Scilab Textbook Companion for Basic Electronics by R. D. S. Samuel, U. B. M. Swamy And V. Nattarasu[1]

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Book Description

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Scilab numbering policy used in this document and the relation to the above book.

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

AP Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

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Chapter 1

PN Junction Diode

Scilab code Exa 1.1.8 Find the forward and reverse resistance for diode

```
1  clc
2  disp("Example 1.8")
3  printf("\n")
4  disp("find out resistance")
5  printf("Given\n")
6  disp("forward current=100mA,Vr=25V,cut in voltage
      =0.7v,reverse current=100nA")
7  //all the values are from fig 1.8
8  Vf=0.7
9  If=100*10^-3 //forward current
10 Vr=25
11 Ir=100*10^-9  //reverse current
12 Rf=Vf/If
13 Rr=Vr/Ir
14 printf("static forward resistance=\n%f ohm\n",Rf)
15 printf("static reverse resistance=\n%f ohm\n",Rr)
```

Scilab code Exa 1.1.9 Find the forward and reverse resistance for diode

```
clc
disp("Example 1.9")
printf("\n")
disp("find out resistance")
printf("Given\n")
disp("forward current=200mA,Vr=75V,cut in voltage
   =0.75v,reverse current=50nA")
//all values are from fig 1.9
Vf=0.75
If=200*10^-3 //forward current
Vr=75
Ir=50*10^-9  //reverse current
Rf=Vf/If
Rr=Vr/Ir
printf("static forward resistance=\n%f ohm\n",Rf)
printf("static reverse resistance=\n%f ohm\n",Rr)
```

Scilab code Exa 1.1.11 Find the forward and reverse resistance and cut in voltage for diode

```
clc
disp("Example 1.11")
printf("\n")
disp("findout resistance and cut in voltage")
printf("Given\n")
disp("forward current=100mA,Vr=25V,cut in voltage
   =0.7v,reverse current=100nA")
//all the values are from fig 1.10
Vf=0.35
If=80*10^-3 //forward current
Vr=40
Ir=10^-6  //reverse current
Rf=Vf/If
Rr=Vr/Ir
printf("static forward resistance=\n%f ohm\n",Rf)
```

```
15 printf("static reverse resistance=\n%f ohm\n",Rr)
16 //from the characteristic curve we can find cut in
      voltage
17 printf("cut in voltage= 0.3V")
```

Scilab code Exa 1.1.20 Find the dynamic resistance

```
1  clc
2  disp("Example 1.20")
3  printf("\n")
4  disp("calculate dynamic and substrate resistance")
5  printf("Given\n")
6  disp("forward current=20mA, cut in voltage=0.33v")
7  If=20*10^-3
8  Vf=0.33
9  Rf=Vf/If
10 If1=If-(10^-2)  //min forward current
11 If2=If+(10^-2)  //max forward current
12 Vf1=0.31
13 Vf2=0.35
14 rd=(Vf2-Vf1)/(If2-If1)
15 rd1=0.026/If
16 rsub=rd-rd1
17 printf("static forward resistance=\n%f ohm\n",Rf)
18 printf("Dynamic resistance=\n%f ohm\n",rd)
19 printf("Dynamic resistance using forward current=\
      n%f ohm\n",rd1)
20 printf("substrate resistance=\n%f ohm\n",rsub)
```

Scilab code Exa 1.1.24 calculate current in circuit in fig 18

```
1 clc
2 disp("Example 1.24")
```

```
3 printf("\n")
4 disp("calculate the current in the circuit in fig
    1.18")
5 //given
6 V=12
7 R1=10^3
8 R2=2*10^3
9 //current
10 I=V/(R1+R2)
11 printf("current in the circuit=%f Ampere",I)
```

Scilab code Exa 1.1.25 calculate diode current

```
1 clc
2 disp("Example 1.25")
3 printf("\n")
4 disp("calculate the diode current")
5 //given
6 V=12
7 R=10^3
8 Vd=0.7
9 //diode current
10 I=(V-Vd)/R
11 printf("Diode current=%f Ampere",I)
```

Scilab code Exa 1.1.26 calculate diode current across 2 diodes

```
1 clc
2 disp("Example 1.26")
3 printf("\n")
4 disp("calculate the diode current across 2 diodes")
5 //given
6 V=12
```

```
Vd1=0.7
Vd2=0.7
R=10^3
//current
I=(V-(Vd1+Vd2))/R
printf("Diode current =%f Ampere",I)
```

Scilab code Exa 1.1.27 find the forward current in circuit of fig 22

```
clc
disp("Example 1.27")
printf("\n")
disp("find the forward current in circuit of fig
    1.22")
//given
V=9
Vd=0.3
R=3.3*10^3
//current
I=(V-Vd)/R
printf("forward current=%f Ampere",I)
```

Scilab code Exa 1.1.28 find out battery voltage

```
clc
disp("Example 1.28")
printf("\n")
disp("find out battery voltage")
//given
R=2.7*10^3
Vd=0.7
I=1.96*10^-3
//battery voltage
```

```
10 V=(I*R)+Vd
11 printf("battery voltage=%f volt",V)
```

Scilab code Exa 1.1.29 find out series resistance

```
1  clc
2  disp("Example 1.29")
3  printf("\n")
4  disp("find out series resistance")
5  //given
6  V=4.5
7  Vd=0.3
8  I=1.25*10^-3
9  //series resistance
10 R=(V-Vd)/I
11 printf("series resistance=%f ohm",R)
```

Scilab code Exa 1.1.31 Plot the piecewise linear characterisic of si diode

```
1  clc
2  disp("Example 1.31")
3  printf("\n")
4  disp("Plot the piecewise-linear characteristic of
      silicon diode")
5  printf("Given\n")
6  //given
7  Vf=[0 0.7 0.74]
8  If=[0 0 0.2]
9  plot2d(Vf, If)
10 xlabel("Vf")
11 ylabel("If")
12 xtitle("Piecewise-linear characteristic of diode")
```

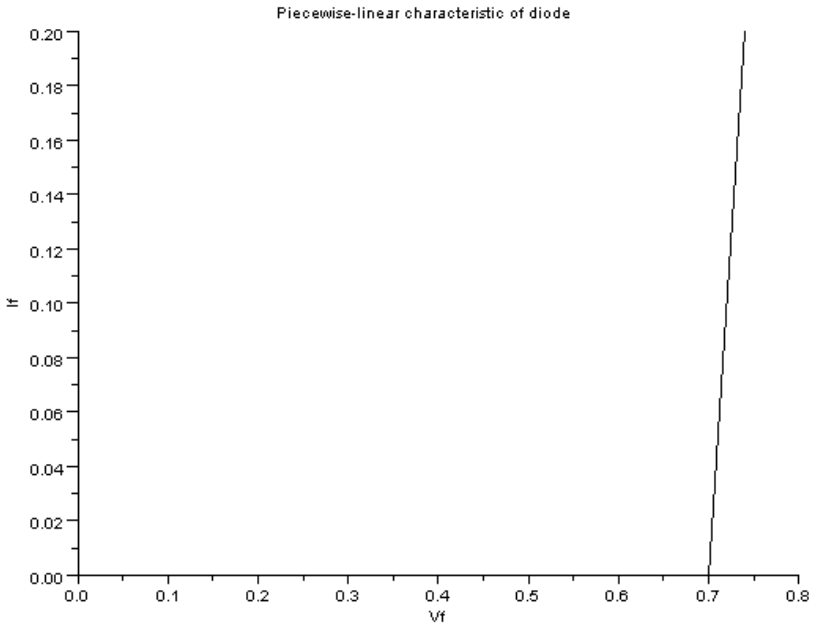

Figure 1.1: Plot the piecewise linear characterisic of si diode

Scilab code Exa 1.1.32 Plot the piecewiselinear characterisic of Germanium diode

```
1 clc
2 disp("Example 1.32")
3 printf("\n")
4 disp("Plot the piecewise-linear characterisic of
    Germanium diode")
5 printf("Given\n")
6 //given
```

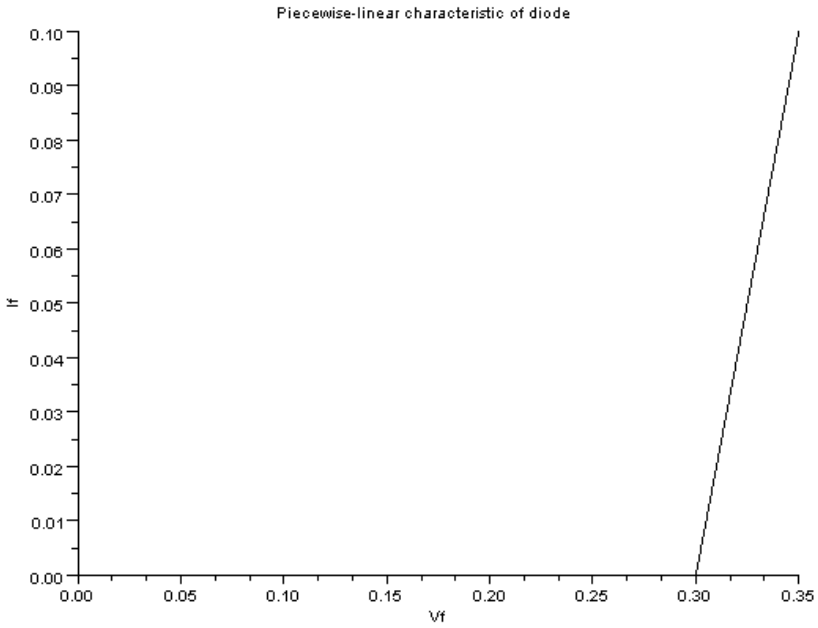

Figure 1.2: Plot the piecewiselinear characterisic of Germanium diode

```
7  Vf=[0 0.3 0.35]
8  If=[0 0 0.1]
9  plot2d(Vf, If)
10 xlabel("Vf")
11 ylabel("If")
12 xtitle("Piecewise-linear characteristic of diode")
```

Scilab code Exa 1.1.34 find out diode current

```
1 clc
2 disp("Example 1.34")
```

```
3 printf("\n")
4 disp("find out diode current")
5 //given
6 V=2
7 Vr=0.6
8 rd1=0
9 rd2=0.2
10 R=14
11 //when rd=0
12 //diode current
13 I1=(V-Vr)/R
14 printf("Diode current when rd=0 is \n%f ampere\n",I1
   )
15 //when rd=0.2
16 //diode current
17 I2=(V-Vr)/(R+rd2)
18 printf("Diode current when rd=0.2 is \n%f ampere\n",
   I2)
```

Scilab code Exa 1.1.35 find out series resistance in circuit fig 32

```
1 clc
2 disp("Example 1.35")
3 printf("\n")
4 disp("find out series resistance in circuit fig 1.32
   ")
5 V=3
6 rd=0.5
7 Vr=0.3
8 IF=174*10^-3
9 //resistance
10 R=(V-Vr-(IF*rd))/IF
11 printf("The value of resistance is \n%f ohm\n",R)
```

Scilab code Exa 1.1.48 Find the maximum forward current at 25c

```
clc
disp("Example 1.48")
printf("\n")
disp("Find the maximum forward current")
T1=25           //to find maximum forward current at
   this temperature
T2=65           //to find maximum forward current at
   this temperature
PT1=600*10^-3   //maximum power dissipation at 25c
D=5*10^-3       //derating factor
VT1=0.6         //forward voltage drop(constant at
   all temperature)
VT2=VT1
IT1=PT1/VT1     //maximum forward current at T1
PT2=PT1-((T2-T1)*D)
IT2=PT2/VT2     //maximum forward current at T2
printf("Forward current at temperature T1=\n%f
   Ampere\n",IT1)
printf("Forward current at temperature T2=\n%f
   Ampere\n",IT2)
```

Scilab code Exa 1.1.49 Find the maximum forward current at 25c and 80c and plot power temperature curve

```
clc
disp("Example 1.49")
printf("\n")
disp("find the maximum forward current at 25c and 80
   c")
printf("Given\n")
```

```
T1=25              //to find maximum forward current
   at this temperature
T2=80              //to find maximum forward current
   at this temperature
VT1=0.65           //forward voltage drop(constant at
   all temperature)
VT2=VT1
PT1=80*10^-3       //maximum power dissipation at 80c
PT2=30*10^-3       //maximum power dissipation at 30c
IT1=PT1/VT1
IT2=PT2/VT2
T=[0 25 80 114]
P=[80 80 30 0]
plot2d(T,P)
xlabel("Temperature in c")
ylabel("Power in mW")
xtitle("Power-Temperature curve")
printf("Forward current at T1=\n%f Ampere\n",IT1)
printf("Forward current at T2=\n%f Ampere\n",IT2)
```

Scilab code Exa 1.1.50 Find maximum forward current at 80c

```
clc
disp("Example 1.50")
printf("\n")
disp("Find the maximum power at 80c")
T1=25
PT1=1000*10^-3     //maximum power dissipation at 25c
T2=80
D=4*10^-3          //derating factor
PT2=PT1-((T2-T1)*D)    //maximum power dissipation at
    80c
printf("Maximum Power dissipated at 80c=\n%f watt\n"
```

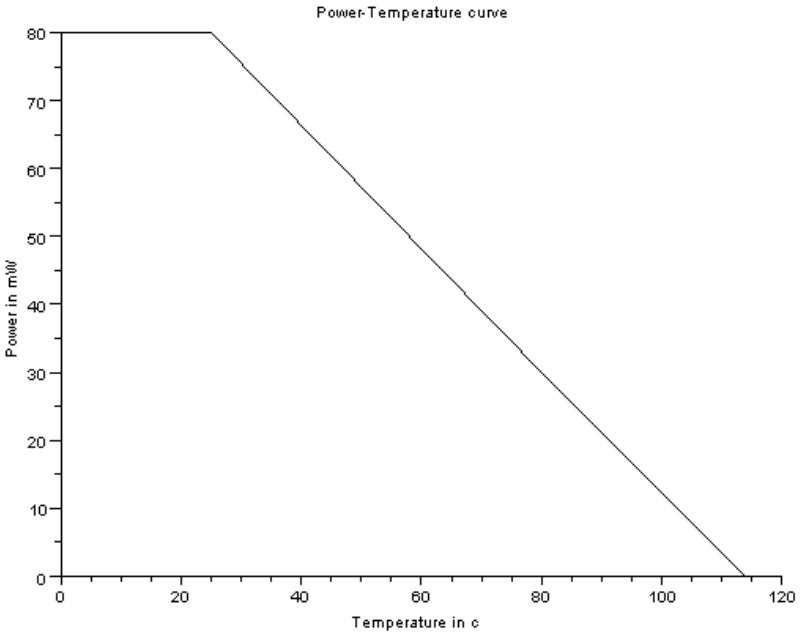

Figure 1.3: Find the maximum forward current at 25c and 80c and plot power temperature curve

```
,PT2)
```

Scilab code Exa 1.1.51 Find maximum forward current at 75c and draw power temperature curve

```
clc
disp("Example 1.51")
printf("\n")
disp("Find the maximum forward current and Draw
   power spectrum curve")
printf("Given\n")
T1=25
PT1=1000*10^-3     //maximum power dissipation at 25c
//Average current
IT1=500*10^-3
IT2=IT1
VT2=0.8           //forward voltage drop
D=10^-2
PT2=VT2*IT2
T2=((PT1-PT2)/D)+T1
//to caculate maximum forward current at 75c
T2!=75
PT2!=PT1-((T2!-T1)*D)
IT2=PT2!/VT2
//for(T>25), to draw graph
  vd=10^-2
  PT=(1000-(75*10))*10^-3  //maximum power
     dissipation at 100c
Temp=[0 25 100 125]
p=[1000 1000 PT*10^3 0]
plot2d(Temp ,p)
xlabel("Temperature in c")
ylabel("Power in mW")
xtitle("Power-Temperature Curve")
printf("Maximum forward current at 75c=\n%f Ampere\n
```

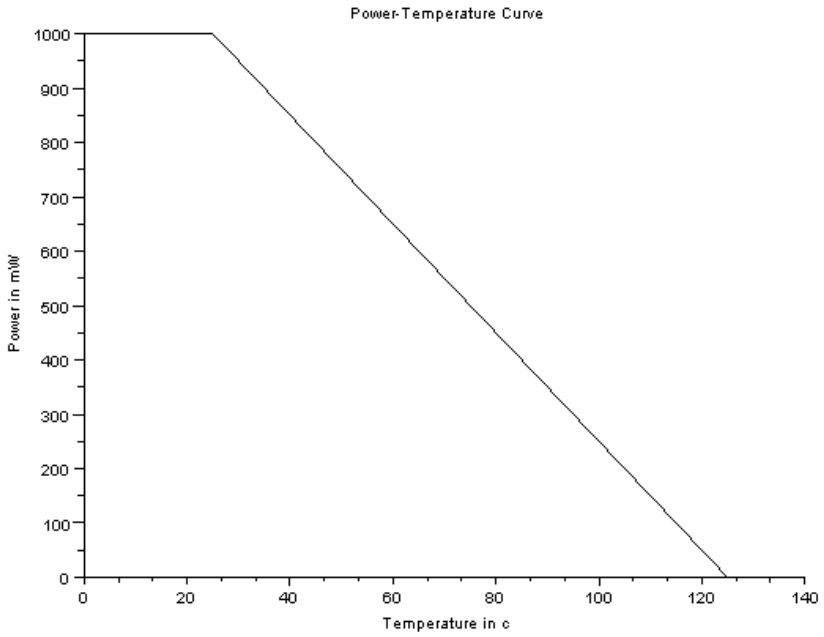

Figure 1.4: Find maximum forward current at 75c and draw power temperature curve

```
    ",IT2)
```

Scilab code Exa 1.1.54 Find the forward voltage drop at 100c and dynamic resistance at 25c and 100c

```
1 clc
2 disp("Example 1.54")
3 printf("\n")
4 disp("Find the forward voltage drop at 100c and
    dynamic resistance")
```

```
T1=25
T2=100
Vft1=0.6    //forward voltage drop at 25c
IT1=26*10^-3  //forward current(constant)
IT2=IT1
//for silicon diode we know that
v=(-1.8*10^-3)
Vft2=Vft1+((T2-T1)*v)
IF=26*10^-3
rd1=(26*10^-3/IF)*((T1+273)/298)
rd2=(26*10^-3/IF)*((T2+273)/298)
printf("Forward voltage drop at 100c=\n%f volt\n",
   Vft2)
printf("Dynamic resistance at 25c and 100c=\n%f ohm\
   n%f ohm\n",rd1,rd2)
```

Scilab code Exa 1.1.55 Find the maximum and mini forward voltage drop and dynamic resistance

```
clc
disp("Example 1.55")
printf("\n")
disp("Calculate maximum & minimum forward voltage
   drop and Junction dynamic resistance")
T1=80
T2=10
T=25
//for germanium diode
v=(-2.2*10^-3)
Vft1=0.3
Vft2maximum=Vft1+((T2-T)*v)    //voltage drop at 10c
Vft2minimum=Vft1+((T1-T)*v)    //voltage drop at 80c
IF=20*10^-3
rd1=(26*10^-3/IF)*((T2+273)/298)
rd2=(26*10^-3/IF)*((T1+273)/298)
```

```
16 printf("Maximum and Minimum Forward voltage drop at
     25c and 10c=\n%f volt\n%f volt\n",Vft2maximum,
     Vft2minimum)
17 printf("Dynamic resistance at 10c and 80c=\n%f ohm\
     n%f ohm\n",rd1,rd2)
```

Scilab code Exa 1.1.56 Find the max forward current and voltage and dynamic resistance

```
1  clc
2  disp("Example 1.56")
3  printf("\n")
4  disp("To find maximum forward current at 25c & 75c
     and Forward voltage drop and Dynamic resistance")
5  PT1=1.5
6  VT1=0.9
7  D=7.5*10^-3
8  //for silicon diodes
9  v=(-1.8*10^-3)
10 IF=20*10^-3
11 T1=25
12 T2=75
13 IT1=PT1/VT1
14 PT2=PT1-((T2-T1)*D)
15 IT2=PT2/VT1    //assume voltage drop remains constant
       at all temperature
16 VF2=VT1+((T2-T1)*v)
17 rd1=(26*10^-3/IF)*((T1+273)/298)
18 rd2=(26*10^-3/IF)*((T2+273)/298)
19 printf("Maximum forward current at 25c & 75c =\n%f
     Ampere\n%f Ampere\n",IT1,IT2)
20 printf("Forward voltage drop at 75c=\n%f volt\n",VF2
     )
21 printf("Dynamic resistance at 25c and 75c=\n%f ohm\
     n%f ohm\n",rd1,rd2)
```

Scilab code Exa 1.1.57 Find the diode currents at 25c and 100c

```
clc
disp("Example 1.57")
printf("\n")
disp("To find diode current at 25c and 75c")
RL=150
//both diode voltage drop as given in fig 1.47
Vr1=0.7    //for silicon
Vr2=0.3    //for Germanium
Vdc=5
//apply KVL to given circuit
IF1=(Vdc-(Vr1+Vr2))/RL
//for silicon diode
v=(-1.8*10^-3)
T1=25
T2=75
VFT2=Vr1+((T2-T1)*v)
//for Germanium Diode
v=(-2.2*10^-3)
VFT2!=Vr2+((T2-T1)*v)
IF2=(Vdc-(VFT2!+VFT2))/RL
printf("Diode current at 25c and 75c =\n%f ampere\
   n%f ampere\n",IF1,IF2)
```

Scilab code Exa 1.1.65 Find the minimal fall time

```
clc
disp("Example 1.65")
printf("\n")
disp("Find the minimal fall-time")
```

```
5 //reverse-recovery time is
6 trr=4*10^-9
7 tfmin=10*trr
8 printf("The minimal fall-time for voltage pulses
    applied=\n%3.2e sec\n",tfmin)
```

Scilab code Exa 1.1.66 Estimate the maximum reverse recovery time

```
1 clc
2 disp("Example 1.66")
3 printf("\n")
4 disp("Find the maximum recovery time")
5 //fall-time is
6 tf=0.5*10^-6
7 trrmax=tf/10
8 printf("The minimal fall-time for voltage pulses
    applied=\n%3.2e sec\n",trrmax)
```

Scilab code Exa 1.1.72 Find the maximum current flow through zener

```
1 clc
2 disp("Example 1.72")
3 printf("\n")
4 disp("Find the maximum current flow through Zener
    diode")
5 Vz=7.5    //zener voltage
6 Pd1=400*10^-3 //maximum power dissipation at 50c
7 T1=50
8 T2=100
9 D=3.2*10^-3
10 //current at 50c
11 Izm1=Pd1/Vz
12 //current at 100
```

```
13 Pd2=Pd1-((T2-T1)*D)
14 Izm2=Pd2/Vz
15 printf("maximum current flow through Zener diode at
      50c & 100c=\n%f Ampere\n%f Ampere\n",Izm1,Izm2)
```

Scilab code Exa 1.1.75 Find the current through zener at 50c and 80c

```
1 clc
2 disp("Example 1.75")
3 printf("\n")
4 disp("Find the current through diode at 50c & 80c")
5 T1=50
6 T2=80
7 D=3.2*10^-3
8 Pd1=400*10^-3
9 Vz=6.2
10 //at 50c
11 Izm1=Pd1/Vz
12 //at 80c
13 Pd2=Pd1-((T2-T1)*D)
14 Izm2=Pd2/Vz
15 printf("the current through diode at 50c & 80c=\n%f
      ampere\n%f ampere\n",Izm1,Izm2)
```

Scilab code Exa 1.1.76 Find the diode current and power dissipation

```
1 clc
2 disp("Example 1.76")
3 printf("\n")
4 disp("Find the diode current and power dissipation")
5 Vdc=12
6 Vz=4.3  //zener voltage
7 R=820
```

```
Iz=(Vdc-Vz)/R
Pd=Vz*Iz
printf("the diode current=\n%f ampere\n",Iz)
printf("the power dissipation=\n%f watt\n",Pd)
```

Chapter 2

Semiconductor Diode Applications

Scilab code Exa 2.2.11 Calculate Peak ac dc load current dc diode voltage total input power percentage regulation of HW Rectifier

```
clc
disp("Example 2.11")
printf("\n")
disp("Calculate Peak,ac,dc load current,dc diode
    voltage,total input power,percentage regulation
    of HW Rectifier")
printf("Given\n")
Rf=20
RL=1000
N1=1
N2=N1
V1=110
V2=V1                    //since (V1/V2)=(N1/N2)
Vm=sqrt(2)*V2
Im=Vm/(Rf+RL)            //peak load current
Idc=Im/%pi               //DC load current
Irms=Im/2                //AC load current
V!dc=-Idc*RL             //DC diode Voltage
```

```
17 Pi=(Irms)^2*(Rf+RL)     //Total power input to
     circuit
18 %reg=(Rf/RL)*100          //percentage regulation
19 printf("Peak,DC,AC load current are =\n%f ampere\n%f
     ampere\n%f ampere\n",Im,Idc,Irms)
20 printf("DC Diode voltage =\n%f volt\n",V!dc)
21 printf("Total power input to circuit =\n%f watt\n",
     Pi)
22 printf("percentage regulation =\n%f\n",%reg)
```

Scilab code Exa 2.2.12 Calculate DC RMS load voltage PIV across diode Rectification efficiency DC power delivered to load Frequency of output waveform of HW rectifier

```
1  clc
2  disp("Example 2.12")
3  printf("\n")
4  disp("Calculate DC,RMS load voltage,PIV across diode
     ,Rectification efficiency,DC power delivered to
     load,Frequency of output waveform ")
5  printf("Given\n")
6  Rf=50
7  RL=500
8  N1=10
9  N2=1
10 V1=230
11 Vm=(N2/N1)*V1
12 w=314
13 f=w/(2*%pi)
14 Vdc=(Vm/%pi)/(1+(Rf/RL))      //DC load voltage
15 Vrms=(Vm/2)/(1+(Rf/RL))       //RMS load voltage
16 PIV=Vm
17 %n=40.6/(1+(Rf/RL))           //Rectification
     efficiency
18 Pdc=(Vdc^2)/RL
```

```
19 printf("DC,RMS load voltage=\n%f volt\n%f volt\n",
     Vdc,Vrms)
20 printf("PIV across the diode =\n%f volt\n",PIV)
21 printf("Rectification efficiency=\n%f\n",%n)
22 printf("DC power delivered to a load=\n%f watt\n",
     Pdc)
```

Scilab code Exa 2.2.20 Calculate peak RMS DC load current DC in each diode DC output voltage percentage regulation PIV RMS current DC load voltage of FW rectifier

```
1  clc
2  disp("Example 2.20")
3  printf("\n")
4  disp("Calculate peak,RMS,DC load current, DC in each
       diode,DC output voltage,% regulation,PIV,RMS
     current,DC load voltage")
5  printf("Given\n")
6  Rf=500
7  RL=2000
8  V2=280
9  //Secondary voltage is
10 Vm=sqrt(2)*V2
11 //Peak load current
12 Im=Vm/(Rf+RL)
13 //DC load current
14 Idc=2*Im/(%pi)
15 //Since each diode acts as a half-wave rectifier,the
       dc current through each diode is
16 Idc1=Im/(%pi)
17 //dc output power
18 Pdc=[Idc]^2*RL
19 %reg=(Rf/RL)*100
20 //PIV across each diode
21 PIV=2*Vm
```

```
22 //RMS load current
23 Irms=Im/(sqrt(2))
24 //RMS through each diode is
25 Irms1=(Im/2)
26 //Dc load voltage
27 Vdc=Idc*RL
28 printf("peak load, DC load current is \n%f ampere\
      n%f ampere\n",Im,Idc)
29 printf("direct current in each diode is \n%f ampere\
      n",Idc1)
30 printf("dc output power is \n%f watt\n",Pdc)
31 printf("percentage regulation is \n%f\n",%reg)
32 printf("PIV across each diode is \n%f volt\n",PIV)
33 printf("rms load current and rms current through
      each diode is\n%f ampere\n%f ampere \n",Irms,
      Irms1)
34 printf("DC load voltage is \n%f volt\n",Vdc)
```

Scilab code Exa 2.2.21 Find the load current and rms value of input current of FW rectifier

```
1 clc
2 disp("Example 2.21")
3 printf("\n")
4 disp("Find the load current and rms value of input
      current")
5 printf("Given\n")
6 V2=100
7 Rf=50
8 RL=950
9 //secondary voltage
10 Vm=sqrt(2)*V2
11 //DC load current
12 Idc=(2*Vm)/(%pi*(Rf+RL))
13 //RMS input current is same as RMS load current
```

```
Im=(Idc*%pi)/2
Irms=Im/sqrt(2)
printf("The load current=\t%f ampere\n",Idc)
printf("RMS load current=\t%f ampere\n",Irms)
```

Scilab code Exa 2.2.22 Calculate Average load current and voltage and Ripple voltage of FW rectifier

```
clc
disp("Example 2.22")
printf("\n")
disp("Calculate Average load current & voltage,
   Ripple voltage")
printf("Given\n")
RL=2000
//diodes are ideal
Rf=0
C=500*10^-6
f=50
V2=200
Vm=sqrt(2)*V2
//average load current
Idc=(2*Vm)/(%pi*(Rf+RL))
//Average load voltage
Vdc=Idc*RL
//ripple factor
V=0.483
Vac=V*Vdc
//with capacitor connected across RL
V1=1/(4*sqrt(3)*RL*C*f)
//with capacitor filter we have Vdc=Vm
Vdc1=282.84
Vac1=V1*Vdc1
printf("Average load current=\t%f ampere\n",Idc)
printf("Average load voltage=\t%f ampere\n",Vdc)
```

```
27 printf("Ripple voltage=\t%f volt\n",Vac)
28 printf("Ripple voltage when capacitor connected=\t%f
       volt\n",Vac1)
```

Scilab code Exa 2.2.23 Calculate Average voltage rectification efficiency and percentage regulation of FW rectifier

```
1  clc
2  disp("Example 2.23")
3  printf("\n")
4  disp("Calculate Average voltage, rectification
       efficiency & percentage regulation")
5  printf("Given\n")
6  V2=30
7  RL=100
8  Rf=10
9  Vm=sqrt(2)*V2
10 //Average output voltage
11 Vdc=(((2*Vm)/(%pi))/(1+(Rf/RL)))
12 //Rectification effeiciency
13 nr=0.812/(1+(Rf/RL))
14 //percentage regulation
15 PR=(Rf/RL)*100
16 printf("Average output voltage=\t%f volt\n",Vdc)
17 printf("Rectification efficiency=\t%f\n",nr)
18 printf("Percentage regulation=\t%f\n",PR)
```

Scilab code Exa 2.2.24 Calculate Average load voltage RMS load current PIV DC output power Frequency of output waveform

```
1 clc
2 disp("Example 2.24")
3 printf("\n")
```

```
4 disp("Calculate Average load voltage,RMS load
    current,PIV,DC o/p power,Frequency of output
    waveform")
5 printf("Given\n")
6 V1=220
7 N1=10
8 N2=1
9 V2=V1*(N2/N1)
10 Vm=V2
11 Rf=20
12 RL=1000
13 w=314
14 f=w/(2*%pi)
15 //Average load voltage
16 Vdc=(((2*Vm)/(%pi))/(1+(Rf/RL)))
17 //RMS load current
18 Irms=Vm/(sqrt(2)*(Rf+RL))
19 //PIV across each diode
20 PIV=2*Vm
21 //dc output power
22 Pdc=Vdc^2/RL
23 //Frequency of output waveform
24 Fout=2*f
25 printf("average load voltage is \n%f volt\n",Vdc)
26 printf("RMS load current is \n%f ampere\n",Irms)
27 printf("PIV across each diode is \n %f volt\n",PIV)
28 printf("DC ouput power \n%f watt\n",Pdc)
29 printf("frequency of output waveform is \n%f hz\n",
    Fout)
```

Scilab code Exa 2.2.28 Calculate all characteristics of FW bridge rectifier

```
1 clc
2 disp("Example 2.28")
3 printf("\n")
```

```
4  disp("Calculate DC output voltage,Ripple factor,
       Effeciency,PIV,%regulation,Peak diode current, Dc
        load current, dc current,RMS current")
5  printf("Given\n")
6  Vm=100
7  Rf=25
8  RL=950
9  //dc output voltage
10 Vdc=(((2*Vm)/(%pi))/(1+(2*Rf/RL)))
11 //Ripple factor
12 Vrms=(Vm/sqrt(2))/(1+(2*Rf/RL))
13 r=sqrt((Vrms/Vdc)^2-1)
14 //Efficiency of rectification
15 Rr=0.812/(1+(2*Rf/RL))
16 //PIV across the non-conducting diode
17 PIV=Vm
18 //Percentage regulation
19 %reg=(2*Rf/RL)*100
20 //Peak load current
21 Im=Vm/(2*Rf+RL)
22 //DC load current
23 Idc=2*Im/%pi
24 //Dc current through each diode
25 Idc1=Idc/2
26 //RMS current through each diode
27 Irms1=Im/2
28 printf("dc output voltage \n%f volt\n",Vdc)
29 printf("Ripple factor \n%f\n",r)
30 printf("Efficiency of rectification \n%f\n",Rr)
31 printf("PIV across non-conducting diode \n%f volt \n
       ",PIV)
32 printf("percentage regulation \n%f\n",%reg)
33 printf("Peak diode current \n%f ampere\n",Im)
34 printf("dc load current \n%f ampere\n",Idc)
35 printf("dc current through each diode \n %f ampere\n
       ",Idc1)
36 printf("RMS current through each diode \n %f ampere\
       n",Irms1)
```

Scilab code Exa 2.2.29 Calculate Average output voltage avg load current frequency of output waveform dc power output of FWBR

```
clc
disp("Example 2.29")
printf("\n")
disp("Calculate Average output voltage,avg load
   current,frequency of output waveform,dc power
   output")
printf("Given\n")
Vm=141.42
Rf=0    //Ideal diodes
RL=100
f=50
//Average output voltage
Vdc=(((2*Vm)/(%pi))/(1+(2*Rf/RL)))
//Average load current
Idc=Vdc/RL
//frequency of output waveform
Fout=2*f
//dc power output
Pdc=Idc^2*RL
printf("average output voltage \n%f volt\n",Vdc)
printf("average load current \n%f ampere\n",Idc)
printf("frequency of output waveform \n%f hz\n",Fout
   )
printf("dc output power \n %f watt\n",Pdc)
```

Scilab code Exa 2.2.34 Calculate Ripple factor DC output voltage DC load current PIV RMS output ripple voltage of HWR

```
clc
disp("Example 2.34")
printf("\n")
disp("Calculate Ripple factor,DC output voltage,DC
   load current,PIV,RMS output ripple voltage")
printf("Given\n")
Vm=311.13
f=50
c=200*10^-6
RL=1000
//Ripple factor
r=1/(2*sqrt(3)*RL*f*c)
//dc output voltage
Vdc=Vm/(1+(1/(2*f*c*RL)))
//DC load current
Idc=Vdc/RL
//peak inverse voltage
PIV=Vm
//RMS ripple voltage on capacitor
Vac=r*Vdc
printf("ripple factor \n%f\n",r)
printf("dc output voltage \n%f volt\n",Vdc)
printf(" DC load current \n%f ampere\n",Idc)
printf("PIV across the diode \n%f volt\n",PIV)
printf("RMS ripple voltage on capacitor \n%f volt \n
   ",Vac)
```

Scilab code Exa 2.2.35 Calculate the capacitance of HWR

```
clc
disp("Example 2.35")
printf("\n")
disp("Calculate the capacitance")
f=50
RL=500
```

```
7 r=0.1
8 C=1/(2*sqrt(3)*f*RL*0.1)
9 printf("Capacitance value=\t%f Farad\n",C)
```

Scilab code Exa 2.2.40 Estimate the value of capacitor required to keep ripple factor less than 1per of FWR

```
1 clc
2 disp("Example 2.40")
3 printf("\n")
4 disp("Estimate the value of capacitor required to
     keep ripple factor less than 1%")
5 Vm=325.27
6 f=50
7 Idc=10*10^-3
8 r=0.01
9 RL=Vm/Idc
10 C=(1/r)/(4*sqrt(3)*f*RL)
11 printf("capacitor required >\t%e Farad\n",C)
```

Scilab code Exa 2.2.41 Calculate minimum value of capacitance used in the filter to keep ripple voltage below 2per of FWR

```
1 clc
2 disp("Example 2.41")
3 printf("\n")
4 disp("Calculate minimum value of capacitance used in
     the filter to keep ripple voltage below 2%")
5 Vm=282.84
6 f=50
7 Idc=12*10^-3
8 r=0.02
9 RL=Vm/Idc
```

```
C=(1/r)/(4*sqrt(3)*f*RL)
printf("capacitor required >\t%e Farad\n",C)
```

Scilab code Exa 2.2.42 Find Ripple factor Dc output voltage Ripple voltage DC load current of FWR

```
clc
disp("Example 2.42")
printf("\n")
disp("Find Ripple factor,Dc output voltage,Ripple voltage,DC load current")
printf("Given\n")
Vm=282.84
f=50
C=500*10^-6
RL=2*10^3
//Ripple factor
r=1/(4*sqrt(3)*RL*f*C)
//Dc output voltage
Vdc=Vm/(1+(1/(4*f*C*RL)))
//Ripple voltage on capacitor
Vac=r*Vdc
//DC load current
Idc=Vdc/RL
printf("Ripple factor \n%f\n",r)
printf("dc ouput voltage \n%f volt\n",Vdc)
printf("Ripple voltage on capacitor \n%f volt\n",Vac)
printf("DC load current \n %f ampere\n",Idc)
```

Scilab code Exa 2.2.43 Find the ripple factor and output voltage if a capacitor of 160uf is connected in parallel with load of FWR

```
clc
disp("Example 2.43")
printf("\n")
disp("Find the ripple factor & output voltage if a
   capacitor of 160uf is connected in parallel with
   load")
RL=250
C=160*10^-6
f=50
Vm=49.497
//ripple factor
r=1/(4*sqrt(3)*f*RL*C)
//Dc output voltage
Vdc=Vm/(1+(1/(4*f*C*RL)))
printf("ripple factor \n %f\n",r)
printf("DC output voltage \n%f volt\n",Vdc)
```

Scilab code Exa 2.2.44 Find the ripple factor and DC load current of FWBR

```
clc
disp("Example 2.44")
printf("\n")
disp("Find the ripple factor & DC load current")
printf("Given\n")
Vm=230
f=(314/(2*%pi))
RL=400
C=500*10^-6
//ripple factor
r=1/(4*sqrt(3)*f*RL*C)
//DC load current
Vdc=Vm/(1+(1/(4*f*C*RL)))
Idc=Vdc/RL
printf("ripple factor \n %f\n",r)
```

```
16 printf("DC laod current \n%f ampere\n",Idc)
```

Scilab code Exa 2.2.45 Find the capacitor value for half wave rectifier

```
1  clc
2  disp("Example 2.45")
3  printf("\n")
4  disp("Find the capacitor value for half wave
      rectifier")
5  Vdc=20
6  f=60
7  RL=500
8  r=0.1/(2*sqrt(3))
9  c=1/(2*sqrt(3)*r*f*RL)
10 printf("Capacitor value =\t%e farad\n",c)
```

Scilab code Exa 2.2.46 Find the capacitor value for full wave rectifier

```
1  clc
2  disp("Example 2.46")
3  printf("\n")
4  disp("Find the capacitor value for full wave
      rectifier")
5  printf("Given\n")
6  Vdc=20
7  f=60
8  RL=500
9  r=0.1/(2*sqrt(3))
10 c=1/(4*sqrt(3)*r*f*RL)
11 printf("Capacitor value =\t%e farad\n",c)
```

Scilab code Exa 2.2.50 calculate load and source effects and load and line regulation

```
clc
disp("Example 2.50")
printf("\n")
disp("calculate load & source effects & the load &
    line regulation")
printf("Given\n")
Vo1=20
Vo2=19.7
//load effect=delVo for delIL(max)
LE=Vo1-Vo2
//Load regulation
LR=(LE*100)/Vo1
//source effect=delVo for 10% change in Vs
V=20.2
SE=V-Vo1
//Line regulation
LiR=(SE/Vo1)*100
printf("load effect \n %f volt\n",LE)
printf("load regulation \n%f \n",LR)
printf("source effect \n %f volt\n",SE)
printf("line regulation \n%f\n",LiR)
```

Scilab code Exa 2.2.51 calculate load and source effects and load and line regulation

```
clc
disp("Example 2.51")
printf("\n")
disp("calculate load & source effects & load & line
    regulation")
printf("Given\n")
Vo1=15
```

```
Vo2=14.9
//load effect=delVo for delIL(max)
LE=Vo1-Vo2
//Load regulation
LR=LE*100/Vo1
//source effect=delVo for 10% change in Vs
V=14.95
SE=Vo1-V
//Line regulation
LiR=(SE/Vo1)*100
printf("load effect \n %f volt\n",LE)
printf("load regulation \n%f \n",LR)
printf("source effect \n %f volt\n",SE)
printf("line regulation \n%f\n",LiR)
```

Scilab code Exa 2.2.54 Design the Zener Diode Voltage regulator for given specification

```
clc
disp("Example 2.54")
printf("\n")
disp("Design the Zener Diode Voltage regulator for
   given specification")
printf("Given\n")
printf("1 Resistance are in ohms \n 2 Current are in
    ampere \n 3 voltage sources are in volt\n")
//unregulated dc input voltage
Vimin=8
Vimax=12
//regulated dc output voltage
Vo=5
//minimum zener current
Izmin=5*10^-3
//maximum zener current
Izmax=80*10^-3
```

```
16 //load current
17 ILmin=0
18 ILmax=20*10^-3
19 //load resistance
20 RL=Vo/ILmax
21 //maximum Resistance
22 Rmax=(Vimin-Vo)/(Izmin+ILmax)
23 //minimum resistance
24 Rmin=(Vimax-Vo)/(Izmax+ILmin)
25 //Required resistance
26 R=(Rmax+Rmin)/2
27 printf("minimum resistance %d ohm \n",Rmin)
28 printf("maximum resistance %d ohm \n",Rmax)
29 printf("required resistance %d ohm \n",R)
```

Scilab code Exa 2.2.55 Design a zener diode voltage regulator to meet following specification

```
1 clc
2 disp("Example 2.55")
3 printf("\n")
4 disp("Design a zener diode voltage regulator to meet
      following specification")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt\n")
7 //unregulated dc input voltage
8 Vimin=13
9 Vimax=17
10 //Load current
11 ILmin-0
12 ILmax=10*10^-3
13 //regulated output voltage
14 Vo=10
15 //minimum zener current
```

```
16 Izmin=5*10^-3
17 //Maximum power dissipation
18 Pzmax=500*10^-3
19 //maximum zener current
20 Izmax=Pzmax/Vo
21 //maximum Resistance
22 Rmax=(Vimin-Vo)/(Izmin+ILmax)
23 //minimum resistance
24 Rmin=(Vimax-Vo)/(Izmax+ILmin)
25 //Required resistance
26 R=(Rmax+Rmin)/2
27 //load resistance
28 RLmin=Vo/ILmax
29 printf("minimum resistance %d ohm \n",Rmin)
30 printf("maximum resistance %d ohm \n",Rmax)
31 printf("required resistance %d ohm \n",R)
32 printf("load resistance %d ohm \n",RLmin)
```

Scilab code Exa 2.2.56 Design a zener diode voltage regulator to meet following specification

```
1 clc
2 disp("Example 2.56")
3 printf("\n")
4 disp("Design a zener diode voltage regulator to meet
    following specification")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
    ampere \n 3 voltage sources are in volt\n")
7 //dc input voltage
8 Vimin=20
9 Vimax=Vimin
10 //dc output voltage
11 Vo=10
12 //load current
```

```
13 ILmin=0
14 ILmax=20*10^-3
15 //minimum zener current
16 Izmin=10*10^-3
17 //maximum zener current
18 Izmax=100*10^-3
19 //load resistance
20 RLmin=Vo/ILmax
21 //maximum Resistance
22 Rmax=(Vimin-Vo)/(Izmin+ILmax)
23 //minimum resistance
24 Rmin=(Vimax-Vo)/(Izmax+ILmin)
25 //Required resistance
26 R=(Rmax+Rmin)/2
27 printf("minimum resistance %d ohm \n",Rmin)
28 printf("maximum resistance %d ohm \n",Rmax)
29 printf("required resistance %d ohm \n",R)
30 printf("load resistance %d ohm \n",RLmin)
```

Scilab code Exa 2.2.57 Calculate the value of series resistance and Zener diode current when load is 1200ohm

```
1 clc
2 disp("Example 2.57")
3 printf("\n")
4 disp("Calculate the value of series resistance &
     Zener diode current when load is 1200ohm")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
     ampere \n 3 voltage sources are in volt\n")
7 //Input voltage
8 Vi=32
9 //Zener diode voltage
10 Vz=24
11 //maximum power
```

```
12 Pzmax=600*10^-3
13 //output voltage
14 Vo=24
15 //since Vi has no variation
16 Vimax=32
17 Vimin=Vimax
18 //Zener current
19 Izmax=Pzmax/Vz
20 //series resistance
21 ILmin=0
22 R=(Vimax-Vo)/(Izmax+ILmin)
23 //Diode current
24 RL=1200
25 IL=Vo/RL       //load current
26 I=(Vi-Vo)/R     //total current
27 IZ=I-IL
28 printf("The diode current=\t%f ampere\n",IZ)
```

Scilab code Exa 2.2.58 Design a voltage regulator using zener diode to meet following specification

```
1 clc
2 disp("Example 2.58")
3 printf("\n")
4 disp("Design a voltage regulator using zener diode
     to meet following specification")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
     ampere \n 3 voltage sources are in volt\n")
7 //unregulated dc input voltage
8 Vimin=20
9 Vimax=30
10 //regulated dc output voltage
11 Vo=10
12 //minimum zener current
```

```
13 Izmin=2*10^-3
14 //maximum zener current
15 Izmax=100*10^-3
16 //load current
17 ILmin=0
18 ILmax=25*10^-3
19 //load resistance
20 RL=Vo/ILmax
21 //maximum Resistance
22 Rmax=(Vimin-Vo)/(Izmin+ILmax)
23 //minimum resistance
24 Rmin=(Vimax-Vo)/(Izmax+ILmin)
25 //Required resistance
26 R=(Rmax+Rmin)/2
27 printf("minimum resistance %d ohm \n",Rmin)
28 printf("maximum resistance %d ohm \n",Rmax)
29 printf("required resistance %d ohm \n",R)
30 printf("load resistance %d ohm \n",RLmin)
```

Scilab code Exa 2.2.59 Design a zener voltage regulator to meet following specification

```
1 clc
2 disp("Example 2.59")
3 printf("\n")
4 disp("Design a zener voltage regulator to meet
     following specification")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
     ampere \n 3 voltage sources are in volt\n")
7 //DC input voltage
8 Vimin=10-2
9 Vimax=10+2
10 //DC output voltage
11 Vo=5
```

```
12 //Load current
13 ILmax=10*10^-3
14 ILmin=0
15 //zener wattage
16 Pzmax=400*10^-3
17 Vz=Vo
18 //maximum zener current
19 Izmax=Pzmax/Vz
20 //since Izmin is not given so let us take IZmin=5mA
21 Izmin=5*10^-3
22 //maximum Resistance
23 Rmax=(Vimin-Vo)/(Izmin+ILmax)
24 //minimum resistance
25 Rmin=(Vimax-Vo)/(Izmax+ILmin)
26 //Required resistance
27 R=(Rmax+Rmin)/2
28 //load resistance
29 RL=Vo/ILmax
30 printf("minimum resistance %d ohm \n",Rmin)
31 printf("maximum resistance %d ohm \n",Rmax)
32 printf("required resistance %d ohm \n",R)
33 printf("load resistance %d ohm \n",RL)
```

Scilab code Exa 2.2.60 Design a zener voltage regulator to meet following specification

```
1 clc
2 disp("Example 2.60")
3 printf("\n")
4 disp("Design a zener voltage regulator to meet
     following specification")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
     ampere \n 3 voltage sources are in volt\n")
7 //DC input voltage(10V[+-]20%)
```

```
Vimin=10-2
Vimax=10+2
//DC output voltage
Vo=5
//Load current
ILmax=20*10^-3
ILmin=0
//zener current
Izmax=80*10^-3
Izmin=5*10^-3
//maximum Resistance
Rmax=(Vimin-Vo)/(Izmin+ILmax)
//minimum resistance
Rmin=(Vimax-Vo)/(Izmax+ILmin)
//Required resistance
R=(Rmax+Rmin)/2
//load resistance
RL=Vo/ILmax
printf("minimum resistance %d ohm \n",Rmin)
printf("maximum resistance %d ohm \n",Rmax)
printf("required resistance %d ohm \n",R)
printf("load resistance %d ohm \n",RL)
```

Scilab code Exa 2.2.61 Design a zener voltage regulator to meet following specification

```
clc
disp("Example 2.61")
printf("\n")
disp("Design a zener voltage regulator to meet
   following specification")
printf("Given\n")
printf("1 Resistance are in ohms \n 2 Current are in
    ampere \n 3 voltage sources are in volt\n")
//DC input voltage
```

```
Vimin=12-3
Vimax=12+3
//DC output voltage
Vo=5
//Load current
ILmax=20*10^-3
ILmin=0
//zener wattage
Pzmax=500*10^-3
Vz=Vo
//maximum zener current
Izmax=Pzmax/Vz
//since Izmin is not given so let us take IZmin=5mA
Izmin=5*10^-3
//maximum Resistance
Rmax=(Vimin-Vo)/(Izmin+ILmax)
//mini resistance
Rmin=(Vimax-Vo)/(Izmax+ILmin)
//Required resistance
R=(Rmax+Rmin)/2
//load resistance
RL=Vo/ILmax
printf("minimum resistance %d ohm \n",Rmin)
printf("maximum resistance %d ohm \n",Rmax)
printf("required resistance %d ohm \n",R)
printf("load resistance %d ohm \n",RL)
```

Scilab code Exa 2.2.63 Design a 6V dc reference source to operate from a 16v supply

```
clc
disp("Example 2.63")
printf("\n")
disp("Design a 6V dc reference source to operate
   from a 16v supply")
```

```
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt\n")
7 //output voltage
8 Vo=6
9 //input voltage
10 Vi=16
11 //zener power
12 Pzmax=400*10^-3
13 //zener current maximum
14 Izmax=Pzmax/Vo
15 //I=Iz+IL & ILmin=0, we have Izmax=I
16 //take Izmin=5*10^-3
17 Izmin=5*10^-3
18 //maximum load current
19 ILmax=Izmax-Izmin
20 //load resistance
21 RLmin=Vo/ILmax
22 //series resistance
23 R=(Vi-Vo)/Izmax
24 printf("maximum load current %d ampere\n",ILmax)
25 printf("Load resistance %d ohm\n",RLmin)
26 printf("sereies resistance %d ohm\n",R)
```

Scilab code Exa 2.2.64 Design a 8V dc reference source to operate from a 20v supply and find maximum load current

```
1 clc
2 disp("Example 2.64")
3 printf("\n")
4 disp("Design a 8V dc reference source to operate
    from a 20v supply and find maximum load current")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt\n")
```

```
7 //output voltage
8 Vo=8
9 //input voltage
10 Vi=20
11 //zener power
12 Pzmax=400*10^-3
13 //zener current maximum
14 Izmax=Pzmax/Vo
15 //I=Iz+IL & ILmin=0, we have Izmax=I
16 //take Izmin=5*10^-3
17 Izmin=5*10^-3
18 //maximum load current
19 ILmax=Izmax-Izmin
20 //load resistance
21 RLmin=Vo/ILmax
22 //series resistance
23 R=(Vi-Vo)/Izmax
24 printf("maximum load current %d ampere\n",ILmax)
25 printf("Load resistance %d ohm\n",RLmin)
26 printf("sereies resistance %d ohm\n",R)
```

Scilab code Exa 2.2.65 Calculate circuit current when supply voltage drops to 27V select suitable components

```
1 clc
2 disp("Example 2.65")
3 printf("\n")
4 disp("Calculate circuit current when supply voltage
    drops to 27V, select suitable components")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
    ampere \n 3 voltage sources are in volt\n")
7 //input voltage
8 Vi=30
9 //output voltage
```

```
10 Vo=9
11 //test current(lies b/w Izmin & Izmax)
12 Izt=20*10^-3
13 //load current(assume zero, no load operation)
14 IL=0
15 //circuit current
16 I=Izt
17 //series resistance
18 R=(Vi-Vo)/I
19 //zener current when Vi drops to 27V
20 Vi1=27
21 Iz=(Vi1-Vo)/R
22 printf("Zener current is %f ampere\n",Iz)
```

Scilab code Exa 2.2.66 Calculate the effect of a 10per variation supply voltage on diode current

```
1 clc
2 disp("Example 2.66")
3 printf("\n")
4 disp("Calculate the effect of a 10% variation supply
      voltage on diode current")
5 printf("Given\n")
6 //input voltage
7 Vi=25
8 //output voltage
9 Vo=10
10 //test current(lies b/w Izmin & Izmax)
11 Izt=20*10^-3
12 //load current(assume zero, no load operation)
13 IL=10^-3
14 //select R such that
15 Iz=Izt
16 //series resistance
17 R=(Vi-Vo)/(Iz+IL)
```

```
18 //maximum input voltage
19 Vimax=25+2.5
20 //minimum input voltage
21 Vimin=25-2.5
22 //ciruit current
23 I1=(Vimax-Vo)/R
24 //zener current when Vimax
25 Izmax=I1-IL
26 //cicuit current when Vimin
27 I2=(Vimin-Vo)/R
28 //zener current when Vimin
29 Izmin=I2-IL
30 printf("circuit current when Vimax is %f ampere\n",
      I1)
31 printf("zener current when Vimax is %f ampere\n",
      Izmax)
32 printf("circuit current when Vimin is %f ampere\n",
      I2)
33 printf("zener current when Viin is %f ampere\n",
      Izmin)
```

Scilab code Exa 2.2.68 Calculate the line regulation output resistance load regulation and ripple rejection ratio

```
1 clc
2 disp("Example 2.68")
3 printf("\n")
4 disp("Calculate the line regulation, output
      resistance, load regulation & ripple rejection
      ratio")
5 printf("Given\n")
6 printf("1 Resistance are in ohms \n 2 Current are in
      ampere \n 3 voltage sources are in volt\n")
7 //input voltage
8 Vi=16
```

```
//output voltage
Vo=6
//load current
ILmax=60*10^-3
//dynamic impedence
Zz=7
//series resistance
R=150
//Source effect
delVi=(10*16)/100
RL=Vo/ILmax
//Zz||RL
Rp=(Zz*RL)/(Zz+RL)
delVo=(delVi*Rp)/(R+Rp)
//Line regulation
LR=(delVo*100)/Vo
//load effect
delIL=ILmax
Ro=(Zz*R)/(Zz+R)
delVo1=delIL*Ro
//output resistance
Rout=Ro
//Ripple rejection ratio
VrobyVri=Rp/(R+Rp)
printf("line regulation is %f \n",LR)
printf("output resistance is %d ohm\n",Rout)
printf("Ripple rejection ratio %f \n",VrobyVri)
```

Chapter 3

pnp and npn Transistors

Scilab code Exa 3.3.14 calculate the value of Ic Ie beta for a transistor

```
1  clc
2  disp("Example 3.14")
3  printf("\n")
4  disp("calculate the value of Ic,Ie,beta for a
       transistor")
5  printf("Given\n")
6  alpha=0.98
7  //base current
8  Ib=120*10^-6
9  //Value of Ic
10 Ic=alpha*Ib/(1-alpha)
11 //Value of Ie
12 Ie=Ic+Ib
13 //value of beta
14 beta=alpha/(1-alpha)
15 printf("base current \n%f ampere\n",Ib)
16 printf("collector current \n%f ampere\n",Ic)
17 printf("Emitter current \n%f ampere\n",Ie)
18 printf("beta \n%f\n",beta)
```

Scilab code Exa 3.3.15 Find the value of alpha and beta of transistor and Ib for desired Ic

```
clc
disp("Example 3.15")
printf("\n")
disp("Find the value of alpha & beta of transistor
   and Ib for desired Ic")
printf("Given\n")
Ic=1.2*10^-3
Ib=20*10^-6
//the value of beta
beta=Ic/Ib
//the value of alpha
alpha=beta/(1+beta)
//the value of Ib for desired value of Ic=5mA
Ic1=5*10^-3
Ib1=Ic1/beta
printf("beta \n%f\n",beta)
printf("alpha \n%f\n",alpha)
printf("base current when collector current is 5mA
   is \n%f ampere\n",Ib1)
```

Scilab code Exa 3.3.16 calculate the value of alpha beta and Ib for a transistor

```
clc
disp("Example 3.16")
printf("\n")
disp("calculate the value of alpha,Ib,beta for a
   transistor")
printf("Given\n")
```

```
6 //collector current
7 Ic=2.5*10^-3
8 //emitter current
9 Ie=2.55*10^-3
10 //Value of alpha
11 alpha=Ic/Ie
12 //Value of Ib
13 Ib=Ie-Ic
14 //value of beta
15 beta=Ic/Ib
16 printf("collector current \n%f ampere\n",Ic)
17 printf("Emitter current \n%f ampere\n",Ie)
18 printf("alpha \n%f\n",alpha)
19 printf("base current \n%f ampere\n",Ib)
20 printf("beta \n%f\n",beta)
```

Scilab code Exa 3.3.17 calculate the value of beta for transistor and find new collector current when beta of new transistor is 70

```
1 clc
2 disp("Example 3.17")
3 printf("\n")
4 disp("calculate the value of beta for transistor.
    find new collector current when beta of new
    transistor is 70")
5 printf("Given\n")
6 //old transistor
7 Ic=3*10^-3
8 Ie=3.03*10^-3
9 //find Ib
10 Ib=Ie-Ic
11 //value of beta
12 beta=Ic/Ib
13 //for new transistor beta=70
14 beta1=70
```

```
15 //the value of Ic
16 Ic=beta1*Ib
17 printf("base current \n%f ampere\n",Ib)
18 printf("beta \n%f\n",beta)
19 printf("new value of collector current for beta 70
      is \n%f ampere\n",Ic)
```

Scilab code Exa 3.3.18 calculate the value of Ic Ie for a transistor and Find beta for transistor

```
1 clc
2 disp("Example 3.18")
3 printf("\n")
4 disp("calculate the value of Ic,Ie for a transistor.
      Find beta for transistor")
5 printf("Given\n")
6 //For old transistor
7 alpha=0.97
8 Ib=50*10^-6
9 //value of collector current
10 Ic=alpha*Ib/(1-alpha)
11 //value of emitter current
12 Ie=Ic/alpha
13 //value of beta
14 beta=Ic/Ib
15 printf("collector current \n%f ampere\n",Ic)
16 printf("Emitter current \n%f ampere\n",Ie)
17 printf("beta \n%f\n",beta)
```

Scilab code Exa 3.3.19 calculate the value of Ie alpha beta for a transistor and find Ib for new value of Ic

```
1 clc
```

```
2 disp("Example 3.19")
3 printf("\n")
4 disp("calculate the value of Ie,alpha,beta for a
     transistor and find Ib for new value of Ic")
5 printf("Given\n")
6 //for old transistor
7 Ic=5.25*10^-3
8 Ib=100*10^-6
9 //value of Ie
10 Ie=Ic+Ib
11 //value of alpha
12 alpha=Ic/Ie
13 //value of beta
14 beta=Ic/Ib
15 //for new value of Ib the Ic value is
16 Ic1=15*10^-3
17 Ib=Ic1/beta
18 printf("emitter current \n%f ampere\n",Ie)
19 printf("alpha \n%f\n",alpha)
20 printf("beta \n%f\n",beta)
21 printf("new base current \n%f ampere\n",Ib)
```

Scilab code Exa 3.3.20 calculate the value of Ic and Ie for a transistor

```
1 clc
2 disp("Example 3.20")
3 printf("\n")
4 disp("calculate the value of Ic,Ie for a transistor"
     )
5 printf("Given\n")
6 alpha=0.99
7 //base current
8 Ib=20*10^-6
9 //value of collector current
10 Ic=alpha*Ib/(1-alpha)
```

```
11 //value of emitter current
12 Ie=Ic+Ib
13 printf("base current \n%f ampere\n",Ib)
14 printf("collector current \n%f ampere\n",Ic)
15 printf("Emitter current \n%f ampere\n",Ie)
```

Scilab code Exa 3.3.21 calculate the value of Ic alpha beta for a transistor and Ic when Ib is 150uA

```
1  clc
2  disp("Example 3.21")
3  printf("\n")
4  disp("calculate the value of Ic,alpha,beta for a
      transistor and Ic when Ib=150uA")
5  printf("Given\n")
6  Ic=12.42*10^-3
7  Ib=200*10^-6
8  //value of Ie
9  Ie=Ic+Ib
10 //value of alpha
11 alpha=Ic/Ie
12 //value of beta
13 beta=Ic/Ib
14 //value of Ic when Ib=150uA
15 Ib1=150*10^-6
16 Ic=beta*Ib1
17 printf("Emitter current \n%f ampere\n",Ie)
18 printf("alpha \n%f\n",alpha)
19 printf("beta \n%f\n",beta)
20 printf("collector current \n%f ampere\n",Ic)
```

Scilab code Exa 3.3.22 calculate the value of Ib beta for a transistor and Ic Ie for new value of beta

```
clc
disp("Example 3.22")
printf("\n")
disp("calculate the value of Ib,beta for a
   transistor and Ic, Ie for new value of beta")
printf("Given\n")
Ic=16*10^-3
Ie=16.04*10^-3
//base current
Ib=Ie-Ic
//beta value
beta=Ic/Ib
//for beta=25
beta1=25
Ic1=beta1*Ib
Ie1=Ic1+Ib
printf("base current \n%f ampere\n",Ib)
printf("beta \n%f\n",beta)
printf("emitter current \n%f ampere\n",Ie1)
```

Scilab code Exa 3.3.25 Find the DC collector voltage and voltage gain of ckt for Vi is 50mV

```
clc
disp("Example 3.25")
printf("\n")
disp("Find the DC collector voltage & voltage gain
   of circuit for Vi=50mV")
printf("Given\n")
//base current for Vbe=0.7
Ib=30*10^-6
Vbe=0.7
beta=80
//collector current
Ic=beta*Ib
```

```
12 //given from ckt
13 Vcc=20
14 Rc=5.8*10^3
15 //writing KVL for Common Emitter circuit
16 Vc=Vcc-(Ic*Rc)
17 //for input characteristics delVi=delVb=50mV
18 Vi=50*10^-3
19 delIb=5*10^-6
20 Ic1=beta*delIb
21 //output voltage
22 Vo=Ic1*Rc
23 //voltage gain
24 Av=Vo/Vi
25 printf("Dc collector voltage \n%f volt\n",Vc)
26 printf("voltage gain \n%f\n",Av)
```

Scilab code Exa 3.3.26 FInd the DC current gain for circuit fig 15 and ac voltage gain

```
1 clc
2 disp("Example 3.26")
3 printf("\n")
4 disp("FInd the DC current gain for circuit fig 3.15
     and ac voltage gain")
5 printf("Given\n")
6 //to find dc current gain
7 //given
8 Vcc=15
9 Vc=7
10 Rc=5.6*10^3
11 Ib=20*10^-6
12 //to find Vrc
13 Vrc=Vcc-Vc
14 //collector current
15 Ic=Vrc/Rc
```

```
16 //dc current gain
17 betadc=Ic/Ib
18 //to find ac voltage gain
19 //given
20 Vi=50*10^-3
21 delIb=10*10^-6
22 delIc=betadc*delIb
23 //output voltage
24 Vo=delIc*Rc
25 //voltage gain
26 Av=Vo/Vi
27 printf("DC current gain \n%f\n",betadc)
28 printf("voltage gain \n%f\n",Av)
```

Scilab code Exa 3.3.27 Find the parameters of the ckt of question 27

```
1 clc
2 disp("Example 3.27")
3 printf("\n")
4 disp("Find the following terms as given in question
    3.27")
5 printf("Given\n")
6 //to find collector voltage
7 //given
8 Vbe=0.7
9 Ib=30*10^-6
10 beta=50
11 Rc=12*10^3
12 Vcc=25
13 //collector current
14 Ic=beta*Ib
15 //collector voltage
16 Vc=Vcc-(Ic*Rc)
17 //to find voltage gain
18 //given
```

```
Vi=50*10^-3
Ib1=15*10^-6
Ic1=beta*Ib1
Vo=Ic1*Rc
//voltage gain
Av=Vo/Vi
//to find Vce
//given
Vbe=0.73
Ib2=40*10^-6
Ic2=beta*Ib2
Vce=Vcc-(Ic2*Rc)
//to find voltage gain when Rc changed to 6.8k
Rc1=6.8*10^3
Vo1=Ic1*Rc1
Av1=Vo1/Vi
//to find current gain of replaced transistor
//given
Vc1=9
Vrc=Vcc-Vc1
Ic3=Vrc/Rc
beta1=Ic3/Ib
printf("collector voltage \n%f volt \n",Vc)
printf("Voltage gain for vi=50mv \n%f\n",Av)
printf("Vce if Vbe=0.73 is \n%f volt\n",Vce)
printf("Voltage gain when Rc=6.8k \n%f Volt\n",Av1)
printf("current gain of replaced transistor \n%f\n",
   beta1)
```

Scilab code Exa 3.3.34 Obtain the CB current gain and output characteristics

```
clc
```

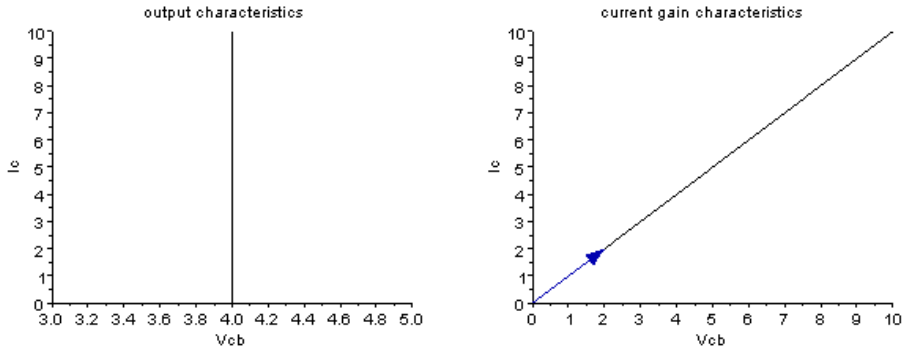

Figure 3.1: Obtain the CB current gain and output characteristics

```
2  disp("Example 3.34")
3  printf("\n")
4  disp("Obtain the Common base current gain & output
       characteristics")
5  printf("Given\n")
6  Vcb=[ 4 4 4 4 4 4 ]
7  Ic=[ 0 2 4 6 8 10]
8  subplot(221)
9  plot2d(Vcb,Ic)
10 xlabel("Vcb in volt")
11 ylabel("Ic in Ampere")
12 xtitle("output characteristics")
13 Ic1=[0 2 10 ]
14 Ie=[0 2 10 ]
15 subplot(222)
16 plot2d(Ie,Ic1)
17 xarrows(Ie,Ic1,2,2)
18 xarrows(Ie,Ic1,10,10)
19 xlabel("Vcb in volt")
20 ylabel("Ic in Ampere")
21 xtitle("current gain characteristics")
```

Scilab code Exa 3.3.46 For the circuit given draw a DC load line

```
1  clc
2  disp("Example 3.46")
3  printf("\n")
4  disp("For the circuit shown in example 3.46 draw a
       DC load line")
5  printf("Given\n")
6  //to find Vce value when Ic=0
7  Ic1=0
8  //given
9  Rc=12*10^3
10 Vcc=20
```

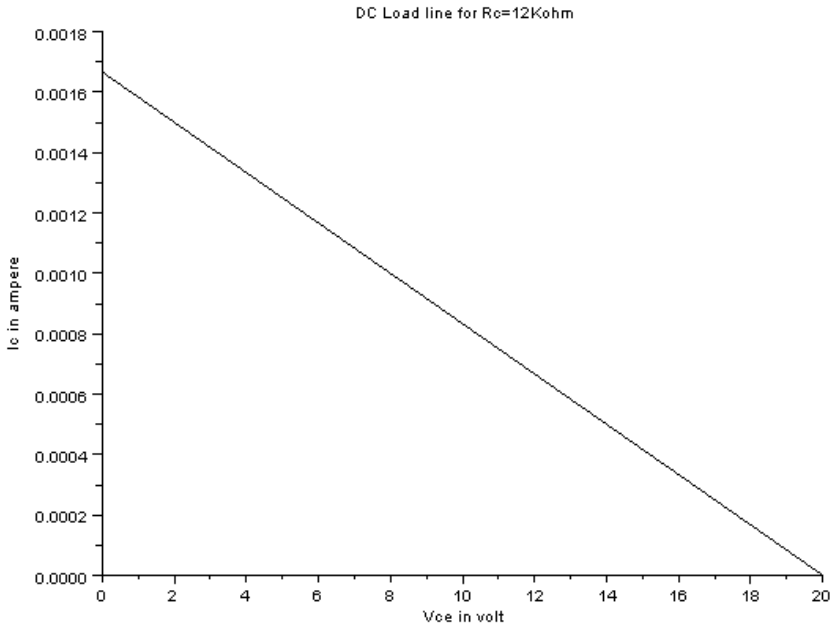

Figure 3.2: For the circuit given draw a DC load line

```
11 //from circuit
12 Vce=Vcc-(Ic1*Rc)
13 //to find Ic when Vce=0
14 Vce1=0
15 Ic=Vcc/Rc
16 //To draw DC load line
17 Vceg=[Vce, Vce1]
18 Icg=[Ic1,Ic]
19 plot2d(Vceg,Icg)
20 xlabel("Vce in volt")
21 ylabel("Ic in ampere")
22 xtitle("DC Load line for Rc=12Kohm")
```

Scilab code Exa 3.3.50 Draw a DC load line for the base bias circuit

```
clc
disp("Example 3.50")
printf("\n")
disp("Draw a DC load line for the base bias circuit")
printf("Given\n")
//given
Rc=2.2*10^3
Rb=470*10^3
Vcc=18
Vbe=0.7
hFE=100
//find the Ib
Ib=(Vcc-Vbe)/Rb  // from ciruit
//find the Ic
Icq=hFE*Ib
//find the Vceq
Vceq=Vcc-(Icq*Rc)
//to draw Dc load line
Ic1=Vcc/Rc
Vce1=Vcc
Vce=[Vcc Vceq 0]
Ic=[0 Icq Ic1]
printf("Q(%f,%f)\n",Vceq,Icq)
plot2d(Vce, Ic)
xlabel("Vce in volt")
ylabel("Ic in Ampere")
xtitle("DC load line for base bias circuit")
```

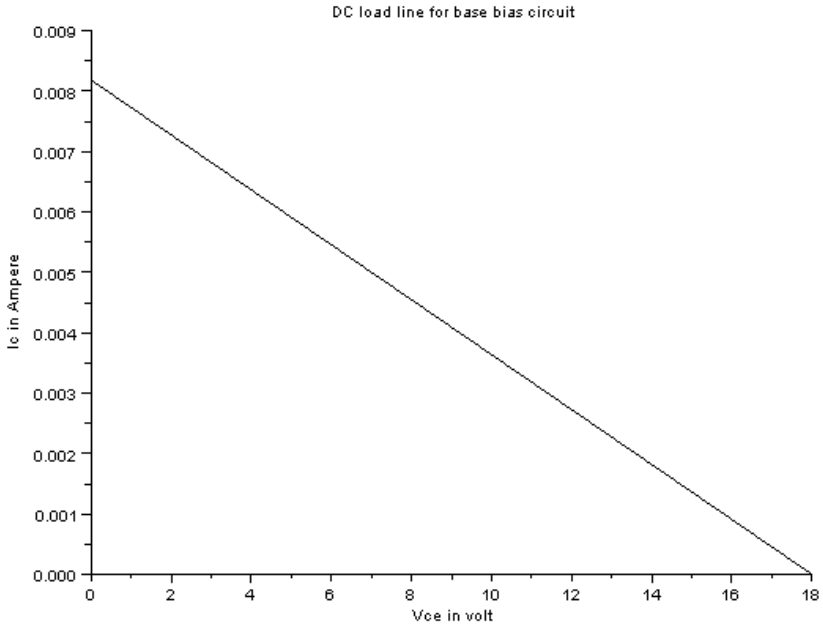

Figure 3.3: Draw a DC load line for the base bias circuit

Scilab code Exa 3.3.51 Draw a DC load line for the base bias circuit for different hFE

```
clc
disp("Example 3.51")
printf("\n")
disp("Draw a DC load line for the base bias circuit
   for different hFE")
printf("Given\n")
//given
Rc=2.2*10^3
Rb=470*10^3
Vcc=18
Vbe=0.7
hFE1=50
hFE2=200
//find the Ib
Ib=(Vcc-Vbe)/Rb  // from ciruit
//find the Ic for hFE1
Icq1=hFE1*Ib
//find the Vceq1
Vceq1=Vcc-(Icq1*Rc)
//find the Ic for hFE2
Icq2=hFE2*Ib
//find the Vceq2
Vceq2=Vcc-(Icq2*Rc)
//to draw Dc load line
Ic1=Vcc/Rc
Vce1=Vcc
Vce=[Vcc Vceq1 Vceq2 0]
Ic=[0 Icq1 Icq2 Ic1]
printf("Q1(%f volt ,%f ampere)\n",Vceq1,Icq1)
printf("Q2(%f volt ,%f ampere)\n",Vceq2,Icq2)
plot2d(Vce, Ic)
```

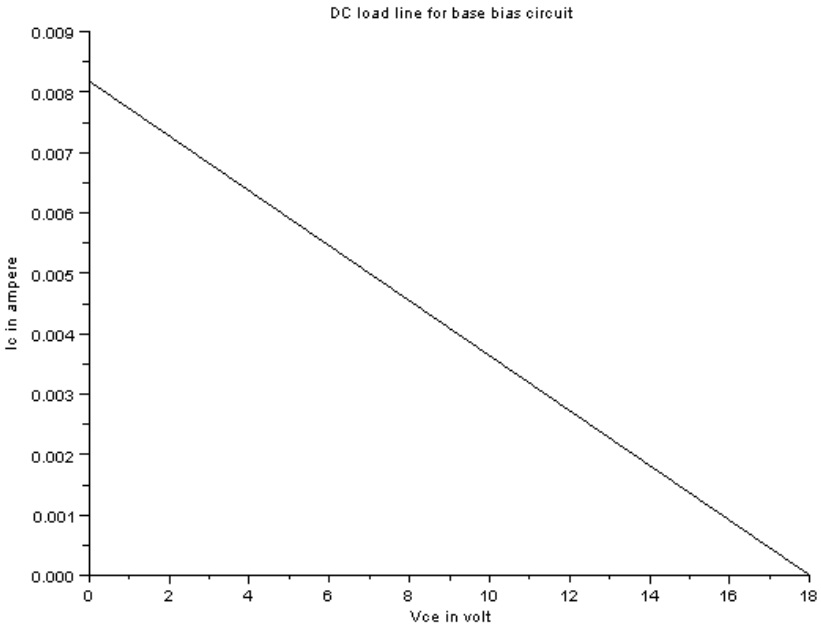

Figure 3.4: Draw a DC load line for the base bias circuit for different hFE

```
31 xlabel("Vce in volt")
32 ylabel("Ic in ampere")
33 xtitle("DC load line for base bias circuit")
```

Scilab code Exa 3.3.52 Find Ic and Vce and Draw a DC load line for the base bias circuit

```
1 clc
2 disp("Example 3.52")
3 printf("\n")
4 disp(" Find Ic & Vce. Draw a DC load line for the
```

```
    base bias circuit")
printf("Given\n")
//given
betadc=100
Vbe=0.7
Rc=10^3
Rb=10^5
Vb=5
Vc=10
//to find Ib
Ib=(Vb-Vbe)/Rb  //from ciruit
//Ic value
Icq=betadc*Ib
//Vce value
Vceq=Vc-(Icq*Rc)
//to draw DC load line
Ic1=Vc/Rc
Vce1=Vc
Vce=[Vc Vceq 0]
Ic=[0 Icq Ic1]
printf("Q(%f volt,%f ampere)\n",Vceq,Icq)
plot2d(Vce, Ic)
xlabel("Vce in volt")
ylabel("Ic in ampere")
xtitle("DC load line for base bias circuit")
```

Scilab code Exa 3.3.53 Find Ic and Vce and Draw a DC load line for the base bias circuit

```
clc
disp("Example 3.53")
printf("\n")
disp(" Find Ic & Vce. Draw a DC load line for the
```

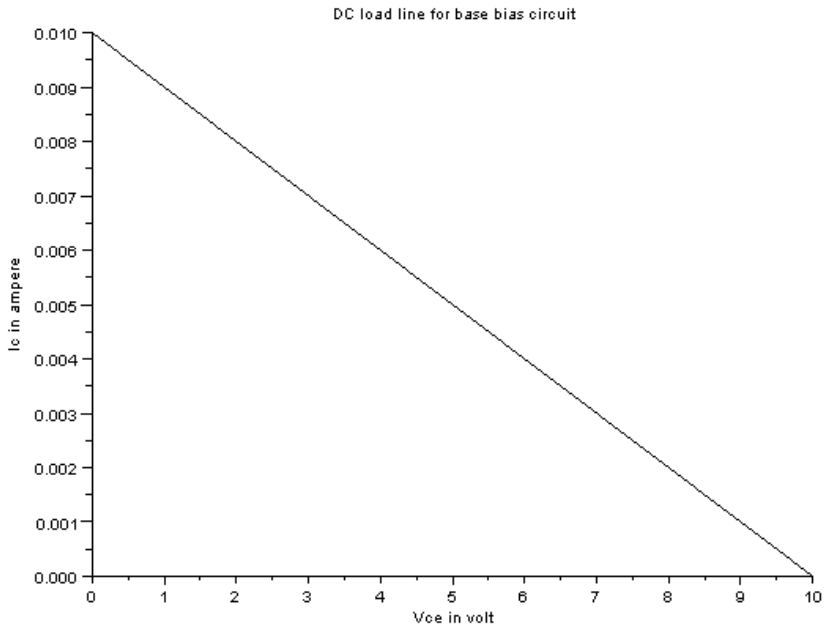

Figure 3.5: Find Ic and Vce and Draw a DC load line for the base bias circuit

```
    base bias circuit")
printf("Given\n")
//given
betadc=50
Vbe=0.7
Rc=2.2*10^3
Rb=240*10^3
Vc=12
//to find Ib
Ib=(Vc-Vbe)/Rb  //from ciruit
//Ic value
Icq=betadc*Ib
//Vce value
Vceq=Vc-(Icq*Rc)
//to draw DC load line
Ic1=Vc/Rc
Vce1=Vc
Vce=[Vc Vceq 0]
Ic=[0 Icq Ic1]
printf("Q(%f volt,%f ampere)\n",Vceq,Icq)
plot2d(Vce, Ic)
xlabel("Vce in volt")
ylabel("Ic in ampere")
xtitle("DC load line for base bias circuit")
```

Scilab code Exa 3.3.54 Draw a DC load line for the base bias circuit neglecting Vbe

```
clc
disp("Example 3.54")
printf("\n")
disp(" Draw a DC load line for the base bias circuit
    neglecting Vbe")
```

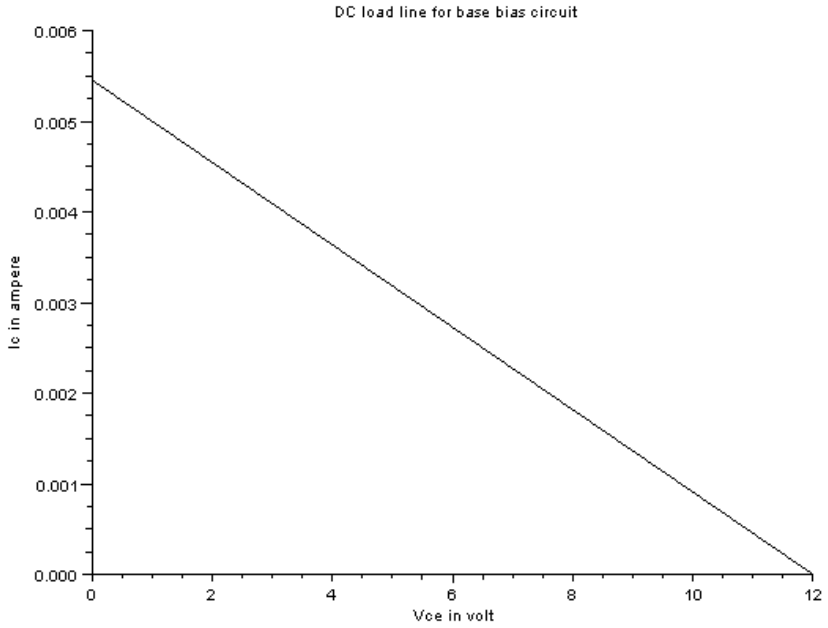

Figure 3.6: Find Ic and Vce and Draw a DC load line for the base bias circuit

```
printf("Given\n")
//given
betadc=100
Rc=5*10^3
Rb=1.5*10^6
Vc=30
//to find Ib
Ib=Vc/Rb  //from ciruit
//Ic value
Icq=betadc*Ib
//Vce value
Vceq=Vc-(Icq*Rc)
//to draw DC load line
Ic1=Vc/Rc
Vce1=Vc
Vce=[Vc Vceq 0]
Ic=[0 Icq Ic1]
printf("Q(%f volt,%f ampere)\n",Vceq,Icq)
plot2d(Vce, Ic)
xlabel("Vce in volt")
ylabel("Ic in ampere")
xtitle("DC load line for base bias circuit")
```

Scilab code Exa 3.3.55 Calculate transistor hFE and new Vce level for hFE is 100 of base bias ciruit

```
clc
disp("Example 3.55")
printf("\n")
disp("Calculate transistor hFE & new Vce level for
   hFE=100 of base bias ciruit")
printf("Given\n")
//given
```

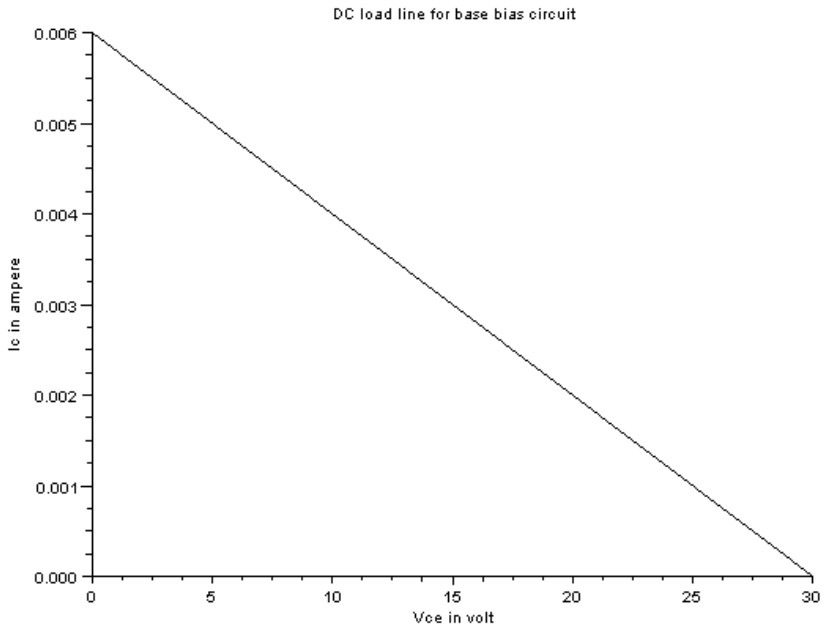

Figure 3.7: Draw a DC load line for the base bias circuit neglecting Vbe

```
Vcc=24
Rb=390*10^3
Rc=3.3*10^3
Vce=10
//Find Ic
Ic=(Vcc-Vce)/Rc  //from circuit
//find Ib
Ib=(Vcc-Vbe)/Rb  //from ciruit
//the value of hFE
hFE=Ic/Ib
//to find Vce when hFE=100
hFE1=100
Ic1=hFE1*Ib
Vce1=Vcc-(Ic1*Rc)
printf("Value of hFE is \n%f\n",hFE)
printf("New value of Vce is \n%f volt\n",Vce1)
```

Scilab code Exa 3.3.57 Design a Base bias circuit

```
clc
disp("Example 3.57")
printf("\n")
disp("Design a Base bias circuit")
printf("Given\n")
//given
Vce=5
Ic=5*10^-3
Vcc=15
hFE=100
//Value of Rc
Rc=(Vcc-Vce)/Ic
Ib=Ic/hFE
//value of Rb
Vbe=0.7
Rb=(Vcc-Vbe)/Ib
```

```
17 printf("The value of Rc=%f ohm\nRb=%f ohm\n",Rc,Rb)
```

Scilab code Exa 3.3.58 Draw the DC load line and determine Rc for base bias circuit

```
1  clc
2  disp("Example 3.58")
3  printf("\n")
4  disp("Draw the DC load line & determine Rc for base
       bias circuit")
5  printf("Given\n")
6  //given
7  Vcc=18
8  Vbe=0.7
9  Vceq=9
10 Icq=2*10^-3
11 //to find Rc
12 Rc=(Vcc-Vceq)/Icq //from circuit
13 //to draw DC load line
14 Ic1=Vcc/Rc
15 Vce=[Vcc Vceq 0]
16 Ic=[0 Icq Ic1]
17 printf("Q(%f volt,%f ampere)\n",Vceq,Icq)
18 plot2d(Vce, Ic)
19 xlabel("Vce in volt")
20 ylabel("Ic in ampere")
21 xtitle("DC load line for base bias circuit")
```

Scilab code Exa 3.3.59 Calculate Base resistance for base bias circuit

```
1  clc
```

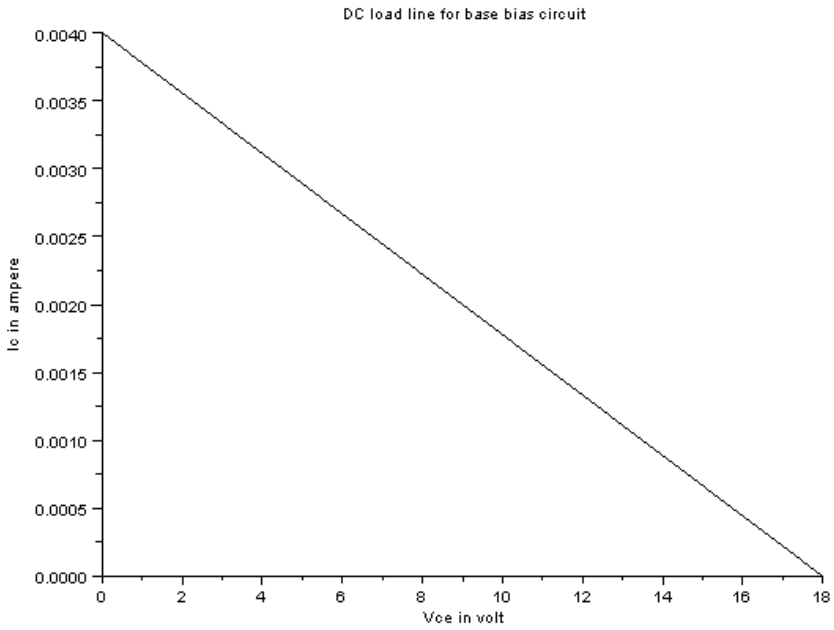

Figure 3.8: Draw the DC load line and determine Rc for base bias circuit

```
2 disp("Example 3.59")
3 printf("\n")
4 disp("Calculate Base resistance for base bias
    circuit")
5 printf("Given\n")
6 //given
7 Vcc=20
8 Vce=5
9 Rc=6.8*10^3
10 hFE=120
11 Vbe=0.7
12 //collector current
13 Ic=(Vcc-Vce)/Rc
14 //base current
15 Ib=Ic/hFE
16 //the required base resistance
17 Rb=(Vcc-Vbe)/Ib
18 printf("The base resistance \n%f ohm\n",Rb)
```

Scilab code Exa 3.3.61 Determine the Ic and Vce levels and draw DC load line for Collector to base bias

```
1 clc
2 disp("Example 3.61")
3 printf("\n")
4 disp("Determine the Ic & Vce levels & draw DC load
    line for Collector to base bias")
5 printf("Given\n")
6 //given
7 Vcc=15
8 Vbe=0.7
9 hFE=50
10 Rc=1.8*10^3
11 Rb=39*10^3
12 //base current
```

```
13 Ib=(Vcc-Vbe)/(Rb+(1+hFE)*Rc)
14 //collector current
15 Icq=hFE*Ib
16 //value of Vce
17 Vceq=(Ib*Rb)+Vbe
18 //to draw DC load line
19 Ic1=Vcc/Rc
20 Vce=[Vcc Vceq 0]
21 Ic=[0 Icq Ic1]
22 printf("Q(%f volt,%f ampere)\n",Vceq,Icq)
23 plot2d(Vce, Ic)
24 xlabel("Vce in volt")
25 ylabel("Ic in ampere")
26 xtitle("DC load line for base bias circuit")
```

Scilab code Exa 3.3.62 Determine the hFE and new Vce for hFE is 50 for Collector to base bias

```
1 clc
2 disp("Example 3.62")
3 printf("\n")
4 disp("Determine the hFE and new Vce for hFE=50 for
     Collector to base bias")
5 printf("Given\n")
6 //given
7 Vcc=15
8 Vce=5
9 Vbe=0.7
10 Rb=82*10^3
11 Rc=5.6*10^3
12 //base current
13 Ib=(Vce-Vbe)/Rb
14 //hFE value
```

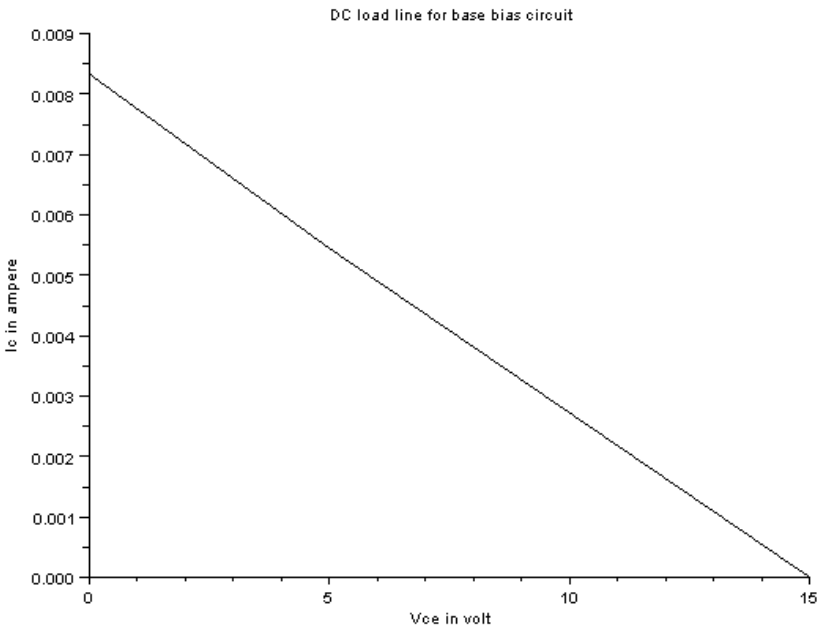

Figure 3.9: Determine the Ic and Vce levels and draw DC load line for Collector to base bias

```
15 hFE=((Vcc-Vbe)/(Ib*Rc))-(Rb/Rc)-1
16 //to find Vce for hFE=50
17 hFE1=50
18 Ib1=(Vcc-Vbe)/(Rb+(1+hFE1)*Rc)
19 Vce1=(Ib1*Rb)+Vbe
20 printf("The hFE is \n%f\n",hFE)
21 printf("new Vce is \n%fvolt \n",Vce1)
```

Scilab code Exa 3.3.63 Draw a DC load line for Collector to base bias

```
1  clc
2  disp("Example 3.63")
3  printf("\n")
4  disp("Draw a DC load line for Collector to base bias
   ")
5  printf("Given\n")
6  //given
7  Vcc=20
8  Vbe=0.7
9  hFE=50
10 Rc=1.8*10^3
11 Rb=39*10^3
12 //base current
13 Ib=(Vcc-Vbe)/(Rb+(1+hFE)*Rc)
14 //collector current
15 Icq=hFE*Ib
16 //to find Vce
17 Vceq=(Ib*Rb)+Vbe
18 //to draw DC load line
19 Ic1=Vcc/Rc
20 Vce=[Vcc Vceq 0]
21 Ic=[0 Icq Ic1]
22 printf("Q(%f,%f)\n",Vceq,Icq)
23 plot2d(Vce, Ic)
24 xlabel("Vce")
```

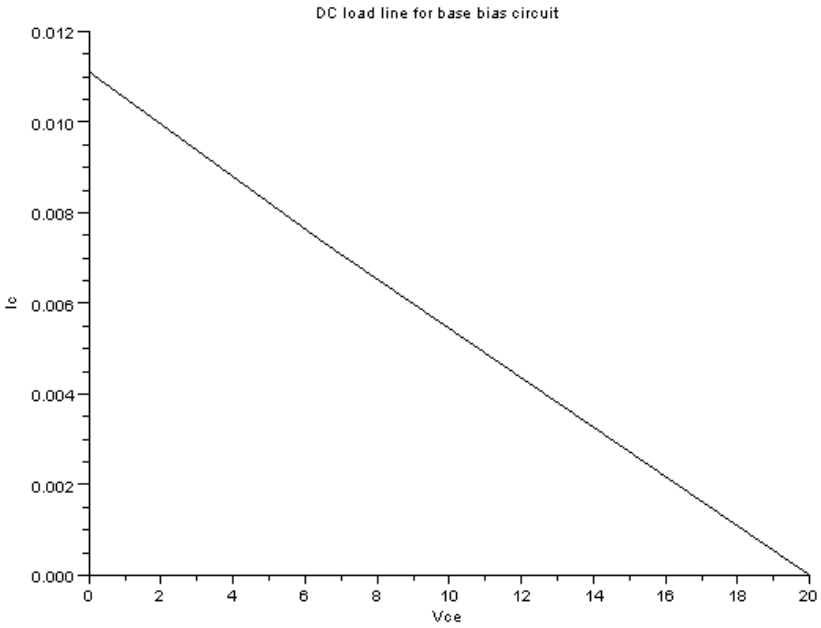

Figure 3.10: Draw a DC load line for Collector to base bias

```
25 ylabel("Ic")
26 xtitle("DC load line for base bias circuit")
```

Scilab code Exa 3.3.64 Draw a DC load line for Collector to base bias for different hFE

```
1 clc
2 disp("Example 3.64")
3 printf("\n")
4 disp("Draw a DC load line for Collector to base bias
    for different hFE")
```

```
printf("Given\n")
//given
Vcc=18
Vbe=0.7
hFE1=50
hFE2=200
Rc=2.2*10^3
Rb=270*10^3
//for hFE=50
//base current
Ib1=(Vcc-Vbe)/(Rb+(1+hFE1)*Rc)
//collector current
Icq1=hFE1*Ib1
//to find Vce
Vceq1=(Ib1*Rb)+Vbe
//for hFE=200
//base current
Ib2=(Vcc-Vbe)/(Rb+(1+hFE2)*Rc)
//collector current
Icq2=hFE2*Ib2
//to find Vce
Vceq2=(Ib2*Rb)+Vbe
//to draw DC load line
Ic1=Vcc/Rc
Vce=[Vcc Vceq1 Vceq2 0]
Ic=[0 Icq1 Icq2 Ic1]
printf("Q1(%f volt,%f ampere)\n",Vceq1,Icq1)
printf("Q2(%f volt,%f ampere)\n",Vceq2,Icq2)
plot2d(Vce, Ic)
xlabel("Vce in volt")
ylabel("Ic in ampere")
xtitle("DC load line for base bias circuit")
```

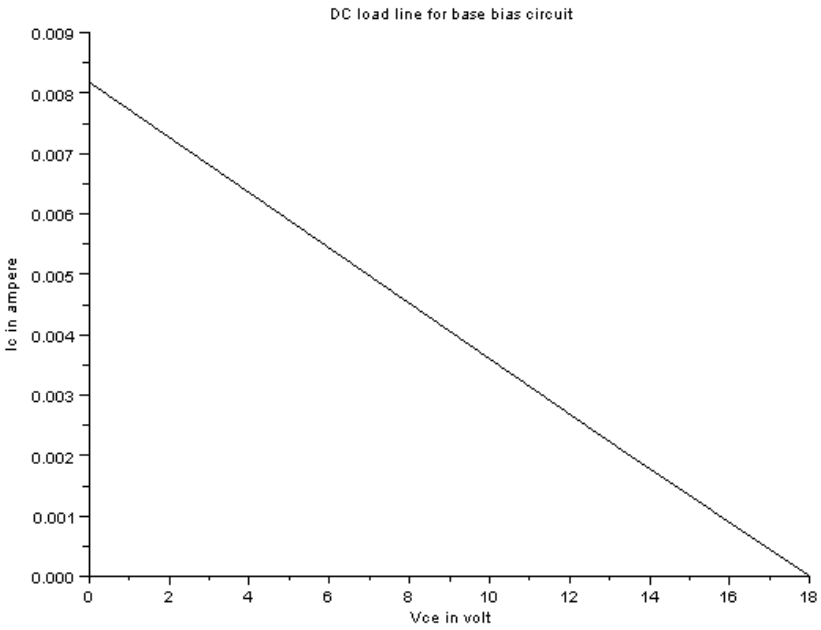

Figure 3.11: Draw a DC load line for Collector to base bias for different hFE

Scilab code Exa 3.3.66 Design a Collector to base bias circuit

```
clc
disp("Example 3.66")
printf("\n")
disp("Design a Collector to base bias circuit")
printf("Given\n")
//Given
Vce=5
Ic=5*10^-3
Vbe=0.7
Vcc=15
hFE=100
//base current
Ib=Ic/hFE
//collector resistance
Rc=(Vcc-Vce)/(Ic+Ib)
//base resistance
Rb=(Vce-Vbe)/Ib
printf("base current %f ampere \n",Ib)
printf("Collector resistance %f ohm \n",Rc)
printf("base resistance %f ohm \n",Rb)
```

Scilab code Exa 3.3.67 Design a Collector to base bias circuit

```
clc
disp("Example 3.67")
printf("\n")
disp("Design a Collector to base bias circuit")
printf("Given\n")
//Given
Vce=10
Ic=3*10^-3
Vbe=0.7
Vcc=25
```

```
hFE=80
//base current
Ib=Ic/hFE
//collector resistance
Rc=(Vcc-Vce)/(Ic+Ib)
//base current
Rb=(Vce-Vbe)/Ib
printf("base current %f ampere \n",Ib)
printf("Collector resistance %f ohm \n",Rc)
printf("base resistance %f ohm \n",Rb)
```

Scilab code Exa 3.3.68 Calculate required base resistance for Collector to base bias circuit

```
clc
disp("Example 3.68")
printf("\n")
disp("Calculate required base resistance for
   Collector to base bias circuit")
printf("Given\n")
//given
Vcc=30
Vce=7
Vbe=0.7
Rc=8.2*10^3
hFE=100
//base current
Ib=(Vcc-Vce)/(Rc*(1+hFE))
//base resistance
Rb=(Vce-Vbe)/Ib
printf("base resistance is \n%f ohm\n",Rb)
```

Scilab code Exa 3.3.72 Draw a DC load line for Voltage divider circuit

```
clc
disp("Example 3.72")
printf("\n")
disp("Draw a DC load line for Voltage divider
   circuit")
printf("Given\n")
//given
Vcc=15
Rc=2.7*10^3
Re=2.2*10^3
R1=22*10^3
R2=12*10^3
Vbe=0.7
//base voltage
Vb=(Vcc*R2)/(R1+R2)
//emitter voltage
Ve=Vb-Vbe
//emitter current
Ie=Ve/Re
//collector current
Icq=Ie
//collector to emitter voltage
Vceq=Vcc-(Icq*(Rc+Re))
//collector voltage
Vc=Vce+Ve
//to draw DC load line
Ic1=Vcc/(Rc+Re)
Vce=[Vcc Vceq 0]
Ic=[0 Icq Ic1]
printf("Q(%f volt,%f ampere)\n",Vceq,Icq)
plot2d(Vce, Ic)
xlabel("Vce in volt")
ylabel("Ic in ampere")
xtitle("DC load line for base bias circuit")
```

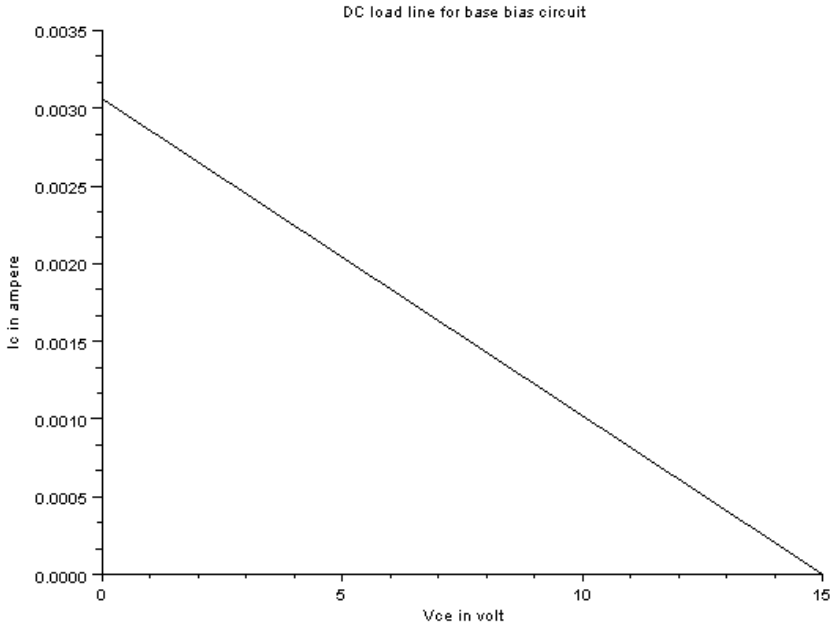

Figure 3.12: Draw a DC load line for Voltage divider circuit

Scilab code Exa 3.3.73 Find the Ve Ic Vce and Vc and Draw a DC load line for Voltage divider circuit

```
clc
disp("Example 3.73")
printf("\n")
disp("Find the Ve, Ic,Vce & Vc. Draw a DC load line
   for Voltage divider circuit")
printf("Given\n")
//given
Vcc=18
Vbe=0.7
hFE=50
R1=33*10^3
R2=12*10^3
Rc=1.2*10^3
Re=10^3
//thevenin voltage
Vt=(Vcc*R2)/(R1+R2)
//thevenin resistance
Rt=(R1*R2)/(R1+R2)
//base current
Ib=(Vt-Vbe)/(Rt+(1+hFE)*Re)
//collector current
Icq=hFE*Ib
//emitter current
Ie=Ib+Icq
//emitter voltage
Ve=Ie*Re
//collector to emitter voltage
Vceq=Vcc-(Icq*Rc)-(Ie*Re)
//collector voltage
Vc=Vce+Ve
//to draw DC load line
```

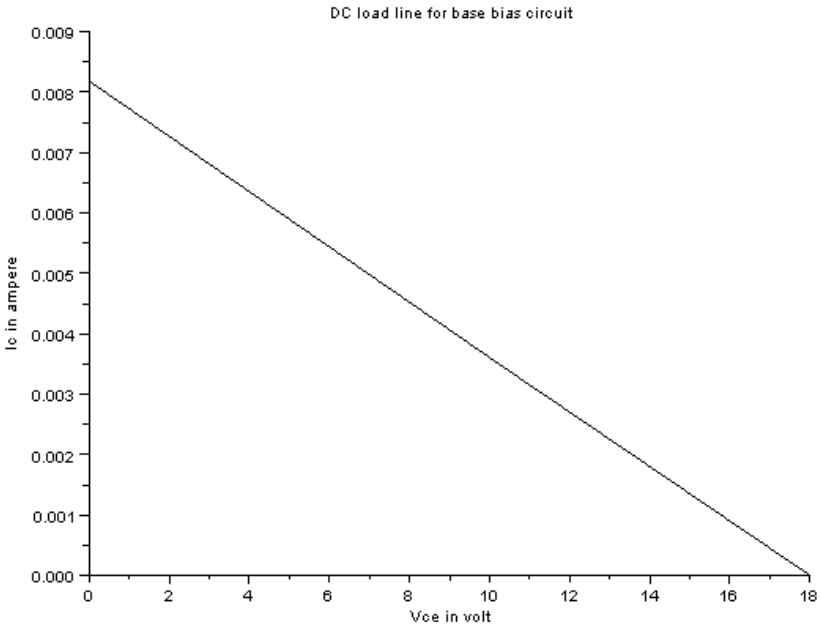

Figure 3.13: Find the Ve Ic Vce and Vc and Draw a DC load line for Voltage divider circuit

```
31 Ic1=Vcc/(Rc+Re)
32 Vce=[Vcc Vceq 0]
33 Ic=[0 Icq Ic1]
34 printf("Q(%f volt,%f ampere)\n",Vceq,Icq)
35 plot2d(Vce, Ic)
36 xlabel("Vce in volt")
37 ylabel("Ic in ampere")
38 xtitle("DC load line for base bias circuit")
```

Scilab code Exa 3.3.74 Find the Ve Ic Vce and Vc and Draw a DC load

line for Voltage divider circuit

```
clc
disp("Example 3.74")
printf("\n")
disp("Find the Ve, Ic,Vce & Vc. Draw a DC load line
   for Voltage divider circuit")
printf("Given\n")
//given
Vcc=15
Vbe=0.7
hFE=50
R1=6.8*10^3
R2=3.3*10^3
Rc=0.9*10^3
Re=0.9*10^3
//thevenin voltage
Vt=(Vcc*R2)/(R1+R2)
//thevenin resistance
Rt=(R1*R2)/(R1+R2)
//base current
Ib=(Vt-Vbe)/(Rt+(1+hFE)*Re)
//collector current
Icq=hFE*Ib
//emitter current
Ie=Ib+Icq
//emitter voltage
Ve=Ie*Re
//collector to emitter voltage
Vceq=Vcc-(Icq*Rc)-(Ie*Re)
//collector voltage
Vc=Vce+Ve
//to draw DC load line
Ic1=Vcc/(Rc+Re)
Vce=[Vcc Vceq 0]
Ic=[0 Icq Ic1]
printf("Q(%f,%f)\n",Vceq,Icq)
plot2d(Vce, Ic)
```

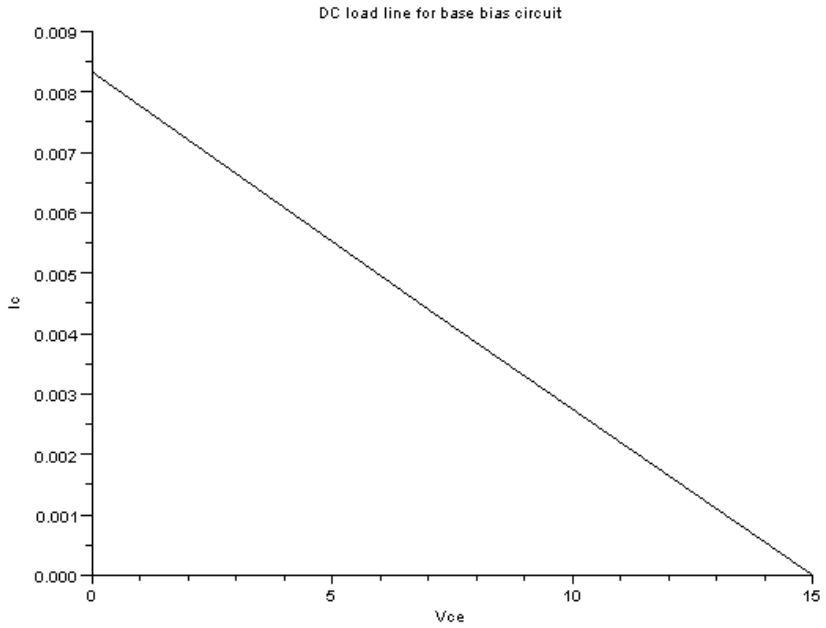

Figure 3.14: Find the Ve Ic Vce and Vc and Draw a DC load line for Voltage divider circuit

```
36 xlabel("Vce")
37 ylabel("Ic")
38 xtitle("DC load line for base bias circuit")
```

Scilab code Exa 3.3.76 Design a Voltage divider bias circuit

```
1 clc
2 disp("Example 3.76")
3 printf("\n")
4 disp("Design a Voltage divider bias circuit")
```

```
5  printf("Given\n")
6  //given
7  Vce=5
8  Ve=Vce
9  Ic=5*10^-3
10 Vcc=15
11 hFE=100
12 Vbe=0.7
13 //emitter resistance
14 Re=Ve/Ic
15 //collector resistance
16 Rc=(Vcc-Vce-Ve)/Ic
17 //current through resistor R2
18 I2=Ic/10
19 //base voltage
20 Vb=Vbe+Ve
21 //resistance 1
22 R1=(Vcc-Vb)/I2
23 //resistance 2
24 R2=Vb/I2
25 printf("Collector resistance %f ohm \n",Rc)
26 printf("emitter resistance %f ohm \n",Re)
27 printf("base voltage %f volt \n",Vb)
28 printf("voltage divider resistance R1 & R2 %f ohm\n
     %f ohm\n",R1,R2)
```

Scilab code Exa 3.3.77 Design a Voltage divider bias circuit

```
1  clc
2  disp("Example 3.77")
3  printf("\n")
4  disp("Design a Voltage divider bias circuit")
5  printf("Given\n")
6  //given
7  Vce=3
```

```
Ve=5
Ic=10^-3
Vcc=12
Vbe=0.7
//emitter resistance
Re=Ve/Ic
//collector resistance
Rc=(Vcc-Vce-Ve)/Ic
//current through resistor R2
I2=Ic/10
//base voltage
Vb=Vbe+Ve
//resistance 1
R1=(Vcc-Vb)/I2
//resistance 2
R2=Vb/I2
printf("Collector resistance %f ohm \n",Rc)
printf("emitter resistance %f ohm \n",Re)
printf("base voltage %f volt \n",Vb)
printf("voltage divider resistance R1 & R2 %f ohm\n
   %f ohm\n",R1,R2)
```

Scilab code Exa 3.3.79 Calculate the suitable resistor values for Voltage divider bias circuit

```
clc
disp("Example 3.79")
printf("\n")
disp("Calculate the suitable resistor values for
   Voltage divider bias circuit")
printf("Given\n")
printf("1 Resistance are in ohms \n2 Current are in
   ampere \n3 voltage sources are in volt")
//given
Vcc=20
```

```
Vce=8
hFE=80
Vbe=0.7
Rc=6*10^3
//select Ve
Ve=5
//find collector resistor
Ic=(Vcc-Vce-Ve)/Rc
//find I2
I2=Ic/10
//emitter resistance
Re=Ve/Ic
//base voltage
Vb=Vbe+Ve
//resistance R1
R1=(Vcc-Vb)/I2
//resistance R2
R2=Vb/I2
printf("Collector resistance %f ohm \n",Rc)
printf("emitter resistance %f ohm \n",Re)
printf("base voltage %f volt \n",Vb)
printf("voltage divider resistance R1 & R2 %f ohm\n
   %f ohm\n",R1,R2)
```

Scilab code Exa 3.3.85 Find the stability factor and change in Ic for increase in temperature of base bias circuit

```
clc
disp("Example 3.85")
printf("\n")
disp("Find the stability factor & change in Ic for
   increase in temperature of base bias circuit")
printf("Given\n")
//given
hFE=100
```

```
Rc=2.2*10^3
Rb=470*10^3
Icbo1=15*10^-9
T1=25
T2=105
//stability factor
S=1+hFE
//Change in collector to base reverse saturation
   current(delIcbo)
n=(T2-T1)/10
Icbo2=Icbo1*2^8
delIcbo=Icbo2-Icbo1
//Change in Ic for increase in temperature
delIc=S*delIcbo
printf("Stability factor is \n%f\n",S)
printf("the change in collector current is \n%f
   ampere\n",delIc)
```

Scilab code Exa 3.3.86 Find the stability factor and change in Ic for increase in temperature of collector to base bias circuit

```
clc
disp("Example 3.86")
printf("\n")
disp("Find the stability factor & change in Ic for
   increase in temperature of collector to base bias
    circuit")
printf("Given\n")
//given
hFE=100
Rc=2.2*10^3
Rb=270*10^3
Icbo1=15*10^-9
T1=25
T2=105
```

```
13 //stability factor
14 S=(1+hFE)/(1+((hFE*Rc)/(Rc+Rb)))
15 //Change in collector to base reverse saturation
      current(delIcbo)
16 n=(T2-T1)/10
17 Icbo2=Icbo1*2^8
18 delIcbo=Icbo2-Icbo1
19 //Change in Ic for increase in temperature
20 delIc=S*delIcbo
21 printf("stability factor %f \n",S)
22 printf("change in Ic %f ampere\n",delIc)
```

Scilab code Exa 3.3.87 Find the stability factor and change in Ic for increase in temperature of Voltage divider bias circuit

```
1 clc
2 disp("Example 3.87")
3 printf("\n")
4 disp("Find the stability factor & change in Ic for
      increase in temperature of Voltage divider bias
      circuit")
5 printf("Given\n")
6 //given
7 hFE=100
8 Rc=1.2*10^3
9 R1=33*10^3
10 R2=12*10^3
11 Re=10^3
12 Icbo1=15*10^-9
13 T1=25
14 T2=105
15 //thevenin resistance
16 Rt=(R1*R2)/(R1+R2)
17 //stability factor
18 S=(1+hFE)/(1+((hFE*Re)/(Re+Rt)))
```

```
19 //Change in collector to base reverse saturation
      current(delIcbo)
20 n=(T2-T1)/10
21 Icbo2=Icbo1*2^8
22 delIcbo=Icbo2-Icbo1
23 //Change in Ic for increase in temperature
24 delIc=S*delIcbo
25 printf("stability factor %f \n",S)
26 printf("change in Ic %f ampere\n",delIc)
```

Scilab code Exa 3.3.89 Calculate the change in Ic produced by effect of Vbe changes over temperature of Voltage divider bias circuit

```
1 clc
2 disp("Example 3.89")
3 printf("\n")
4 disp("Calculate the change in Ic produced by effect
      of Vbe changes over temperature of Voltage
      divider bias circuit")
5 printf("Given\n")
6 //given
7 Re=4.7*10^3
8 T1=25
9 T2=125
10 //change in temperature
11 delT=T2-T1
12 //change in Vbe
13 delVbe=delT*(-1.8*10^-3)  //change in Vbe for 1C
      raise in temperature=-1.8mV/C
14 //change in Ic
15 delIc=-delVbe/Re
16 printf("change in Ic %f ampere\n",delIc)
```

Scilab code Exa 3.3.90 Calculate the change in Ic produced by effect of Vbe changes over temperature of Voltage divider bias circuit

```
1 clc
2 disp("Example 3.90")
3 printf("\n")
4 disp("Calculate the change in Ic produced by effect
    of Vbe changes over temperature of Voltage
    divider bias circuit")
5 printf("Given\n")
6 //given
7 Re=4.7*10^3
8 T1=-35
9 T2=100
10 //change in temperature
11 delT=T2-T1
12 //change in Vbe
13 delVbe=delT*(-1.8*10^-3)  //change in Vbe for 1C
    raise in temperature=-1.8mV/C
14 //change in Ic
15 delIc=-delVbe/Re
16 printf("The change in IC is \n%f ampere\n",delIc)
```

Chapter 4

Other Devices

Scilab code Exa 4.4.18 Calculate input votage that turns SCR ON and supply voltage that turns OFF

```
1 clc
2 disp("Example 4.18")
3 printf("\n")
4 disp("Calculate input voltage that turns SCR ON, &
    find supply voltage that turns SCR OFF if holding
     current is 10mA")
5 printf("Given\n")
6 printf("Resistance are in ohms \nCurrent are in
    Ampere \n Voltage sources are in volt\n")
7 //gate trigger voltage
8 Vgt=0.75
9 //trigger current
10 Igt=5*10^-3
11 //gate resistance
12 Rg=1000
13 //load resistance
14 RL=100
15 //diode forward voltage
16 Vf=0.7
17 //holding current
```

```
18 Ih=10*10^-3
19 //minimum input voltage to trigger the SCR is
20 Vin=Vgt+(Igt*Rg)
21 //The supply voltage that turns OFF the SCR is
22 VCC=Vf+(Ih*RL)
23 printf("minimum input voltage to trigger the SCR is
     %f volt \n",Vin)
24 printf("The supply voltage that turns OFF the SCR is
     %f volt \n",VCC)
```

Scilab code Exa 4.4.28 Calculate the values of R1 R2 and Rp of SCR circuit

```
1  clc
2  disp("Example 4.28")
3  printf("\n")
4  disp("Calculate suitable values of R1,Rp,R2 for SCR
     in circuit Fig 4.12")
5  printf("Given\n")
6  printf("Resistance are in ohms \nCurrent are in
     Ampere \n Voltage sources are in volt\n")
7  //gate current
8  Ig=250*10^-6
9  //gate trigger voltage
10 Vgt=0.75
11 Vd=0.7
12 //supply voltage
13 Vs=40
14 //peak value of supply voltage
15 Vm=sqrt(2)*Vs
16 //supply voltage at angle 10deg
17 Vs1=Vm*sin(10*%pi/180)
18 //supply voltage at angle 90deg
19 Vs2=Vm*sin(90*%pi/180)
20 Vt=Vd+Vgt
```

```
21 //to trigger SCR at 10deg moving contact of Rp is at
       top
22 //from circuit
23 VR1=Vs1-Vt
24 //choose I1min>>Ig
25 I1min=1.5*10^-3
26 R1=VR1/I1min
27 //since Ig<<I1min, current through Rp & R2 is I1min
28 RpPLUSR2=Vt/I1min
29 //to trigger SCR at 90deg moving contact of Rp is at
       bottom
30 VR2=Vt
31 I1=Vs2/(R1+RpPLUSR2)
32 R2=Vt/I1
33 Rp=RpPLUSR2-R2
34 printf("Resistance R1 is %f ohm \n",R1)
35 printf("Resistance R2 is %f ohm \n",R2)
36 printf("Resistance Rp is %f ohm \n",Rp)
```

Scilab code Exa 4.4.29 Calculate the values of R1 R2 and Rp of SCR circuit

```
1 clc
2 disp("Example 4.29")
3 printf("\n")
4 disp("Calculate suitable values of R1,Rp,R2 for SCR
      in circuit Fig 4.12")
5 printf("Given\n")
6 printf("Resistance are in ohms \nCurrent are in
      Ampere \n Voltage sources are in volt\n")
7 //gate current
8 Ig=600*10^-6
9 //gate trigger voltage
10 Vg=0.7
11 Vd=0.7
```

```
12 //supply voltage
13 Vs=230
14 //peak value of supply voltage
15 Vm=sqrt(2)*Vs
16 //supply voltage at angle 8deg
17 Vs1=Vm*sin(8*%pi/180)
18 //supply voltage at angle 90deg
19 Vs2=Vm*sin(90*%pi/180)
20 //to trigger SCR at 10deg moving contact of Rp is at
       top
21 //from circuit
22 VR1=Vs1-Vg
23 //choose I1min>>Ig
24 I1min=6*10^-3
25 R1=VR1/I1min
26 //since Ig<<I1min, current through Rp & R2 is I1min
27 RpPLUSR2=Vg/I1min
28 //to trigger SCR at 90deg moving contact of Rp is at
       bottom
29 VR2=Vt
30 I1=Vs2/(R1+RpPLUSR2)
31 R2=Vg/I1
32 Rp=RpPLUSR2-R2
33 printf("Resistance R1 is %f ohm \n",R1)
34 printf("Resistance R2 is %f ohm \n",R2)
35 printf("Resistance Rp is %f ohm \n",Rp)
```

Scilab code Exa 4.4.40 Design the SCR crowbar circuit to protect the load from voltage levels greater than 12V

```
1 clc
2 disp("Example 4.40")
3 printf("\n")
4 disp("Design the SCR crowbar circuit to protect the
     load from voltage levels greater than 12V")
```

```
printf("Given\n")
//gate trigger voltage
Vgt=0.75
//load voltage maximum
VLmax=12
//Zener voltage is
Vz=VLmax-Vgt
//assume zener current(mini) as
Izmin=10^-3
R=Vgt/Izmin
printf("zener voltage \n%f volt\n",Vz)
printf("Resistance \n%f ohm\n",R)
```

Scilab code Exa 4.4.41 Design the SCR crowbar circuit to protect the load from voltage levels greater than specified voltage

```
clc
disp("Example 4.41")
printf("\n")
disp("Design the SCR crowbar circuit to protect the
   load from voltage levels greater than 7.5V")
printf("Given\n")
//gate trigger voltage
Vgt=0.7
//load voltage maximum
VLmax=7.5
//Zener voltage is
Vz=VLmax-Vgt
//assume zener current(mini) as
Izmin=10^-3
R=Vgt/Izmin
printf("zener voltage \n%f volt\n",Vz)
printf("Resistance \n%f ohm\n",R)
```

Scilab code Exa 4.4.49 Determine the minimum and maximum triggering voltage for a UJT

```
clc
disp("Example 4.49")
printf("\n")
disp("Determine the minimum & maximum triggering
    voltage for a UJT")
printf("Given\n")
Vbb=20
//intrinsic ratios
nmin=0.6
nmax=0.8
V=0.7
//minimum triggering voltage is
Vpmini=nmin*Vbb+Vd
//maximum triggering voltage is
Vpmax=nmax*Vbb+Vd
printf("Minimum triggering Voltage \n%f volt\n",
    Vpmini)
printf("Maximum triggering Voltage \n%f volt\n",
    Vpmax)
```

Scilab code Exa 4.4.51 find maximum oscillating frequency of UJT

```
clc
disp("Example 4.51")
printf("\n")
disp("Calculate minimum & maximum values of Re for
    the relaxation oscillator & also find maximum
    oscillating frequency")
printf("Given\n")
```

```
Vbb=15
//the parameters of UJT
Ip=10^-6
Iv=2.5*10^-3
Vv=2.5
n=0.7
PRe=20*10^3
C=10^-6
Vp=12
Vd=0.7
Vp1=(n*Vbb)+Vd
//minimum Re
Remin=(Vbb-Vv)/Iv
//maximum Re
Remax=(Vbb-Vp1)/Ip
//to find maximum oscillating frequency
T=PRe*C*log((Vbb-Vv)/(Vbb-Vp))
f=1/T
printf("maximum Re \n%f ohm\n",Remax)
printf("minimum Re \n%f ohm\n",Remin)
printf("maximum oscillating frequency \n%f hz \n",f)
```

Scilab code Exa 4.4.52 Determine the minimum and maximum values of VEB1 for a UJT

```
clc
disp("Example 4.52")
printf("\n")
disp("Determine the minimum & maximum values of VEB1
    for a UJT")
printf("Given\n")
Vbb=15
//intrinsic ratios
nmin=0.68
nmax=0.82
```

```
10 V=0.7
11 //mini triggering voltage is
12 Vpmini=nmin*Vbb+Vd
13 //max triggering voltage is
14 Vpmax=nmax*Vbb+Vd
15 printf("minimum triggering voltage \n%f volt\n",
      Vpmini)
16 printf("maximum triggering voltage \n%f volt\n",
      Vpmax)
```

Scilab code Exa 4.4.53 find maximum oscillating frequency of UJT

```
1  clc
2  disp("Example 4.53")
3  printf("\n")
4  disp("find maximum oscillating frequency")
5  Vbb=20
6  //the parameters of UJT
7  Ip=10^-6
8  Iv=10*10^-3
9  Vv=3.5
10 n=0.75
11 PRe=4.7*10^3
12 C=0.5*10^-6
13 Vd=0.7
14 Vp1=(n*Vbb)+Vd
15 //to find maximum oscillating frequency
16 T=PRe*C*log((Vbb-Vv)/(Vbb-Vp1))
17 f=1/T
18 printf("Oscillator frequency \n%f hz\n",f)
```

Scilab code Exa 4.4.74 plot the drain characteristics of JFET

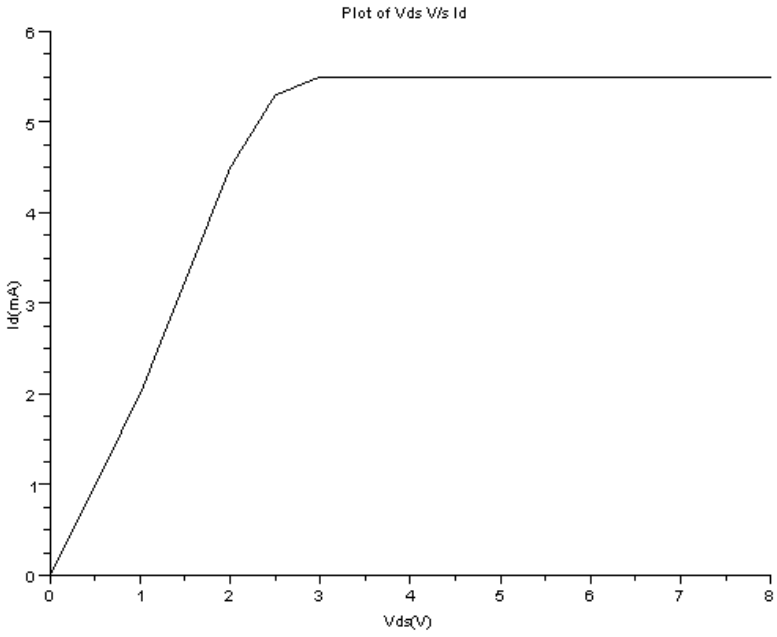

Figure 4.1: plot the drain characteristics of JFET

```
clc
disp("Example 4.74")
printf("\n")
disp("plot the drain characteristics of JFET")
//given
Vds=[0 1 2 2.5 3 4 6 8]
Id=[0 2 4.5 5.3 5.5 5.5 5.5 5.5]
plot2d(Vds,Id)
xlabel("Vds(V)")
ylabel("Id(mA)")
xtitle("Plot of Vds V/s Id")
```

Scilab code Exa 4.4.77 calculate Vds at these gate source voltages and circuit voltage gain of JFET

```
clc
disp("Example 4.77")
printf("\n")
disp("calculate Vds at these gate_source voltages &
   circuit voltage gain of JFET")
printf("Given\n")
//drain current
Id=9*10^-3
//gate to source voltage
Vgs=(-2)
//when Vgs is reduced to -1V then Id is 12mA
Vgs1=-1
Id1=12*10^-3
//from circuit (fig 4.49)
Rd=1.5*10^3
Vdd=20
//to find Vds
//when Vgs=-2
Vds=Vdd-(Id*Rd)
//when Vgs=-1
Vds1=Vdd-(Id1*Rd)
//change in input voltage Vgs is
delVi=Vgs1-Vgs
//change in output voltage is
delVo=Vds-Vds1
//Voltage gain
Av=delVo/delVi
printf("The value of Vds at gate-source voltages is
   \n%f volt\n",Vds)
printf("The circuit voltage gain \n%f\n",Av)
```

Scilab code Exa 4.4.78 calculate the minimum and maximum variation in Vds and circuit voltage gain of JFET

```
clc
disp("Example 4.78")
printf("\n")
disp("calculate the minimum & maximum variation in
    the drain source voltage Vds produced by a change
     of 0.1V & circuit voltage gain of JFET")
printf("Given\n")
//transconductance
gmmax=5000*10^-6
gmmin=1500*10^-6
//change in gate to source voltage
delVgs=0.1
Rd=1.5*10^3
//the maximum change in drain current
delIdmax=gmmax*delVgs
delVdsmax=delIdmax*Rd
//voltage gain
Av1=delVdsmax/delVgs
//the minimum change in drain current
delIdmin=gmmin*delVgs
delVdsmin=delIdmin*Rd
//voltage gain
Av2=delVdsmin/delVgs
printf("maximum change in drain voltage is %f volt\n
    ",delVdsmax)
printf("maximum voltage gain %f \n",Av1)
printf("minimum change in drain voltage is %f volt\n
    ",delVdsmin)
printf("minimum voltage gain %f \n",Av2)
```

Scilab code Exa 4.4.79 calculate transconductance of JFET

```
clc
disp("Example 4.79")
printf("\n")
disp("calculate transconductance of JFET")
printf("Given\n")
//voltage gain
Av=20
//drain resistance
Rd=3.3*10^3
//transconductance
gm=Av/Rd
printf("Transconductance of JFET \n%f (1/ohm)\n",gm)
```

Scilab code Exa 4.4.80 determine the suitable value of load resistor Rd of JFET

```
clc
disp("Example 4.80")
printf("\n")
disp("determine the suitable value of load resistor
   Rd of JFET")
printf("Given\n")
//voltage gain
Av=10
//transconductance
gm=4500*10^-6
//load resistance
Rd=Av/gm
printf("load resistance \n%f ohm \n",Rd)
```

Chapter 5

Amplifiers and Oscillators

Scilab code Exa 5.5.3 Calculate output power change in decibel of amplifier

```
clc
disp("Example 5.3")
printf("\n")
disp("Calculate output power change in decibel of
    amplifier")
printf("Given\n")
//output power when frequency is 5khz
P1=50*10^-3
//output power when frequency is 20khz
P2=25*10^-3
//output power change in decibel
delPo=10*log10(P2/P1)
printf("output power change \n%f dB\n",delPo)
```

Scilab code Exa 5.5.4 Calculate output power change in decibel of amplifier

```
clc
disp("Example 5.4")
printf("\n")
disp("Calculate output power change in decibel of
   amplifier")
printf("Given\n")
//output voltage of amplifier when frequency 3khz
V1=2
//output voltage of amplifier when frequency 50khz
V2=0.5
//output power change in decibel
delPo=20*log10(V2/V1)
printf("output power change \n%f dB\n",delPo)
```

Scilab code Exa 5.5.5 Calculate power gain of amplifier

```
clc
disp("Example 5.5")
printf("\n")
disp("Calculate power gain of amplifier")
printf("Given\n")
//have equal input & load resistance
//input voltage
Vi=100*10^-3
//output voltage
Vo=3
//power gain of amplifier
Apdb=20*log10(Vo/Vi)
printf("power gain of amplifier \n%f\n",Apdb)
```

Scilab code Exa 5.5.6 Calculate new level of output voltage when it has fallen by 4db

```
clc
disp("Example 5.6")
printf("\n")
disp("Calculate new level of output voltage when it
    has fallen by 4db")
printf("Given\n")
//output voltage of an amplifier is 2V when
    frequency 1khz
V1=2
//power in db
Po=-4
//new level of output voltage
V2=10^(Po/20)*V1
printf("new output voltage \n%f volt\n",V2)
```

Scilab code Exa 5.5.10 Calculate overall voltage gain and output voltage when input voltage is 1uV for cascaded amplifier

```
clc
disp("Example 5.10")
printf("\n")
disp("Calculate overall voltage gain in db & output
    voltage when input voltage is 1uV for cascaded
    amplifier")
printf("Given\n")
//Voltage gain of amplifier
Av1=10
Av2=100
Av3=1000
//input voltage
Vi=10^-6
//overall voltage gain
Av=Av1*Av2*Av3
//in db
Avdb=20*log10(Av)
```

```
16 //output voltage when input voltage is 10^-6V
17 Vo=Av*Vi
18 printf("overall voltage gain in dB \n%f dB\n",Avdb)
19 printf("output voltage \n%f volt\n",Vo)
```

Scilab code Exa 5.5.11 Calculate overall voltage gain in db of cascaded 2 stage amplifier

```
1 clc
2 disp("Example 5.11")
3 printf("\n")
4 disp("Calculate overall voltage gain in db of
     cascaded 2 stage amplifier")
5 printf("Given\n")
6 //Voltage gain
7 Av1=10
8 Av2=20
9 //overall voltage gain
10 Av=Av1*Av2
11 //in db
12 Avdb=20*log10(Av)
13 printf("Overall gain is \n%f dB\n",Avdb)
```

Scilab code Exa 5.5.12 Calculate overall voltage gain and gain of 2nd and 3rd stage and input voltage of 2nd stage

```
1 clc
2 disp("Example 5.12")
3 printf("\n")
4 disp("Calculate overall voltage gain ,gain of 2nd &
     3rd stage,input voltage of 2nd stage & all in db
     of three stage amplifier")
5 printf("Given\n")
```

```
6 //input voltage
7 Vi=0.05
8 //output voltage
9 Vo=150
10 //voltage gain of 1st stage
11 Av1=20
12 //input to 3rd stage
13 V2=15
14 //overall voltage gain
15 Av=Vo/Vi
16 //input to 2nd stage
17 V1=Av1*Vi
18 //voltage gain of 2nd stage
19 Av2=V2/V1
20 //voltage gain of 3rd stage
21 Av3=Vo/V2
22 //all stages gain in db
23 Av1db=20*log10(Av1)
24 Av2db=20*log10(Av2)
25 Av3db=20*log10(Av3)
26 //overall gain in db
27 Av=Av1db+Av2db+Av3db
28 printf("overall voltage gain \n%f\n",Av)
29 printf("voltage gain of 2nd & 3rd stages \n%f\n%f\n"
   ,Av2,Av3)
30 printf("input voltage of 2nd stage \n%f volt\n",V1)
31 printf("Decibal voltage gain of 1st, 2nd, 3rd stage
   \n%fdB\n%fdB\n%fdB\n",Av1db,Av2db,Av3db)
32 printf("Overall gain in db \n%f dB\n",Av)
```

Scilab code Exa 5.5.15 For CE amplifier find R1 R2 Re and Rc

```
1 clc
2 disp("Example 5.15")
3 printf("\n")
```

```
4 disp("For CE amplifier shown in fig 5.5 find R1,R2,
    Re & Rc")
5 printf("Given\n")
6 Vcc=24
7 //load resistance
8 RL=120*10^3
9 //since Rc<<RL
10 Rc=RL/10
11 //select Ve & Vce
12 Ve=5
13 Vce=3
14 Vrc=Vcc-Vce-Ve  //from circuit
15 Ic=Vrc/Rc
16 //find Re
17 Re=Ve/Ic
18 R2=10*Re
19 //Vbe for si transistor
20 Vbe=0.7
21 Vb=Vbe+Ve
22 I2=Vb/R2
23 R1=(Vcc-Vb)/I2
24 printf("The resistance values are\nR1=%f ohm\nR2=%f
    ohm\nRe=%f ohm\nRc=%f ohm\n",R1,R2,Re,Rc)
```

Scilab code Exa 5.5.16 For CE amplifier find R1 R2 Re and Rc

```
1 clc
2 disp("Example 5.16")
3 printf("\n")
4 disp("For CE amplifier shown in fig 5.5 find R1,R2,
    Re & Rc")
5 printf("Given\n")
6 Vcc=18
7 //load resistance
8 RL=56*10^3
```

```
9 //since Rc<<RL
10 Rc=RL/10
11 //select Ve & Vce
12 Ve=5
13 Vce=3
14 Vrc=Vcc-Vce-Ve  //from circuit
15 Ic=Vrc/Rc
16 //find Re
17 Re=Ve/Ic
18 R2=10*Re
19 //Vbe for si transistor
20 Vbe=0.7
21 Vb=Vbe+Ve
22 I2=Vb/R2
23 R1=(Vcc-Vb)/I2
24 printf("The resistance values are\nR1=%f ohm\nR2=%f
   ohm\nRe=%f ohm\nRc=%f ohm\n",R1,R2,Re,Rc)
```

Scilab code Exa 5.5.19 calculate upper cutoff frequency and voltage gain at lower cutoff frequency

```
1 clc
2 disp("Example 5.19")
3 printf("\n")
4 disp("calculate upper cut-off frequency & voltage
   gain at lower cut-off frequency")
5 printf("Given\n")
6 //bandwidth of amplifier
7 BW=500*10^3
8 //lower cut-off frequency
9 f1=25
10 //midband gain
11 Ao=120
12 //upper cut-off frequency
13 f2=BW+f1
```

```
14 //voltage gain at lower cut-off frequency
15 A1=Ao/sqrt(2)
16 printf("upper cut-off frequency \n %f hz\n",f2)
17 printf("Voltage gain at lower cut-off frequency \n
   %f \n",A1)
```

Scilab code Exa 5.5.23 calculate closed loop gain for the negative feedback amplifier

```
1 clc
2 disp("Example 5.23")
3 printf("\n")
4 disp("calculate closed-loop gain for the negative
   feedback amplifier")
5 printf("Given\n")
6 //voltage gain without feedback
7 Av=100000
8 //feedback factor
9 B=1/100
10 //voltage gain with feedback
11 Acl=Av/(1+(B*Av))
12 //when Av is changed by 50%
13 Av1=50*100000/100
14 Av2=Av+Av1
15 //voltage gain with feedback when Av changed by +50%
16 Acl1=Av2/(1+(B*Av2))
17 //voltage gain with feedback when Av changed by -50%
18 Av3=Av-Av1
19 Acl2=Av3/(1+(B*Av3))
20 printf("closed loop gain of negative feedback
   amplifier is \n %f \n",Acl2)
```

Scilab code Exa 5.5.24 calculate closed loop gain for the negative feedback amplifier

```
clc
disp("Example 5.24")
printf("\n")
disp("calculate closed-loop gain for the negative
   feedback amplifier")
printf("Given\n")
//voltage gain without feedback
Av=1000
//feedback factor
B=0.1
//voltage gain with feedback
Acl=Av/(1+(B*Av))
printf("closed loop gain of negative feedback
   amplifier is \n %f \n",Acl)
```

Scilab code Exa 5.5.27 calculate input impedance of amplifier with negative feedback

```
clc
disp("Example 5.27")
printf("\n")
disp("calculate input impedance of amplifier with
   negative feedback")
printf("Given\n")
//input impedance without feedback
Zb=10^3
//open loop voltage gain
Av=100000
//feedback network resistance
RF1=56*10^3
RF2=560
//input side resistance
```

```
14 R1=68*10^3
15 R2=33*10^3
16 //feedback factor
17 B=RF2/(RF1+RF2)
18 //input impedance with feedback
19 Zi=Zb*(1+(B*Av))
20 //input impedance with feedback by considering R1 &
     R2
21 Rp=(R1*R2)/(R1+R2)
22 Zin=(Zi*Rp)/(Zi+Rp)
23 printf("input impedance with negative feedback \n%f
     ohm\n",Zin)
```

Scilab code Exa 5.5.29 calculate input and output impedance of amplifier with negative feedback

```
1 clc
2 disp("Example 5.29")
3 printf("\n")
4 disp("calculate input & output impedance of
     amplifier with negative feedback")
5 printf("Given\n")
6 //input impedance without feedback
7 Zb=10^3
8 //open loop voltage gain
9 Av=7533
10 //input side resistance
11 R1=68*10^3
12 R2=47*10^3
13 //feedback factor
14 B=1/101
15 //input impedance with feedback
16 Zi=Zb*(1+(B*Av))
17 //input impedance with feedback by considering R1 &
     R2
```

```
Rp=(R1*R2)/(R1+R2)
Zin=(Zi*Rp)/(Zi+Rp)
//output impedance without feedback
Zc=50*10^3
Rc=3.9*10^3
//output impedance with feedback
Zo=Zc/(1+(B*Av))
//output impedance with feedback by considering Rc
Zout=(Rc*Zo)/(Rc+Zo)
printf("input impedance with negative feedback \n%f ohm\n",Zin)
printf("output impedance with negative feedback \n%f ohm\n",Zout)
```

Scilab code Exa 5.5.35 Estimate the closed loop upper cut off frequency and total harmonic distortion

```
clc
disp("Example 5.35")
printf("\n")
disp("Estimate the closed loop upper cut-off frequency & total harmonic distortion")
printf("Given\n")
//open loop gain
Av=60000
//closed loop gain
Acl=300
//open loop upper cut-off frequency
F2OL=15*10^3
//closed loop upper cut-off frequency & Av/Acl=(1+BAv)
F2CL=F2OL*Av/Acl
//total harmonic distortion with feedback if there is 10% distortion without feedback
HD=10/(Av/Acl)
```

```
16 printf("closed loop upper cut-off frequency \n%f hz\
   n",F2CL)
17 printf("total harmonic distortion with feedback if
   there is 10per distortion without feedback \n%f\n
   ",HD)
```

Scilab code Exa 5.5.36 calculate open loop cut off frequency if the open loop gain is 200000

```
1 clc
2 disp("Example 5.36")
3 printf("\n")
4 disp("calculate open loop cut-off frequency if the
   open loop gain is 200000")
5 printf("Given\n")
6 //open loop gain
7 Av=200000
8 //closed loop gain
9 Acl=250
10 //upper cut-off frequency with feedback
11 F2CL=4*10^6
12 //upper cut-off frequency without feedback
13 F2OL=F2CL/(Av/Acl)
14 printf("upper cut-off frequency without feedback \
   n%f hz\n",F2OL)
```

Scilab code Exa 5.5.37 calculate the phase shift with negative feedback

```
1 clc
2 disp("Example 5.37")
3 printf("\n")
4 disp("calculate the phase shift with negative
   feedback")
```

```
5 printf("Given\n")
6 //open loop phase shift
7 Po=15
8 //open loop gain
9 Av=60000
10 //closed loop gain
11 Acl=300
12 //to calculate phase shift with feedback
13 AvB=(Av/Acl)-1
14 k=((AvB*sin(Po*%pi/180))/(1+(AvB*cos(Po*%pi/180))))
15 Pcl=Po-(atan(k)*180/%pi)
16 printf("The phase shift with negative feedback=\t%f
   degree\n",Pcl)
```

Scilab code Exa 5.5.38 calculate bandwidth and gain and harmonic distortion with feedback

```
1 clc
2 disp("Example 5.38")
3 printf("\n")
4 disp("calculate bandwidth,gain & harmonic distortion
    with feedback")
5 printf("Given\n")
6 //open loop gain
7 Av=1000
8 //bandwidth without feedback
9 BWol=500*10^3
10 //feedback factor
11 B=0.1
12 //bandwidth with feedback
13 BWcl=BWol*(1+(B*Av))
14 //closed loop gain
15 Acl=Av/(1+(B*Av))
16 //harmonic distortion if 15% negative feedback used
17 HDcl=15/(1+(B*Av))
```

```
18 printf("bandwidth with feedback is \n %f hz \n",BWcl
   )
19 printf("closed loop gain \n %f \n",Acl)
20 printf("Harmonic distortion with feedback \n %f \n",
   HDcl)
```

Scilab code Exa 5.5.40 calculate the frequency of oscillation and feedback factor of Hartley oscillator

```
1  clc
2  disp("Example 5.50")
3  printf("\n")
4  disp("calculate the frequency of oscillation &
      feedback factor of Hartley oscillator")
5  printf("Given\n")
6  //inductance
7  L1=2*10^-3
8  L2=8*10^-3
9  //mutual inductance
10 M=100*10^-6
11 //capacitor
12 C=0.001*10^-6
13 //total inductance
14 L=L1+L2+M
15 //frequency of oscillation
16 f=1/(2*%pi*sqrt(L*C))
17 //feedback factor
18 B=L1/L2
19 printf("frequency of oscillation of hartley
      oscillator \n %f hz \n",f)
20 printf("feedback factor \n %f \n",B)
```

Scilab code Exa 5.5.43 calculate the frequency of oscillation of RC phase shift oscillator

```
clc
disp("Example 5.43")
printf("\n")
disp("calculate the frequency of oscillation of RC
   phase shift oscillator")
printf("Given\n")
R=500
C=0.1*10^-6
//frequency of oscillation
f=1/(2*%pi*R*C*sqrt(6))
printf("frequency of oscillation \n%f hz\n",f)
```

Scilab code Exa 5.5.44 calculate the value of Capacitor for a RC phase shift oscillator

```
clc
disp("Example 5.44")
printf("\n")
disp("calculate the value of Capacitor for a RC
   phase shift oscillator")
printf("Given\n")
R=1000
//frequency of oscillation
f=5000
//capacitor value
C=1/(2*%pi*R*f*sqrt(6))
printf("Capacitor value \n%e farad \n",C)
```

Scilab code Exa 5.5.45 calculate the value of R and C for RC phase shift oscillator

```
clc
disp("Example 5.45")
printf("\n")
disp("calculate the value of R & c for RC phase
    shift oscillator")
printf("Given\n")
//oscillating frequency
f=2000
//select Capacitor value
C=0.1*10^-6
//resistance value
R=1/(2*%pi*f*C*sqrt(6))
printf("Resistance value \n%f ohm\n",R)
```

Scilab code Exa 5.5.49 calculate frequency of oscillation and feedback factor and gain of hartley oscillator

```
clc
disp("Example 5.49")
printf("\n")
disp("calculate frequency of oscillation ,feedback
    factor & gain required for sustained oscillation
    of hartley oscillator")
printf("Given\n")
//inductance
L1=5*10^-3
L2=10*10^-3
//capacitor
C=0.01*10^-6
//frequency of oscillation
f=1/(2*%pi*sqrt((L1+L2)*C))
//feedback factor
B=L1/L2
//gain required for sustained oscillation
Av=L2/L1
```

```
17 printf("gain required for sustained oscillation=\t>
     %f\n",Av)
```

Scilab code Exa 5.5.51 calculate the value of L1 and L2 of Hartley oscillator

```
1  clc
2  disp("Example 5.51")
3  printf("\n")
4  disp("calculate the value of L1 & L2 of Hartley
     oscillator")
5  printf("Given\n")
6  //frequency of oscillation
7  f=25*10^3
8  C=0.02*10^-6
9  //feedback factor
10 B=0.2
11 //Total inductance
12 L=1/(4*(%pi)^2*f^2*C)
13 L1byL2=B
14 L1plusL2=L
15 //therefore
16 L2=L/1.2
17 L1=L-L2
18 printf("The values of L1=\t%f henry\nL2=\t%f henry\n
     ",L1,L2)
```

Scilab code Exa 5.5.53 Design the value of L1 L2 and C for a hartley oscillator

```
1  clc
2  disp("Example 5.53")
3  printf("\n")
```

```
4 disp("Design the value of L1,L2 & C for a hartley
    oscillator")
5 printf("Given\n")
6 //frequency of oscillation
7 f=30*10^3
8 //then value of LC
9 LC=1/(4*(%pi)^2*f^2)
10 //select c as
11 C=0.1*10^-6
12 //Total inductance
13 L=LC/C
14 //let L1=L2
15 L1=L/2
16 L2=L1
17 printf("The values of L1=\t%f henry\nL2=\t%f henry\
    nC=\t%e farad\n",L1,L2,C)
```

Scilab code Exa 5.5.55 calculate the frequency of oscillation of Colpitts oscillator

```
1 clc
2 disp("Example 5.55")
3 printf("\n")
4 disp("calculate the frequency of oscillation of
    Colpitts oscillator")
5 printf("Given\n")
6 //capacitor
7 C1=400*10^-12
8 C2=C1
9 //inductance
10 L=2*10^-3
11 //Total capacitance
12 C=C1*C2/(C1+C2)
13 //frequency of oscillation
14 f=1/(2*%pi*sqrt(L*C))
```

```
15 printf("frequency of oscillations \n%f hz\n",f)
```

Scilab code Exa 5.5.56 calculate the frequency of oscillation feedback factor and gain required for sustained oscillation

```
1  clc
2  disp("Example 5.56")
3  printf("\n")
4  disp("calculate the frequency of oscillation,
      feedback factor & gain required for sustained
      oscillation")
5  printf("Given\n")
6  //Capacitance
7  C1=40*10^-12
8  C2=10*10^-12
9  //inductance
10 L=3*10^-3
11 //total effective capacitance
12 C=C1*C2/(C1+C2)
13 //frequency of oscillation
14 f=1/(2*%pi*sqrt(L*C))
15 //feedback factor
16 B=C2/C1
17 //gain required for sustained oscillation
18 Av=C1/C2
19 printf("gain required for sustained oscillation =\t>
      %f\n",Av)
```

Scilab code Exa 5.5.57 calculate the value of L of Colpitts oscillator

```
1  clc
2  disp("Example 5.57")
3  printf("\n")
```

```
4 disp("calculate the value of L of Colpitts
     oscillator ")
5 printf("Given\n")
6 //capacitor
7 C1=100*10^-12
8 C2=60*10^-12
9 //total effective capacitance
10 C=C1*C2/(C1+C2)
11 //frequency of oscillation
12 f=40*10^3
13 //inductance
14 L=1/(4*(%pi)^2*f^2*C)
15 printf("inductance value is \n%f henry\n",L)
```

Scilab code Exa 5.5.58 calculate the value of C1 and C2 of Colpitts oscillator

```
1 clc
2 disp("Example 5.58")
3 printf("\n")
4 disp("calculate the value of C1 & C2 of Colpitts
     oscillator")
5 printf("Given\n")
6 //inductance
7 L=5*10^-3
8 //frequency of oscillation
9 f=50*10^3
10 //total effective capacitance
11 C=1/(4*(%pi)^2*f^2*L)
12 //feedback factor
13 B=0.1
14 //then C2/C1=0.1, so substituting in C=C1C2/(C1+C2)
     we get
15 C1=1.1*C/0.1
16 C2=0.1*C1
```

```
17 printf("The value of C1=\t%e farad\nC2=\t%e farad\n"
   ,C1,C2)
```

Scilab code Exa 5.5.59 calculate the value of L and C for a colpitts oscillator

```
1  clc
2  disp("Example 5.59")
3  printf("\n")
4  disp("calculate the value of L & C for a colpitts
   oscillator")
5  printf("Given\n")
6  //frequency of oscillation
7  f=40*10^3
8  LC=1/(4*(%pi)^2*f^2)
9  //select L
10 L=10*10^-3
11 //find C
12 C=1/(4*(%pi)^2*f^2*L)
13 //let C1=C2 so we get
14 C1=2*C
15 C2=C1
16 printf("The values of L=\t%f henry\nC1=\t%e farad\
   nC2=\t%e farad\n",L,C1,C2)
```

Scilab code Exa 5.5.61 calculate the frequency of oscillation for Wein Bridge Oscillator

```
1  clc
2  disp("Example 5.61")
3  printf("\n")
4  disp("calculate the frequency of oscillation for
   Wein_Bridge Oscillator")
```

```
5 printf("Given\n")
6 //Resistance
7 R=2*10^3
8 //capacitor
9 C=0.1*10^-6
10 //frequency of oscillation
11 f=1/(2*%pi*R*C)
12 printf("frequecy of oscillation \n%f hz\n",f)
```

Scilab code Exa 5.5.62 calculate the value of R and C for Wein Bridge oscillator

```
1 clc
2 disp("Example 5.62")
3 printf("\n")
4 disp("calculate the value of R & c for Wein-Bridge
    oscillator")
5 printf("Given\n")
6 //frequency of oscillation
7 f=1000
8 //find RC
9 RC=1/(2*%pi*f)
10 //select C<10^-6F
11 C=0.1*10^-6
12 //the value of R
13 R=1/(2*%pi*f*C)
14 printf("the value of c \n%f farad\n",C)
15 printf("the value of R \n%f ohm\n",R)
```

Scilab code Exa 5.5.65 calculate the Series and parallel resonant frequencies of Crystal

```
1 clc
```

```
disp("Example 5.65")
printf("\n")
disp("calculate the Series & parallel resonant
   frequencies of Crystal")
printf("Given\n")
//indutance
L=3
//Capacitor due to mechanical mounting of crystal
Cm=10*10^-12
//electrical equivalent capacitance of crystal
   compliance
Cs=0.05*10^-12
//electrical equivalent resistance of crystal
   structure internal friction
R=2*10^3
//series resonant frequency
fs=1/(2*%pi*sqrt(L*Cs))
Cp=Cm*Cs/(Cm+Cs)
//parallel resonant frequency
fp=1/(2*%pi*sqrt(L*Cp))
printf("series resonant frequency \n%f hz\n",fs)
printf("parallel resonant frequency \n%f hz\n",fp)
```

Chapter 6

Operational Amplifier

Scilab code Exa 6.6.15 Calculate maximum frequency at which output is faithful reproduction of input

```
1 clc
2 disp("Example 6.15")
3 printf("\n")
4 disp("calculate the maximum frequency at which
     output is faithful reproduction of input")
5 printf("given")
6 disp("slew rate=3Mv/s")
7 sr=3*10^6
8 Vm=12
9 //calculate Frequency
10 fmax=(sr/(2*%pi*Vm))
11 printf("maximum frequency=%d hz",fmax)
```

Scilab code Exa 6.6.19 Calculate common mode output voltage

```
1 clc
2 disp("Example 6.19")
```

```
printf("\n")
disp("calculate common mode gain & output voltage")
printf("Given")
disp("differential gain=500")
disp("CMRR=80dB,Input signal is 2*sin100*%pi*t")
Ad=500
CMRR=80
t=1/200
Vc=2*sin(100*%pi*t)
//calculate common mode gain
Ac=Ad/(10^(CMRR/20))
//calculate common mode output voltage
Vcmov=Ac*Vc
printf("Common mode gain =%f\n",Ac)
printf("Common mode output voltage =%f volt\n",Vcmov
   )
```

Scilab code Exa 6.6.20 Express CMRR in dB

```
clc
disp("Example 6.20")
printf("\n")
disp("To express CMRR in dB")
printf("given")
disp("Ad=10^4,Ac=0.1")
Ad=10^4
Ac=0.1
//to find CMMR in dB
CMRR=20*log10(Ad/Ac)
printf("CMRR in dB=%d dB",CMRR)
```

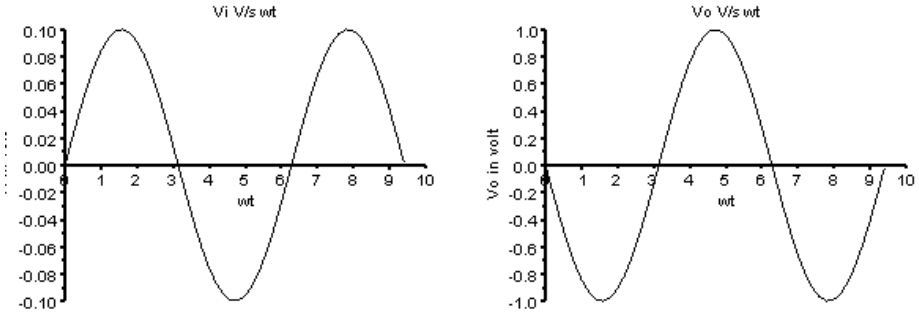

Figure 6.1: Calculate and sketch the output

Scilab code Exa 6.6.24 Calculate and sketch the output

```
clc
disp("Example 6.24")
printf("\n")
disp("calculate output voltage for inverting
   amplifier & sketch the waveform")
printf("given")
disp("Peak to peak input votage=200mV, Rf/R1=10")
Vpp=200*10^(-3)
Vm=Vpp/2
RfdivR1=10
wt=0:0.2:3*%pi
Vi=Vm*sin(wt)
Vo=-(RfdivR1)*Vi
disp(Vo)
a= gca ();
subplot(221)
a= gca();
a. x_location = "origin";
a. y_location = "origin";
plot2d(wt,Vi)
xtitle("Vi V/s wt","wt","Vi in volt")
a.thickness=2
subplot(222)
a= gca();
a. x_location = "origin";
a. y_location = "origin";
plot2d(wt,Vo)
xtitle("Vo V/s wt","wt","Vo in volt")
a.thickness=2
```

Scilab code Exa 6.6.25 Calculate design value of inverting amplifier

```
clc
```

```
2 disp("Example 6.25")
3 printf("\n")
4 disp("Design An Inverting Amplifier for the given
    closed loop gain")
5 printf("given")
6 disp("closed loop gain=-15")
7 Af=(-15)
8 R1=10^3
9 Rf=(-Af)*R1
10 printf("The resistance values are=\n%f ohm,\n%f ohm"
    ,R1,Rf)
```

Scilab code Exa 6.6.26 Calculate output voltage of inverting amplifier

```
1 clc
2 disp("Example 6.26")
3 printf("\n")
4 disp("calculate the output voltage for a given input
    voltages")
5 printf("given")
6 disp("input voltages=0.2,0.5sin314t,-0.4")
7 Rf=200*10^3
8 R1=20*10^3
9 Af=(-Rf)/R1// calculate open loop gain
10 t=%pi/(2*314)//intialise t value
11 Vi=[0.2,0.5*(sin(314*t)),-0.4]
12 Vo=Af*Vi//calculate output voltage
13 printf("Output voltages are=\n%f volt,\n%f volt,\n%f
    volt",Vo)
```

Scilab code Exa 6.6.27 Calculate closed loop gain and input voltage for a specified output voltage

```
clc
disp("Example 6.27")
printf("\n")
disp("Calculate closed loop gain & input voltage to
    get output voltage 2v")
printf("given")
disp("Rf=1M,R1=20K,output voltage=2V")
Rf=10^6
R1=20*10^3
Vo=2
//calculate closed loop gain
Af=(-Rf/R1)
//calculate input voltage
Vi=Vo/Af
printf("closed loop voltage gain=%f\n",Af)
printf("Input voltage=%f volt",Vi)
```

Scilab code Exa 6.6.28 Calculate feedback resistor and closed loop gain

```
clc
disp("Example 6.27")
printf("\n")
disp("Calculate closed loop gain & input voltage to
    get output voltage 2v")
print("given")
disp("Rf=1M,R1=20K,output voltage=2V")
Rf=10^6
R1=20*10^3
Vo=2
//calculate closed loop gain
Af=(-Rf/R1)
//calculate input voltage
Vi=Vo/Af
printf("closed loop voltage gain=%f\n",Af)
printf("Input voltage=%f",Vi)
```

Scilab code Exa 6.6.31 Calculate output voltage for given input voltage of non inverting amplifier

```
clc
disp("Example 6.31")
printf("\n")
disp("calculate output voltage for given
    specification")
printf("given")
disp("Rf=360k,R1=120k,Vi=0.5,0.6sin314t,-0.3")
Rf=360*10^3
R1=120*10^3
Af=1+(Rf/R1)
t=0 //initialise t value
Vi=[0.5, 0.6*cos(314*t),-0.3]
Vo=Af*Vi //calculate output voltage
printf("output voltage =%f volt,\n%f volt,\n%f volt"
    ,Vo)
```

Scilab code Exa 6.6.32 Calculate closed loop gain and input voltage for a specified output voltage of noninverting amplifier

```
clc
disp("Example 6.32")
printf("\n")
disp("Calculate Gain & input voltage")
printf("Given")
disp("Rf=100K,R1=10K")
Rf=100*10^3
R1=10^4
//calculate voltage gain
```

```
10 Af=1+(Rf/R1)
11 Vo=4
12 //calculate input voltage
13 Vi=Vo/Af
14 //display values
15 printf("Closed loop gain =%f\n",Af)
16 printf("Input voltage=%f volt",Vi)
```

Scilab code Exa 6.6.33 Calculate output voltage for inverting amplifier

```
1  clc
2  disp("Example 6.33")
3  printf("\n")
4  disp("Calculate output voltage if input voltage is 1
     V")
5  printf("Given")
6  disp("R1=1K, Rf=100K, V+=15V, V-=-15, Vi=1v")
7  Rf=10^5
8  R1=10^3
9  //supply votage
10 Vplus=15
11 Vminus=(-15)
12 //calculate voltage gain
13 Af=(-Rf)/R1
14 Vi=1
15 // calculate output voltage
16 Vo=Af*Vi
17 //condition to check output votage is greater than
     Vplus
18 if(Vo>Vplus) then
19   printf("The Maximum positive output voltage=%f
       volt",Vplus)
20 //condition to check output voltage is less than
     Vminus
21 elseif (Vo<Vminus) then
```

```
22    printf("The maximum negative output voltage=%f
         volt",Vminus)
23  //else display Vo
24    else
25    printf("The output voltage=%f volt",Vo)
26  end
```

Scilab code Exa 6.6.34 Calculate output voltage for non inverting amplifier

```
1  clc
2  disp("Example 6.34")
3  printf("\n")
4  disp("Calculate output voltage")
5  printf("Given")
6  disp("R1=2K, Rf=200K, V+=12V, V-=-12, Vi=1.5V")
7  Rf=20^4
8  R1=2*10^3
9  Vplus=12
10 Vminus=-12
11 Af=1+(Rf/R1)
12 Vi=1.5
13 Vo=Af*Vi
14 //condition to check output votage is greater than
     Vplus
15 if(Vo>Vplus) then
16   printf("The Maximum positive output voltage=%f
       volt",Vplus)
17 //condition to check output voltage is less than
     Vminus
18 elseif(Vo<Vminus)
19   printf("The maximum negative output voltage=%f
       volt",Vminus)
20  //else display Vo
21 else
```

```
22   printf("The output voltage=%f volt",Vo)
23 end
```

Scilab code Exa 6.6.37 Calculate closed loop gain and current

```
1  clc
2  disp("example 6.37")
3  printf("\n")
4  disp("calculate voltage gain,input resistance,
      current through R1")
5  printf("Given")
6  disp("Rf=100k,R1=10k")
7  disp("input voltage is 0.5v")
8  Rf=10^5
9  R1=10^4
10 Af=-Rf/R1
11 Rif=R1
12 Vi=0.5
13 I1=(Vi/R1)
14 printf("closed loop voltage gain is %3.1f\n",Af)
15 printf("input resistance is\n %3.1f ohm\n",Rif)
16 printf("current flowing through R1 is %f ampere\n",
      I1)
```

Scilab code Exa 6.6.45 Calculate output voltage for summer

```
1  clc
2  disp("Example 6.45")
3  printf("\n")
4  disp("Calculate output votage")
5  printf("Given")
6  disp("input voltage V1=-1v,V2=-2v,V3=3v")
7  disp("Resistance Rf=60k,R1=10k,R2=20k,R3=30k")
```

```
Rf=60*10^3;R1=10^4;R2=20*10^3;R3=30*10^3;
V1=-1;V2=-2;V3=3;
Vo=-[(Rf/R1)*V1+(Rf/R2)*V2+(Rf/R3)*V3]
printf("The output voltage is %f volt",Vo)
```

Scilab code Exa 6.6.55 Calculate bandwidth

```
clc
disp("Example 6.55")
printf("\n")
disp("Calculate Bandwidth with feedback")
printf("Given")
disp("Open loop voltage gain=2*10^5 \n")
disp("Break frequency is 5Hz,10% negative feedback\n
   ")
A=2*10^5
B=0.1
Fi=5
//bandwidth with feedback
Fb=Fi*(1+A*B)
printf("Bandwidth with feedback is %f hz\n",Fb)
```

Scilab code Exa 6.6.56 Calculate the design value of amplifier circuit

```
clc
disp("Example 6.56")
printf("\n")
printf("Given")
disp("open loop gain is 100")
disp("Gain Bandwidth Product is 1MHz")
Af=100
GBW=10^6
ReqBandwidth=GBW/Af
```

```
10 RfbyR1=Af-1
11 printf("the ratio of resistance is=%f",RfbyR1)
```

Scilab code Exa 6.6.57 Calculate design value of circuit

```
1  clc
2  disp("Example 6.57")
3  printf("\n")
4  printf("given")
5  disp("gain is 200 & gain bandwidth product is 1MHz")
6  Af=200
7  GBW=10^6
8  BW=10^4
9  reqBW=GBW/Af
10 if(reqBW>BW) then
11   printf("Required bandwidth is=%f",reqBW)
12   else
13     Af2=10
14     Af1=200/Af2
15     R1fbyR11=Af1-1
16     R2fbyR21=Af2-1
17     printf("The ratio of resistance of both
          amplifier circuit is=\n%d,\n%d",R1fbyR11,
          R2fbyR21)
18 end
```

Chapter 7

Communication System

Scilab code Exa 7.7.25 Determine sideband frequencies and Bandwidth

```
1  clc
2  disp("Example 7.25")
3  printf("\n")
4  disp("calculate side band frequencies & bandwidth \n
   ")
5  printf("Given")
6  disp("Fc=600khz ,Fm=1khz")
7  Fc=6*10^5
8  Fm=10^3
9  Flsb=Fc-Fm
10 Fusb=Fc+Fm
11 BW=2*Fm
12 printf("Side band frequencies are= %d hz,\t%d hz\n",
   Flsb,Fusb)
13 printf("Bandwidth is=%d hz",BW)
```

Scilab code Exa 7.7.27 Calculate total power in modulated wave

```
clc
disp("Example 7.27")
printf("\n")
disp("Calculate the total power in the modulated
    wave")
printf("Given")
disp("carrier power=400W, modulation index=75%")
Pc=400
Ma=0.75
Pt=Pc*(1+(Ma^2/2))
printf("The total power in modulated wave =\n%f watt
    ",Pt)
```

Scilab code Exa 7.7.28 Determine radiated power

```
clc
disp("Example 7.28")
printf("\n")
disp("Determine the radiated power at a modulation
    index of 0.6")
printf("Given")
disp("carrier power=50Khz, modulation index=0.6")
Pc=5*10^4
Ma=0.6
Pt=Pc*(1+(Ma^2/2))
printf("The total power in modulated wave =\n%f watt
    ",Pt)
```

Scilab code Exa 7.7.34 Calculate carrier power

```
clc
disp("Example 7.34")
printf("\n")
```

```
4 disp("calculate carrier power")
5 printf("Given\n")
6 disp("total power=10KW, modulation index=0.6")
7 Pt=10^4
8 Ma=0.6
9 Pc=Pt/(1+(Ma^2/2))
10 printf("The carrier power is=%f watt\n",Pc)
```

Scilab code Exa 7.7.35 Determine power content of carrier and sidebands

```
1 clc
2 disp("Example 7.35")
3 printf("\n")
4 disp("Determine power content of carrier & each
   sideband")
5 printf("Given\n")
6 disp("Total power=2.64KW, modulation index=80%")
7 Pt=2.64*10^3
8 Ma=0.8
9 Pc=Pt/(1+(Ma^2/2))
10 Plsb=Ma^2*Pc/4
11 Pusb=Plsb
12 printf("The total power is=%f watt\n",Pc)
13 printf("The sideband power is=\n%f watt,\t%f watt",
   Plsb,Pusb)
```

Scilab code Exa 7.7.36 Calculate sideband frequencies and bandwidth and total power

```
1 clc
2 disp("Example 7.36")
3 printf("\n")
```

```
4 disp("Calculate sideband frequencies,bandwidth,power
      in sidebands,Total power")
5 printf("Given")
6 disp("carrier power=1KW,carrier frequency=2MHz,
     Modulation frequency=2KHz,Modulation index=0.6")
7 Pc=10^3
8 Fc=2*10^6
9 Fm=2*10^3
10 Ma=0.6
11 Flsb=Fc-Fm
12 Fusb=Fc+Fm
13 BW=2*Fm
14 Plsb=Ma^2*Pc/4
15 Pusb=Plsb
16 Pt=Pc*(1+(Ma^2/2))
17 printf("Sideband frequencies are=\n%d hz,\t%d hz\n",
     Flsb,Fusb)
18 printf("Bandwidth=%d hz\n",BW)
19 printf("Power in sidebands=\n%f watt,\t%f watt\n",
     Plsb,Pusb)
20 printf("Total power=\n%f watt",Pt)
```

Scilab code Exa 7.7.37 Calculate modulation index

```
1 clc
2 disp("Example 7.37")
3 printf("\n")
4 disp("Calculate the modulation index")
5 printf("Given\n")
6 disp("carrier voltage=100V,Total modulated voltage
     in rms=110V")
7 Vt=110
8 Vcar=100
9 //assume R value as 1
10 R=1
```

```
Pt=Vt^2/R
Pc=Vcar^2/R
Ma=sqrt(2*((Pt/Pc)-1))
printf("Modulation index =%f",Ma)
```

Scilab code Exa 7.7.38 Determine antenna current

```
clc
disp("Example 7.38")
printf("\n")
disp("Determine modulation index & Antenna current
   when MOdulation index changes to 0.8")
printf("given\n")
disp("carrier current=8A,Modulated carrier current
   =8.93A")
Icar=8
It=8.93
//assume R=1
R=1
Pc=Icar^2*R
Pt=It^2*R
Ma=sqrt(2*((Pt/Pc)-1))
//Modulated carrier current when Ma changes to 8
Ma1=0.8
It1=Icar*sqrt(1+(Ma1^2/2))
printf("Modulation index =%f\n",Ma)
printf("Modulated carrier current when Ma changes to
    8 is =%f ampere",It1)
```

Scilab code Exa 7.7.39 Calculate tranmission power efficiency and average power in carrier component

```
clc
```

```
2 disp("Example 7.39")
3 printf("\n")
4 disp("Calculate transmission power efficiency and
     average power in carrier component")
5 printf("Given \n")
6 disp("Total power=20KW, Modulation index=0.7")
7 Pt=2*10^4
8 Ma=0.7
9 Pc=Pt/(1+(Ma^2/2))
10 %n=(Ma^2/(2+Ma^2))*100
11 printf("The carrier Power =%f watt\n",Pc)
12 printf("The transmission power efficiency =%f",%n)
```

Scilab code Exa 7.7.40 Calculate modulation index

```
1 clc
2 disp("Example 7.40")
3 printf("\n")
4 disp("Calculate modulation index")
5 printf("Given\n")
6 disp("maximum & minimum amplitudes are 600mv,200mv")
7 Vmax=600*10^-3
8 Vmin=200*10^-3
9 Ma=(Vmax-Vmin)/(Vmax+Vmin)
10 printf("Modulation Index is =\n%f",Ma)
```

Scilab code Exa 7.7.41 Sketch the frequency spectrum

```
1 clc
2 disp("Example 7.41")
3 printf("\n")
```

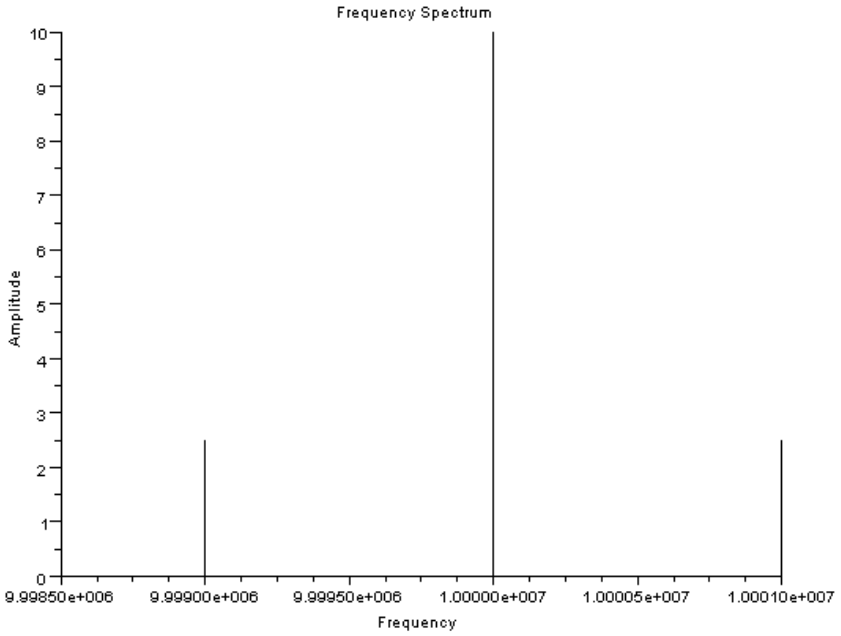

Figure 7.1: Sketch the frequency spectrum

```
4  disp("sketch the frequency spectrum")
5  printf("Given\n")
6  disp("carrier amplitude=10V, carrier frequency=10MHz,
       Modulating frequency=1Khz, MI=0.5")
7  Vc=10
8  fc=10^7
9  fm=10^3
10 ma=0.5
11 wc=2*%pi*fc
12 wm=2*%pi*fm
13 t=10^-7
14 v=Vc*(1+(ma*sin(wm*t)))*cos(wc*t)
15 Vs=(ma*Vc)/2
16 flsb=fc-fm
17 fusb=fc+fm
18 // take below values just for plotting graph with
       intial values
19 f1=9.9989*10^6
20 v1=0
21 f=[f1 flsb fc fusb]
22 a=[v1 Vs Vc Vs]
23 plot2d3(f,a)
24 xtitle("Frequency Spectrum")
25 xlabel("Frequency")
26 ylabel("Amplitude")
```

Scilab code Exa 7.7.42 Find the saving power in LSB alone

```
1  clc
2  disp("Example 7.42")
3  printf("\n")
4  disp("Find the saving power if power contained in
       the LSB alone is used")
5  printf("Given\n")
6  disp("Total power=20KW, Modulation Index=0.8")
```

```
Pt=20*10^3
Ma=0.8
Pc=Pt/(1+(Ma^2/2))
Plsb=(Pt-Pc)/2
%Ps=((Pt-Plsb)/Pt)*100
printf("power in sideband=%f watt\n",Plsb)
printf("Saving in power=\n%f\n",%Ps)
```

Scilab code Exa 7.7.55 Find maximum frequency deviation and modulation index

```
clc
disp("Example 7.55")
printf("\n")
disp("Find the maximum frequency deviation &
   modulation index")
printf("Given\n")
disp("Kf=1KHz/v,Modulating voltage=15v,frequency=3
   KHz")
K=10^3
Vm=15
Fm=3*10^3
del=K*Vm
Mf=del/Fm
printf("Maximum frequency Deviation is =\n%d hz\n",
   del)
printf("Modulation Index=\n%f\n",Mf)
```

Scilab code Exa 7.7.56 Calculate frequency deviation and modulation index

```
clc
disp("Example 7.56")
```

```
3 printf("\n")
4 disp("find the frequency deviation & modulation
    index")
5 printf("Given\n")
6 del=5*10^3
7 Vm=2.5
8 Kf=del/Vm
9 //when Vm=7.5
10 Vm=7.5
11 del1=Kf*Vm
12 //when Vm=10v
13 Vm=10
14 del2=Kf*Vm
15 Fm1=500
16 Mf1=del/Fm1
17 Mf2=del1/Fm1
18 Fm2=250
19 Mf3=del2/Fm2
20 printf("Frequency deviation at different modulating
    Voltage =\n%d hz\n%d hz\n",del1,del2)
21 printf("Modulation index at different frequency
    deviation & modulating frequency =\n%d\n%d\n%d\n"
    ,Mf1,Mf2,Mf3)
```

Scilab code Exa 7.7.92 Find the peak value of unknown voltage

```
1 clc
2 disp("Example 7.92")
3 printf("\n")
4 disp("Find the Peak Value")
5 printf("Given\n")
6 disp("Vpp=100v, deflection=5cm")
7 Vpp=100
8 D=5
9 DS=Vpp/D
```

```
10 //another sinusoidal produces a deflection of 8cm
11 D1=8
12 Vpp1=DS*D1
13 printf("The peak value of unknown voltage=\n%d volt\
   n",Vpp1)
```

Chapter 8

Digital Logic

Scilab code Exa 8.8.7 Convert the binary number to decimal without decimal point

```
1  clc
2  disp("Example 8.7")
3  printf("\n")
4  disp("convert the following binary numbers to
       decimal")
5  disp("a)1011 b)110101 c)10101")
6  //Given binary number
7  bin=1011
8  i=1
9  //storing each integer digit in b(i)
10 while(bin>0)
11     b(i)=modulo(bin,10)
12     bin=floor(bin/10)
13     i=i+1;
14 end
15 //checking whether it is a binary number or not
16 for i=1:length(b)
17     if(b(i)>1) then
18         disp('not a binary number')
19         abort
```

```
20      end
21    end
22  dec=0
23  for i=1:length(b)
24  //multipliying bits of integer part with their
       position values and adding
25      dec=dec+(b(i)*2^(i-1))
26  end
27  //displaying the output
28  printf("decimal format is")
29  disp(dec)
```

Scilab code Exa 8.8.8 Convert the binary number to decimal with decimal point

```
1  clc
2  clear
3  disp("Example 8.8")
4  printf("\n")
5  disp("convert the following binary numbers to
       decimal")
6  disp("a)11.101 b)0.0111 c)110.1101")
7  //Given binary number
8  i=1;w=1
9  bin=11.101
10 //separating integer part
11 IP=floor(bin)
12 IP1=IP
13 //separating decimal part
14 DP=modulo(bin,1)
15 //converting decimal value to interger
16 p=4
17 DP=DP*10^p //should change power of 10 as according
       to number of digits in decimal digit
18 //storing each integer digit in I(i)
```

```
19 while(IP>0)
20     I(i)=modulo(IP,10);
21     IP=floor(IP/10);
22     i=i+1;
23   end
24 //storing each decimal digit in D(w)
25 while(DP>0)
26     D(w)=modulo(DP,2)
27     DP=(DP/10)
28     DP=floor(DP)
29     w=w+1;
30   end
31 //to do zero padding of remaining erm of D(w)
32 if(length(D)<p)
33     q=length(D)
34   for f=q+1 :p
35     D(f)=0
36     end
37 end
38 if(IP1>0)
39 for i=1:length(I)//checking whether it is a binary
      number or not
40     if(I(i)>1) then
41         disp('not a binary number')
42         abort
43     end
44   end
45 end
46 if(IP1>0)
47 IP=0
48 for i=1:length(I)
49 //multipliying bits of integer part with their
      position values and adding
50     IP=IP+(I(i)*2^(i-1))
51   end
52   end
53 DP=0
54 for z=1:length(D)
```

```
55 //multipliying bits of decimal part with their
      position values and adding
56     DP=DP+(D(z)*2^(-1*(length(D)+1-z)))
57 end
58 decimal=IP+DP
59 //displaying the output
60 printf("Decimal format is")
61 disp(decimal)
```

Scilab code Exa 8.8.10 convert the decimal to binary numbers

```
1  clc
2  clear
3  disp("Example 8.10")
4  printf("\n")
5  disp("convert the following decimal to binary
      numbers")
6  disp("a)47.8125 b)100.0001 c)29.3749")
7  //given decimal number
8  i=1;x=1
9  dec=47.8125
10 //separating integer part
11 IP=floor(dec)
12 IP1=IP
13 //separating decimal part
14 DP=modulo(dec,1)
15 //storing each integer digit in I(i)
16 while(IP>0)
17     I(i)=(modulo(floor(IP),2))
18     IP=floor(IP)/2
19     i=i+1
20 end
21 if(IP1>0)
22 IP=0
23 for j=1:length(I)
```

```
24 //multipliying bits of integer part with their
      position values and adding
25      IP=IP+(I(j)*10^(j-1));
26    end
27 else
28    IP=0
29 end
30
31 //storing each decimal digit in D(x)
32 while(x<=4)
33      DP=DP*2
34      D(x)=floor(DP)
35      x=x+1
36      DP=modulo(DP,1)
37 end
38
39 DP=0
40 for j=1:length(D)
41 //multipliying bits of decimal part with their
      position values and adding
42      DP=DP+(10^(-1*j)*D(j))
43 end
44 Binary=IP+DP;
45 printf("Binary format is")
46 disp(Binary)
```

Scilab code Exa 8.8.12 convert the octal to decimal

```
1 clc
2 clear
3 disp("Example 8.12")
4 printf("\n")
5 disp("convert the following octal to decimal")
6 disp("a)243 b)124.21 c)0.65")
7 //Given octal number
```

```
i=1;w=1
oct=243
//separating integer part
IP=floor(oct)
IP1=IP
//separating decimal part
DP=modulo(oct,1)
DP1=DP
//converting decimal value to interger
p=2
DP=DP*10^p //should change power of 10 as according
   to number of digits in decimal digit
//storing each integer digit in I(i)
while(IP>0)
    I(i)=modulo(IP,10);
    IP=floor(IP/10);
    i=i+1;
  end
//storing each decimal digit in D(w)
while(DP>0)
    D(w)=modulo(DP,10)
    DP=(DP/10)
    DP=floor(DP)
    w=w+1;
  end
//to do zero padding of remaining erm of D(w)
if(DP1<1)
    if(DP1>0)
if(length(D)<p)
    q=length(D)
  for f=q+1 :p
    D(f)=0
    end
  end
end
end

if(IP1>0)
```

```
45 for i=1:length(I)//checking whether it is a octal
   number or not
46     if(I(i)>8) then
47         disp('not a octal number')
48         abort
49     end
50   end
51 end
52 if(IP1>0)
53 IP=0
54 for i=1:length(I)
55 //multipliying bits of integer part with their
   position values and adding
56     IP=IP+(I(i)*8^(i-1))
57   end
58 end
59
60 if(DP1<1)
61   if(DP1>0)
62 DP=0
63 for z=1:length(D)
64   //multipliying bits of decimal part with their
      position values and adding
65   if(D(z)<8)
66     DP=DP+(D(z)*8^(-1*(length(D)+1-z)))
67   else
68     IP=0
69     DP=0
70     printf("not a octal number")
71     abort
72   end
73 end
74 end
75
76 decimal=IP+DP
77 //displaying the output
78 printf("Decimal format")
79 disp(decimal)
```

Scilab code Exa 8.8.13 convert the decimael numbers to Octal

```
clc
clear
disp("Example 8.13")
printf("\n")
disp("convert the following decimael numbers to
   Octal")
disp("a)283 b)847.951 c)0.728")
//given decimal number
i=1;x=1
dec=283
//separating integer part
IP=floor(dec)
IP1=IP
//separating decimal part
DP=modulo(dec,1)
//storing each integer digit in I(i)
while(IP>0)
    I(i)=(modulo(floor(IP),8))
    IP=floor(IP)/8
    i=i+1
end
if(IP1>0)
IP=0
for j=1:length(I)
//multipliying bits of integer part with their
   position values and adding
     IP=IP+(I(j)*10^(j-1));
  end
else
  IP=0
end

```

```
31 //storing each decimal digit in D(x)
32 if(DP<1)
33   if(DP>0)
34 while(x<=4)
35     DP=DP*8
36     D(x)=floor(DP)
37     x=x+1
38     DP=modulo(DP,1)
39 end
40
41 DP=0
42 for j=1:length(D)
43 //multipliying bits of decimal part with their
      position values and adding
44     DP=DP+(10^(-1*j)*D(j))
45   end
46 end
47 end
48 octal=IP+DP
49 printf("Octal format")
50 disp(octal)
```

Scilab code Exa 8.8.14 convert the binary number to Octal

```
1 clc
2 clear
3 disp("Example 8.14")
4 printf("\n")
5 disp("convert the following binary number to Octal")
6 disp("a)101111 b)1010101 c)1110.01101")
7 i=1;x=1;w=1
8 //convert binary to decimal
9 bin=101111
10 //separating integer part
11 IP=floor(bin)
```

```
12 IP1=IP
13 //separating decimal part
14 DP=modulo(bin,1)
15 DP1=DP
16 //converting decimal value to interger
17 p=5
18 DP=DP*10^p //should change power of 10 as according
      to number of digits in decimal digit
19 //storing each integer digit in I(i)
20 while(IP>0)
21     I(i)=modulo(IP,10);
22     IP=floor(IP/10);
23     i=i+1;
24   end
25 //storing each decimal digit in D(w)
26 while(DP>0)
27     D(w)=modulo(DP,2)
28     DP=(DP/10)
29     DP=floor(DP)
30     w=w+1;
31   end
32   //to do zero padding of remaining erm of D(w)
33   if(DP1>0)
34     if(DP1<1)
35 if(length(D)<p)
36     q=length(D)
37   for f=q+1 :p
38     D(f)=0
39     end
40   end
41 end
42 end
43 if(IP1>0)
44 for i=1:length(I)//checking whether it is a binary
      number or not
45     if(I(i)>1) then
46         disp('not a binary number')
47         abort
```

```
48      end
49    end
50  end
51  if(IP1>0)
52  IP=0
53  for i=1:length(I)
54  //multipliying bits of integer part with their
       position values and adding
55      IP=IP+(I(i)*2^(i-1))
56    end
57  end
58  if(DP1>0)
59    if(DP1<1)
60  DP=0
61  for z=1:length(D)
62  //multipliying bits of decimal part with their
       position values and adding
63      DP=DP+(D(z)*2^(-1*(length(D)+1-z)))
64    end
65    else
66    DP=0
67  end
68  else
69  DP=0
70  end
71  decimal=IP+DP
72  //displaying the output
73  disp(decimal)
74
75
76
77  //convert decimal to octal
78  i=1;
79  //separating integer part
80  IP2=floor(decimal)
81  IP3=IP2
82  //separating decimal part
83  DP2=modulo(decimal,1)
```

```
84 //storing each integer digit in I(i)
85 while(IP2>0)
86     J(i)=(modulo(floor(IP2),8))
87     IP2=floor(IP2)/8
88     i=i+1
89 end
90 if(IP3>0)
91 IP2=0
92 for j=1:length(J)
93 //multipliying bits of integer part with their
      position values and adding
94     IP2=IP2+(J(j)*10^(j-1));
95   end
96 else
97   IP2=0
98 end
99
100 //storing each decimal digit in D(x)
101 if(DP2<1)
102   if(DP2>0)
103 while(x<=4)
104     DP2=DP2*8
105     E(x)=floor(DP2)
106     x=x+1
107     DP2=modulo(DP2,1)
108 end
109
110 DP2=0
111 for j=1:length(E)
112 //multipliying bits of decimal part with their
      position values and adding
113     DP2=DP2+(10^(-1*j)*E(j))
114   end
115 end
116 end
117 octal=IP2+DP2
118 printf("Octal format")
119 disp(octal)
```

Scilab code Exa 8.8.15 convert the octal to binary number

```
clc
clear
disp("Example 8.15")
printf("\n")
disp("convert the following octal to binary number")
disp("a)724 b)365.217 c)0.506")
//Given binary number
i=1;w=1
bin=724
//separating integer part
IP=floor(bin)
IP1=IP
//separating decimal part
DP=modulo(bin,1)
DP1=DP
//converting decimal value to interger
p=2
DP=DP*10^p //should change power of 10 as according
   to number of digits in decimal digit
//storing each integer digit in I(i)
while(IP>0)
    I(i)=modulo(IP,10);
    IP=floor(IP/10);
    i=i+1;
  end
//storing each decimal digit in D(w)
while(DP>0)
    D(w)=modulo(DP,10)
    DP=(DP/10)
    DP=floor(DP)
    w=w+1;
  end
```

```
32 //to do zero padding of remaining erm of D(w)
33 if(DP1<1)
34     if(DP1>0)
35 if(length(D)<p)
36     q=length(D)
37   for f=q+1 :p
38     D(f)=0
39     end
40   end
41 end
42 end
43
44 if(IP1>0)
45 for i=1:length(I)//checking whether it is a octal
      number or not
46     if(I(i)>8) then
47         disp('not a octal number')
48         abort
49     end
50   end
51 end
52 if(IP1>0)
53 IP=0
54 for i=1:length(I)
55 //multipliying bits of integer part with their
      position values and adding
56     IP=IP+(I(i)*8^(i-1))
57   end
58 end
59
60 if(DP1<1)
61   if(DP1>0)
62 DP=0
63 for z=1:length(D)
64   //multipliying bits of decimal part with their
       position values and adding
65   if(D(z)<8)
66     DP=DP+(D(z)*8^(-1*(length(D)+1-z)))
```

```
67    else
68      IP=0
69      DP=0
70      printf("not a octal number")
71      abort
72    end
73  end
74  end
75
76  decimal=IP+DP
77  //displaying the output
78  disp(decimal)
79
80
81
82  //decimal to Binary
83  //given decimal number
84  i=1;x=1
85  //separating integer part
86  IP2=floor(decimal)
87  IP3=IP2
88  //separating decimal part
89  DP2=modulo(decimal,1)
90  //storing each integer digit in I(i)
91  while(IP2>0)
92      J(i)=(modulo(floor(IP2),2))
93      IP2=floor(IP2)/2
94      i=i+1
95  end
96  if(IP3>0)
97  IP2=0
98  for j=1:length(J)
99  //multipliying bits of integer part with their
       position values and adding
100     IP2=IP2+(J(j)*10^(j-1));
101   end
102 else
103   IP2=0
```

```
104 end
105
106 //storing each decimal digit in D(x)
107 while(x<=4)
108     DP2=DP2*2
109     E(x)=floor(DP)
110     x=x+1
111     DP2=modulo(DP2,1)
112 end
113
114 DP2=0
115 for j=1:length(E)
116 //multipliying bits of decimal part with their
      position values and adding
117     DP2=DP2+(10^(-1*j)*E(j))
118 end
119 Binary=IP2+DP2;
120 printf("Binary format")
121 disp(Binary)
```

Scilab code Exa 8.8.17 convert the hexadecimael numbers to decimal

```
1 clc
2 clear
3 disp("Example 8.17")
4 printf("\n")
5 disp("convert the following hexadecimael numbers to
    decimal")
6 disp("a)FACE b)31C c)CAD")
7 //this progra, converts only integer part to decimal
8 Hdec='FACE'
9 dec=hex2dec(Hdec);
10 printf("decimal=%d",dec)
```

Scilab code Exa 8.8.18 convert the decimael numbers to hexadecimal

```
clc
clear
disp("Example 8.17")
printf("\n")
disp("convert the following decimael numbers to
   hexadecimal")
disp("a)2146 b)843 c)2604")
//this program, converts only integer part to
   hexadecimal
dec=843
Hdec=dec2hex(dec);
printf("decimal=%s",Hdec)
```

Scilab code Exa 8.8.19 convert the binary numbers to hexadecimal

```
clc
clear
disp("Example 8.19")
printf("\n")
disp("convert the following binary numbers to
   hexadecimal")
disp("a)101110 b)11010 c)1011101")
//this program, converts only integer part to
   decimal
bin='101110'
dec=bin2dec(bin)
Hdec=dec2hex(dec)
printf("decimal=%s",Hdec)
```

Scilab code Exa 8.8.21 Add the binary numbers

```
1  kclc
2  clear
3  disp("Example 8.21")
4  printf("\n")
5  disp("Add the following binary numbers")
6  disp("a)11011 & 10110 b)1100 & 111 c)10.1011 &
       11.011")
7  //Given binary number
8  i=1;w=1
9  a=11011
10 b=10110
11 //Given binary number
12 i=1;w=1
13 bin=11.101
14 //separating integer part
15 IPa=floor(a)
16 IP1a=IPa
17 //separating decimal part
18 DPa=modulo(a,1)
19 DP1a=DPa
20 //converting decimal value to interger
21 p=4
22 DPa=DPa*10^p //should change power of 10 as
       according to number of digits in decimal digit
23
24 //storing each integer digit in I(i)
25 while(IPa>0)
26     Ia(i)=modulo(IPa,10);
27     IPa=floor(IPa/10);
28     i=i+1;
29   end
30 //storing each decimal digit in D(w)
```

```
while(DPa>0)
    Da(w)=modulo(DPa,2)
    DPa=(DPa/10)
    DPa=floor(DPa)
    w=w+1;
  end
  //to do zero padding of remaining erm of D(w)
  if(DP1a<1)
    if(DP1a>0)
if(length(Da)<p)
    q=length(Da)
  for f=q+1 :p
    Da(f)=0
    end
  end
end
end

if(IP1a>0)
for i=1:length(Ia)//checking whether it is a binary
   number or not
    if(Ia(i)>1) then
        disp('not a binary number')
        abort
    end
  end
end
if(IP1a>0)
IPa=0
for i=1:length(Ia)
//multipliying bits of integer part with their
   position values and adding
    IPa=IPa+(Ia(i)*2^(i-1))
  end
  end
  DPa=0
  if(DP1a>0)
    if(DP1a<1)
```

```
67  for z=1:length(Da)
68  //multipliying bits of decimal part with their
       position values and adding
69      DPa=DPa+(Da(z)*2^(-1*(length(Da)+1-z)))
70    end
71  end
72  end
73  decimala=IPa+DPa
74  //displaying the output
75  disp(decimala)
76
77  //for b
78  //Given binary number
79  i=1;w=1
80  //separating integer part
81  IPb=floor(b)
82  IP1b=IPb
83  //separating decimal part
84  DPb=modulo(b,1)
85  DP1b=DPb
86  //converting decimal value to interger
87  p=3
88  DPb=DPb*10^p //should change power of 10 as
       according to number of digits in decimal digit
89
90  //storing each integer digit in I(i)
91  while(IPb>0)
92      Ib(i)=modulo(IPb,10);
93      IPb=floor(IPb/10);
94      i=i+1;
95    end
96  //storing each decimal digit in D(w)
97  while(DPb>0)
98      Db(w)=modulo(DPb,2)
99      DPb=(DPb/10)
100     DPb=floor(DPb)
101     w=w+1;
102   end
```

```
103   //to do zero padding of remaining erm of D(w)
104   if(DP1b>0)
105     if(DP1b<1)
106 if(length(Db)<p)
107     q=length(Db)
108   for f=q+1 :p
109     Db(f)=0
110     end
111   end
112 end
113 end
114 if(IP1b>0)
115 for i=1:length(Ib)//checking whether it is a binary
      number or not
116     if(Ib(i)>1) then
117         disp('not a binary number')
118         abort
119     end
120   end
121 end
122 if(IP1b>0)
123 IPb=0
124 for i=1:length(Ib)
125 //multipliying bits of integer part with their
      position values and adding
126     IPb=IPb+(Ib(i)*2^(i-1))
127   end
128   end
129 DPb=0
130 if(DP1b>0)
131   if(DP1b<1)
132   for z=1:length(Db)
133 //multipliying bits of decimal part with their
      position values and adding
134     DPb=DPb+(Db(z)*2^(-1*(length(Db)+1-z)))
135   end
136 end
137 end
```

```
138 decimalb=IPb+DPb
139 //displaying the output
140 disp(decimalb)
141
142 sum1=decimala+decimalb
143 i=1;x=1
144
145 //separating integer part
146 IP=floor(sum1)
147 IP1=IP
148 //separating decimal part
149 DP=modulo(sum1,1)
150 //storing each integer digit in I(i)
151 while(IP>0)
152     I(i)=(modulo(floor(IP),2))
153     IP=floor(IP)/2
154     i=i+1
155 end
156 if(IP1>0)
157 IP=0
158 for j=1:length(I)
159 //multipliying bits of integer part with their
      position values and adding
160     IP=IP+(I(j)*10^(j-1));
161   end
162 else
163   IP=0
164 end
165
166 //storing each decimal digit in D(x)
167 while(x<=4)
168     DP=DP*2
169     D(x)=floor(DP)
170     x=x+1
171     DP=modulo(DP,1)
172 end
173
174 DP=0
```

```
175 for j=1:length(D)
176 //multipliying bits of decimal part with their
       position values and adding
177     DP=DP+(10^(-1*j)*D(j))
178 end
179 Binary=IP+DP;
180 printf("Sum")
181 disp(Binary)
```

Scilab code Exa 8.8.23 Add the octal numbers

```
1  clc
2  clear
3  disp("Example 8.23")
4  printf("\n")
5  disp("Add the following octal numbers")
6  disp("a)46 & 375 b)27.34 & 11.76")
7  //Given octal number
8  i=1;w=1
9  a=46
10 b=375
11 //separating integer part
12 IPa=floor(a)
13 IP1a=IPa
14 //separating decimal part
15 DPa=modulo(a,1)
16 DP1a=DPa
17 //converting decimal value to interger
18 p=2
19 DPa=DPa*10^p //should change power of 10 as
       according to number of digits in decimal digit
20 //storing each integer digit in I(i)
21 while(IPa>0)
22     Ia(i)=modulo(IPa,10);
23     IPa=floor(IPa/10);
```

```
24      i=i+1;
25    end
26  //storing each decimal digit in D(w)
27  while(DPa>0)
28      Da(w)=modulo(DPa,10)
29      DPa=(DPa/10)
30      DPa=floor(DPa)
31      w=w+1;
32    end
33  //to do zero padding of remaining erm of D(w)
34  if(DP1a<1)
35      if(DP1a>0)
36  if(length(Da)<p)
37      q=length(Da)
38    for f=q+1 :p
39      Da(f)=0
40      end
41    end
42  end
43  end
44
45  if(IP1a>0)
46  for i=1:length(Ia)//checking whether it is a octal
       number or not
47      if(Ia(i)>8) then
48          disp('not a octal number')
49          abort
50      end
51    end
52  end
53  if(IP1a>0)
54  IPa=0
55  for i=1:length(Ia)
56  //multipliying bits of integer part with their
       position values and adding
57      IPa=IPa+(Ia(i)*8^(i-1))
58    end
59  end
```

```
60
61 if(DP1a<1)
62   if(DP1a>0)
63 DPa=0
64 for z=1:length(Da)
65   //multipliying bits of decimal part with their
       position values and adding
66   if(Da(z)<8)
67     DPa=DPa+(Da(z)*8^(-1*(length(Da)+1-z)))
68   else
69     IPa=0
70     DPa=0
71     printf("not a octal number")
72     abort
73   end
74 end
75 end
76
77 decimala=IPa+DPa
78 //displaying the output
79 disp(decimala)
80
81 //for b
82 //Given octal number
83 i=1;w=1
84 //separating integer part
85 IPb=floor(b)
86 IP1b=IPb
87 //separating decimal part
88 DPb=modulo(b,1)
89 DP1b=DPb
90 //converting decimal value to interger
91 p=2
92 DPb=DPb*10^p //should change power of 10 as
     according to number of digits in decimal digit
93 //storing each integer digit in I(i)
94 while(IPb>0)
95     Ib(i)=modulo(IPb,10);
```

```
96      IPb=floor(IPb/10);
97      i=i+1;
98    end
99  //storing each decimal digit in D(w)
100 while(DPb>0)
101     Db(w)=modulo(DPb,10)
102     DPb=(DPb/10)
103     DPb=floor(DPb)
104     w=w+1;
105   end
106 //to do zero padding of remaining erm of D(w)
107 if(DP1b<1)
108     if(DP1b>0)
109 if(length(Db)<p)
110     q=length(Db)
111   for f=q+1 :p
112     Db(f)=0
113     end
114   end
115 end
116 end
117
118 if(IP1b>0)
119 for i=1:length(Ib)//checking whether it is a octal
      number or not
120     if(Ib(i)>8) then
121         disp('not a octal number')
122         abort
123     end
124   end
125 end
126 if(IP1b>0)
127 IPb=0
128 for i=1:length(Ib)
129 //multipliying bits of integer part with their
      position values and adding
130     IPb=IPb+(Ib(i)*8^(i-1))
131   end
```

```
132 end
133
134 if(DP1b<1)
135   if(DP1b>0)
136 DPb=0
137 for z=1:length(Db)
138   //multipliying bits of decimal part with their
        position values and adding
139   if(Db(z)<8)
140     DPb=DPb+(Db(z)*8^(-1*(length(Db)+1-z)))
141   else
142     IPb=0
143     DPb=0
144     printf("not a octal number")
145     abort
146   end
147 end
148 end
149
150 decimalb=IPb+DPb
151 //displaying the output
152 disp(decimalb)
153
154 sum1=decimala+decimalb
155 i=1;x=1
156 //separating integer part
157 IP=floor(sum1)
158 IP1=IP
159 //separating decimal part
160 DP=modulo(sum1,1)
161 //storing each integer digit in I(i)
162 while(IP>0)
163     I(i)=(modulo(floor(IP),8))
164     IP=floor(IP)/8
165     i=i+1
166 end
167 if(IP1>0)
168 IP=0
```

```
for j=1:length(I)
//multipliying bits of integer part with their
   position values and adding
    IP=IP+(I(j)*10^(j-1));
  end
else
  IP=0
end

//storing each decimal digit in D(x)
if(DP<1)
  if(DP>0)
while(x<=4)
    DP=DP*8
    D(x)=floor(DP)
    x=x+1
    DP=modulo(DP,1)
end

DP=0
for j=1:length(D)
//multipliying bits of decimal part with their
   position values and adding
    DP=DP+(10^(-1*j)*D(j))
  end
end
end
octal=IP+DP
printf("Sum")
disp(octal)
```

Scilab code Exa 8.8.25 Add the hexadecimal numbers

```
clc
clear
```

```
3  disp("Example 8.25")
4  printf("\n")
5  disp("Add the following hexadecimal numbers")
6  disp("a)ABC & ABCDE b) DEF & 12EF")
7  //this program add only integer part
8  a='ABC'
9  b='ABCDE'
10 a1=hex2dec(a)
11 a2=hex2dec(b)
12 sum1=a1+a2
13 sumhex=dec2hex(sum1)
14 printf("%s",sumhex)
```

Scilab code Exa 8.8.30a perform the decimal subtraction using 9s complements

```
1  clc
2  clear
3  disp("Example 8.30a")
4  printf("\n")
5  disp("perform the following decimal subtraction
      using 9s complements")
6  disp("a)49-24     b)321-578")
7  //given numbers
8  a=49
9  b=-24
10 //should set to 99 if input is 2 digit number,999 if
       3digit number
11 c=99
12 //add c with 2nd operand
13 e=c+b
14 N=a+e
15 if(N>100)
16     if(N<199)
17     M=N-100
```

```
18      M=M+1
19      N=M
20  end
21  end
22  if(N>1000)
23      if(N<1999)
24      M=N-1000
25      M=M+1
26      N=M
27  end
28  end
29      M=N
30  if(-b>a)
31      M=-(999-M)
32  end
33  printf("result=%d",M)
```

Scilab code Exa 8.8.30b perform the decimal subtraction using 10s complements

```
1  clc
2  clear
3  disp("Example 8.30b")
4  printf("\n")
5  disp("perform the following decimal subtraction
       using 10s complements")
6  disp("a)49-24     b)321-578")
7  //given numbers
8  a=49
9  b=-24
10 //should set to 100 if input is 2 digit number,1000
       if 3digit number
11 c=1000
12 //add c with 2nd operand
13 e=c+b
```

```
14 N=a+e
15 if(N>100)
16     if(N<199)
17     M=N-100
18     N=M
19 end
20 end
21 if(N>1000)
22     if(N<1999)
23     M=N-1000
24     N=M
25 end
26 end
27     M=N
28 if(-b>a)
29     M=-(999-M+1)
30 end
31 printf("result=%d",M)
```

Scilab code Exa 8.8.31a perform the binary substraction using 1s complement

```
1  clc
2  clear
3  disp("Example 8.31a")
4  printf("\n")
5  disp("perform the following binary substraction
      using 1s complement")
6  disp("a)1010-0111 b)0110-1101")
7  a=[1 0 1 0]
8  b=~[0 1 1 1]
9  d=0
10 for i=1:length(a)
11     c(i)=a(length(a)+1-i)+b(length(a)+1-i)+d
12     if(c(i)==1)
```

```
13          d=0
14      end
15      if[c(i)==2]
16          d=1
17          c(i)=0
18          end
19  end
20  f=1
21  if(d==1)
22      for i=1:length(a)
23          g(i)=c(i)+f
24          if(g(i)==1)
25              f=0
26              end
27          if(g(i)==2)
28              f=1
29              g(i)=0
30          end
31
32      end
33      for i=1:length(a)
34      c(i)=g(i)
35      end
36  end
37  if(d==0)
38      for i=1:length(a)
39      c(i)=~c(i)
40      end
41  end
42  printf("result =%d%d%d%d",c(4),c(3),c(2),c(1))
```

Scilab code Exa 8.8.31b perform the binary substraction using 2s complement

```
1  clc
```

```
clear
disp("Example 8.31b")
printf("\n")
disp("perform the following binary substraction
   using 2s complement")
disp("a)1010-0111 b)0110-1101")
a=[1 0 1 0]
b=~[0 1 1 1]
d=0
h=1
for i=1:length(b)
        n(i)=b(length(b)+1-i)+h
        if(n(i)==1)
            h=0
            end
        if(n(i)==2)
            h=1
            n(i)=0
        end

    end
    for i=1:length(a)
    b(i)=n(i)
    end


for i=1:length(a)
    c(i)=a(length(a)+1-i)+b(length(a)+1-i)+d
    if(c(i)==1)
        d=0
    end
    if[c(i)==2]
        d=1
        c(i)=0
        end
end


```

```
39 if(d==0)
40     for i=1:length(a)
41     c(i)=~c(i)
42 end
43 j=1
44 for i=1:length(b)
45         m(i)=c(i)+j
46         if(m(i)==1)
47             f=0
48             end
49         if(m(i)==2)
50             j=1
51             m(i)=0
52         end
53
54     end
55     for i=1:length(a)
56     c(i)=m(i)
57     end
58 end
59 for i=1:length(a)
60     C(i)=c(i)
61 end
62 printf("result =%d%d%d%d",c(4),c(3),c(2),c(1))
```

Scilab code Exa 8.8.48a Prove the boolean thereom

```
1 clc
2 clear
3 disp("Example 8.48a")
4 printf("\n")
5 disp("Prove the following boolean thereom")
6 disp("A+AB=A")
7 disp("A=a,B=b,AB=s,A+AB=d")
8 a=[0 0 1 1]
```

```
b=[0 1 0 1]
for i=1:length(a)
    s(i)=a(i)*b(i)
end
for i=1:length(a)
    d(i)=s(i)+a(i)
    if(d(i)==2)
        d(i)=1
    end

end

for i=1:length(a)
    if(a(i)==d(i))
        printf("")
    else
        printf("not")
        abort
    end

end
printf("yes")
```

Scilab code Exa 8.8.48b Prove the boolean thereom

```
clc
clear
disp("Example 8.48b")
printf("\n")
disp("Prove the following boolean thereom")
disp("A+AB=A")
disp("A=a,B=b,A1B=s,A+A1B=d")
a=[0 0 1 1]
b=[0 1 0 1]
for i=1:length(a)
```

```
11      s(i)=(~a(i))*b(i)
12  end
13  for i=1:length(a)
14      d(i)=s(i)+a(i)
15      if(d(i)==2)
16          d(i)=1
17      end
18
19  end
20
21  for i=1:length(a)
22      e(i)=a(i)+b(i)
23      if(e(i)==2)
24          e(i)=1
25          end
26  end
27
28  for i=1:length(a)
29      if((e(i)==d(i)))
30          printf("_")
31      else
32          printf("not")
33          abort
34      end
35
36  end
37  printf("yes")
```

Scilab code Exa 8.8.49a Prove the boolean identities

```
1  clc
2  clear
3  disp("Example 8.49a")
4  printf("\n")
5  disp("Prove the following boolean identities")
```

```
disp("A+BC=(A+B)(A+C)")
A=[0 0 0 0 1 1 1 1]
B=[0 0 1 1 0 0 1 1]
C=[0 1 0 1 0 1 0 1]
for i=1:length(A)
  Y(i)=A(i)+(B(i)*C(i))
  if(Y(i)==2)
    Y(i)=1
  end
end
for i=1:length(A)
  Z(i)=(A(i)+B(i))*(A(i)+C(i))
  if(Z(i)==2)
    Z(i)=1
  end
  if(Z(i)==3)
    Z(i)=1
  end
  if(Z(i)==4)
    Z(i)=1
  end
end
for i=1:length(A)
  if(Z(i)==Y(i))
    printf("_")
  else
    printf("NOT")
    abort
  end
end

  printf("proved")
```

Scilab code Exa 8.8.49b Prove the boolean identities

```
clc
clear
disp("Example 8.49b")
printf("\n")
disp("Prove the following boolean identities")
disp("ABC+AB1C+ABC1=AB+AC")
A=[0 0 0 0 1 1 1 1]
B=[0 0 1 1 0 0 1 1]
C=[0 1 0 1 0 1 0 1]
for i=1:length(A)
  Y(i)=(A(i)*B(i)*C(i))+(A(i)*(~B(i))*C(i))+(A(i)*B(
     i)*(~C(i)))
  if(Y(i)==3)
    Y(i)=1
  end
  if(Y(i)==2)
    Y(i)=1
  end
end
for i=1:length(A)
  Z(i)=(A(i)*B(i))+(A(i)*C(i))
  if(Z(i)==2)
    Z(i)=1
  end
end
for i=1:length(A)
  if(Z(i)==Y(i))
    printf("_")
  else
    printf("NOT")
    abort
  end
end
 printf("proved")
```

Scilab code Exa 8.8.50a Construct the Truth Table for logic expression

```
clc
clear
disp("Example 8.50a")
printf("\n")
disp("Construct the Truth Table for logic expression
   ")
disp("AB1+C1")
A=[0 0 0 0 1 1 1 1]
B=[0 0 1 1 0 0 1 1]
C=[0 1 0 1 0 1 0 1]
for i=1:length(A)
  f(i)=(A(i)*(~(B(i))))+(~C(i))
  if(f(i)==2)
    f(i)=1
  end
end
printf("truth table =%d%d%d%d%d%d%d%d",f(1),f(2),f
   (3),f(4),f(5),f(6),f(7),f(8))
```

Scilab code Exa 8.8.50b Construct the Truth Table for logic expression

```
clc
clear
disp("Example 8.50b")
printf("\n")
disp("Construct the Truth Table for logic expression
   ")
disp("AB1+A1B")
A=[0 0 1 1]
B=[0 1 0 1]
for i=1:length(A)
  f(i)=(A(i)*(~(B(i))))+(B(i)*(~(A(i))))
  if(f(i)==2)
```

```
12      f(i)=1
13    end
14  end
15  printf("truth table =%d%d%d%d",f(1),f(2),f(3),f(4))
```

Scilab code Exa 8.8.50c Construct the Truth Table for logic expression

```
1  clc
2  clear
3  disp("Example 8.50c")
4  printf("\n")
5  disp("Construct the Truth Table for logic expression
     ")
6  disp("C1((B+D)1)")
7  B=[0 0 0 0 1 1 1 1]
8  C=[0 0 1 1 0 0 1 1]
9  D=[0 1 0 1 0 1 0 1]
10 for i=1:length(B)
11   f(i)=(~(C(i)))*(~(B(i)+D(i)))
12   if (f(i)==2)
13     f(i)=1
14   end
15 end
16 printf("truth table =%d%d%d%d%d%d%d%d",f(1),f(2),f
     (3),f(4),f(5),f(6),f(7),f(8))
```