

**GAUTENG DEPARTMENT OF EDUCATION  
GAUTENGSE DEPARTEMENT VAN ONDERWYS**

**SENIOR CERTIFICATE EXAMINATION  
SENIORSERTIFIKAAT-EKSAMEN**

**TECHNIKA (ELECTRONICS / ELEKTRONIES) HG**

**POSSIBLE ANSWERS OCT / NOV 2006**

**QUESTION / VRAAG 1**

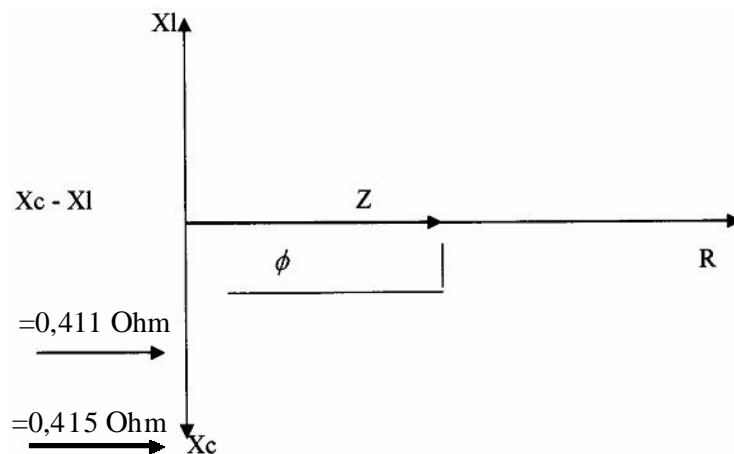
**ELECTRIC CURRENT THEORY / ELEKTRIESE STROOMTEORIE**

1.1.1  $X_L = 2\pi fL$   
 $= 2\pi \times 50 \times 0,1$   
 $= 31,416 \Omega \rightarrow$  (3)

1.1.2  $X_C = \frac{1}{2\pi fC}$   
 $= \frac{1}{2\pi \times 50 \times 100 \times 10^{-6}}$   
 $= 31,831 \Omega \rightarrow$  (3)

1.1.3  $Z = \sqrt{R^2 + (X_C \cong X_L)^2}$   
 $= \sqrt{100^2 + (31,831 \cong 31,416)^2}$   
 $= \sqrt{10000 + (0,172)}$   
 $= 100,000861 \Omega$  (3)

1.1.4



(6)

$$\begin{aligned} \cos\phi &= \frac{R}{Z} \\ &= \frac{100}{100} \\ &= 1 \\ \phi &= 0^\circ \rightarrow \end{aligned} \tag{4}$$

1.2.1

$$\begin{aligned} f_0 &= \frac{1}{2\pi\sqrt{LC}} \\ f_0 &= \frac{1}{2\pi} \sqrt{400 \times 10^{-6} \times 305,7 \times 10^{-12}} \\ f_0 &= 455,131 \text{ kHz} \rightarrow \end{aligned} \tag{3}$$

1.2.2

$$\begin{aligned} \text{or } Q &= \frac{WL}{R} & Q &= \frac{1}{R} \sqrt{\frac{L}{C}} \\ R &= 100\lambda & Q &= \frac{1}{100} \sqrt{\frac{400 \times 10^{-6}}{305,7 \times 10^{-12}}} \\ & & Q &= 11,438 \end{aligned} \tag{3}$$

1.2.3

$$\begin{aligned} I &= \frac{V}{R} & (X_c - X_c = 0)(X_c = X_c) \\ I &= \frac{0,2}{100} \\ &= 0,002 \text{ A} \\ &= 2 \text{ mA} \end{aligned} \tag{4}$$

1.3

$$\begin{aligned} \frac{N_p}{N_s} &= \sqrt{\frac{Z_p}{Z_s}} \\ \frac{N_p}{N_s} &= \sqrt{\frac{500}{4}} \\ \frac{N_p}{N_s} &= 11,18 : 1 \rightarrow \end{aligned} \tag{4}$$

**[33]**

**QUESTION / VRAAG 2**  
**SEMICONDUCTOR DEVICES / HALFGELEIER-TOESTELLE**

- |       |   |     |
|-------|---|-----|
| 2.1.1 | 8,2 V / 0,5 W Zener diode   | (3) |
| 2.1.2 | Reed Switch / <i>Frekwensieskakeelaar</i>                                       | (2) |
| 2.1.3 | BC 557 PNP Transistor   | (3) |
| 2.1.4 | Buzzer / <i>Gonser</i>  | (1) |
| 2.1.5 | 100 $\mu$ Farad / 16 Volt Polarised Capacitor / <i>Gepolariseerde kapasitor</i> | (3) |
| 2.2   | Darlington Pair / <i>-paar</i>  | (1) |

**Characteristics and Working Principle / Kenmerke en werkbeginsel**

High input Impedance / *Hoë insetimpedansie*

Low output Impedance / *Lae uitsetimpedansie*

High Current Gain, typical 1000 or more / *Hoë Stroomwins, tipies 1 000 of meer*

Low voltage gain, typical less than one / *Lae spanningswins, tipies minder as een*

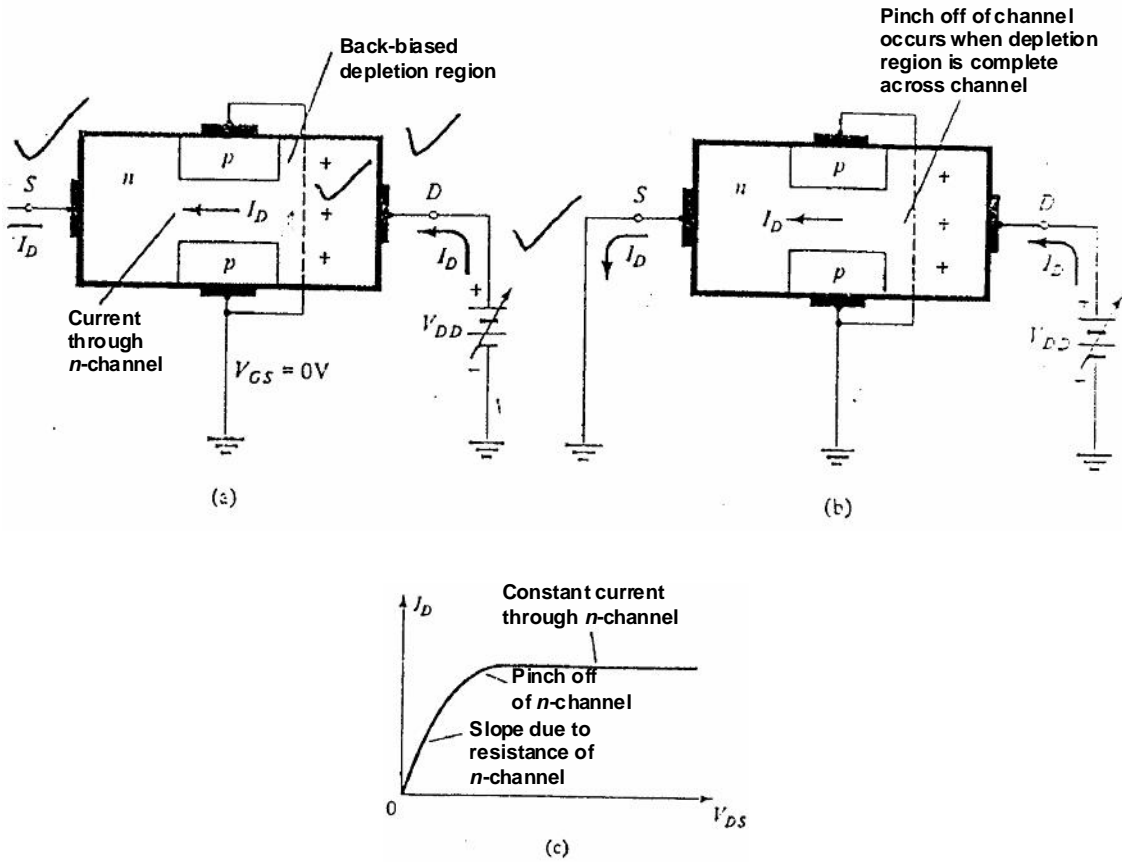
The emitter current of the first transistor is the base current for the second transistor. /

*Die emittorstroom van die eerste transistor is die basisstroom vir die tweede.*

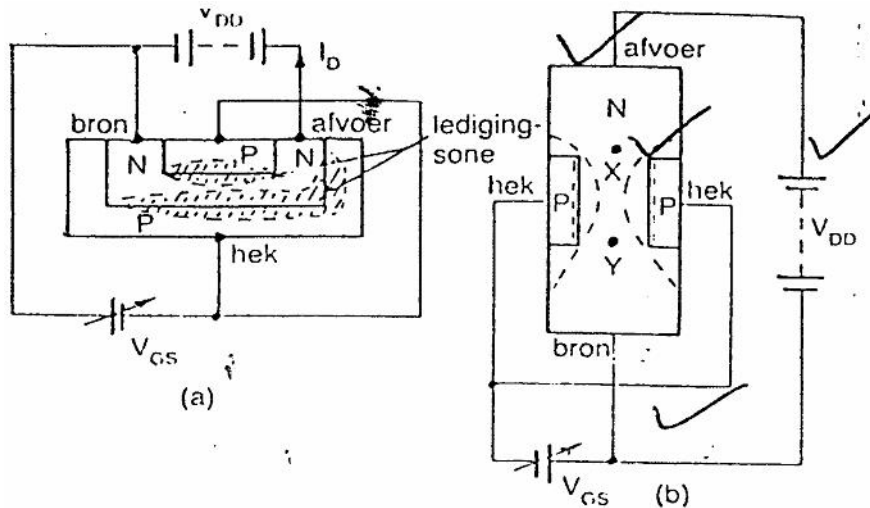
Biasing arrangement: Positive on base, Positive on Collector and Negative on Emitter /

*Voorspanning: positief op basis, positief op kollektor en negatief op die emittor* (10)

2.3



To examine how the device is operated, consider the *n*-channel JFET of Fig. 5.2, shown with applied bias voltage to operate the device. The supply voltage,  $V_{DD}$ , provides a voltage across drain-source,  $V_D$ , which results in a current,  $I_D$ , from drain to source (electrons in an *n*-channel actually move from the source, hence name, to drain). This drain current passes through the *channel* surrounded by the *p*-type gate. A voltage between gate and source,  $V_{GS}$ , is shown here to be set by a voltage supply,  $V_{CC}$ . Since this gate-source voltage will reverse bias the gate-source junction, no gate current will result. The effect of the gate voltage will be to create a depletion region in the channel and thereby reduce the channel width to increase (12) the drain-source resistance resulting in less drain current.



Wanneer die bron-afvoerspanning  $V_{DD}$  aan die veldeffektransistor gekoppel word, soos in figuur 5.20 geïllustreer, sal 'n stroom deur die kanaal vloei. Dié stroom word die afvoerstrom  $I_D$  genoem.

Die PN-voegvlak tussen die hek en die kanaal word teenvoorgespan. Hierdie teenvoorspanning veroorsaak 'n ledigingsone, dit wil sê 'n sone sonder meerderheidsdraers, in die omgewing van die PN-voegvlak. In die afwesigheid van ladingdraers reageer die ledigingsone soos 'n isolator. Wanneer die kanaal dus vernou word, verhoog die weerstand daarvan met 'n gevolglike verlaging in die afvoerstrom  $I_D$ . Dit is dus duidelik dat die effektiewe oppervlakte van die kanaal en dus die stroom  $I_D$ , ekstern beheer kan word.

Volgens figuur 5.20 (a) en (b) skyn dit asof daar twee ledigingsones gevorm word. Die ledigingsone word om die hele kanaal gevorm aangesien al die kante van die N-tipe kanaal in kontak is met die P-tipe substraat. Die konsentrasie van onsuiverhede is laer in die kanaal as in die hekdeel. Gevolglik dring die ledigingsone die kanaalareë dieper as die hekareë binne.

Figuur 5.20 (b) toon ook dat die ledigingsone in die kanaal effens wyer is aan die afvoerkant as aan die bronkant. Die N-tipe kanaalmateriaal reageer soos 'n gewone resistor, met ander woorde die potensiaalverskil verander lineêr oor die lengte van die kanaal tussen die afvoeren bronterminale. Punt X in figuur 5.20 (b) is derhalwe meer positief, met betrekking tot die bronterminaal, as punt Y. Die potensiaalverskil oor die PN-voegvlak tussen punt X en die hek is dus groter as tussen punt Y en die hek, met die gevolg dat die ledigingsone die kanaal dieper binnedring in die omgewing van punt X as by punt Y.

(12)

2.4 Improvement of the ripple factor / Verbetering van die rippelfaktor.

(2)

[37]

**QUESTION / VRAAG 3**  
**AMPLIFIERS / VERSTERKERS**

3.1

$$\begin{aligned}
 V_e &\cong \frac{1}{10} \times (V_{cc}) \\
 &\cong \frac{1}{10} \times (12) \\
 &\cong 1,2 \text{ volt} \rightarrow (3)
 \end{aligned}$$

$$\begin{aligned}
 R_e &= \frac{V_e}{I_c} \\
 &= \frac{1,2}{10 \times 10^{-3}} \\
 &= 120 \Omega \rightarrow (3)
 \end{aligned}$$

Note / neem kennis:  $I_c = I_e$  (1)

$$\begin{aligned}
 R_c &= \frac{V_{cc} - V_{ce} - V_e}{I_c} \\
 &= \frac{12 - 8 - 1,2}{10 \times 10^{-3}} \\
 &= 280 \Omega \rightarrow (3)
 \end{aligned}$$

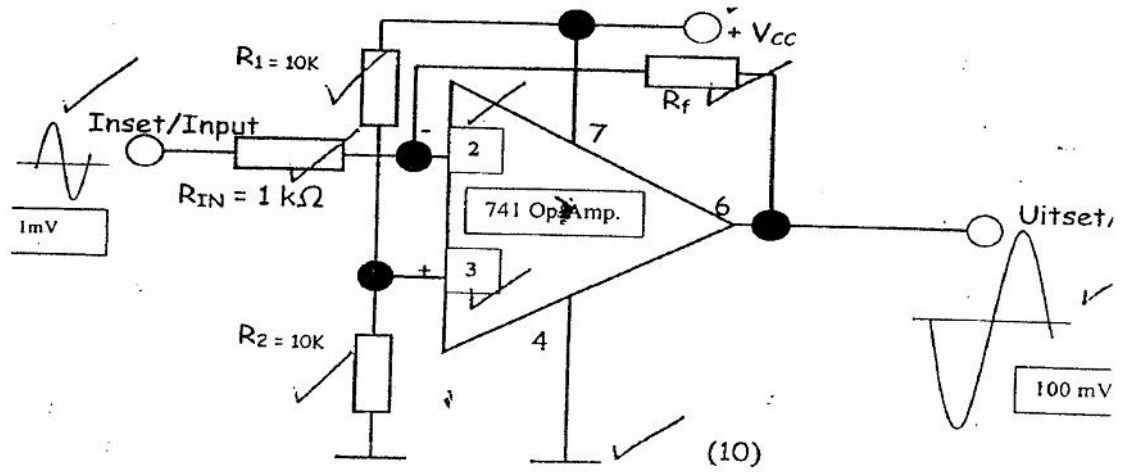
$$\begin{aligned}
 V_b &= V_e + V_{be} \\
 &= 1,2 + 0,7 \\
 &= 1,9 \text{ volt} (3)
 \end{aligned}$$

$$\begin{aligned}
 R_{B2} &= \frac{1}{10(\beta R_e)} \\
 &= \frac{120 \times 120}{10} \\
 &= 1,44 \text{ k}\Omega \rightarrow (3)
 \end{aligned}$$

$$\begin{aligned}
 V_b &= \frac{R_{b2}}{R_{b1} + R_{b2}} (V_{cc}) \\
 1,9 &= \frac{1,44 \times 10^3 \times 12}{R_{b1} + 1,44 \times 10^3} \\
 R_{B1} &= \frac{17\ 280}{1,9} - 1440 \\
 &= 17,65 \text{ k}\Omega \rightarrow (4)
 \end{aligned}$$

[20]

3.2



$$A_v = \frac{V_{out}}{V_{in}}$$

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

$$= 200 \rightarrow$$

$$A = \frac{R_f}{R_{in}}$$

$$R_f = A \times R_{in}$$

$$R_f = 200 \times 1 \times 10^3$$

$$R_f = 200 \text{ k}\Omega \rightarrow$$

(7)

3.3 Gain / Wins = 10 Log (Power ratio)

$$= 10 \text{ Log } (100/50)$$

$$= 10 \text{ Log } 2$$

$$= 3 \text{ dB}$$

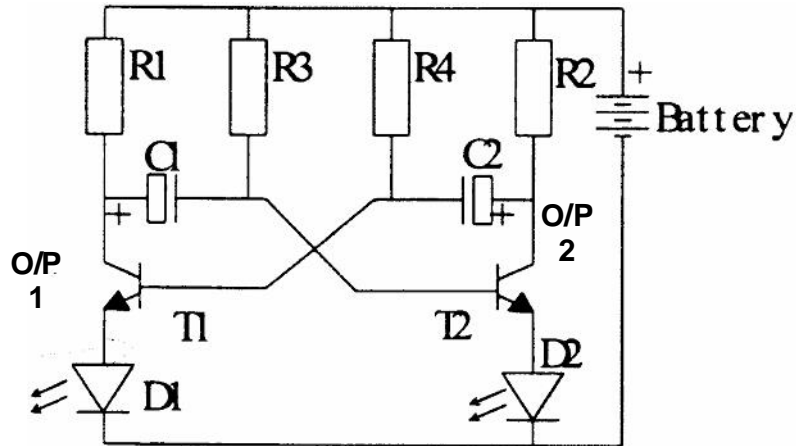
$$= 3 \text{ dB}$$

(4)  
[41]

**QUESTION / VRAAG 4**  
**SWITCHING AND CONTROL CIRCUITS / SKAKEL- EN BEHEERKRINGE**

4.1

(15)



4.2

**INFRA RED CONTROL EXTENDER / INFRAROOI UITGEBREIDE BEHEERDER**

Photodiode D4 is connected to the inverting input of a 741 op-amp through R2 and C1. /

*Fotodiode D4 is verbind aan die omgekeerde inset van ? 741 op-versterker deur R2 en C1.*

(3)

The non-inverting input of the 741 is held at half the supply voltage by means of the equal resistors, R3 and R4. / *Die nie-omgekeerde inset van die 741 word deur die spanningsverdeler R3 en R4 verbind.*

(3)

The output of the 741 is followed by T1, supplying a high current pulse through IR LED D2 and D3 / *Die uitset van die 741 word gevolg deur T1 wat ? hoë uitset na IR LED D2 en D3 tot gevolg het.*

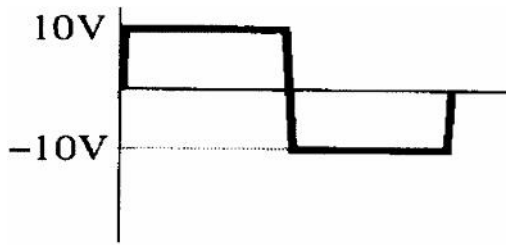
(3)

D1 is an ordinary LED that flashes when the IR signal is received from the remote / *D1 is 'n gewone LED wat flikker elke keer wanneer ? puls van die afstandsbeheer verkry word.*

(3)

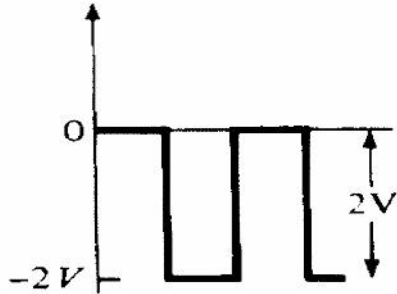


4.3.1



(4)

4.3.2



(4)

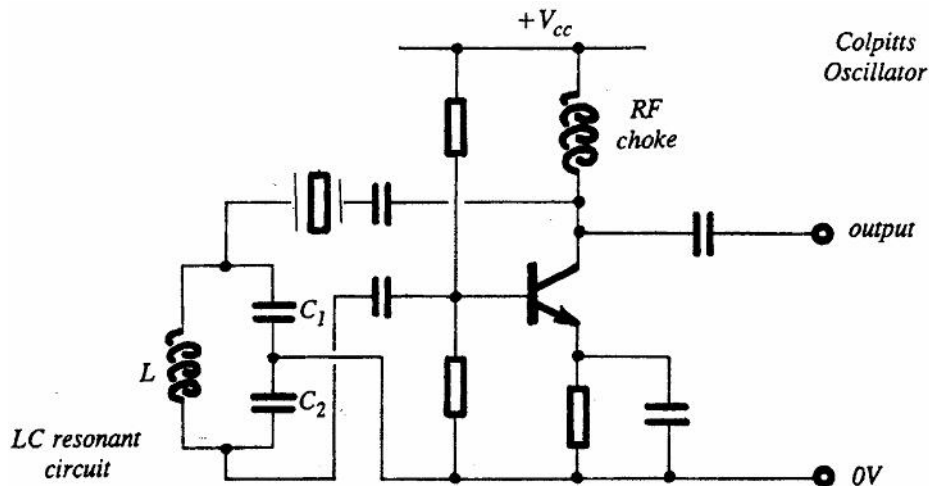
4.4 Any logical explanation / *Enige logiese verduideliking*

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

(15)  
[50]

**QUESTION / VRAAG 5**  
**OSCILLATORS / OSSILLATORS**

5.1



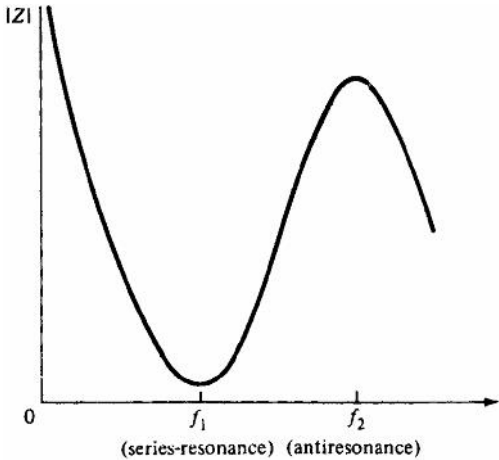
(10)

5.2 When mechanical stress is applied across the faces of a crystal, a difference of potential develops opposite the faces of the crystal. Similarly, a voltage applied across the faces of a crystal will result in mechanical vibrations. These vibrations have a natural resonant frequency dependant on the crystal.

*Wanneer meganiese druk op 'n kristal toegepas word, veroorsaak dit 'n potensiaalverskil oor die kristal. Wanneer 'n potensiaalverskil op 'n kristal toegepas word, veroorsaak dit op soortgelyke wyse dat die kristal sal vibreer (ossilleer) teen 'n resonante frekwensie eie aan die tipe kristal.*

(4)

5.3



(4)  
[18]

**QUESTION / VRAAG 7**  
**INFORMATION TRANSFER / INLIGTINGOORDRAG**

7.1

<i>BAND</i>	<i>TERM</i>	<i>USES/GEBRUIKE</i>
30 kHz – 300 kHz	Low Frequency (LF)	Long-distance Communication
300 kHz – 3 MHz	Medium Frequency (MF)	Medium-wave broadcasting, radio
3 MHz – 30 MHz	High Frequency (HF)	Short wave, amateur and CB radio
30 MHz – 300 MHz	Very High Frequency (VHF)	FM Radio, Police Comm.,
300 MHz – 3 GHz	Ultra High Frequency (UHF)	e.tv, M-Net
Above 3 GHz	Super High Frequency (SHF)	Fibre optic, telephone, Radar, TV links

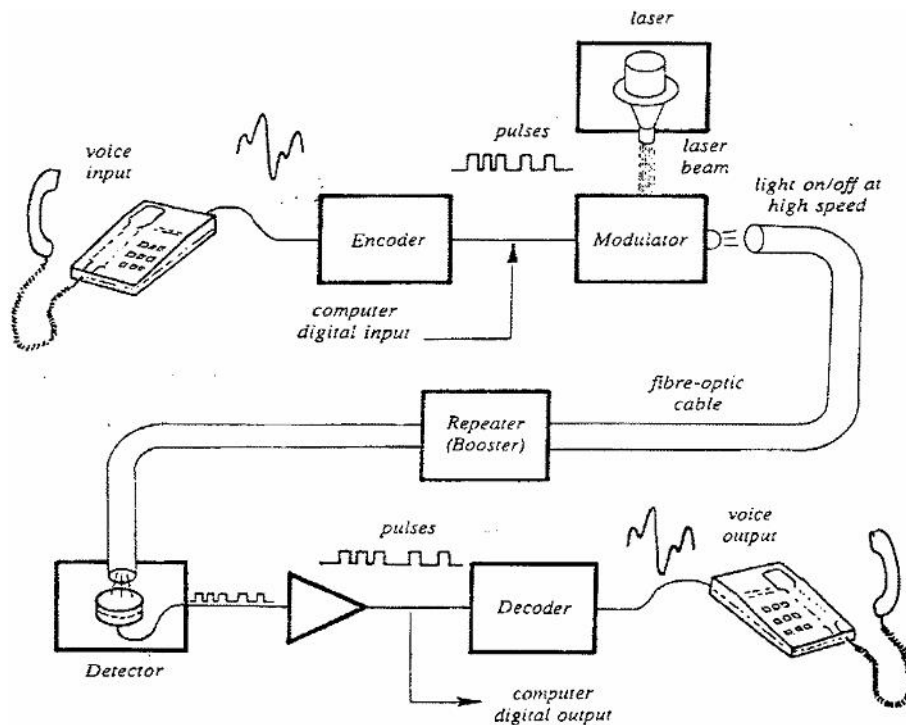
(6)

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 het 'n groter bandwydte en kan sodoende meer verkeer hanteer. Dit is weerligbestand en het geen waarde in die sluikhandel nie.*

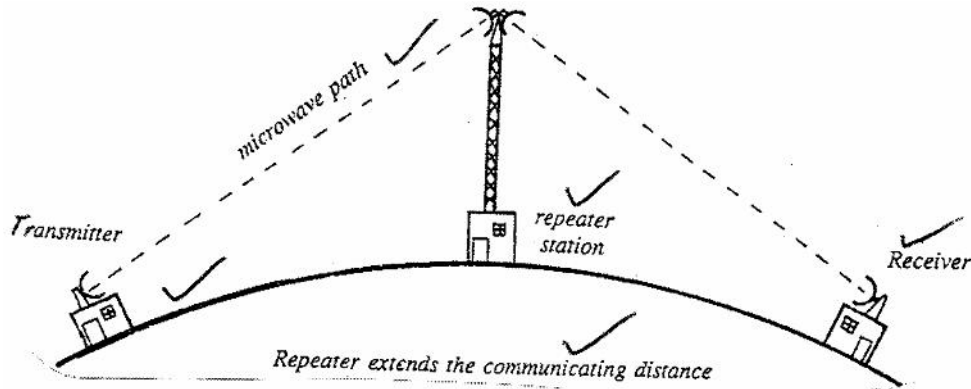
(2)

7.3



(12)

7.4



(5)

OR / OF

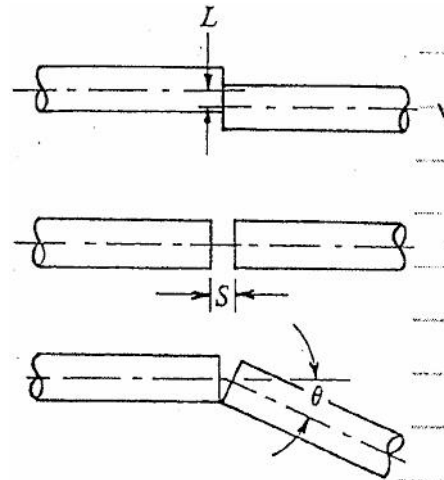
A repeater is a combination of a extremely sensitive receiver and a high power transmitter, with its antenna located at a convenient high position. It picks up the signal from the transmitter and amplifies it.

? Herhaler is ? kombinasie van ? sensitiewe ontvanger en ? hoëkrag-sender met ? antenna wat hoog op ? geskikte posisie geplaas is. Dit ontvang die se in vanaf die sender en versterk dit na die ontvangerstasie.

7.5 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.

The major causes of signal power losses are:

1. Lateral displacement where the two fibre axes are not aligned.
2. End separation where any slight air gap will introduce a change of refractive index leading to some internal reflection loss.
3. Angular misalignment with two ends misaligned, losing much light signal power.

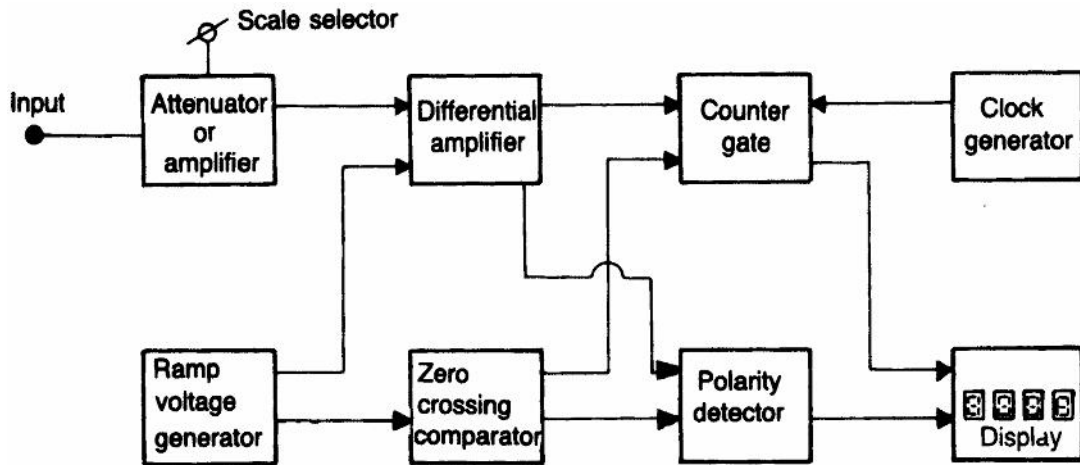


*Die las van optiese vesels is uiters kritiek a.g.v. die lynversteuring van die binnevlak van die vesel wat kan plaasvind. Enige verskuiwing van hierdie oppervlakke bring energieverliese mee soos bo geïllustreer.*

(8)  
[33]

**QUESTION / VRAAG 8**  
**MEASURING INSTRUMENTS / MEETINSTRUMENTE**

8.1



(10)

8.2 20 MΩ

(2)

8.3.1  $V_{p-p} = \text{No. Div.} \times V/\text{Div.} \times 2$ 

$$= 1,6 \times 2 \text{ mV} \times 2$$

$$= 4,8 \text{ mvolt}$$

(3)

8.3.2  $t = \text{No. Div.} \times t/\text{Div.}$ 

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

$$= 160 \mu\text{Sek}$$

(3)

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

$$f = \frac{1}{160 \times 10^{-6}}$$

$$f = 6,25 \text{ kHz}$$

(3)

[21]

**QUESTION / VRAAG 9**  
**SAFETY PRECAUTIONS / VEILIGHEID**

- 9.1 Keep floor clear of hazards / *Hou die vloer skoon van enige ongewenste materiale.*  
 Empty waste bins regularly / *Maak die vullisblik gereeld leeg.*  
 Clean up spilt oil / *Maak olie wat gemors het onmiddellik skoon.*  
 Always clean up / *Ruim altyd op.*  
 Put everything back in its place / *Plaas alles terug in die korrekte plek.*  
 Any similar answer / *Enige soortgelyke antwoord* (4)
- 9.2 Fire hydrant / *Brandkraan* (1)
- 9.3.1 True / *Waar* (1)
- 9.3.2 True / *Waar* (1)
- 9.3.3 False / *Onwaar* (1)
- 9.4 Labour Relations act / *Wet op Arbeidsverhoudinge*  
 Employment Equity Act / *Wet op Gelyke Indiensneming*  
 Occupational Health and Safety Act / *Wet op Beroepsgerigte Gesondheid en Veiligheid*  
 Basic Conditions of Employment Act / *Wet op Basiese Diensvoorwaardes.*  
 Any One / *Enige Een.* (1)
- 9.5 After someone is infected with HIV, it can take up to three months for it to show up in an antibodies test. These three months are commonly known as the “window period”  
 Indien ‘n persoon met die HI-virus besmet is, kan dit tot drie maande neem om die virus in ‘n teenliggampie-toets waar te neem. Hierdie tydperk word na verwys as die **vensterperiode.** (3)

[12]

300