Scilab Manual for
Electronic Devices And Circuits
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Experiment: 1

Determine the base,emitter,collector current of Common Base config ,given alpha value

check Appendix AP 6 for dependency:

```
EX1.jpg
```

Scilab code Solution 1.1 1

```scilab
1  //Determine  the  base ,emitter , collector  current  of
       Common  base  config
2  //Windows  10
3  //Scilab  6.0.0
4
5  clc ;
6  clear ;
7  close ;
8
9  alpha =0.95     //in  Ampere
10 Rl =5*10 e3      //in  kilo  ohms
```

```
11  Vd=4.5          //in volts
12  Ic=Vd/Rl        //Current flowing through resistor (or)
        Collector Current in milli Ampere
13  Ie=Ic/alpha     //emitter current in milli Ampere
14  Ib=Ie-Ic         //base current in micro Ampere
15  Ic1=Ic*10e3
16  Ib1=Ib*10e6
17  Ie1=Ie*10e3
18  mprintf('The value of Ib is %.1fuA',Ib1)
19  mprintf('\nThe value of Ic is %.1fmA',Ic1)
20  mprintf('\nThe value of Ie is %.3fmA',Ie1)
```

Experiment: 2

Determine operating point of Fixed Bias circuit ,given transistor gain,base to emitter voltage

check Appendix AP 5 for dependency:

    EX2.jpg

Scilab code Solution 2.2 2

```
1 //Determine the operating point of Fixed Bias ckt
     given transistor gain ,Vbe
2 //Windows 10
3 //Scilab 6.0.0
4
5 clc;
6 clear;
7 close;
8
9 tgain=100            //beta (or) transistor gain //
     unitless
```

```scilab
10  Vcc=15                      //in volts
11  Vbe=0.7                     //base emitter voltage in volts
12  Rb=1*10e6                   //resistance in ohms
13  Rc=4*10e3                   //resistance in ohms
14  Ic=Vcc/Rc
15  Icq=tgain*((Vcc-Vbe)/Rb)    //collector current in
        milli Ampere
16  Vceq=Vcc-(Icq*Rc)     //collector emitter voltage in
        volts
17  Vce=Vcc-(Ic*Rc)                    //load line equation
        for fixed-bias ckt
18  //Substituting Ic=0,Vce=Vcc=15v
19  Ic1x=0
20  Vcex=Vcc-(Ic1x*Rc)
21  //coordinates of load line on x-axis are(0 mA,15V)
22  //Substituting Vce=0,Ic=Vcc/Rc=3.75mA
23  Vcey=0
24  Icy=Vcc/Rc
25  //coordinates of load line on y-axis are(3.75 mA,0V)
26  Icq=Icq*10e3
27  Vce=Vce*10e3
28  Icy=Icy*10e3
29  mprintf('Collector Current Icq=%.2fmA',Icq)
30  mprintf('\nCollector-Emitter Voltage Vceq=%.2fV',
        Vceq)
31  mprintf('\nX-Axis Coordinates(%dmA,%dV)',Ic1x,Vcex)
32  mprintf('\nY-Axis Coordinates(%.2fmA,%dV)',Icy,Vcey)
33  mprintf('\nOperating Point is Icq=%.2fmA and Vceq=%
        .2fV',Icq,Vceq)
34
35  //plotting the load line
36  x=[Ic1x,Vcex]
37  y=[Icy,Vcey]
38  clf()
39  plot(x,y)
40  xtitle('Load Line');
41  xlabel('Vce(V)');ylabel('Ic(mA)');
```

Experiment: 3

Determine ouput voltage of circuit given Vbe for transistors Q1,Q2

check Appendix AP 4 for dependency:

```
EX3.jpg
```

Scilab code Solution 3.3 3

```
1  //Determine output voltage of a ckt
2  //Windows 10
3  //Scilab 6.0.0
4
5  clc;
6  clear;
7  close;
8
9  Vcc=15           //in volts
10 Vbe2=0.7         //in volts
11 Vq1=1.7          //in volts
12 Rb1=1*10^3       //in kilo ohms
13 Rb2=100          //in ohms
```

```
14  Ie1 =( Vq1 - Vbe2 )/ Rb2
15  Ic1 = Ie1
16  Vc1 = Vcc -( Rb1 * Ie1 )
17  Q2 = Vc1
18  Vb2 = Vc1
19  Ve2 = Vb2 - Vbe2
20  Vout = Ve2
21  Ie1 = Ie1 *10^3      // in  milli  Ampere
22  mprintf ( 'Ie1 :%d mA ', Ie1 )
23  mprintf ( '\nVc1 :%d V ', Vc1 )
24  mprintf ( '\nQ2 :%d V ', Q2 )
25  mprintf ( '\nVe2 :%.1 f V ', Ve2 )
26  mprintf ( '\nVout :%.1 f V ', Vout )
```

Experiment: 4

Determine value of drain current Id and gate source voltage Vgs for self bias circuit

check Appendix AP 3 for dependency:

```
EX4.jpg
```

Scilab code Solution 4.4 4

```
1  //Determine value of drain current−Id and gate−
       source voltage−Vgs for self−bias ckt
2  //Windows 10
3  //Scilab 6.0.0
4
5  clc ;
6  clear ;
7  close ;
8
9  Vdd =20                   //in Volts
10 Vds =15                   //in Volts
11 Rd =4*10^3                //in ohms
12 Rs =0.4*10^3              //in ohms
```

```
13  Id =( Vdd - Vds ) /( Rd + Rs )          // in  milli  Ampere
14  Vgs = Id * Rs                // in  Volts
15  Id = Id *10^3
16  mprintf ( 'Drain  Current  Id  is  %.2 fmA ',Id )
17  mprintf ( '\nGate-Source  Voltage  Vgs  is  %.3 fV ',Vgs )
```

Experiment: 5

Find Freq of RC phase shift oscillator if the 3 resistances are equal and 3 capacitances are equal

Scilab code Solution 5.5 5

```
1  //Given N-channel JFET determine the value of rs to
      achieve Self Bias condition
2  //Windows 10
3  //Scilab 6.0.0
4
5  clc;
6  clear;
7  close;
8
9  Idss=40*10^-3              //in milli Ampere
10 Vp=-10                     //in Volts
11 Vgs=-5                     //in Volts
12 Vds=5                      //in Volts
13 Id=Idss*((1-(Vgs/Vp))^2)
14 Rs=Vds/Id
```

```
15  Id=Id*10^3          //in milli Ampere
16  mprintf('Id is %dmA',Id)
17  mprintf('\nRs is %d ohms',Rs)
```

Experiment: 6

Given N-channel JFET determine the value of Rs to achieve self bias condition

Scilab code Solution 6.6 6

```
1  //Find freq. of RC phase shift oscillator
2  //Windows 10
3  //Scilab 6.0.0
4
5  clc;
6  clear;
7  close;
8
9  R1=200*10^3          //resistance 1 in kilo ohms
10 R2=200*10^3          //resistance 2 in kilo ohms
11 R3=200*10^3          //resistance 3 in kilo ohms
12 C1=100*10^-12            //capacitance 1 in pico
       farads
13 C2=100*10^-12            //capacitance 2 in pico farads
14 C3=100*10^-12            //capacitance 3 in pico farads
15 fr=1/(2*%pi*R1*C1*sqrt(6))
16 fr=fr*10^-3          //in kilo Hertz
```

```
17  mprintf('The freqency of RC phase shift oscillator
         is %f Hz',fr)
```

Experiment: 7

Find the capacitance value in Wien-bridge oscillator given value of R and Freq of oscillation

Scilab code Solution 7.7 7

```
1  //Find the capacitance value in Wien-bridge
       oscillator
2  //Windows 10
3  //Scilab 6.0.0
4
5  clc;
6  clear;
7  close;
8
9  R=100*10^3        //resistance in kilo ohms
10 fr=10*10^3        //frequency of oscillation in kilo
       hertz
11 C=1/(2*%pi*R*fr)
12 C=C*10^12         //in pico Farad
13 mprintf('The capacitance value in the Wien-bridge
```

oscillator is: %.2 f pF',C)

Experiment: 8

Design Zener Shunt voltage regulator with given specifications

Scilab code Solution 8.8 8

```
1  //Design  Zener  Shunt−Voltage  regulator
2  //Windows  10
3  //Scilab  6.0.0
4
5  clc;
6  clear;
7  close;
8
9  Vo=10          //in  volts
10 Vinmin=20      //lowercase  Vin  in  volts
11 Vinmax=30      //uppercase  Vin  in  volts
12 Ilmin=30*10^-3      //lowercase  Il  in  volts
13 Ilmax=50*10^-3      //uppercase  Il  in  volts
14 Izmin=20*10^-3      //lowercase  Iz  in  milli
         Ampere
15 Izmax=40*10^-3      //uppercase  Iz  in  milli
         Ampere
```

```
16  Vz=Vo
17  Pz=Vz*Izmax
18  mprintf('Pz:%.2f W',Pz)
19  //Pz=0.4W,Hence a 0.5Z 10 zener can be selected
20  Rlmin=(Vo/Ilmax)
21  Rlmax=(Vo/Ilmin)
22  Rmax=((Vinmax-Vo)/(Ilmin+Izmax))
23  Rmin=((Vinmin-Vo)/(Ilmax+Izmin))
24  R=(Rmax+Rmin)/2
25  mprintf('\nRlmin:%d ohms',Rlmin)
26  mprintf('\nRlmax:%d ohms',Rlmax)
27  mprintf('\nRmax:%d ohms',Rmax)
28  mprintf('\nRmin:%d ohms',Rmin)
29  mprintf('\nR:%d ohms',R)
```

Experiment: 9

Determine input,output impedance voltage and current gain given h-parameters of transistor

check Appendix AP 2 for dependency:

    EX9.jpg

Scilab code Solution 9.9 9

```
1 //Determine input&output impedance voltage and
      current gain given h-parameters of transistor
2 //Windows 10
3 //Scilab 6.0.0
4
5 clc;
6 clear;
7 close;
8
9 Ic=3*10^-3              //collector current in milli
      Ampere
```

```
10  hfe=60                    //beta value
11  Vcc=12                     //in Volts
12  Vbe=0.6                    //base emitter voltage in
       Volts
13  Rc=5.1*10^3               //resistance in kilo ohms
14  Rb=220*10^3              //resistance in kilo ohms
15  hie=500                  //in ohms
16  Zi=hie
17  Zo=Rc
18  Av=(-hfe*Rc)/hie
19  mprintf('Av:%d',Av)
20  Al=-hfe
21  mprintf('\nAl:%d',Al)
22  //from re model
23  Ib=(Vcc-Vbe)/Rb
24  Ib1=Ib*10^6             //in micro Ampere
25  mprintf('\nIb:%.1f uA',Ib1)
26  Ie=hfe*Ib
27  Ie1=Ie*10^3            //in milli Ampere
28  mprintf('\nIe:%.3f mA',Ie1)
29  re=(26*10^-3)/Ie
30  mprintf('\nre:%.2f ohms',re)
31  Zi=hfe*re
32  mprintf('\nZi:%.1f ohms',Zi)
33  Zo=Rc
34  Zo=Zo*10^-3
35  mprintf('\nZo:%.1f k ohms',Zo)
36  Av=-Rc/re
37  mprintf('\nAv:%d',Av)
38  Al=-hfe
39  mprintf('\nAl:%d',Al)
```

Experiment: 10

Design Schmitt Trigger circuit using 2 silicon NPN transistors with given configuration

check Appendix AP 1 for dependency:

    EX10.jpg

Scilab code Solution 10.10 10

```
1 //Design schmitt trigger ckt using 2 silicon npn
      transistors with given config
2 //Windows 10
3 //Scilab 6.0.0
4
5 clc;
6 clear;
7 close;
8
9 UTP=5              //in volts
10 Vb2=5             //in volts
11 Vbe=0.7           //in volts
12 Vcc=12            //in volts
```

```scilab
13  LTP=3                  //in  volts
14  Ic=2*10^-3         //in  milli  Amperes
15  Ic2=2*10^-3          //in  milli  Amperes
16  hfemin=100
17  UTP=Vb2
18  Ve=Vb2-Vbe
19  mprintf('\nVe:%.2f  V',Ve)
20  Ie=Ic
21  Ie=Ie*10^3
22  mprintf('\nIe:%d mA',Ie)
23  Re=Ve/Ie
24  mprintf('\nRe:%.2f  k  ohms',Re)
25  //taking  q2  saturated
26  Vcesat=0.2                //in  volts
27  IcRc2=Vcc-Ve-Vcesat
28  mprintf('\nIcRc2:%.1f  V',IcRc2)
29  Rc2=(Vcc-Ve-Vcesat)/Ic
30  Rc2=Rc2*10^-3
31  mprintf('\nRc2:%.2f  k  ohms',Rc2)
32  I2=0.1*Ic2
33  I2=I2*10^3
34  mprintf('\nI2:%.2f  mA',I2)
35  R2=Vb2/I2
36  mprintf('\nR2:%d  k  ohms',R2)
37  Ib2=Ic2/hfemin
38  Ib2=Ib2*10^6
39  mprintf('\nIb2:%d uA',Ib2)
40  I1=I2+Ib2
41  //substituting  the  values  and  equating  I1
42  //(Vcc-Vb2)/(Rc1+R1)=I1=0.2*10^-3+20*106-6
43  //12-5/(Rc1+R1)=0.22*10^-3
44  Rc1r1=(Vcc-Vb2)/I1
45  //Rc1+R1=7/(0.22*10^-3)
46  //when  q1  is  on  Vi=LTP=Vb2=3v
47  Vi=LTP
48  Vb1=3
49  Vb2=3
50  I1=Vb2/R2
```

```
51  //I1=I1*10^3
52  mprintf('\nI1:%.2f mA',I1)
53  Ie=(Vb1-Vbe)/Re
54  Ic1=Ie
55  mprintf('\nIc1:%.2f mA',Ic1)
56  mprintf('\nIe:%.2f mA',Ie)
57
58  //Vcc=Rc1(Ic1+I1)+I1(R1+R2)
59  Rc1=(Vcc-I1*(Rc1r1+R2))/(Ie)
60  Rc1=Rc1*10^-3
61  R1=Rc1r1-Rc1
62  //Rb<hfeRe
63  Rb=(hfemin*Re)/10
64  mprintf('\nRb:%.2f k ohms',Rb)
```
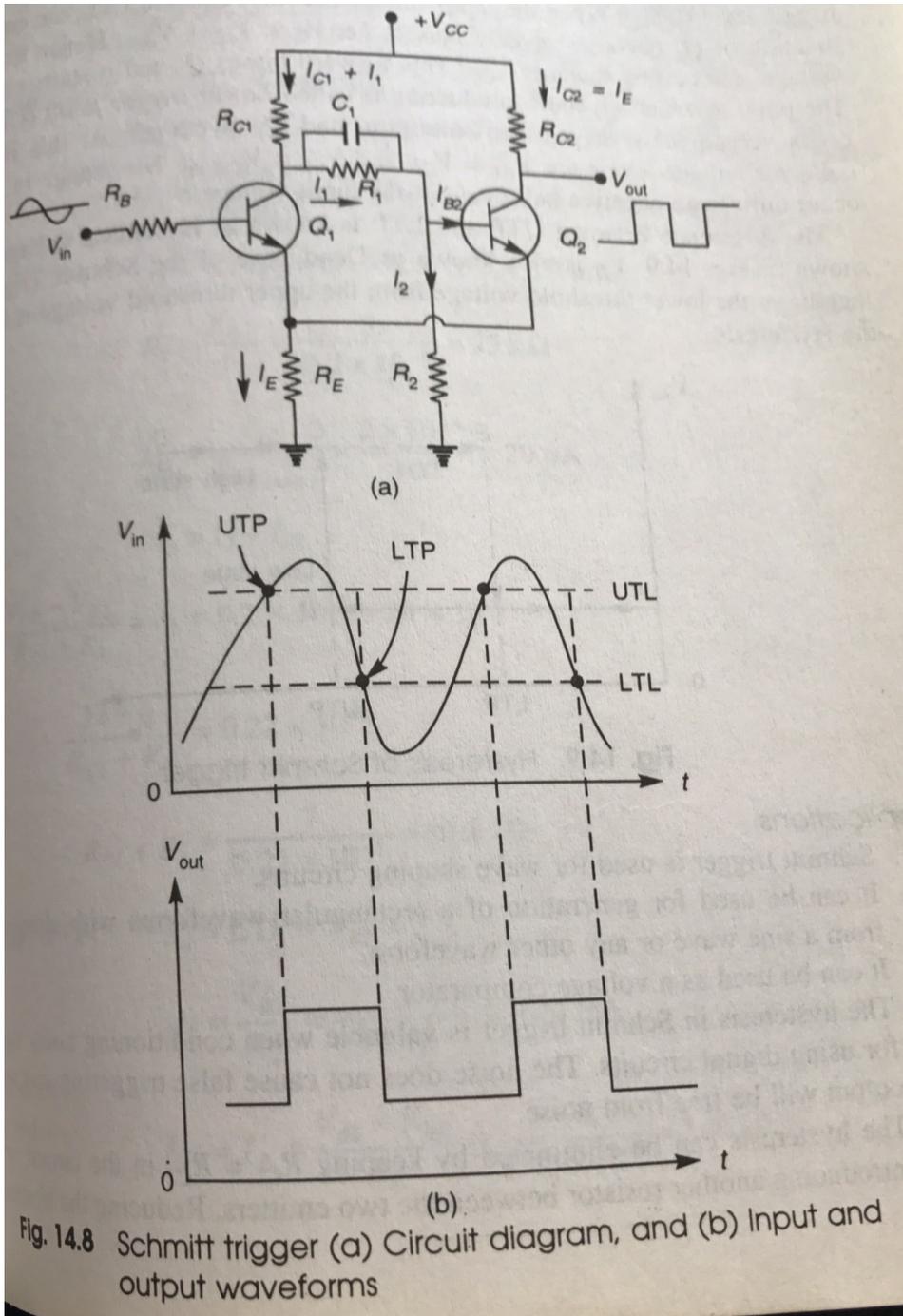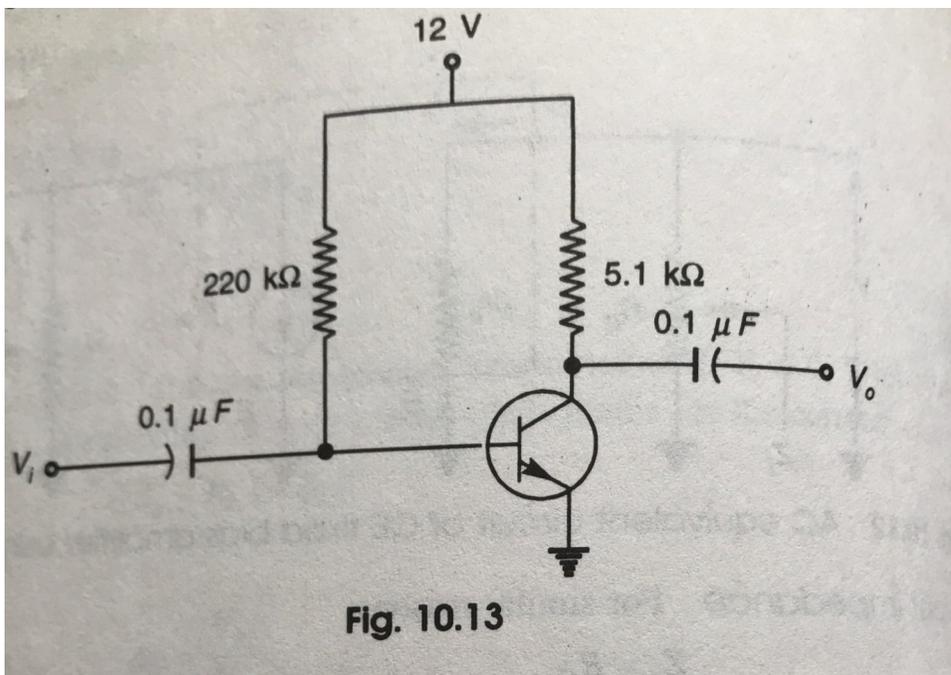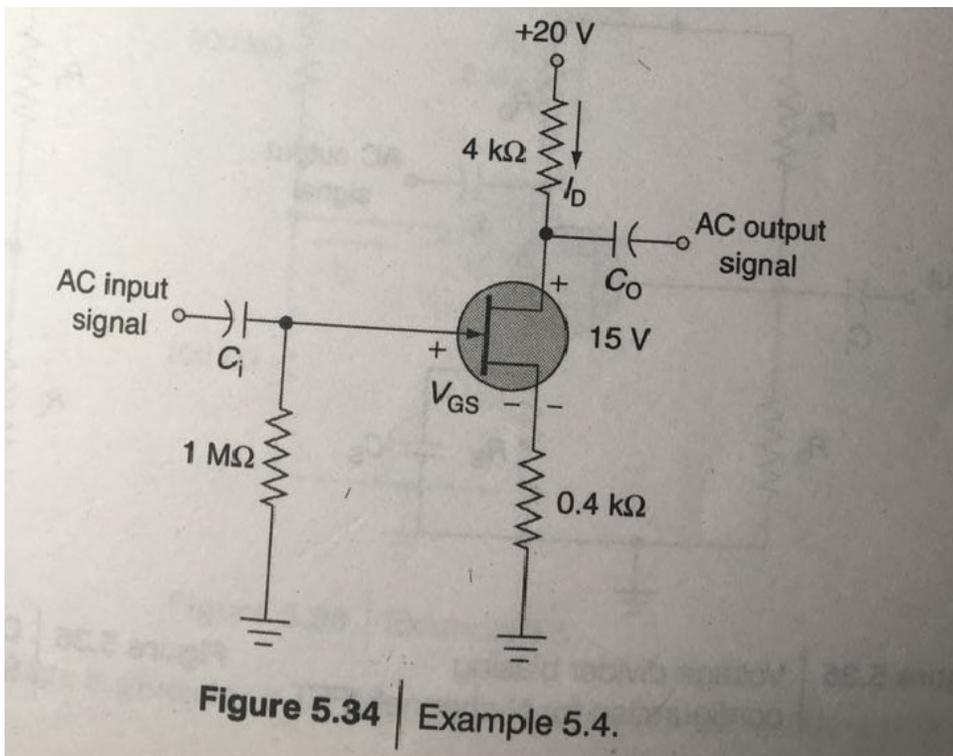
Appendix

Fig. 14.8 Schmitt trigger (a) Circuit diagram, and (b) Input and output waveforms

Fig6

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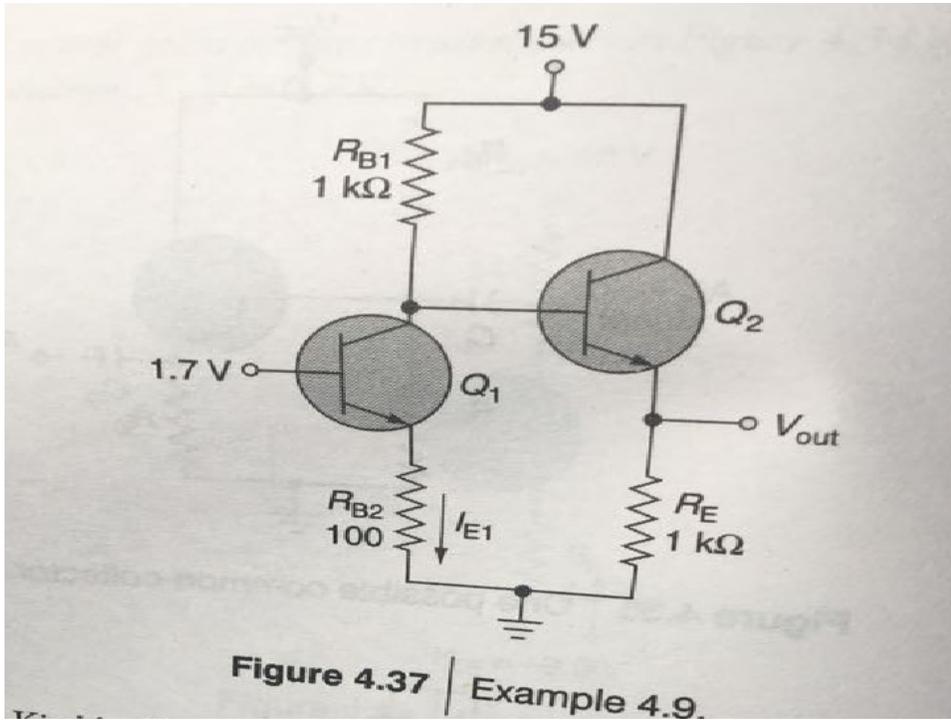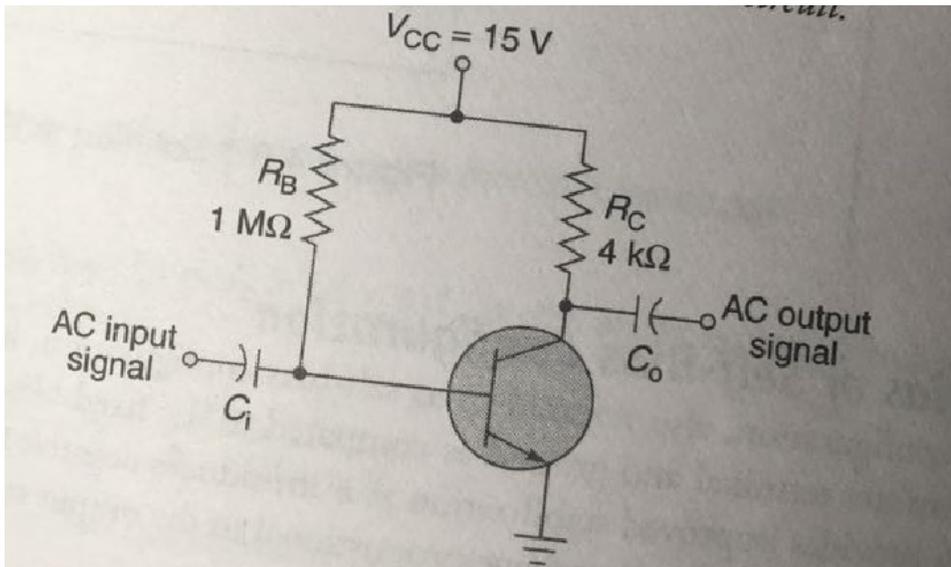**Fig. 10.13**
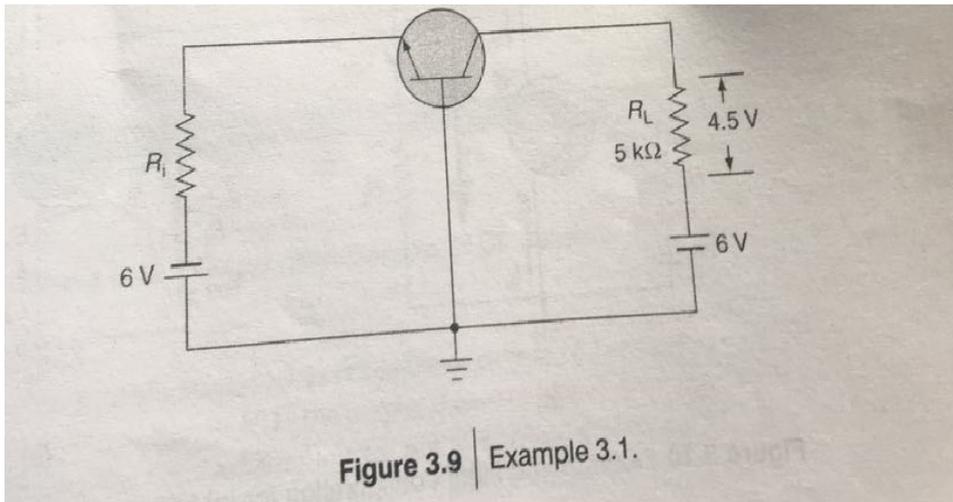
Fig5

Figure 5.34 | Example 5.4.

Fig4

Figure 4.37 | Example 4.9.

Fig3

Fig2

Figure 3.9 | Example 3.1.

Fig1