
0,5 x 2 = 1 carry / oordrag	1	MSB

28,375 = 11100,011 →

2 | 15	1	MSB
2 | 7	1	↑
2 | 3	1	↑
2 | 1	1	↑
0	1	LSB

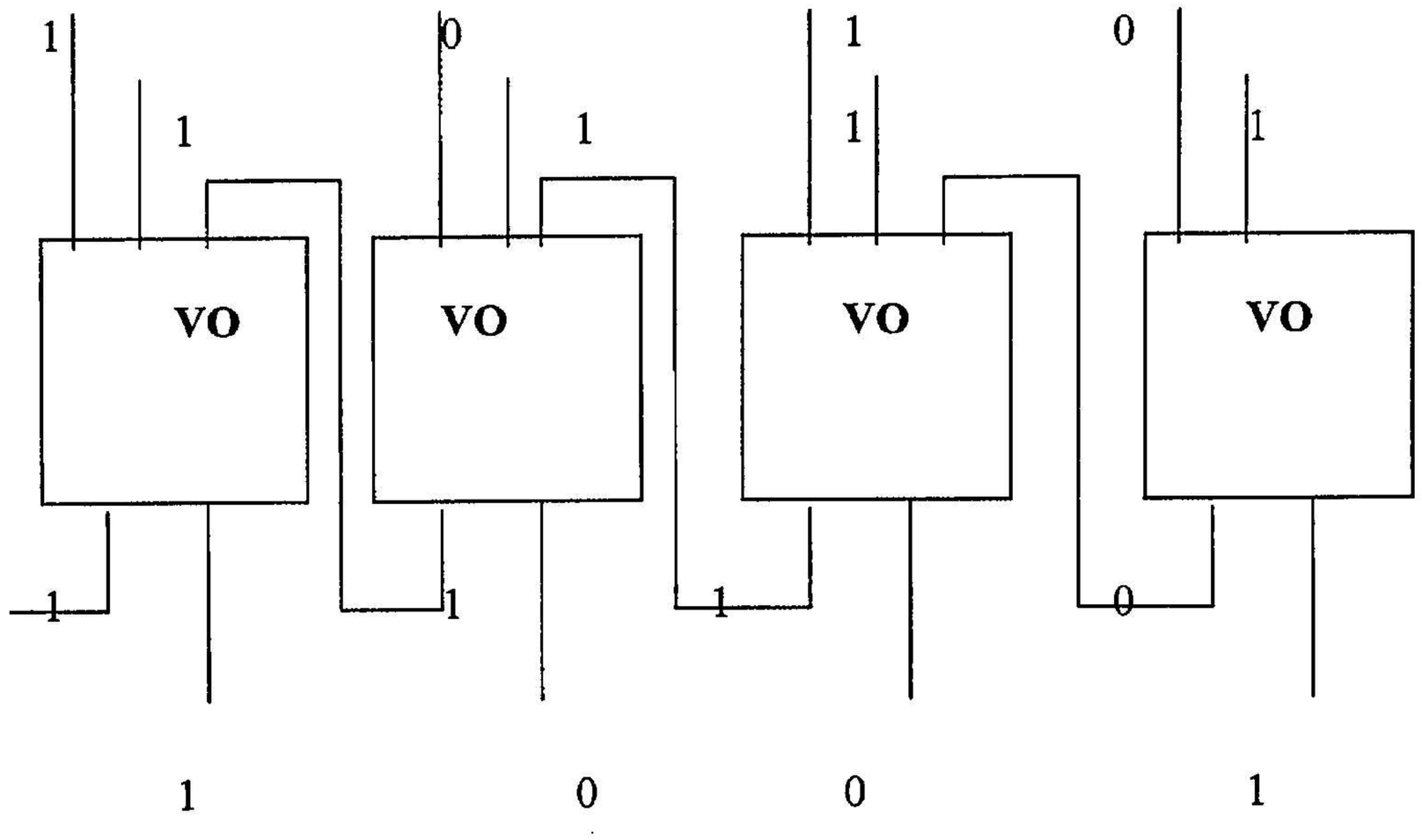
15 = 1111 →

11100,011

+ 1111,000

101011,011 (4)

6.5



(16)

6.6 This memory can store data temporarily and recall it where needed. RAM is a volatile form of memory which means that it is lost every time the computer is turned off. With RAM memory a user can either read the data that has been previously stored in the memory or can write new data into the memory, erasing the old data, making it randomly available.

Die geheue kan data tydelik stoor en dit herroep wanneer nodig. ETG (RAM) is 'n onstabiele vorm van geheue wat beteken dat dit verlore gaan elke keer wat die rekenaar afgeskakel word. Met RAM-geheue kan 'n gebruiker die data wat voorheen in die geheue gestoor is, lees of kan nuwe data na die geheue toe skryf, wat die ou data uitwis, wat dit ewetoeganklik maak.

This is a different form of memory to the RAM memory. ROM memories are usually pre-programmed with data by the manufacturer which can not be changed. A ROM is nonvolatile, so it retains its information after the computer is switched off. The user is able to read this information from the memory but is not able to write to it or change the pre-programmed information in any way.

Dit is 'n ander soort geheue as die RAM-geheue. LAG (ROM)- geheue word met data vanaf die vervaardiger geprogrammeer en kan nie verander word nie. 'n ROM is stabiel en behou sy inligting nadat die rekenaar afgeskakel is. Die gebruiker kan hierdie inligting vanuit die geheue lees maar kan hoegenaamd glad nie na die vooraf geprogrammeerde skryf of dit verander nie.

(6)

[51]

QUESTION / VRAAG 7

7.1

INFORMATION TRANSFER / INFORMASIE OORDRAG

BAND	TERM	USES/GEBRUIKE
30 kHz – 300 kHz	Low Frequency (LF) *Lae Frekwensie*	Long Distance Communication *Langafstand-kommunikasie*
300 kHz – 3 MHz	Medium Frequency (MF) *Medium Frekwensie*	Medium wave broadcasting, radio *Mediumgolf-uitsendingsradio*
3 MHz – 30 MHz	High Frequency (HF) *Hoë Frekwensie*	Short wave, amateur and CB radio *Kortgolf, amateur en Burgerbandradio*
30 MHz – 300 MHz	Very High Frequency (VHF) *Baie hoë Frekwensie (VHF)*	FM Radio, Police Comm., *FM Radio, Frekwensie Modulasie, Polisie komm.*
300 MHz – 3 GHz	Ultra High Frequency (UHF) *Uiters hoë Frekwensie (UHF)*	E-TV, MNET
Above 3 GHz	Super High Frequency (SHF) *Super hoë Frekwensie (SHF)*	Fibre optic, telephone, Radar, TV links Veselopties, telefoon, radar, TV-koppeling

(6)

7.2 Optic fibre systems have broader bandwidth and can thus carry more traffic due to wider range of modulation that can take place. Not prone to lightning and high measure of security Etc.

Optiese vesel-stelsel het 'n groter bandwydte en kan sodoende meer "verkeer" hanteer. deur die breër modulasie strek wat kan plaasvind. Dit is weerlig bestand en het geen waarde in die sluikhandel nie. (2)

7.3 The interfacing between fibre cable ends is also critical as any mis-match between coupling the ends will also contribute to large losses of signal power. When two fibres are not perfectly aligned along their centre axes, losses will result due to loss of light as well as some reflection of light from polished flat end faces.

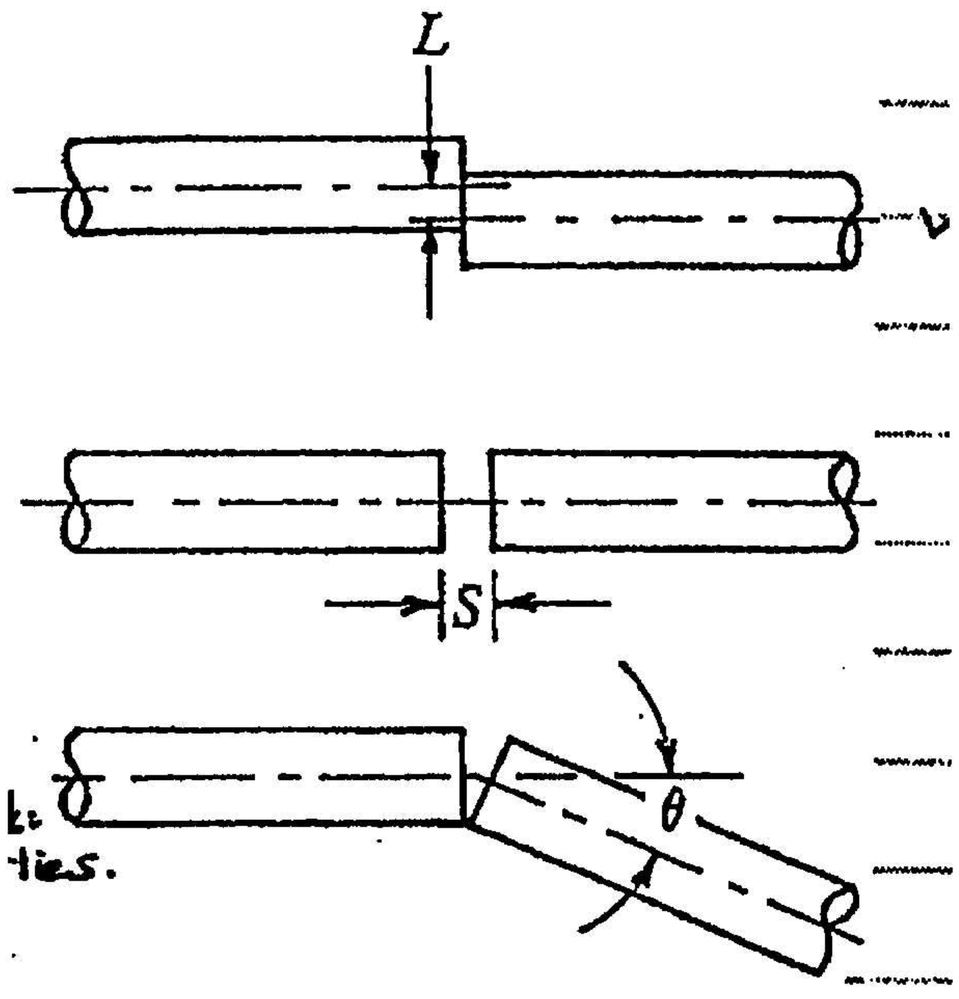
Die koppeling tussen die ente van veseloptiese-kabels is ook baie belangrik omdat enige wanaanpassings tussen verbindings groot seinverliese tot gevolg kan hê. As twee vesels nie perfek langs hulle middelasse verbind word nie, sal daar verliese plaasvind vanweë 'n verlies aan lig asook 'n effense weerkaatsing van lig op die gepoleerde punte en aansigte.

The major causes of signal power losses are:
Die belangrikste oorsake van seinverliese is:

1. Lateral displacement where the two fibre axes are not aligned.
   Laterale verskuiwing waar die twee vesels nie in lyn is nie.

2. End separation where any slight air gap will introduce a change of refractive index leading to some internal reflection loss.
   Entskeiding waarin 'n effense luggaping sal lei tot 'n verandering van refraksie-indeks en lei tot effense interne refleksieverlies.

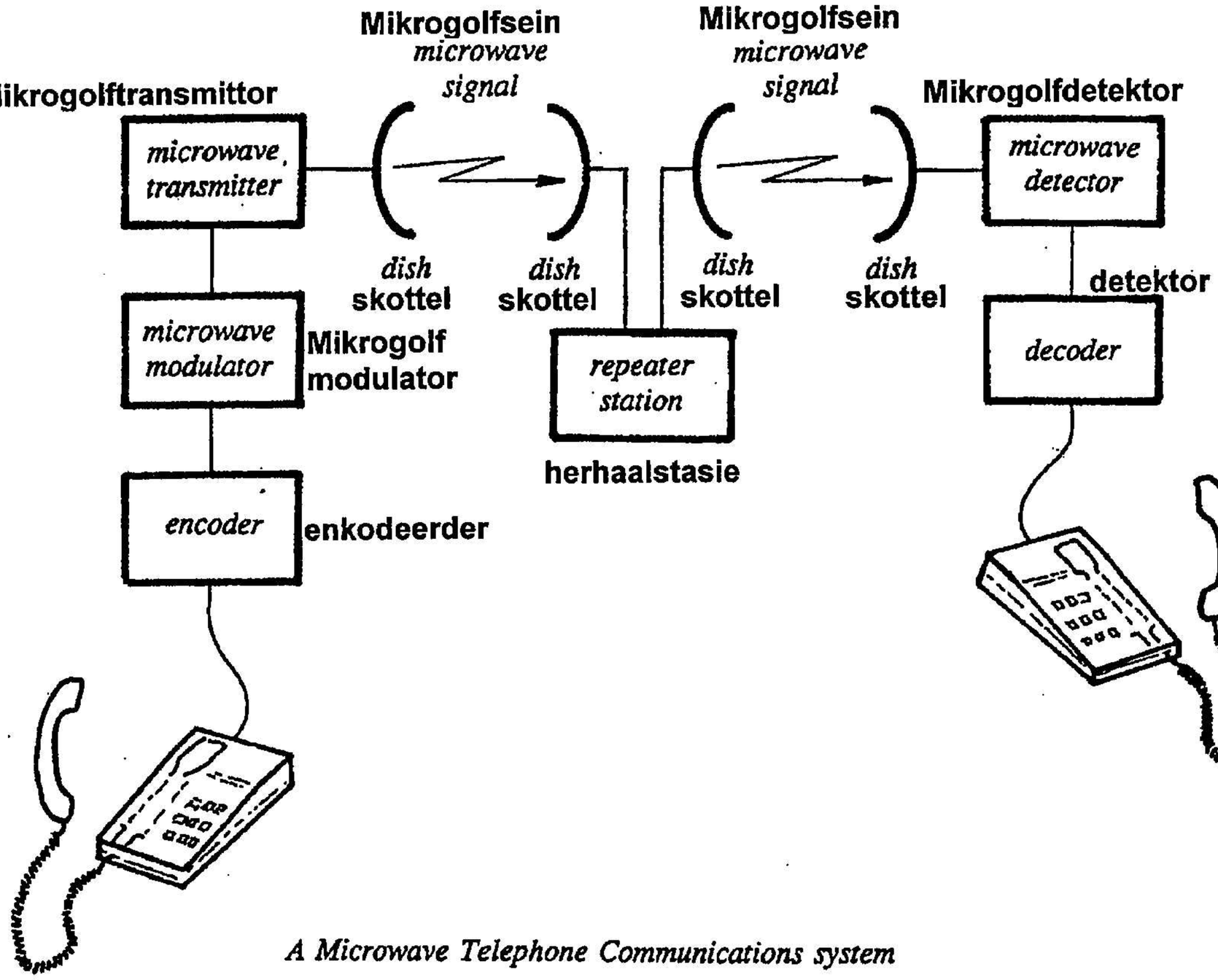
3. Angular misalignment with two ends misaligned, loosing much light signal power.
   Hoek foutief gepas met twee punte wat nie op mekaar pas nie en baie van die lig sein wat verlore gaan



Die las van optiese vesels is uiters kritiek a.g.v. die lynversteuring van die binnevlak van die vesel wat mag plaasvind. Enige verskuiwing van hierdie oppervlakte bring energieverliese mee soos bo geïlustreer.

(6)

7.4



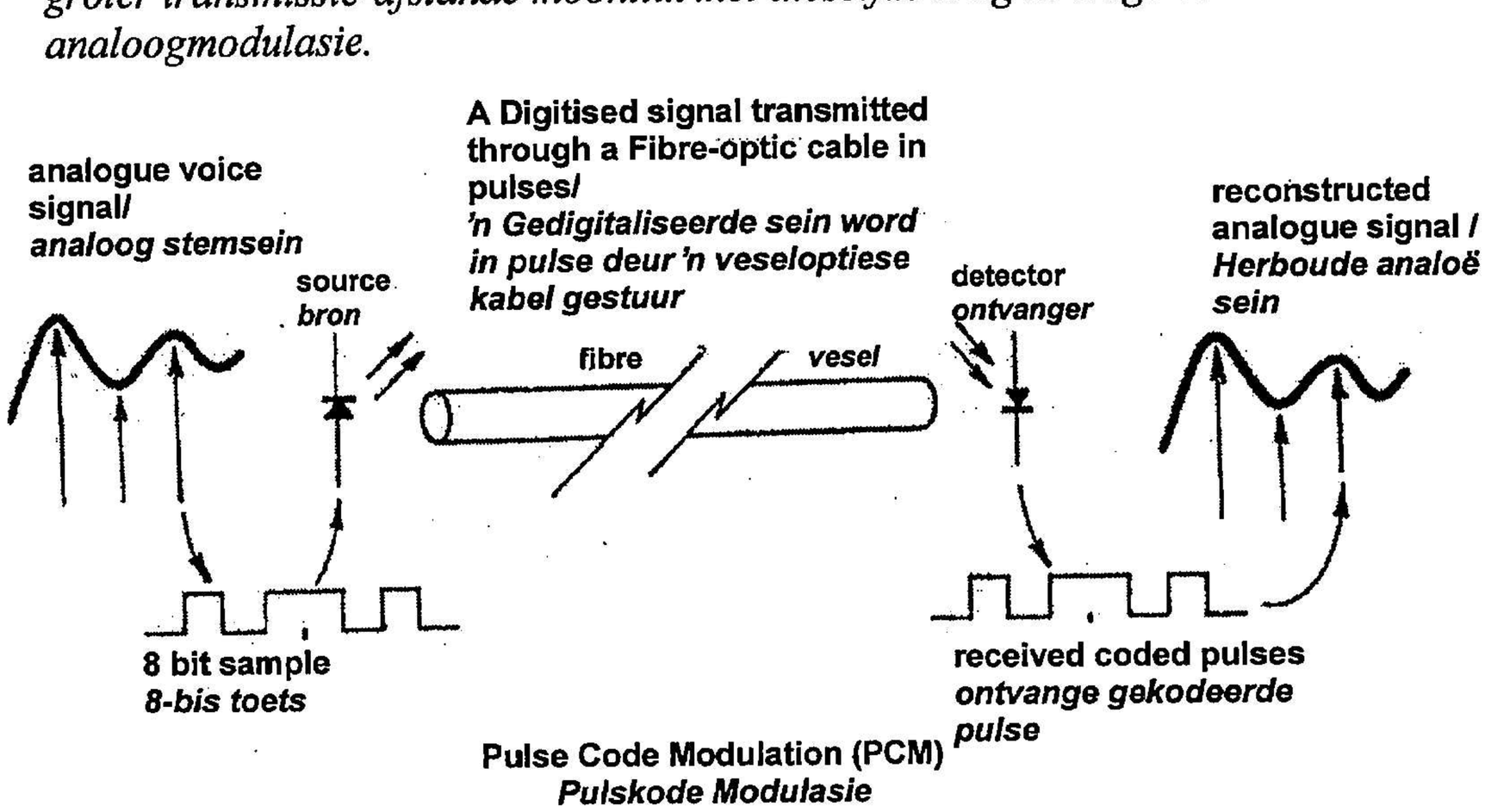
A Microwave Telephone Communications system

'n Mikrogolf-telekommunikasiestelsel

(10)

7.5 The incoming voice signal to be transmitted is sampled at a rate of 8000 times per second. During each sample the amplitude of the signal at that instant is measured and converted into an 8 bit binary code. Using 8 bits means that a total of 256 different amplitudes can be coded into binary form ($2^8 = 256$). The 8000 samples per second each represented by an 8 bit binary code results in 64 000 individual bits of information being transmitted along the fibre optic link every second of operation in the form of "on and off" pulses of light. This figure doubles for a two way conversation of two voices on the same line. Digital modulation enables far greater transmission distances to be covered with the same power than any form of analog modulation.

Die inkomende stemsein wat uitgesaai moet word, word teen 'n tempo van 8000 keer per sekonde getoets. Tydens elke toets word die amplitude van die sein oombliklik gemeet en na 'n 8 bis binêre kode omgesit. Deur 8 bis te gebruik, beteken dit dat 256 verskillende amplitudes in binêre formaat gekodeer kan word ($2^8 = 256$). Die 8000 toetse per sekonde wat elk deur 'n 8-bis binêre kode verteenwoordig word, het tot gevolg dat 64 000 individuele klompe inligting elke sekonde langs die veseloptiese-skakel vervoer word in die vorm van aan-en-af-lig pulse. Die syfer verdubbel in 'n tweerigtinggesprek waar twee stemme vervoer word. Digitale modulasie maak veel groter transmissie-afstande moontlik met dieselfde krag in enige vorm van analoogmodulasie.



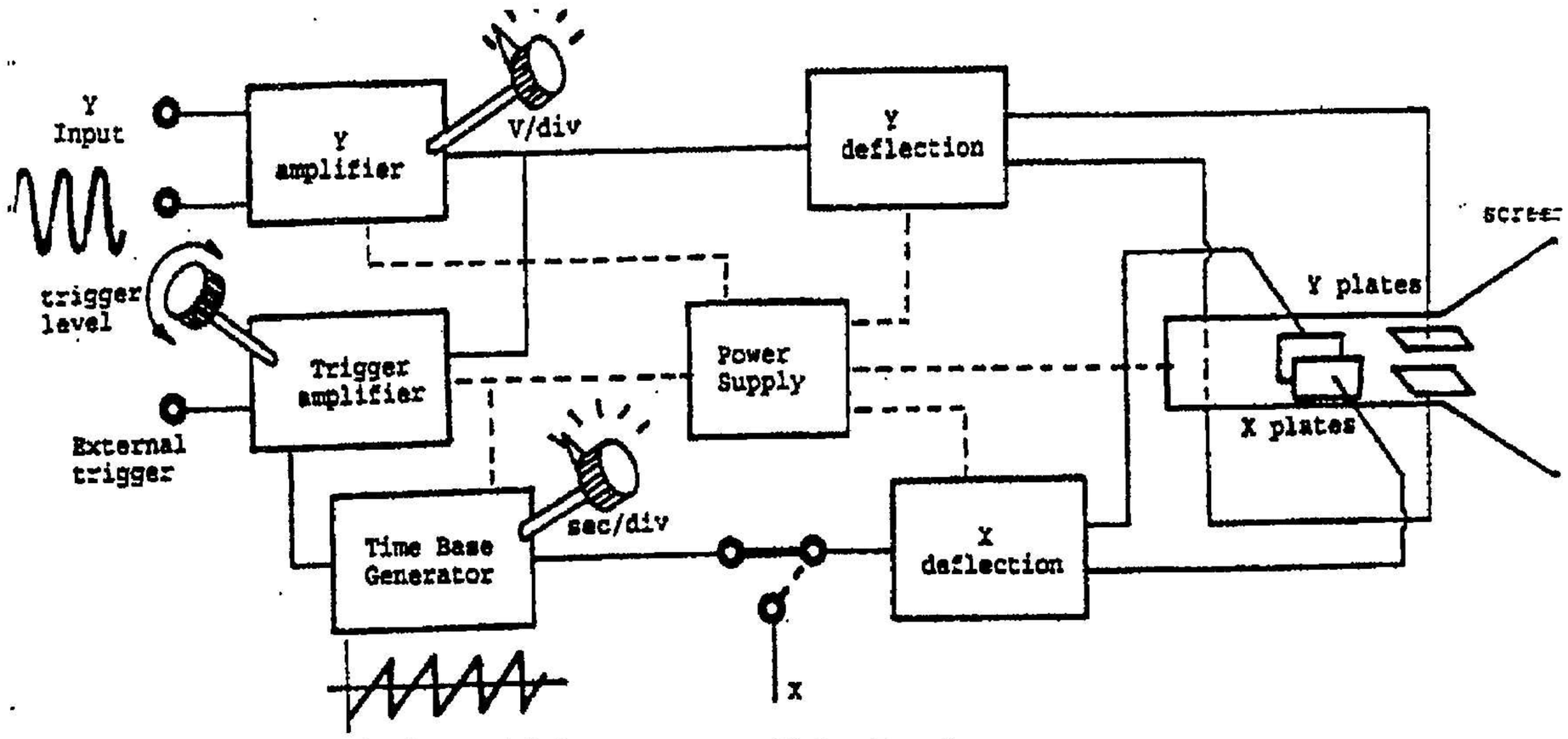
Pulse Code Modulation (PCM)
Pulskode Modulasie

(8)
[32]

QUESTION / VRAAG 8

MEASURING INSTRUMENTS / MEETINSTRUMENTE

8.1



(10)

8.2 Display in a numeric form / *Inligting is maklik afleesbaar.*

High level of accuracy / *Baie akkuraat.*

Short response time / *Vinnige reageertyd.* Any three.

No parallax problems / *Geen paralaksfoute.* Enige drie.

Extremely robust / *Kan skokke en temperatuurveranderings goed hanteer.* (3)

8.3.1 t = No./ Div. x t/Div.

= $3 \times 2 \times 50 \times 10^{-6}$

= 0,3 mS. (3)

$$f = \frac{1}{t}$$

$$f = \frac{1}{0{,}3 \times 10^{-3}}$$

$$f = 3{,}3KHz$$

(3)

8.3.2 Vp = No./ Div. x V/Div.

= 2 x 2

= 4 Volt. (3)

[22]

QUESTION / VRAAG 9

SAFETY PRECAUTIONS / VEILIGHEID

9.1

- The selector switch must be on the right scale / *Die selekteerskakelaar moet op die korrekte skaal gestel word.*
- Set the selector switch to the highest FSD / *Stel die selekteerskakelaar op die hoogste VSD.*
- Check the AC/DC setting / *Kontroleer die WS/GS verstelling.*
- Plug the leads into the correct positions / *Maak seker dat die toets-geleiers in die korrekte sokke geplaas word.*
- Power must be off when measuring Ohms / *Skakel die krag af wanneer Ohm gemeet word.*
- Do not drop the meter / *Moet nie die meter laat val nie.* (Any five / *Enige vyf*)

(5)

9.2 Check for short circuits / *Maak seker dat daar geen kortsluitings is nie.*
Check for loose connections / *Maak seker dat daar geen los verbindings is nie.*
Check earthing / *Maak seker dat die projek geaard is.*
Any other correct measure / *Enige aanvaarbare antwoord* (2)

9.3 Foam is a conductor / *Skuim is 'n geleier.* (2)

9.4 According to Dr. Robert Crookes from the SA National Blood Transfusion service their is no proof that the blood of a donor is safe during the window period / Volgens Dr. Robert Crookes van die SA Nasionale Bloedoortappingsdiens is daar geen manier om sonder twyfel te bewys dat 'n skenker se bloed gedurende die "vensterperiode" met die VIGS-virus besmet is nie. (3)

9.5.1 False / Vals (1)

9.5.2 False / Vals (1)

9.6 080 0012 322 (1)

[15]

[300]