GAUTENG DEPARTMENT OF EDUCATION
SENIOR CERTIFICATE EXAMINATION

POSSIBLE ANSWERS FOR : TECHNIKA (ELECTRONICS) H G

QUESTION 1

1.1
1.1.1

$$Xl = 2\pi fL$$
$$= 2\pi \times 1500 \times \left(150 \times 10^{-3}\right)$$
$$= 1413.716\Omega$$

(3)

$$Xc = \frac{1}{2\pi fC}$$
$$= \frac{1}{2\pi \times 1500 \times \left(2500 \times 10^{-6}\right)}$$
$$= 0.0424\Omega$$

(3)

1.1.2

$$Z = \sqrt{R^2 + (Xl \cong Xc)^2}$$
$$= \sqrt{150^2 + (1413.716 - 0.0424)^2}$$
$$= 1421.609\Omega$$

(3)

1.1.3

$$Iz = \frac{V}{Z}$$
$$= \frac{220}{1421.609}$$
$$= 0.1547A$$
$$= 154.7mA$$

(3)

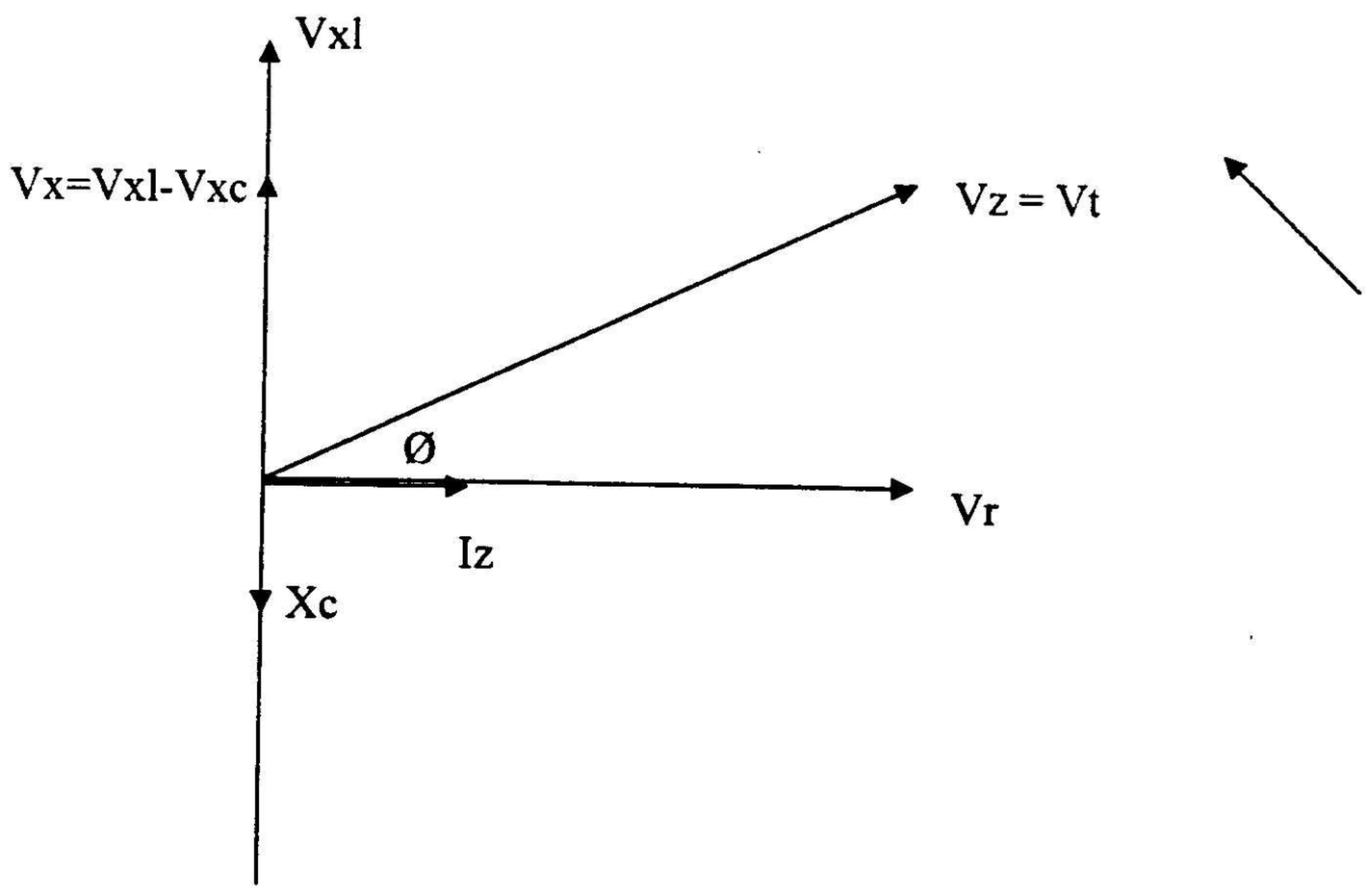
1.1.4

$$Vr = Iz \times R$$
$$= 0.154 \times 150$$
$$= 23.1V \quad (3)$$

$$Vxl = Iz \times Xl$$
$$= 0.154 \times 1413.716$$
$$= 217.712V \quad (3)$$

$$Vxc = Iz \times Xc$$
$$= 0.154 \times 0.0424$$
$$= 0.00652V \quad (3)$$

1.1.5



(9)

1.2

1.2.1-

$$Q = \frac{2\pi FrL}{R}$$
$$= \frac{2\pi\left(150\times10^{3}\right)\times\left(300\times10^{-6}\right)}{60} \quad (3)$$
$$= 4.712$$

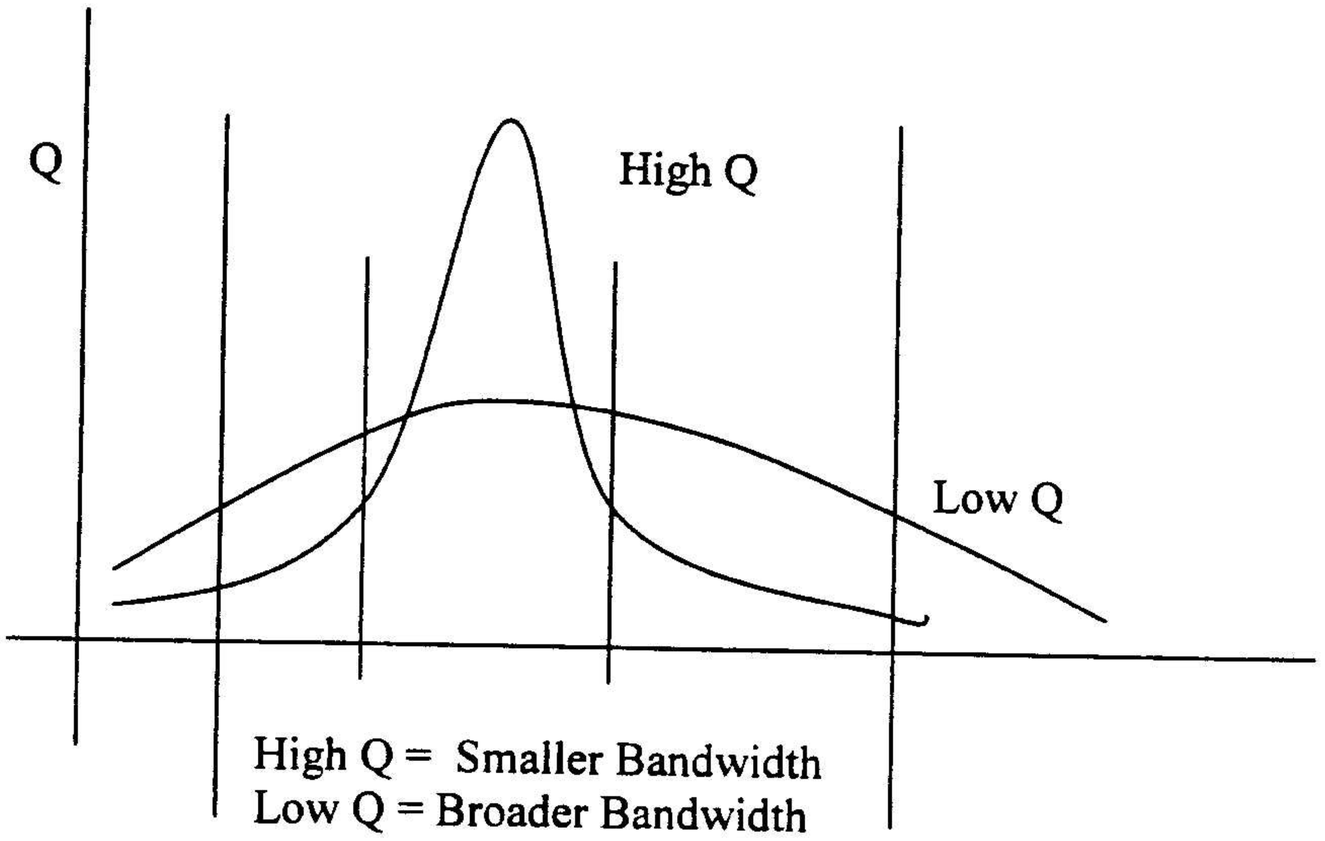
1.3

$$\frac{Np}{Ns} = \sqrt{\frac{Zp}{Zs}}$$
$$\frac{Np}{Ns} = \sqrt{\frac{1050}{4}} \quad (4)$$
$$\frac{Np}{Ns} = 16.201:1$$

1.4

$$Fr = \frac{1}{2\pi\sqrt{LC}}$$
$$= \frac{1}{2\pi\sqrt{(15\times10^{-3})\times\left(220\times10^{-12}\right)}}$$
$$= \frac{1}{0.000036094} \quad (4)$$
$$= 27705.319Hz$$
$$= 27.705kHz$$

1.5



(2)
[43]

QUESTION 2

2.1

2.1.1 Diode (2)

2.1.2 Toroidal core Transformer (2)

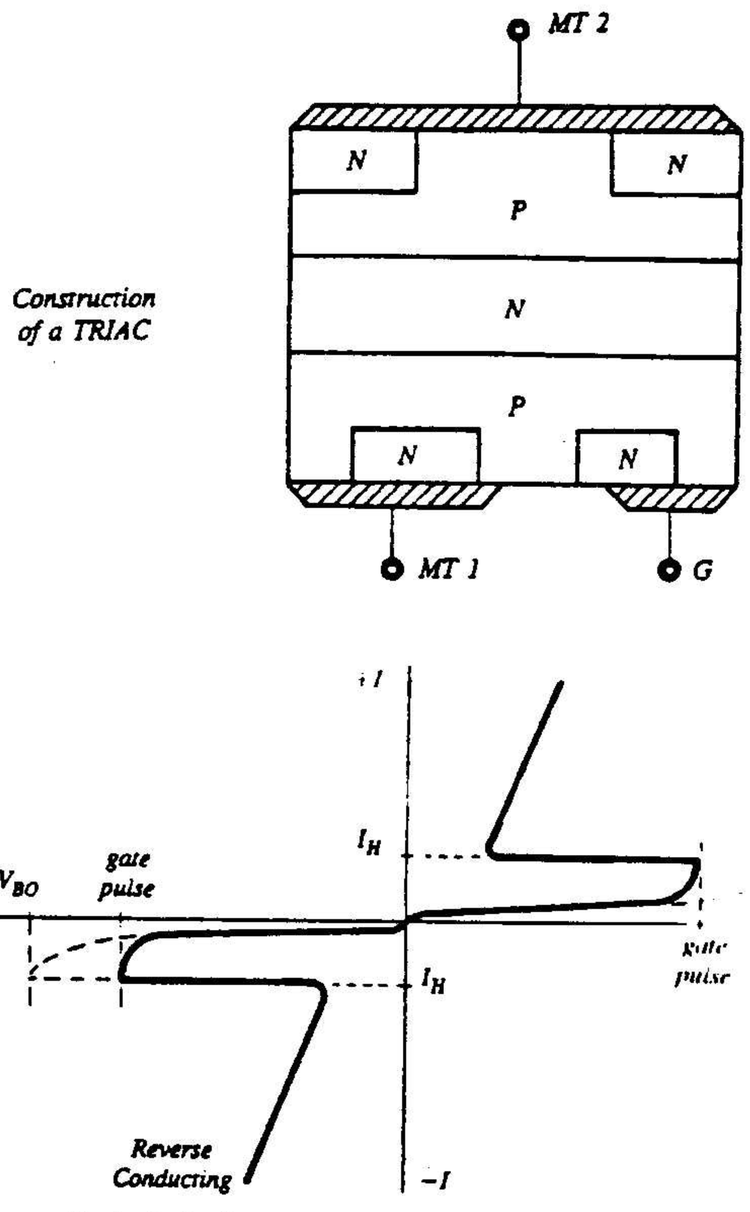
2.1.3 4k7 Potentiometer (2)

2.1.4 SPST Switch (2)

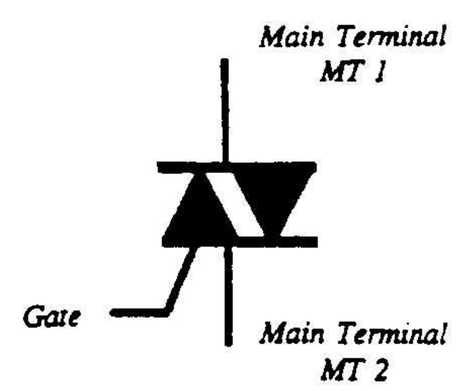
2.1.5 2-10 pF adjustable capacitor (2)

2.2

- Bidirectional triode resistor = TRIAC
- Modification of Standard SCR
- PN Doped silicon sharing a common central p region
- Portion of outer ends on each side are n doped sharing a commin connecting lead with the larger p region
- Connecting leads MT1 and MT2 – Main Terminal and not cathode anode due to the TRIAC conducting in both directions
-

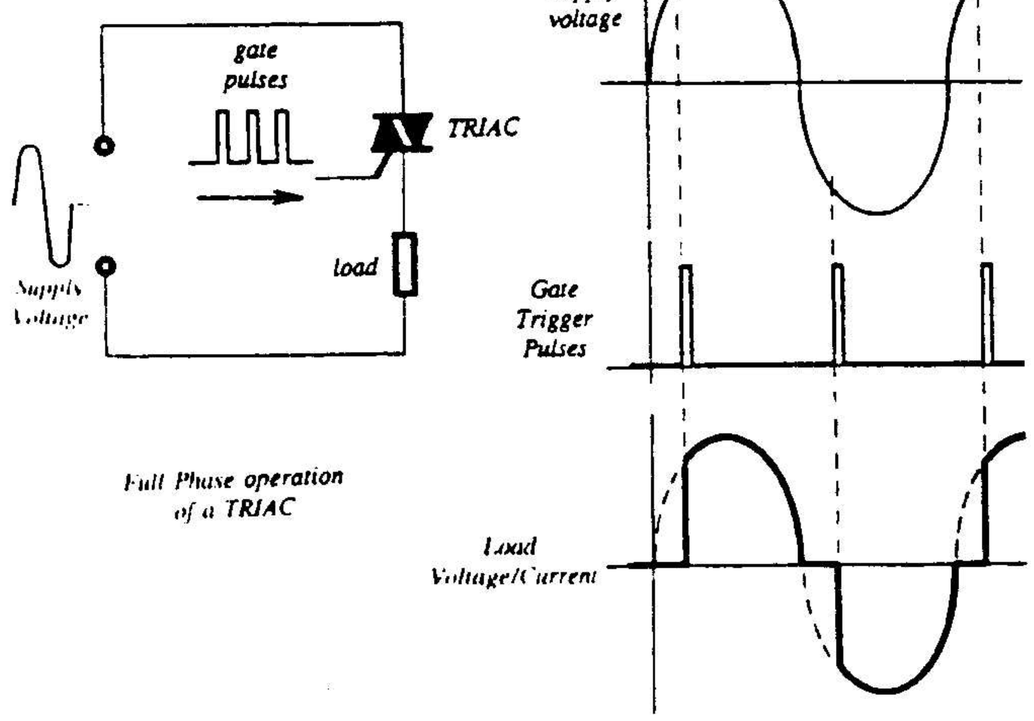


Construction of a TRIAC



Circuit Symbol of a TRIAC

The device operates identically in either direction.

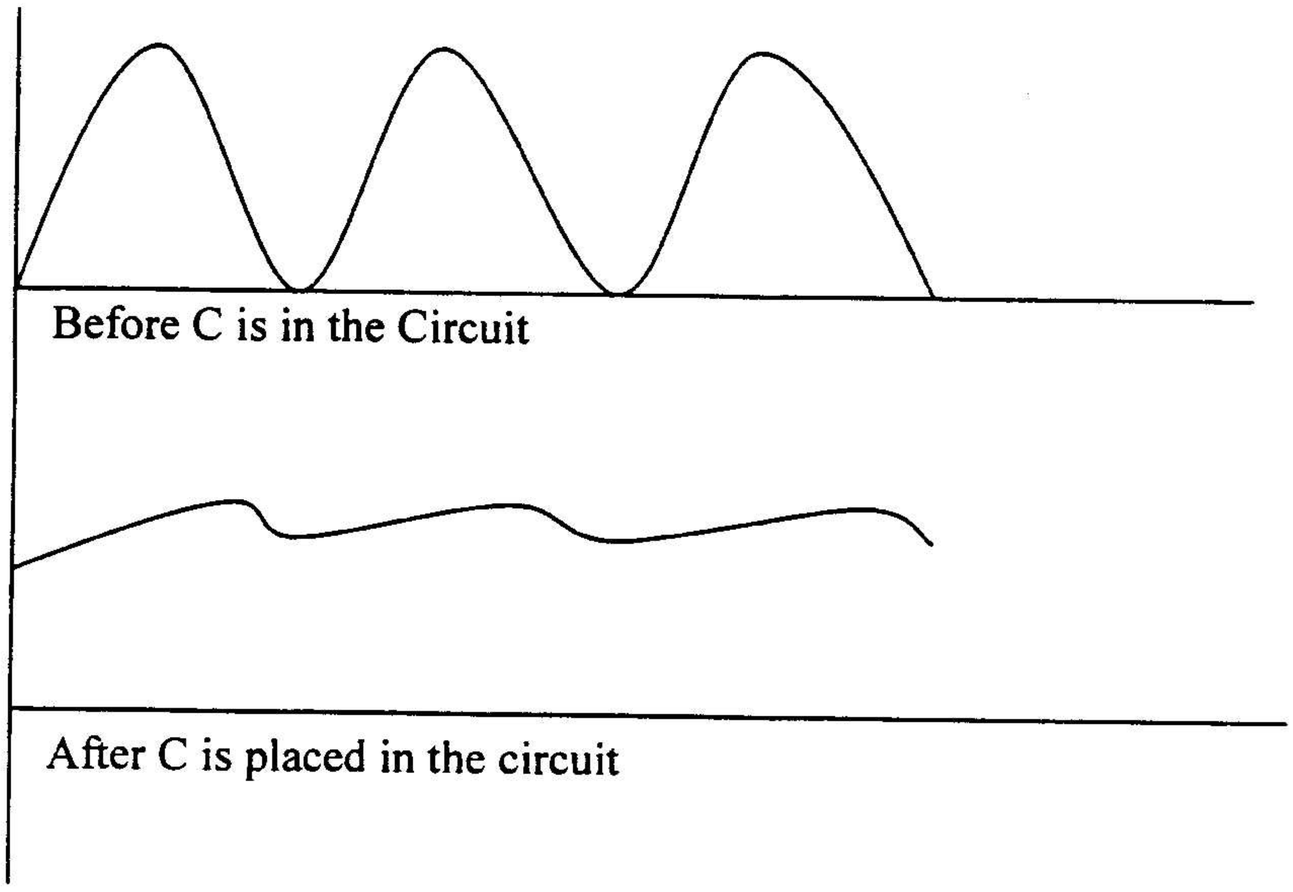


Full Phase operation of a TRIAC

(12)

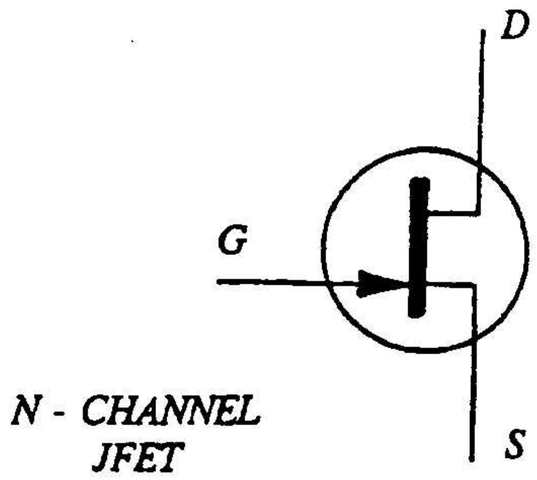
2.3 Layers of P and N type material form a Silicon wafer as used to manufacture IC's
Doped or undoped (2)

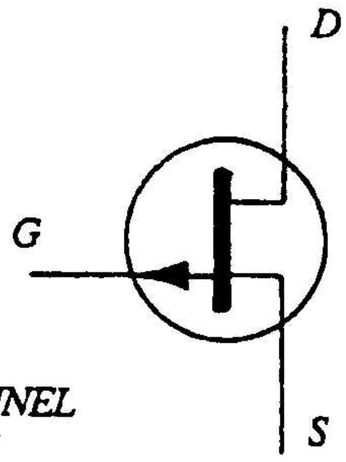
2.4 The ripple is smoothed out



(2)

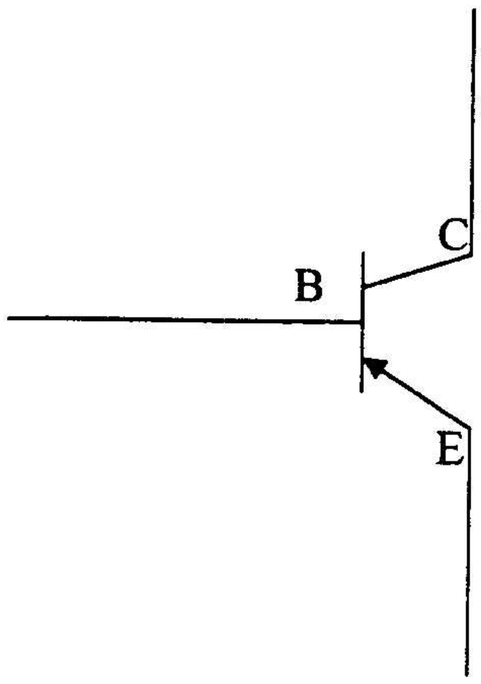
2.5.1





(1)

2.5.2



PNP Transistor

(1)

[28]

QUESTION 3

3.1

3.1.1

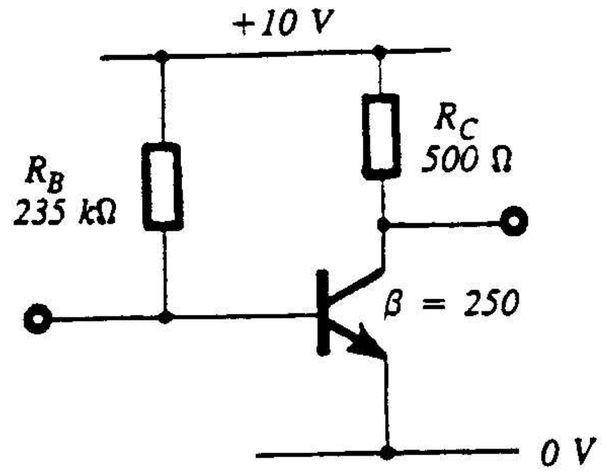
$$Vcc = Vbe + Ib \times Rb$$

$$\therefore Ib = \frac{Vcc - Vbe}{Rb}$$

$$= \frac{10 - 0.6}{235000}$$

$$= 0.00004A$$

$$= 40\mu A$$



(4)

3.1.2

$$\beta = \frac{Ic}{Ib}$$

$$\therefore Ic = \beta \times Ib$$

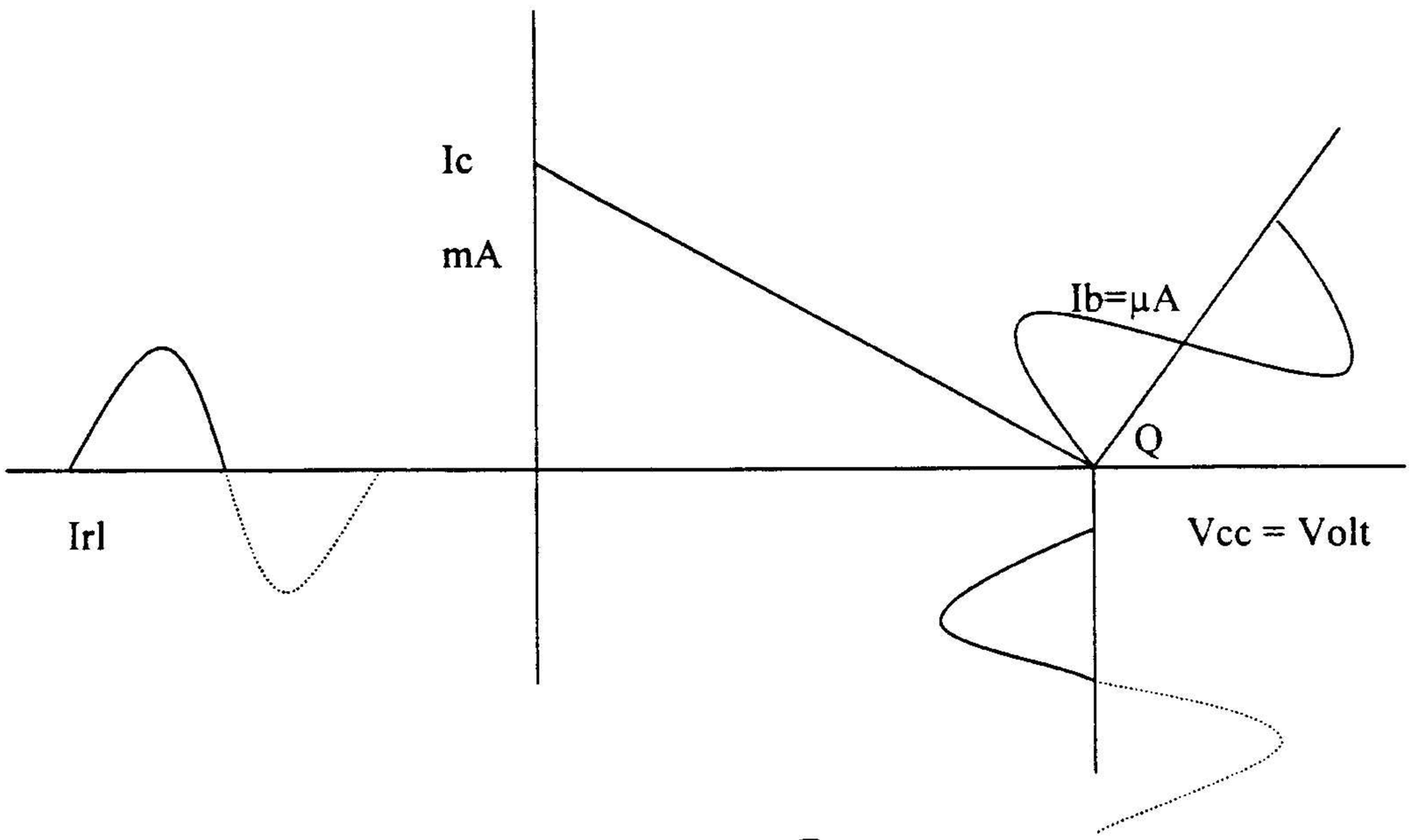
$$= 250 \times \left(40 \times 10^{-6}\right)$$

$$= 0.1A$$

$$= 100mA$$

(4)

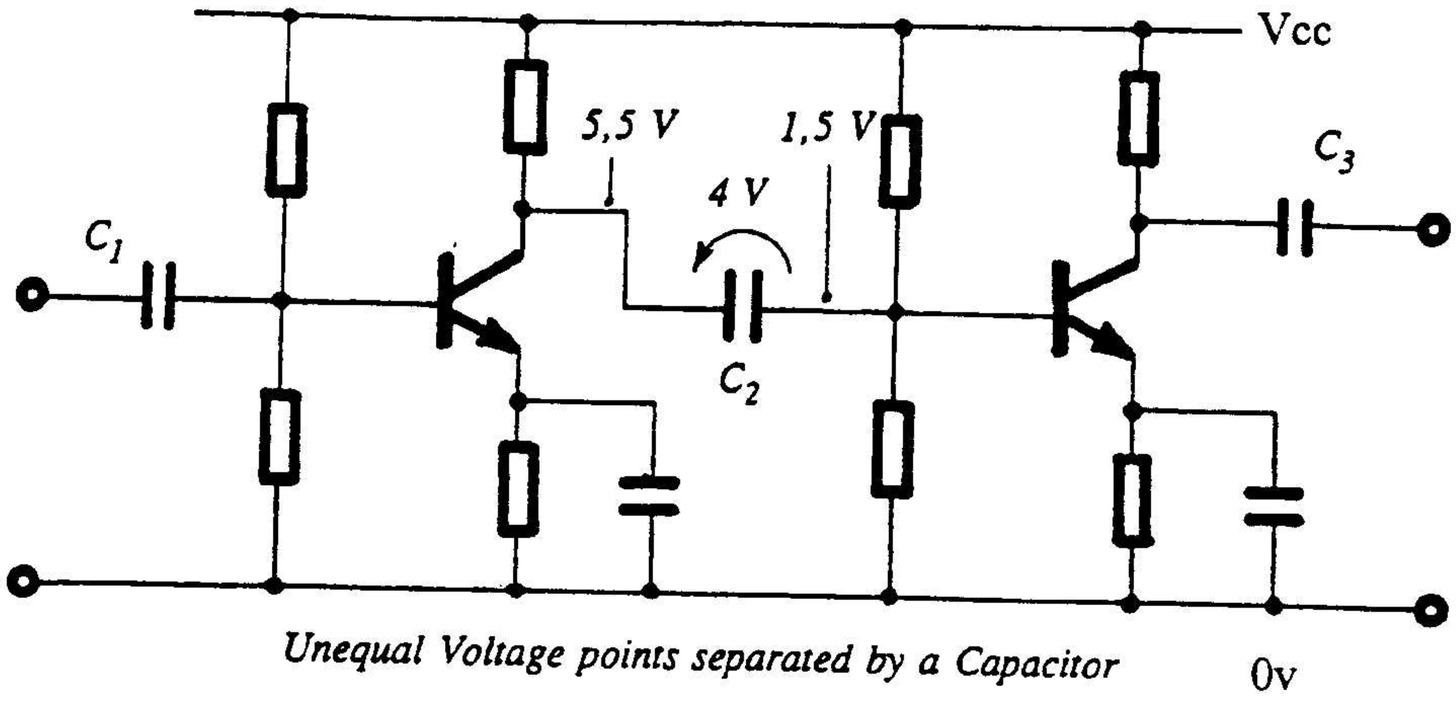
3.1.3



Vce

3.2 (9)

Two RC Coupled Stages

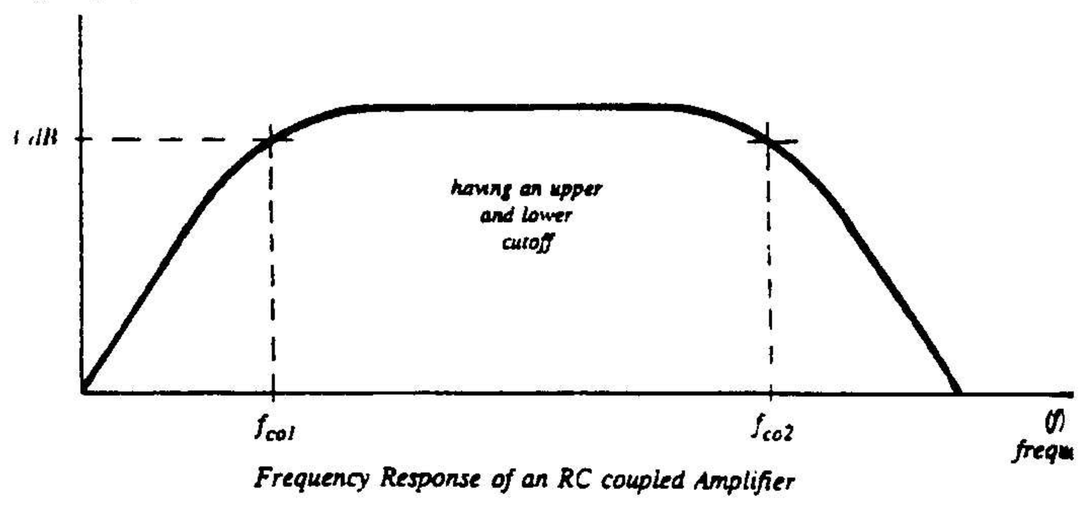


Unequal Voltage points separated by a Capacitor

(10)

3.3

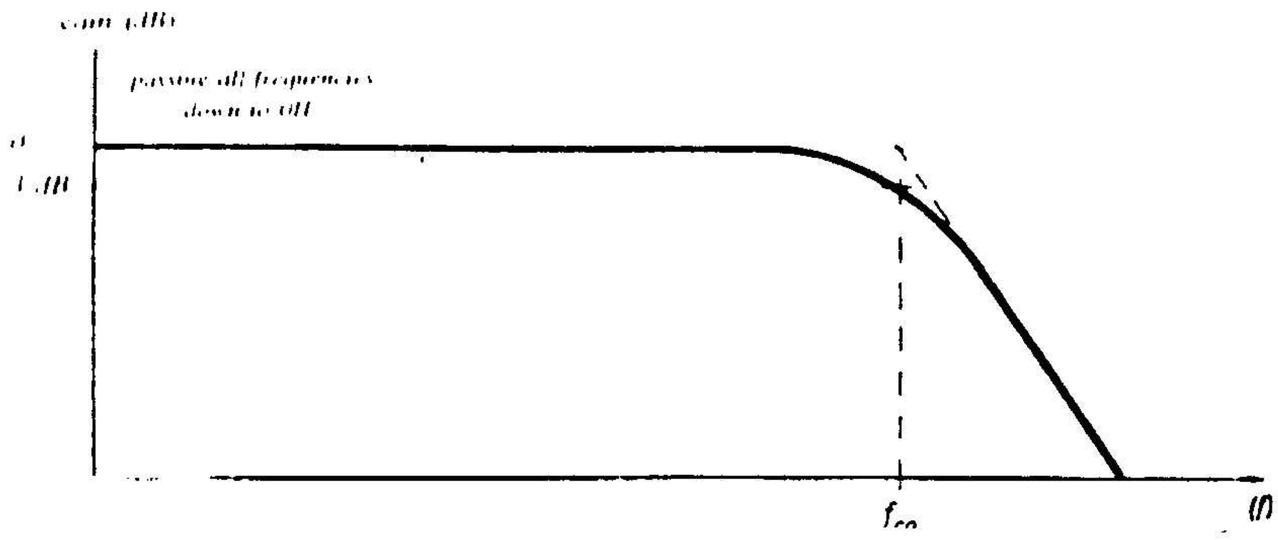
3.3.1



Frequency Response of an RC coupled Amplifier

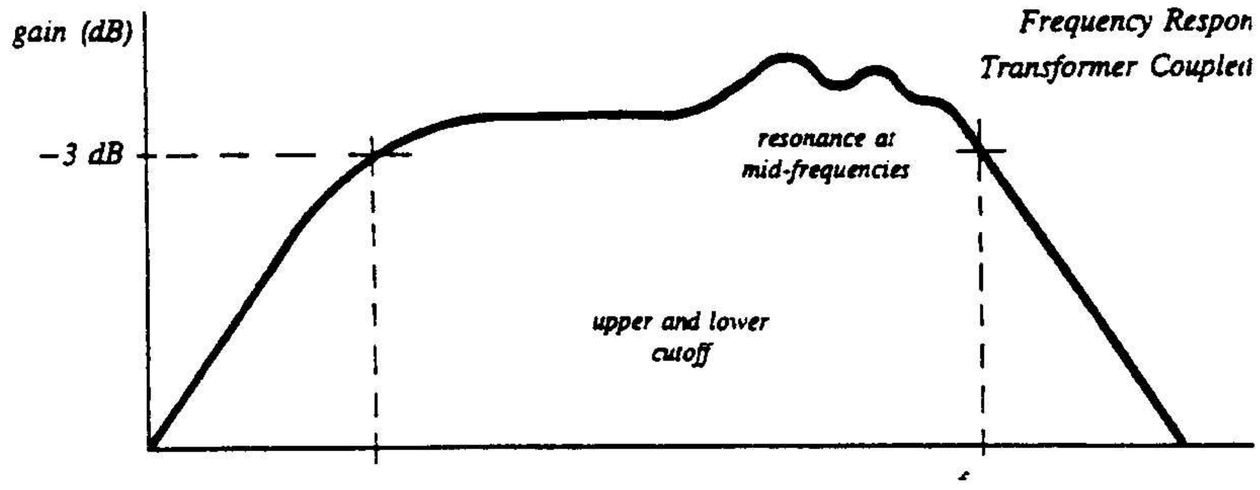
(2)

3.3.2



(2)

3.3.3

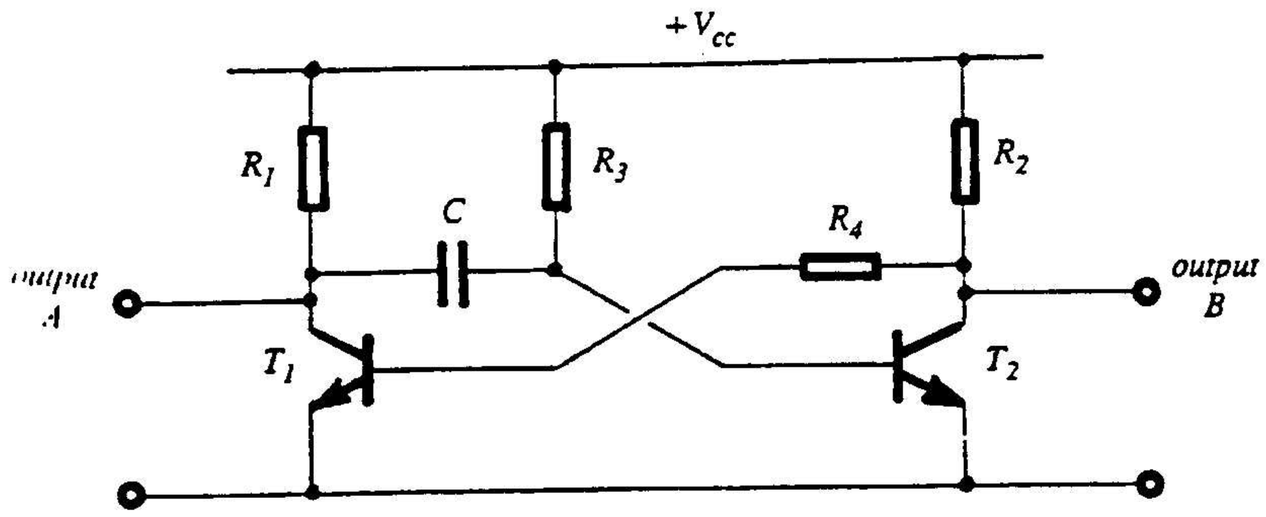


Frequency Respon
Transformer Couplet

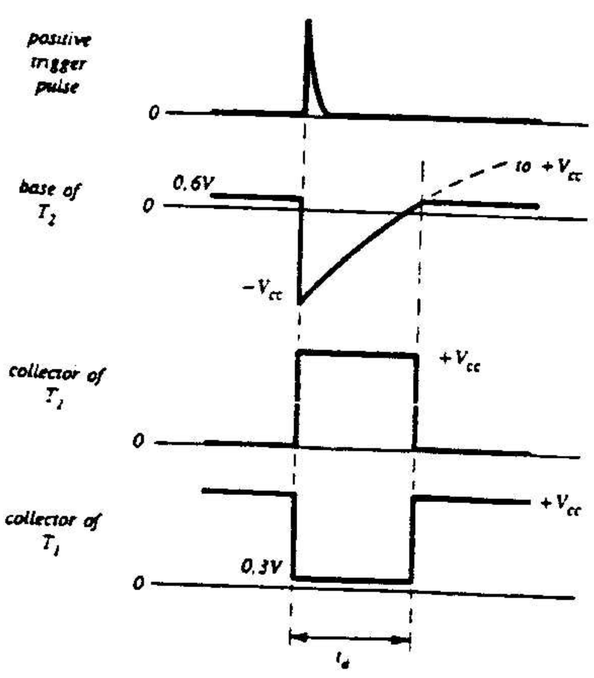
(2)

QUESTION 4

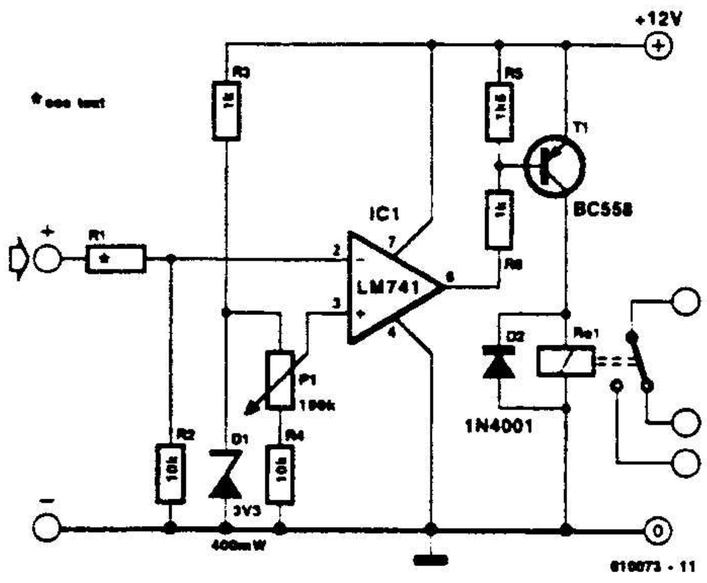
4.1

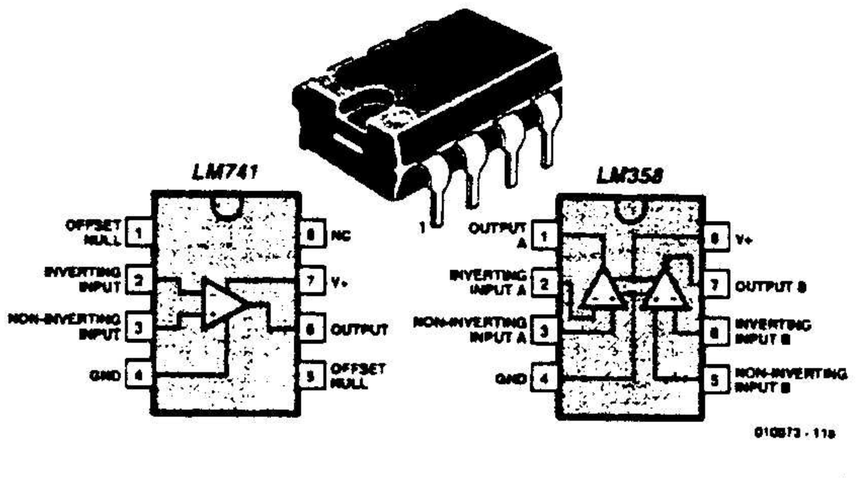


A Monostable Multivibrator



4.2



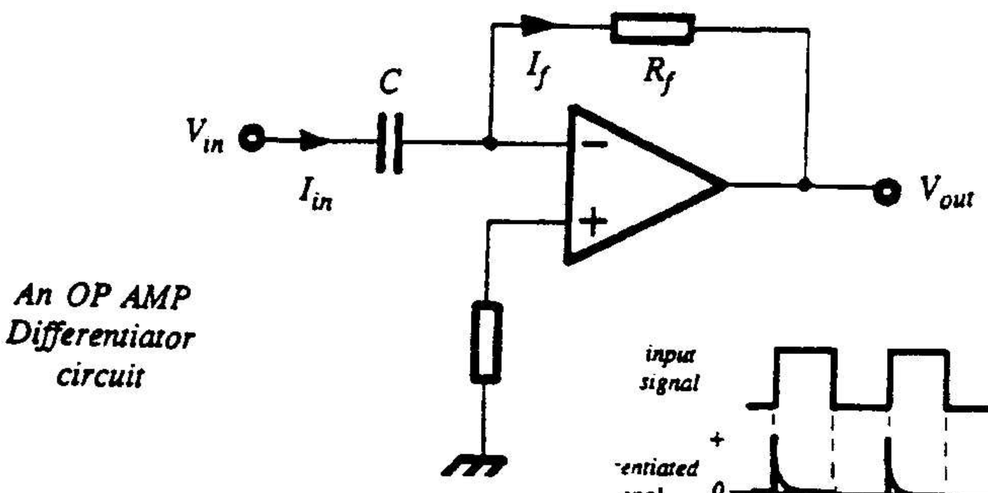


- Comparator Circuit

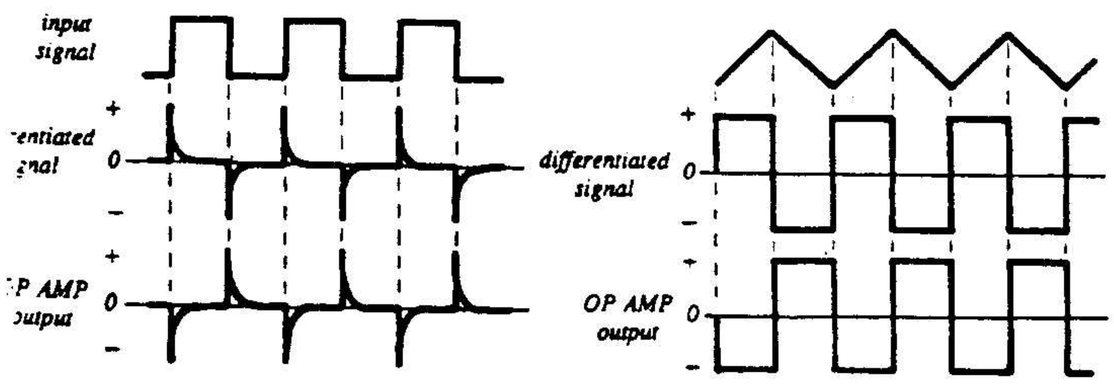
- When input voltage at pin 2 (inv input) becomes higher than the reference voltage at pin 3 (non inv input) the out put if the op-amp will become low.
- When pin 6 = low then T1switches on
- T1 activates Relay Re1 and equipment can be disconnected from PSU
- Purpose of D1 is to protect agains a back emf induced in the coil of Re1
- D1 = 3.3volt Zener diode that provide reference point/voltage
- R1 limits current flow and voltage drop over R1 is sampled.
- P1 allows different refence points to be set through adjustment of P1
- When input voltage at pin 2 falls below the reference voltage the output pin 6 will become high.
- Pin 6 = high then T1 will switch off
- When T1 = off then relay Re1 is switched off and external circuit may be activated
- R5 and R6 provide stable biasing for T1
- Pin 6 = high then Vbe does not = 0,6 volt. For T1 to function Vbe = biased and Vbc = reverse biased.

(10)

4.3



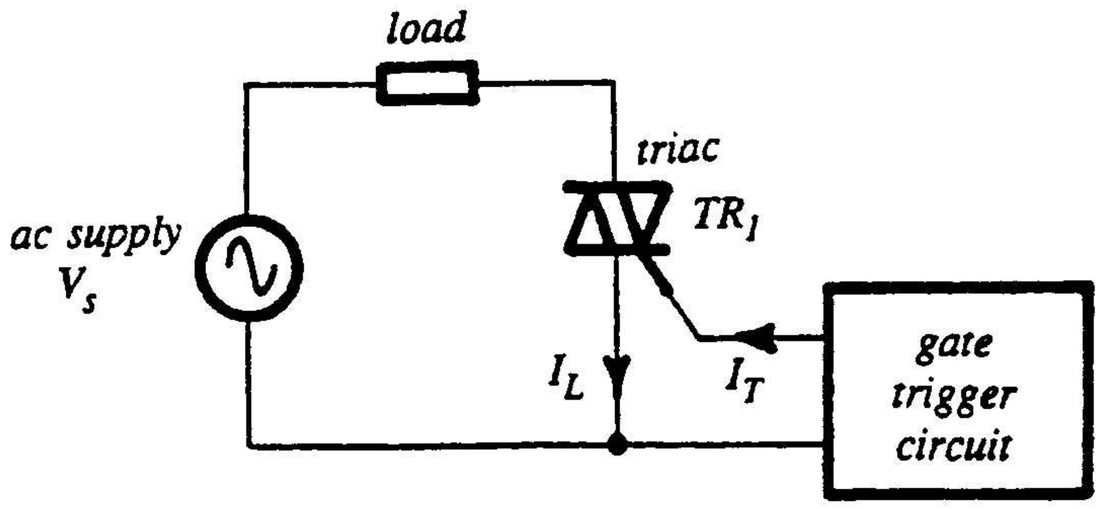
An OP AMP Differentiator circuit

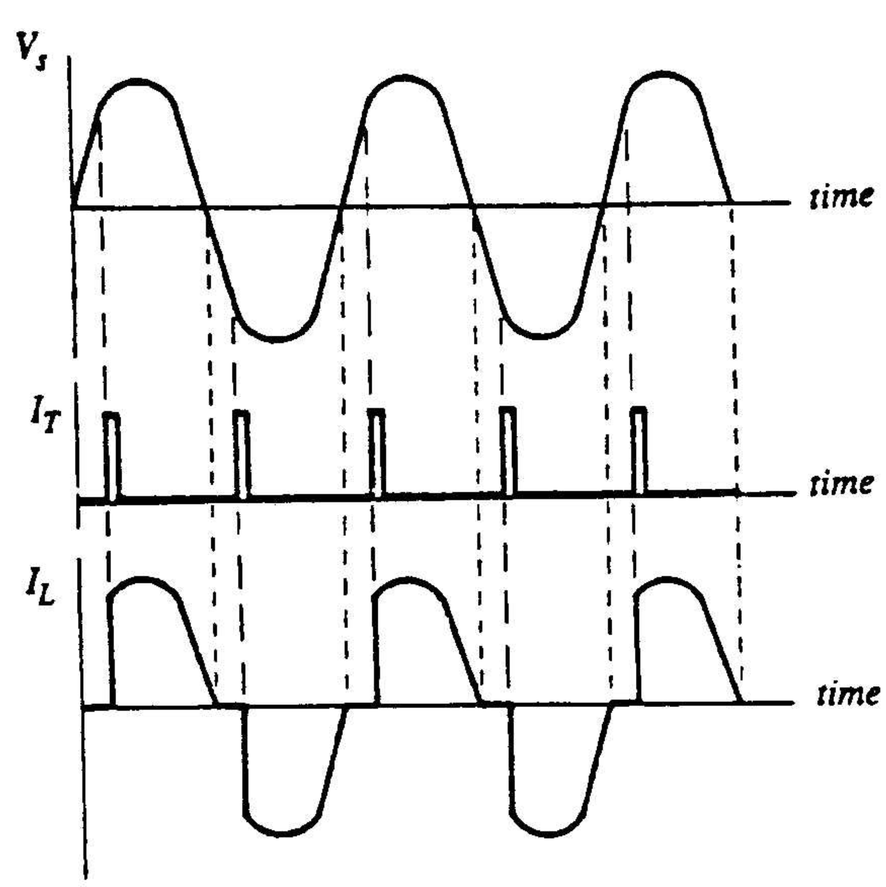


$$\therefore \quad V_o = -CR_f \frac{dV_{in}}{dt}$$

(6)

4.4

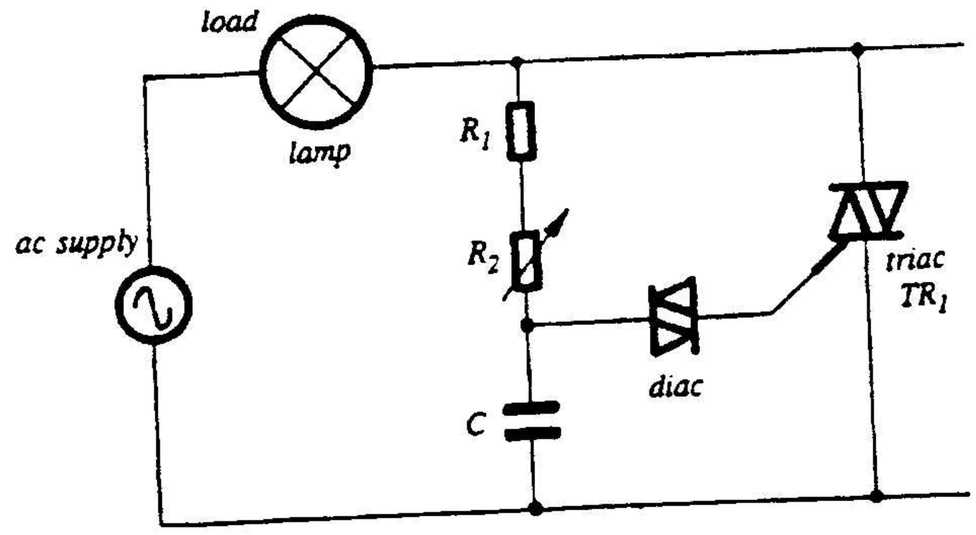




ac supply

gate trigger pulses

load current



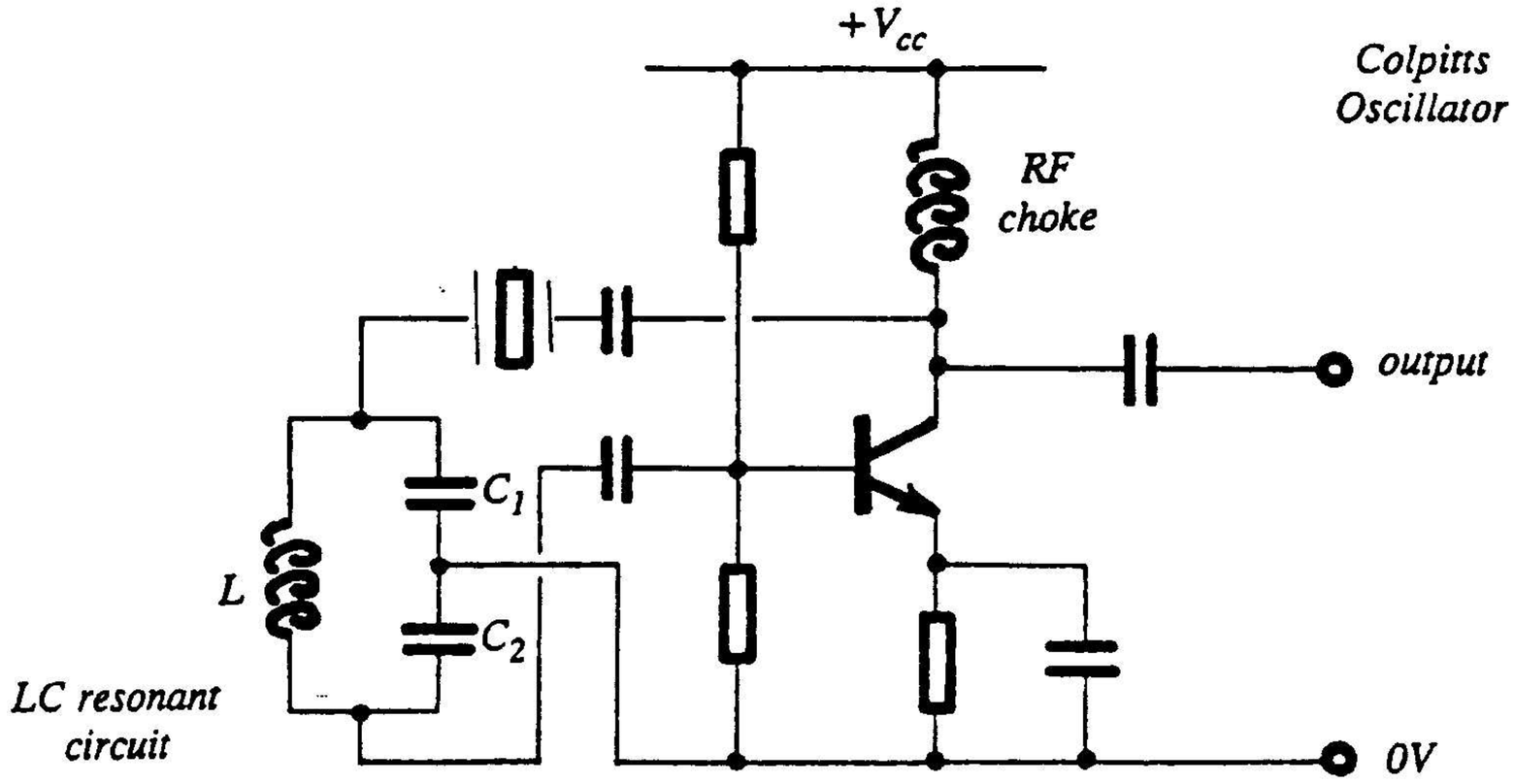
(9)

4.5 Any acceptable answer

(10)
[50]

QUESTION 5

5.1 NB: circuit must contain crystal to be correct.



(10)

5.2

5.2.1 R1C1 causes phase shift to occur. More than on set will cause a further phase shift as well as oscillation (3)

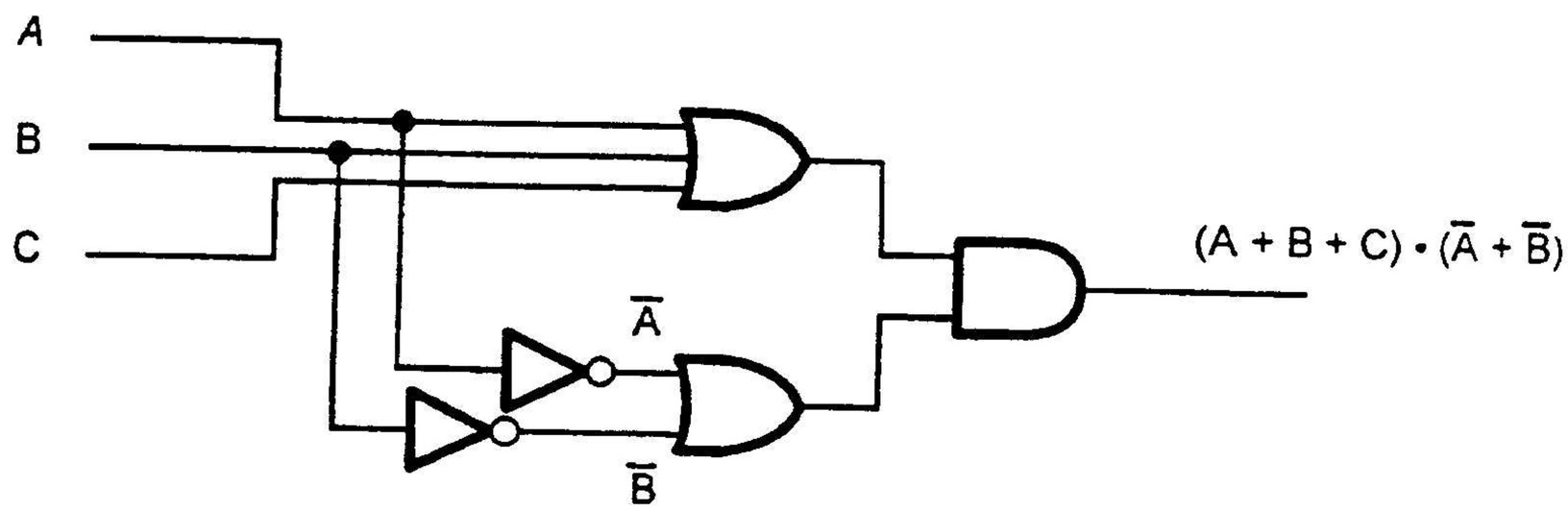
5.2.2 Spanningsverdeler voorspanning op basis van Transistor (3)

5.2.3 Beheer die Ic and positiewe terugvoer na RC oscillator kring. (2)

[18]

QUESTION 6

6.1



(5)

6.2

F = A'B + AB' + AB
Or
$F = \overline{A}B + A\overline{B} + AB$ (5)

6.3

6.3.1

Vol = 1
Leeg = 0

X = Alarm
X=1 alarm aan
X=0 alarm af

$\overline{ABC} = Y$
y=system shutdown

A	B	C	X	Y
0	0	0	**1**	**1**
0	0	1	**1**	**0**
0	1	0	**1**	**0**
0	1	1	**0**	**0**
1	0	0	**1**	**0**
1	0	1	**0**	**0**
1	1	0	**0**	**0**
1	1	1	**0**	**0**

(8)

6.3.2

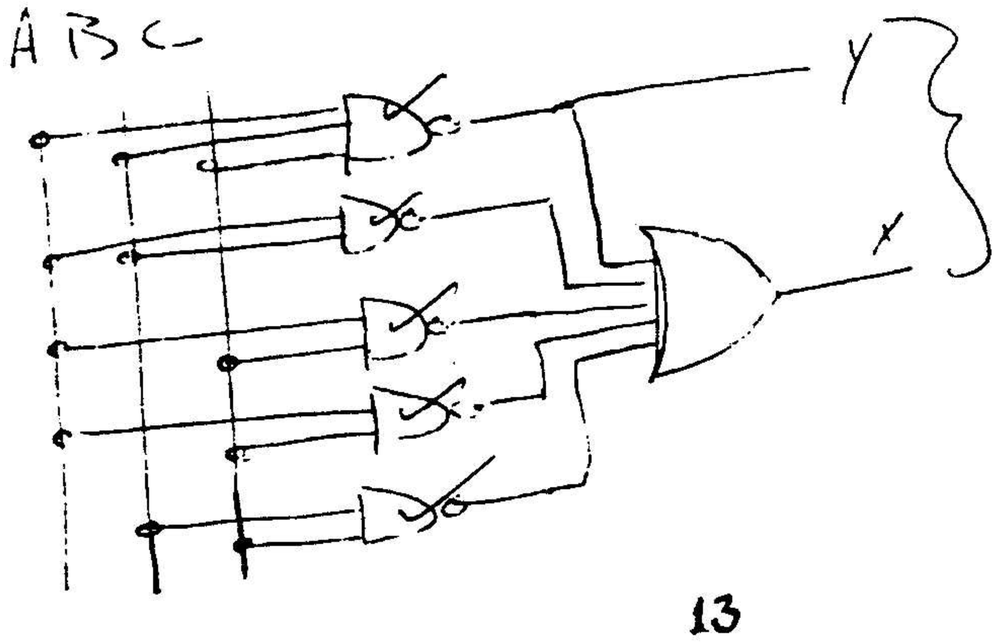
$X = \overline{ABC} + \overline{AB} + \overline{AC} + \overline{BC}$

$\overline{ABC} = Y$

OR

Z=X+Y (7)

6.3.3



(5)

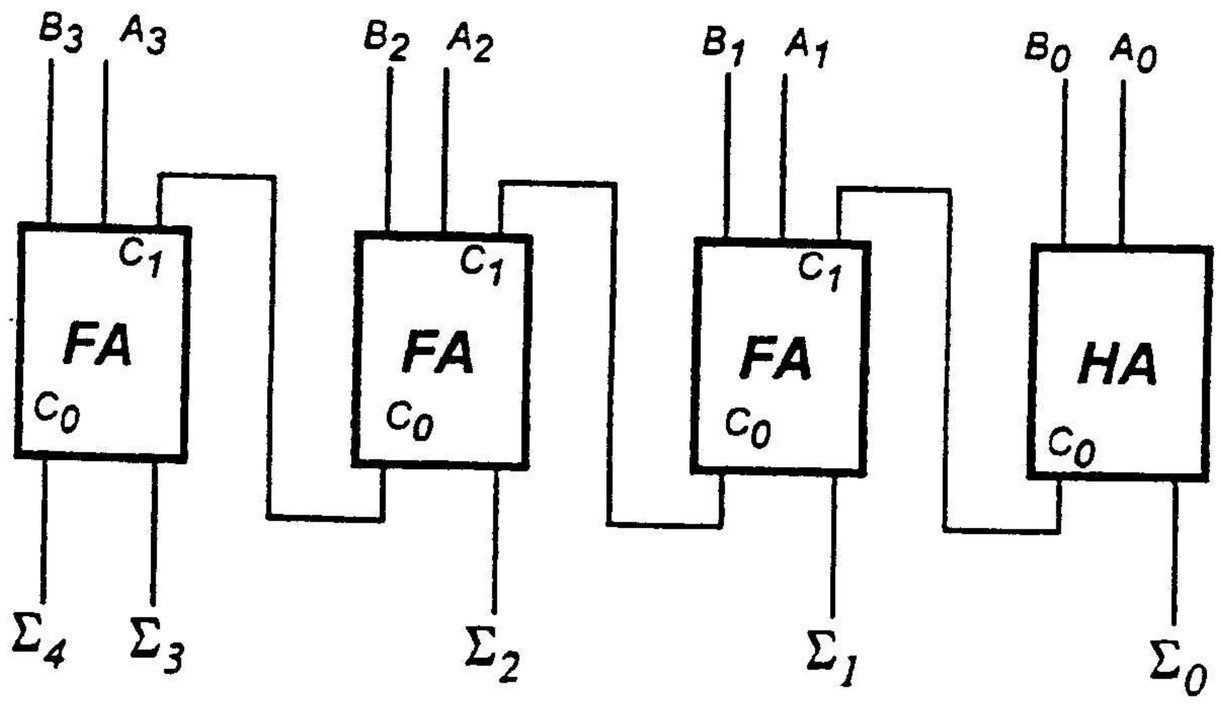
6.4

RAM- Random Access memory – needs to be refreshed every now and then
ROM – Read only memory – keeps memory indefinitely

(4)

6.5

The circuit below shows a four-bit parallel adder.

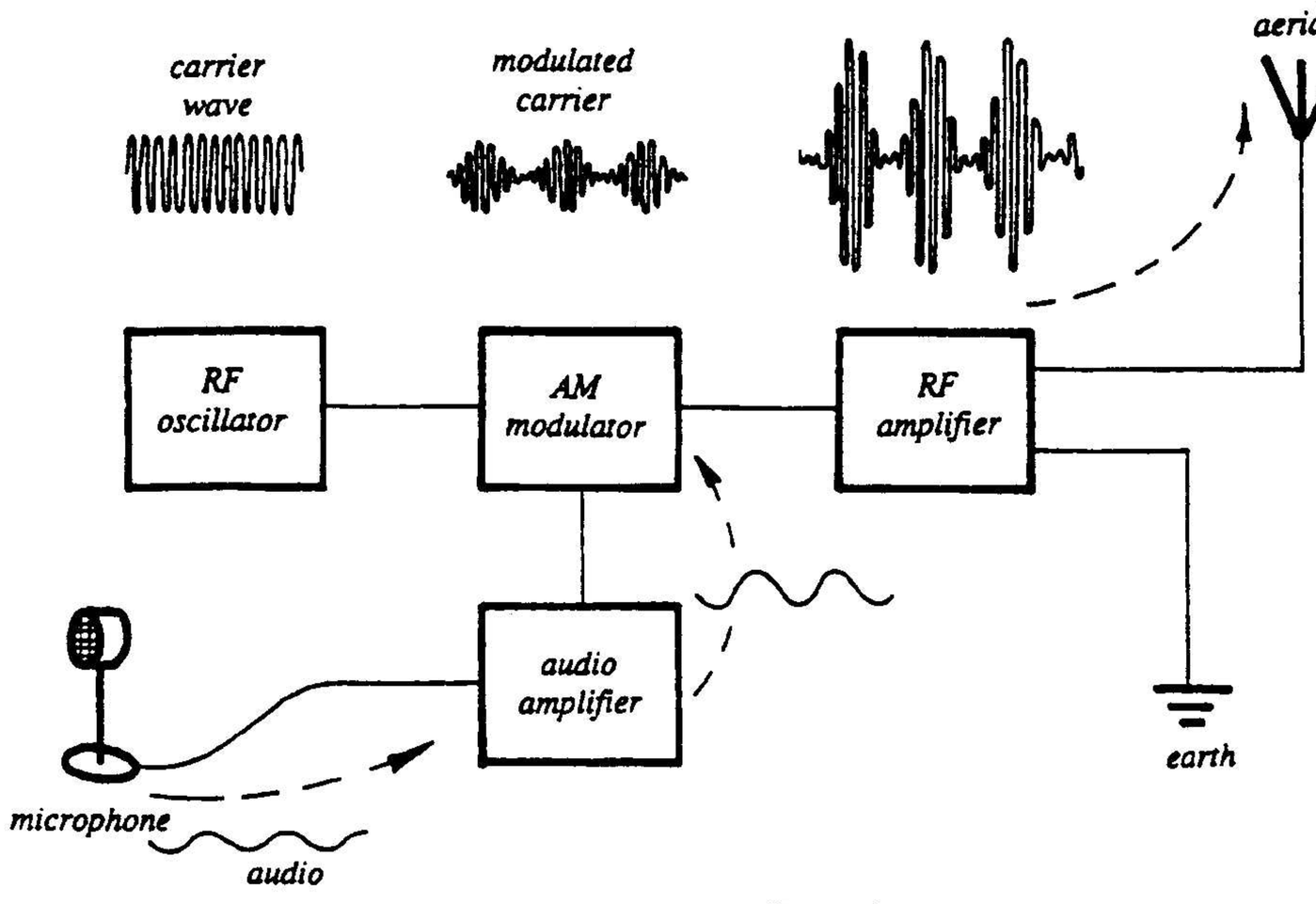


Four-bit Parallel Adder

(16)
[50]

QUESTION 7

7.1



A Simple AM Radio Transmitter (10)

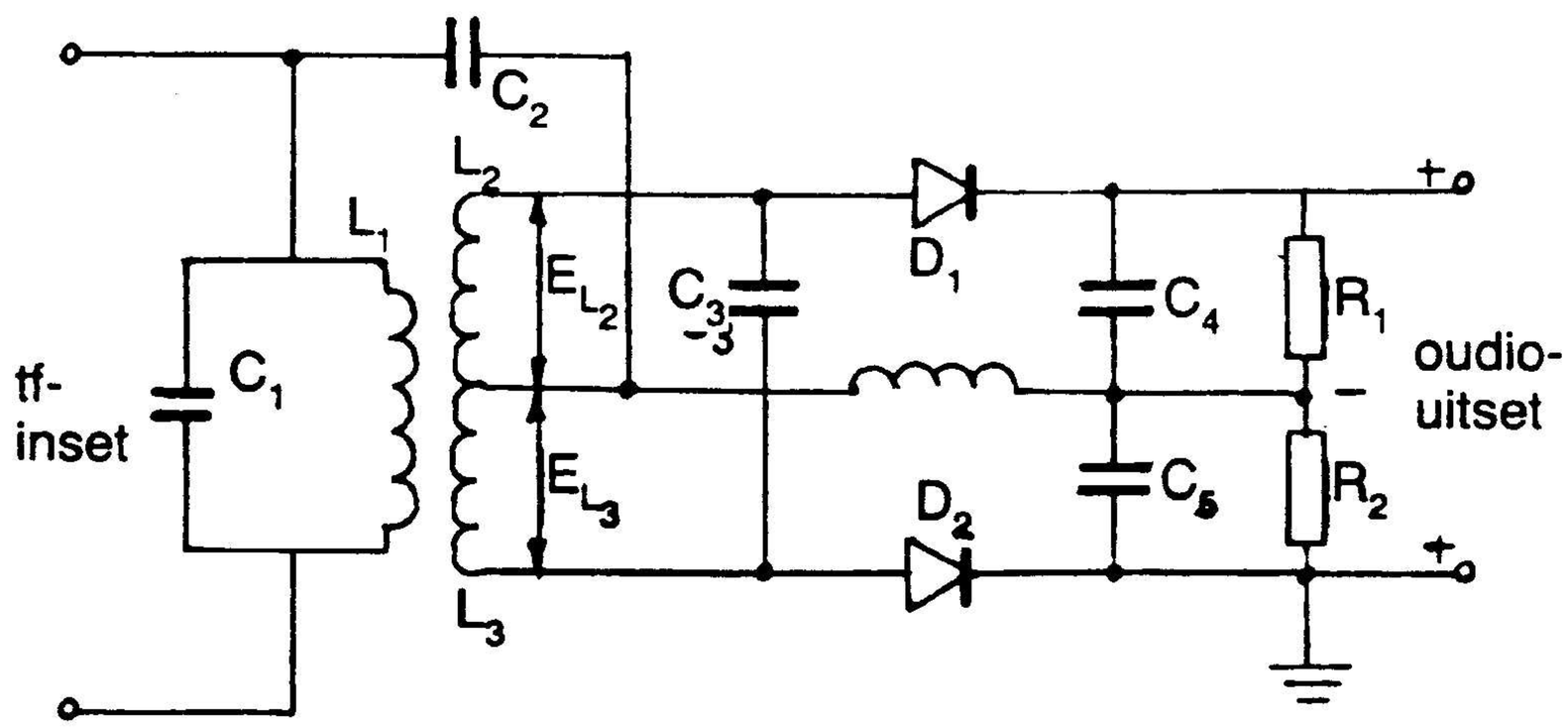
7.2 Optic fibre systems has broader bandwidth and can thus carry more traffic due to wider range of modulation that can take place.
Not prone to lightning
High measure of security
Not as prone to theft as copper wire
Etc. (4)

7.3 Yagi Dipole, Loop antenna, Vertical, folded dipole etc. (2)

7.4 The higher the frequency the more it becomes line of sight and is easier absorbed rather than reflected, lower frequencies is more prone to propagation through the atmosphere by reflecting between the earth surface and the stratosphere although attenuation takes place with every reflection. The frequency determines the propagation characteristics of the signal. Higher frequency signals are absorbed and attenuated easier than lower frequency signals ie.
Light vs sound through a closed door (2)

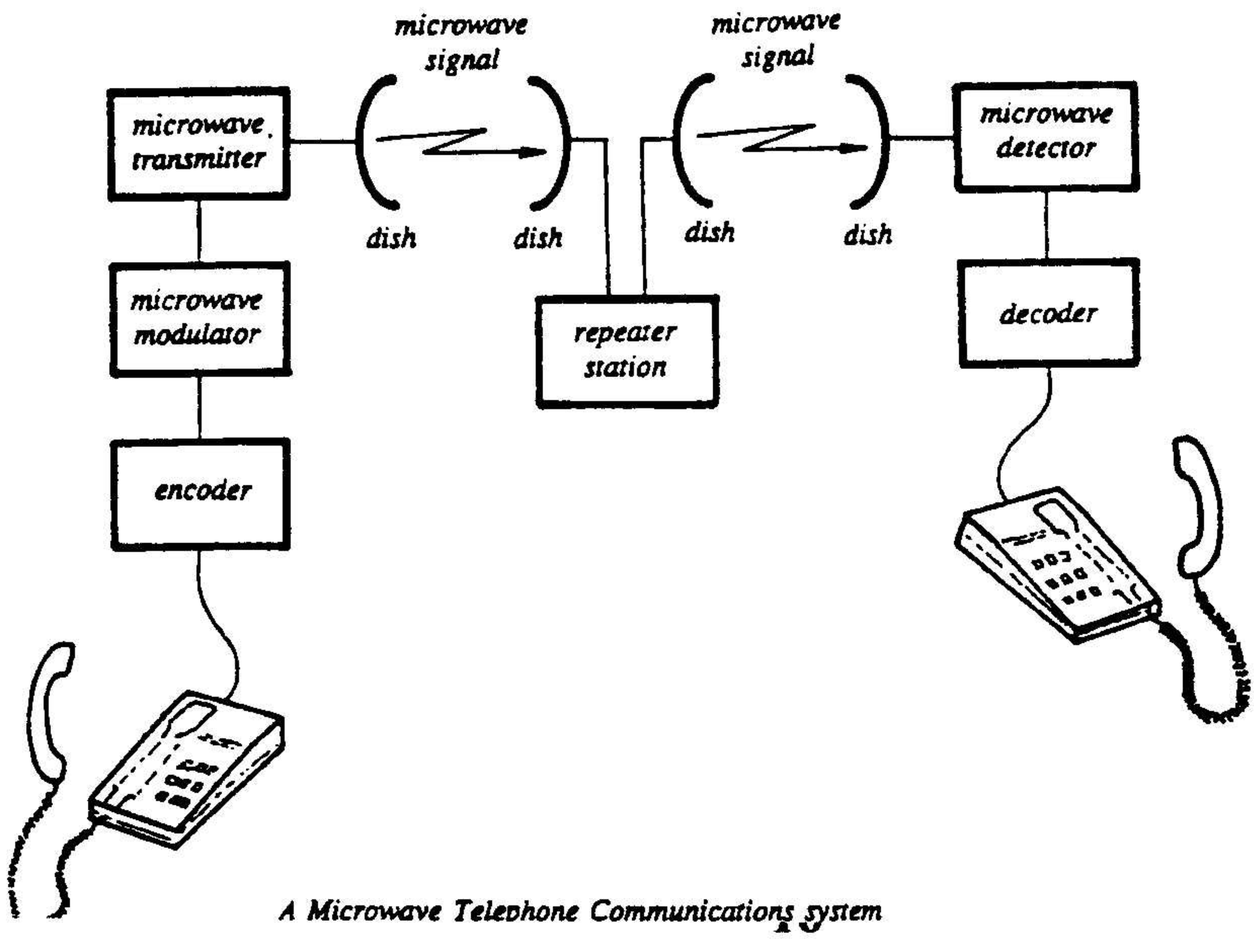
7.5 If alignment is not 100 % the whole signal is attenuated and lost. (2)

7.6



- Werking berus op diskriminasie van frekwensie veranderinge in basiese dragolf frekwensie.
- Ontrekking van oudio informasie(demodulasie) deur diskriminator of verhoudingsdetektor verkry.
- Werking berus of faseverhouding van frekwensie bo en onder die tussenfrekwensie. Frekwnsie van die TF sein wissel met 75 Hz bo en onder die diewaarde van 10.7 MHz
- Beginsel berus opD1 en D2 se geleiding
- As Finset = 10.7MHz dan gelei D1 en D2 eweveel en uitset =0
- As Fin daal onder 10.7MHz dan gelei D2 meer en uitset meet neg
- As Fin styg bo 10.7MHz dan gelei D1 meer en uitset meer pos.
- Uitset word na audio amp gekoppel
- Indien Fin buite die perke van die diskriminator devieer sal uitset audio geknip word en audio sal versteur word. Verskil tussen 2.5 kHz en 5 kHz deviasie op IF (6)

7.7

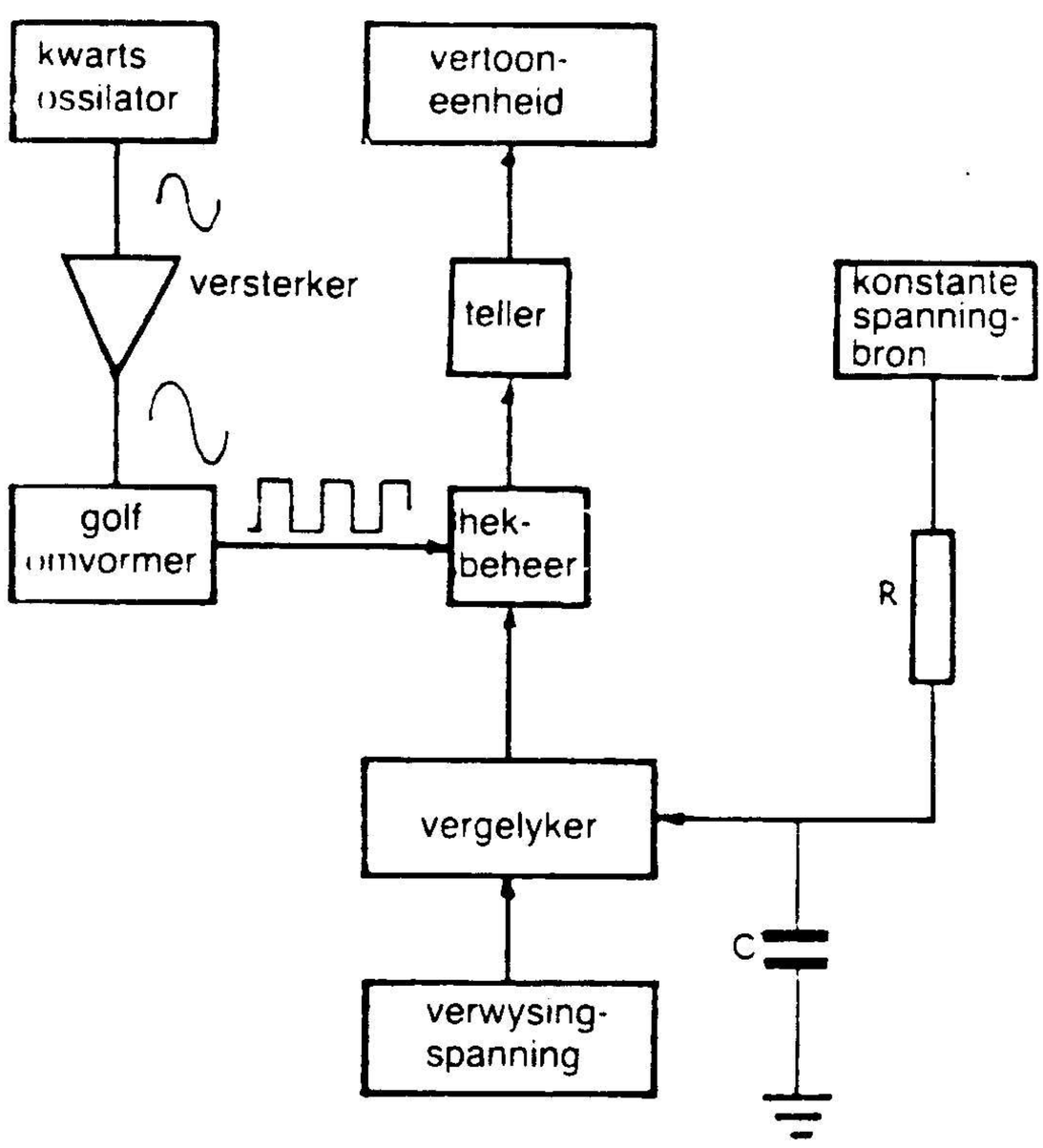


A Microwave Telephone Communications system

(10)
[36]

QUESTION 8

8.1



(10)

8.2 Very accurate
Not prone to damage due to physical shock
Not parallax mistakes
Easy to read
Some models are self adjusting (2)

8.3 Earth equipment.
Use correct settings
Do not abuse instrument
Allow 3-5 minutes to warm up (2)

8.4

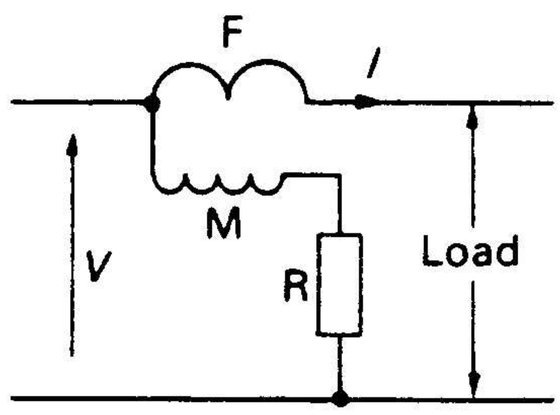
8.4.1

$$T = \frac{T}{div} \times div$$
$$= \frac{120 \times 10^{-3} s}{div} \times 3div \qquad (3)$$
$$= 360 \times 10^{-3} S$$
$$= 360mS$$

8.4.2

$$V = \frac{V}{div} \times div$$
$$= \frac{25 \times 10^{-3} V}{civ} \times 2div \qquad (3)$$
$$= 50 \times 10^{-3} V$$
$$= 50mV$$

8.5



(5)

[25]