

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

```

1  clc
2  disp(" Example 1.9")
3  printf("\n")
4  disp(" find out resistance")
5  printf(" Given\n")
6  disp(" forward current=200mA, Vr=75V, cut in voltage
       =0.75v, reverse current=50nA")
7  //all values are from fig 1.9
8  Vf=0.75
9  If=200*10^-3 //forward current
10 Vr=75
11 Ir=50*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 1.1.11** Find the forward and reverse resistance and cut in voltage

```

1  clc
2  disp(" Example 1.11")
3  printf("\n")
4  disp(" findout resistance and cut in voltage")
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 1.10
8  Vf=0.35
9  If=80*10^-3 //forward current
10 Vr=40
11 Ir=10^-6 //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)

```



```

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
    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
7 Vd1=0.7

```

```

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

```

---

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

```

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

```

---

**Scilab code Exa 1.1.28** find out battery voltage

```

1 clc
2 disp("Example 1.28")
3 printf("\n")
4 disp("find out battery voltage")
5 //given
6 R=2.7*10^3
7 Vd=0.7
8 I=1.96*10^-3
9 //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")
```

---

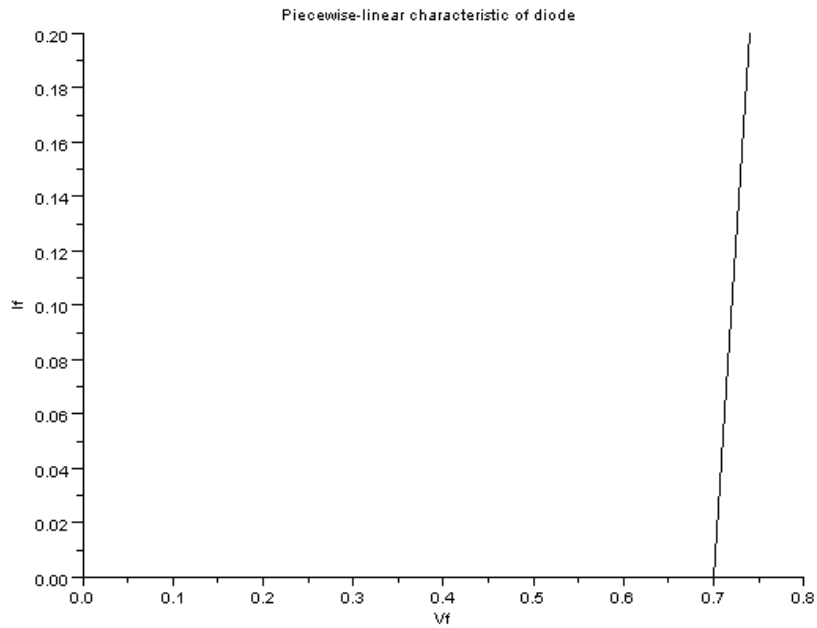


Figure 1.1: Plot the piecewise linear characteristic of si diode

**Scilab code Exa 1.1.32** Plot the piecewiselinear characteristic of Germanium diode

```

1 clc
2 disp(" Example 1.32")
3 printf(" \n")
4 disp(" Plot the piecewise-linear characteristic of
      Germanium diode")
5 printf(" Given \n")
6 //given
7 Vf=[0 0.3 0.35]

```

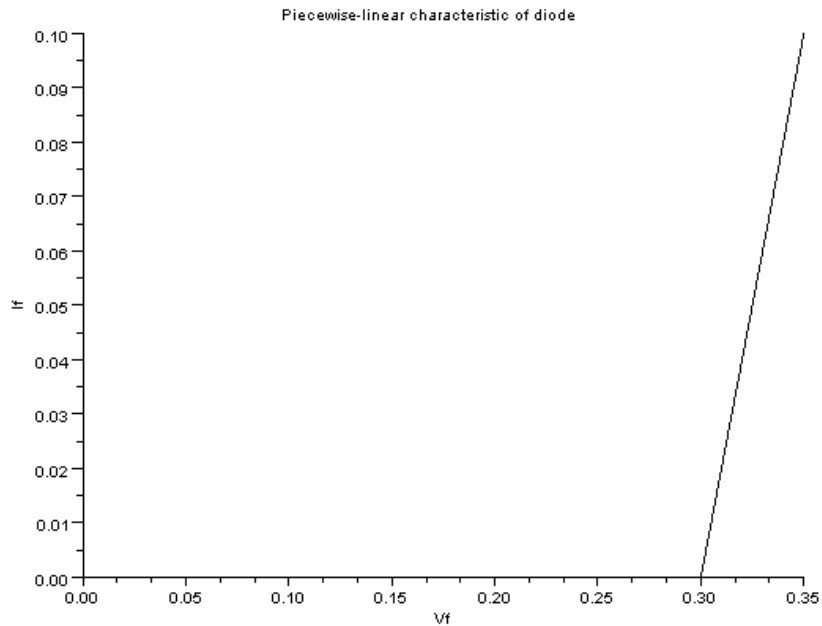


Figure 1.2: Plot the piecewiselinear characterisic of Germanium diode

```

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

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

```
1 clc
2 disp("Example 1.49")
3 printf("\n")
4 disp("find the maximum forward current at 25c and 80
   c")
5 printf("Given\n")
6 T1=25 //to find maximum forward current
   at this temperature
7 T2=80 //to find maximum forward current
   at this temperature
```



```

8 VT1=0.65          //forward voltage drop(constant at
   all temperature)
9 VT2=VT1
10 PT1=80*10^-3     //maximum power dissipation at 80c
11 PT2=30*10^-3     //maximum power dissipation at 30c
12 IT1=PT1/VT1
13 IT2=PT2/VT2
14 T=[0 25 80 114]
15 P=[80 80 30 0]
16 plot2d(T,P)
17 xlabel("Temperature in c")
18 ylabel("Power in mW")
19 xtitle("Power-Temperature curve")
20 printf("Forward current at T1=\n%f Ampere\n",IT1)
21 printf("Forward current at T2=\n%f Ampere\n",IT2)

```

---

**Scilab code Exa 1.1.50** Find maximum forward current at 80c

```

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

```

---

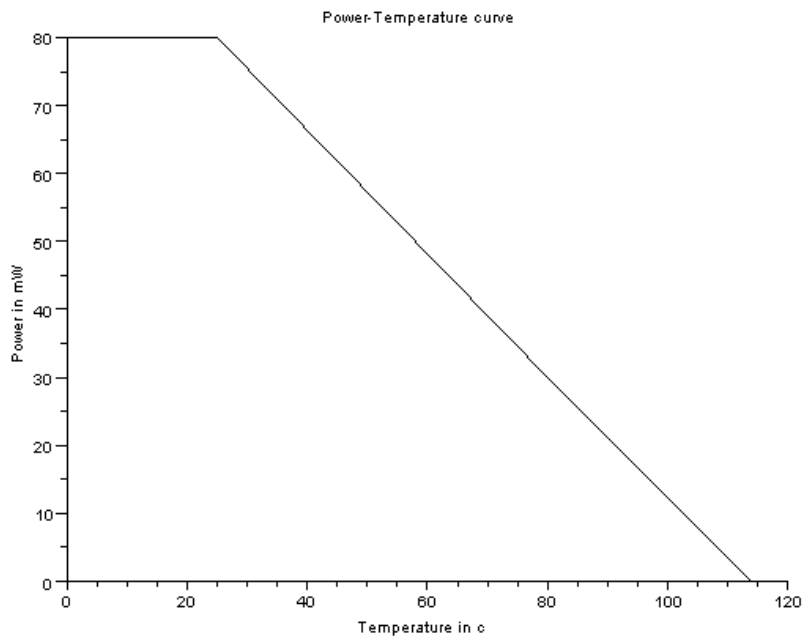


Figure 1.3: Find the maximum forward current at 25c and 80c and plot power temperature curve

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

```
1  clc
2  disp("Example 1.51")
3  printf("\n")
4  disp("Find the maximum forward current and Draw
      power spectrum curve")
5  printf("Given\n")
6  T1=25
7  PT1=1000*10^-3    //maximum power dissipation at 25c
8  //Average current
9  IT1=500*10^-3
10 IT2=IT1
11 VT2=0.8          //forward voltage drop
12 D=10^-2
13 PT2=VT2*IT2
14 T2=((PT1-PT2)/D)+T1
15 //to caculate maximum forward current at 75c
16 T2!=75
17 PT2!=PT1-((T2!-T1)*D)
18 IT2=PT2!/VT2
19 //for(T>25), to draw graph
20   vd=10^-2
21   PT=(1000-(75*10))*10^-3 //maximum power
      dissipation at 100c
22 Temp=[0 25 100 125]
23 p=[1000 1000 PT*10^3 0]
24 plot2d(Temp ,p)
25 xlabel("Temperature in c")
26 ylabel("Power in mW")
27 xtitle("Power-Temperature Curve")
28 printf("Maximum forward current at 75c=\n%f Ampere\n
      ",IT2)
```

---

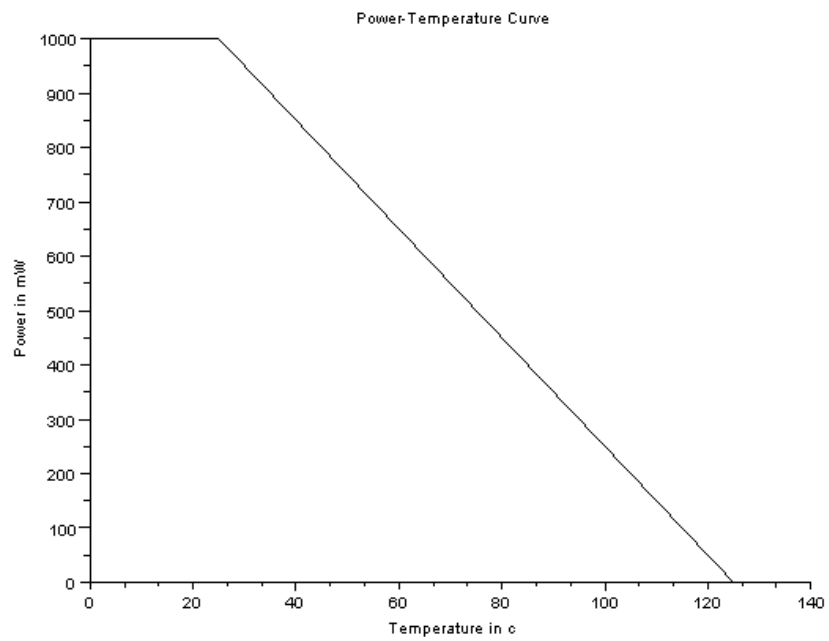


Figure 1.4: Find maximum forward current at 75c and draw power temperature curve

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

```
1 clc
2 disp("Example 1.54")
3 printf("\n")
4 disp("Find the forward voltage drop at 100c and
      dynamic resistance")
5 T1=25
6 T2=100
7 Vft1=0.6 //forward voltage drop at 25c
8 IT1=26*10^-3 //forward current(constant)
9 IT2=IT1
10 //for silicon diode we know that
11 v=(-1.8*10^-3)
12 Vft2=Vft1+((T2-T1)*v)
13 IF=26*10^-3
14 rd1=(26*10^-3/IF)*((T1+273)/298)
15 rd2=(26*10^-3/IF)*((T2+273)/298)
16 printf("Forward voltage drop at 100c=\n%f volt\n",
      Vft2)
17 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

```
1 clc
2 disp("Example 1.55")
3 printf("\n")
4 disp("Calculate maximum & minimum forward voltage
      drop and Junction dynamic resistance")
5 T1=80
6 T2=10
7 T=25
8 //for germanium diode
9 v=(-2.2*10^-3)
```

```

10 Vft1=0.3
11 Vft2maximum=Vft1+((T2-T)*v) //voltage drop at 10c
12 Vft2minimum=Vft1+((T1-T)*v) //voltage drop at 80c
13 IF=20*10^-3
14 rd1=(26*10^-3/IF)*((T2+273)/298)
15 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 resist

```

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

```

1  clc
2  disp("Example 1.57")
3  printf("\n")
4  disp("To find diode current at 25c and 75c")
5  RL=150
6  //both diode voltage drop as given in fig 1.47
7  Vr1=0.7 //for silicon
8  Vr2=0.3 //for Germanium
9  Vdc=5
10 //apply KVL to given circuit
11 IF1=(Vdc-(Vr1+Vr2))/RL
12 //for silicon diode
13 v=(-1.8*10^-3)
14 T1=25
15 T2=75
16 VFT2=Vr1+((T2-T1)*v)
17 //for Germanium Diode
18 v=(-2.2*10^-3)
19 VFT2!=Vr2+((T2-T1)*v)
20 IF2=(Vdc-(VFT2!+VFT2))/RL
21 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

```

1 clc
2 disp(" Example 1.65")
3 printf("\n")
4 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
8 Iz=(Vdc-Vz)/R
9 Pd=Vz*Iz
10 printf("the diode current=\n%f ampere\n",Iz)
11 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 in

```
1 clc
2 disp(" Example 2.11")
3 printf("\n")
4 disp(" Calculate Peak,ac,dc load current ,dc diode
      voltage ,total input power ,percentage regulation
      of HW Rectifier")
5 printf(" Given\n")
6 Rf=20
7 RL=1000
8 N1=1
9 N2=N1
10 V1=110
11 V2=V1 //since (V1/V2)=(N1/N2)
12 Vm=sqrt(2)*V2
13 Im=Vm/(Rf+RL) //peak load current
14 Idc=Im/%pi //DC load current
15 Irms=Im/2 //AC load current
16 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

```

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 outp

```

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 :

```

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

```

---

Scilab code Exa 2.2.22 Calculate Average load current and voltage and Ripple voltage

```
1  clc
2  disp(" Example 2.22")
3  printf("\n")
4  disp(" Calculate Average load current & voltage ,
        Ripple voltage")
5  printf(" Given\n")
6  RL=2000
7  //diodes are ideal
8  Rf=0
9  C=500*10^-6
10 f=50
11 V2=200
12 Vm=sqrt(2)*V2
13 //average load current
14 Idc=(2*Vm)/(pi*(Rf+RL))
15 //Average load voltage
16 Vdc=Idc*RL
17 //ripple factor
18 V=0.483
19 Vac=V*Vdc
20 //with capacitor connected across RL
21 V1=1/(4*sqrt(3)*RL*C*f)
22 //with capacitor filter we have Vdc=Vm
23 Vdc1=282.84
24 Vac1=V1*Vdc1
25 printf(" Average load current=\t%f ampere\n",Idc)
26 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

```
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 efficiency
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

```
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

```

1  clc
2  disp(" Example 2.29")
3  printf("\n")
4  disp(" Calculate Average output voltage ,avg load
        current ,frequency of output waveform ,dc power
        output")
5  printf(" Given\n")
6  Vm=141.42
7  Rf=0      //Ideal diodes
8  RL=100
9  f=50
10 //Average output voltage
11 Vdc=((2*Vm)/(pi))/(1+(2*Rf/RL))
12 //Average load current
13 Idc=Vdc/RL
14 //frequency of output waveform
15 Fout=2*f
16 //dc power output
17 Pdc=Idc^2*RL
18 printf(" average output voltage \n%f volt\n",Vdc)
19 printf(" average load current \n%f ampere\n",Idc)
20 printf(" frequency of output waveform \n%f hz\n",Fout
        )
21 printf(" dc output power \n %f watt\n",Pdc)

```

---

**Scilab code Exa 2.2.34** Calculate Ripple factor DC output voltage DC load current P

```

1  clc
2  disp(" Example 2.34")
3  printf("\n")
4  disp(" Calculate Ripple factor ,DC output voltage ,DC
        load current ,PIV,RMS output ripple voltage")
5  printf(" Given\n")
6  Vm=311.13
7  f=50

```

```

8 c=200*10^-6
9 RL=1000
10 //Ripple factor
11 r=1/(2*sqrt(3)*RL*f*c)
12 //dc output voltage
13 Vdc=Vm/(1+(1/(2*f*c*RL)))
14 //DC load current
15 Idc=Vdc/RL
16 //peak inverse voltage
17 PIV=Vm
18 //RMS ripple voltage on capacitor
19 Vac=r*Vdc
20 printf("ripple factor \n%f\n",r)
21 printf("dc output voltage \n%f volt\n",Vdc)
22 printf(" DC load current \n%f ampere\n",Idc)
23 printf("PIV across the diode \n%f volt\n",PIV)
24 printf("RMS ripple voltage on capacitor \n%f volt \n
",Vac)

```

---

**Scilab code Exa 2.2.35** Calculate the capacitance of HWR

```

1 clc
2 disp(" Example 2.35")
3 printf("\n")
4 disp(" Calculate the capacitance")
5 f=50
6 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 fac

```

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 t

```

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

```

---

**Scilab code Exa 2.2.42** Find Ripple factor Dc output voltage Ripple voltage DC load

```

1 clc
2 disp(" Example 2.42")
3 printf("\n")

```

```

4 disp("Find Ripple factor ,Dc output voltage ,Ripple
      voltage ,DC load current")
5 printf(" Given\n")
6 Vm=282.84
7 f=50
8 C=500*10^-6
9 RL=2*10^3
10 //Ripple factor
11 r=1/(4*sqrt(3)*RL*f*C)
12 //Dc output voltage
13 Vdc=Vm/(1+(1/(4*f*C*RL)))
14 //Ripple voltage on capacitor
15 Vac=r*Vdc
16 //DC load current
17 Idc=Vdc/RL
18 printf("Ripple factor \n%f\n",r)
19 printf("dc ouput voltage \n%f volt\n",Vdc)
20 printf("Ripple voltage on capacitor \n%f volt\n",Vac
      )
21 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

```

1 clc
2 disp("Example 2.43")
3 printf("\n")
4 disp("Find the ripple factor & output voltage if a
      capacitor of 160uf is connected in parallel with
      load")
5 RL=250
6 C=160*10^-6
7 f=50
8 Vm=49.497
9 //ripple factor
10 r=1/(4*sqrt(3)*f*RL*C)

```

```

11 //Dc output voltage
12 Vdc=Vm/(1+(1/(4*f*C*RL)))
13 printf("ripple factor \n %f\n",r)
14 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

```

1 clc
2 disp("Example 2.44")
3 printf("\n")
4 disp("Find the ripple factor & DC load current")
5 printf("Given\n")
6 Vm=230
7 f=(314/(2*%pi))
8 RL=400
9 C=500*10^-6
10 //ripple factor
11 r=1/(4*sqrt(3)*f*RL*C)
12 //DC load current
13 Vdc=Vm/(1+(1/(4*f*C*RL)))
14 Idc=Vdc/RL
15 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 regulat

```

1 clc
2 disp("Example 2.50")
3 printf("\n")
4 disp("calculate load & source effects & the load &
      line regulation")
5 printf("Given\n")
6 Vo1=20
7 Vo2=19.7
8 //load effect=delVo for delIL(max)
9 LE=Vo1-Vo2
10 //Load regulation

```



```

11 LR=(LE*100)/Vo1
12 //source effect=delVo for 10% change in Vs
13 V=20.2
14 SE=V-Vo1
15 //Line regulation
16 LiR=(SE/Vo1)*100
17 printf("load effect \n %f volt\n",LE)
18 printf("load regulation \n%f \n",LR)
19 printf("source effect \n %f volt\n",SE)
20 printf("line regulation \n%f\n",LiR)

```

---

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

```

1 clc
2 disp("Example 2.51")
3 printf("\n")
4 disp("calculate load & source effects & load & line
      regulation")
5 printf("Given\n")
6 Vo1=15
7 Vo2=14.9
8 //load effect=delVo for delIL(max)
9 LE=Vo1-Vo2
10 //Load regulation
11 LR=LE*100/Vo1
12 //source effect=delVo for 10% change in Vs
13 V=14.95
14 SE=Vo1-V
15 //Line regulation
16 LiR=(SE/Vo1)*100
17 printf("load effect \n %f volt\n",LE)
18 printf("load regulation \n%f \n",LR)
19 printf("source effect \n %f volt\n",SE)
20 printf("line regulation \n%f\n",LiR)

```

---

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

```
1 clc
2 disp(" Example 2.54")
3 printf("\n")
4 disp(" Design the Zener Diode Voltage regulator for
      given 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=8
9 Vimax=12
10 //regulated dc output voltage
11 Vo=5
12 //minimum zener current
13 Izmin=5*10^-3
14 //maximum zener current
15 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 sp

```
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 sp

```
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 cu

```

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 follow

```
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",RL)
```

---

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

```
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 specific

```

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%)
8  Vimin=10-2
9  Vimax=10+2
10 //DC output voltage
11 Vo=5
12 //Load current
13 ILmax=20*10^-3
14 ILmin=0
15 //zener current
16 Izmax=80*10^-3
17 Izmin=5*10^-3
18 //maximum Resistance
19 Rmax=(Vimin-Vo)/(Izmin+ILmax)
20 //minimum resistance
21 Rmin=(Vimax-Vo)/(Izmax+ILmin)
22 //Required resistance
23 R=(Rmax+Rmin)/2
24 //load resistance
25 RL=Vo/ILmax
26 printf("minimum resistance %d ohm \n",Rmin)
27 printf("maximum resistance %d ohm \n",Rmax)

```



```
28 printf("required resistance %d ohm \n",R)
29 printf("load resistance %d ohm \n",RL)
```

---

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

```
1 clc
2 disp("Example 2.61")
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=12-3
9 Vimax=12+3
10 //DC output voltage
11 Vo=5
12 //Load current
13 ILmax=20*10^-3
14 ILmin=0
15 //zener wattage
16 Pzmax=500*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 //mini 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 2.2.63** Design a 6V dc reference source to operate from a 16v supply.

```

1  clc
2  disp("Example 2.63")
3  printf("\n")
4  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("series resistance %d ohm\n",R)
```

---

**Scilab code Exa 2.2.64** Design a 8V dc reference source to operate from a 20v supply

```
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("series resistance %d ohm\n",R)
```

---

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

```
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 Iz=20*10^-3
13 //load current(assume zero, no load operation)
14 IL=0
15 //circuit current
16 I=Iz
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

```
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 Iz=20*10^-3
12 //load current(assume zero , no load operation)
13 IL=10^-3
14 //select R such that
15 Iz=Iz
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 //circuit current
23 I1=(Vimax-Vo)/R
24 //zener current when Vimax
25 Izmax=I1-IL
26 //circuit 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 regula

```

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
9  //output voltage
10 Vo=6
11 //load current
12 ILmax=60*10^-3
13 //dynamic impedance
14 Zz=7
15 //series resistance
16 R=150
17 //Source effect
18 delVi=(10*16)/100
19 RL=Vo/ILmax
20 //Zz || RL
21 Rp=(Zz*RL)/(Zz+RL)
22 delVo=(delVi*Rp)/(R+Rp)
23 //Line regulation
24 LR=(delVo*100)/Vo
25 //load effect
26 delIL=ILmax
27 Ro=(Zz*R)/(Zz+R)
28 delVo1=delIL*Ro
29 //output resistance
30 Rout=Ro
31 //Ripple rejection ratio
32 VrobyVri=Rp/(R+Rp)
33 printf(" line regulation is %f \n",LR)
34 printf(" output resistance is %d ohm\n",Rout)
35 printf(" Ripple rejection ratio %f \n",VrobyVri)

```



# Chapter 3

## pnp and npn Transistors

Scilab code Exa 3.3.14 calculate the value of  $I_c$   $I_e$   $\beta$  for a transistor

```
1 clc
2 disp("Example 3.14")
3 printf("\n")
4 disp("calculate the value of  $I_c$ ,  $I_e$ ,  $\beta$  for a
   transistor")
5 printf("Given\n")
6 alpha=0.98
7 //base current
8 Ib=120*10^-6
9 //Value of  $I_c$ 
10 Ic=alpha*Ib/(1-alpha)
11 //Value of  $I_e$ 
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 d

```
1 clc
2 disp("Example 3.15")
3 printf("\n")
4 disp("Find the value of alpha & beta of transistor
      and Ib for desired Ic")
5 printf("Given\n")
6 Ic=1.2*10^-3
7 Ib=20*10^-6
8 //the value of beta
9 beta=Ic/Ib
10 //the value of alpha
11 alpha=beta/(1+beta)
12 //the value of Ib for desired value of Ic=5mA
13 Ic1=5*10^-3
14 Ib1=Ic1/beta
15 printf("beta \n%f\n",beta)
16 printf("alpha \n%f\n",alpha)
17 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

```
1 clc
2 disp("Example 3.16")
3 printf("\n")
4 disp("calculate the value of alpha ,Ib ,beta for a
      transistor")
5 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 col

```

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  $I_c$   $I_e$  for a transistor and Find beta

```

1 clc
2 disp("Example 3.18")
3 printf("\n")
4 disp("calculate the value of  $I_c$ ,  $I_e$  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  $I_e$   $\alpha$   $\beta$  for a transistor and f

```

1 clc
2 disp("Example 3.19")
3 printf("\n")
4 disp("calculate the value of  $I_e$ ,  $\alpha$ ,  $\beta$  for a
    transistor and find  $I_b$  for new value of  $I_c$ ")
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     )
6 printf("Given\n")
7 alpha=0.99
8 //base current
9 Ib=20*10^-6
10 //value of collector current
11 Ic=alpha*Ib/(1-alpha)
12 //value of emitter current
13 Ie=Ic+Ib
14 printf("base current \n%f ampere\n",Ib)
15 printf("collector current \n%f ampere\n",Ic)
16 printf("Emitter current \n%f ampere\n",Ie)

```

---

Scilab code Exa 3.3.21 calculate the value of  $I_c$  alpha beta for a transistor and I

```
1 clc
2 disp("Example 3.21")
3 printf("\n")
4 disp("calculate the value of  $I_c$ , alpha, beta for a
      transistor and  $I_c$  when  $I_b=150\mu A$ ")
5 printf("Given\n")
6  $I_c=12.42*10^{-3}$ 
7  $I_b=200*10^{-6}$ 
8 //value of  $I_e$ 
9  $I_e=I_c+I_b$ 
10 //value of alpha
11  $\alpha=I_c/I_e$ 
12 //value of beta
13  $\beta=I_c/I_b$ 
14 //value of  $I_c$  when  $I_b=150\mu A$ 
15  $I_{b1}=150*10^{-6}$ 
16  $I_c=\beta*I_{b1}$ 
17 printf("Emitter current \n%f ampere\n",  $I_e$ )
18 printf("alpha \n%f\n",  $\alpha$ )
19 printf("beta \n%f\n",  $\beta$ )
20 printf("collector current \n%f ampere\n",  $I_c$ )
```

---

Scilab code Exa 3.3.22 calculate the value of  $I_b$  beta for a transistor and  $I_c$   $I_e$  f

```
1 clc
2 disp("Example 3.22")
3 printf("\n")
4 disp("calculate the value of  $I_b$ , beta for a
      transistor and  $I_c$ ,  $I_e$  for new value of beta")
```

```

5 printf(" Given\n")
6 Ic=16*10^-3
7 Ie=16.04*10^-3
8 //base current
9 Ib=Ie-Ic
10 //beta value
11 beta=Ic/Ib
12 //for beta=25
13 beta1=25
14 Ic1=beta1*Ib
15 Ie1=Ic1+Ib
16 printf(" base current \n%f ampere\n",Ib)
17 printf(" beta \n%f\n",beta)
18 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 V

```

1 clc
2 disp(" Example 3.25")
3 printf("\n")
4 disp(" Find the DC collector voltage & voltage gain
      of circuit for Vi=50mV")
5 printf(" Given\n")
6 //base current for Vbe=0.7
7 Ib=30*10^-6
8 Vbe=0.7
9 beta=80
10 //collector current
11 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
19 Vi=50*10^-3
20 Ib1=15*10^-6
21 Ic1=beta*Ib1
22 Vo=Ic1*Rc
23 //voltage gain
24 Av=Vo/Vi
25 //to find Vce

```



```

26 //given
27 Vbe=0.73
28 Ib2=40*10^-6
29 Ic2=beta*Ib2
30 Vce=Vcc-(Ic2*Rc)
31 //to find voltage gain when Rc changed to 6.8k
32 Rc1=6.8*10^3
33 Vo1=Ic1*Rc1
34 Av1=Vo1/Vi
35 //to find current gain of replaced transistor
36 //given
37 Vc1=9
38 Vrc=Vcc-Vc1
39 Ic3=Vrc/Rc
40 beta1=Ic3/Ib
41 printf(" collector voltage \n%f volt \n",Vc)
42 printf(" Voltage gain for vi=50mv \n%f\n",Av)
43 printf(" Vce if Vbe=0.73 is \n%f volt\n",Vce)
44 printf(" Voltage gain when Rc=6.8k \n%f Volt\n",Av1)
45 printf(" current gain of replaced transistor \n%f\n",
        beta1)

```

---

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

```

1 clc
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)

```

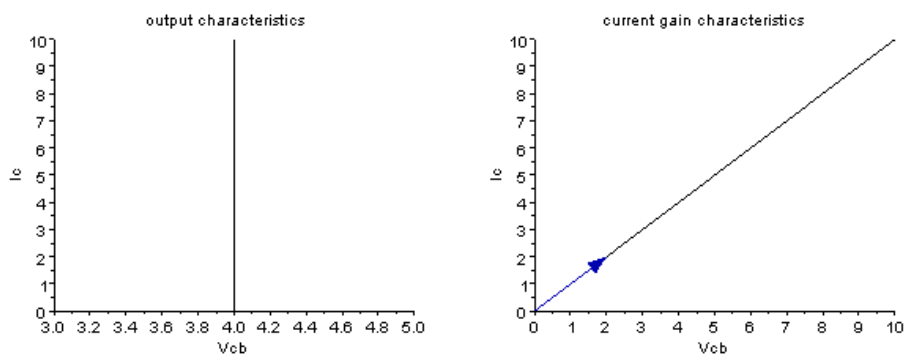


Figure 3.1: Obtain the CE current gain and output characteristics

```

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
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]

```

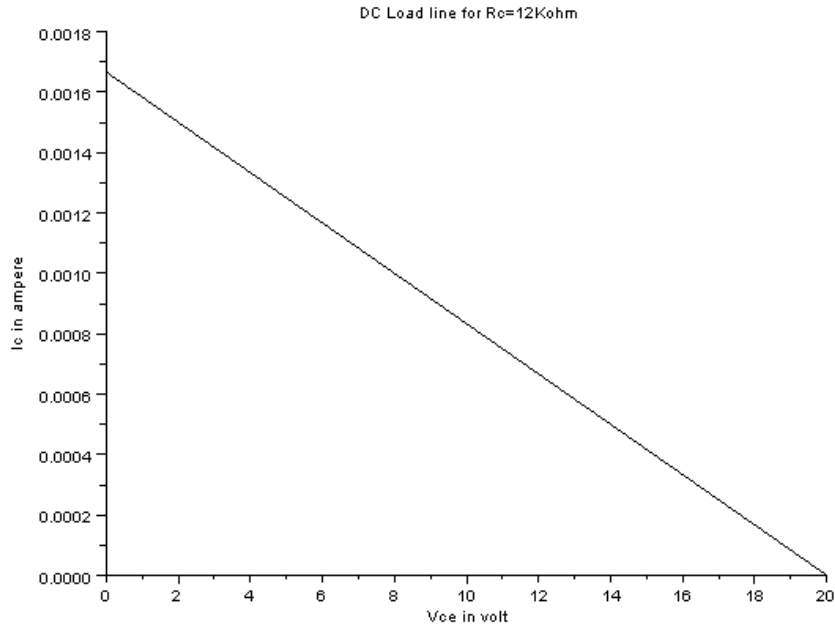


Figure 3.2: For the circuit given draw a DC load line

```

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

```

1 clc
2 disp("Example 3.50")
3 printf("\n")
4 disp("Draw a DC load line for the base bias circuit")

```

```

    )
5  printf(" Given\n")
6  //given
7  Rc=2.2*10^3
8  Rb=470*10^3
9  Vcc=18
10 Vbe=0.7
11 hFE=100
12 //find the Ib
13 Ib=(Vcc-Vbe)/Rb // from circuit
14 //find the Ic
15 Icq=hFE*Ib
16 //find the Vceq
17 Vceq=Vcc-(Icq*Rc)
18 //to draw Dc load line
19 Ic1=Vcc/Rc
20 Vce1=Vcc
21 Vce=[Vcc Vceq 0]
22 Ic=[0 Icq Ic1]
23 printf("Q(%f,%f)\n",Vceq,Icq)
24 plot2d(Vce, Ic)
25 xlabel("Vce in volt")
26 ylabel("Ic in Ampere")
27 xtitle("DC load line for base bias circuit")

```

---

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

```

1  clc
2  disp(" Example 3.51")
3  printf("\n")
4  disp("Draw a DC load line for the base bias circuit
      for different hFE")
5  printf(" Given\n")

```

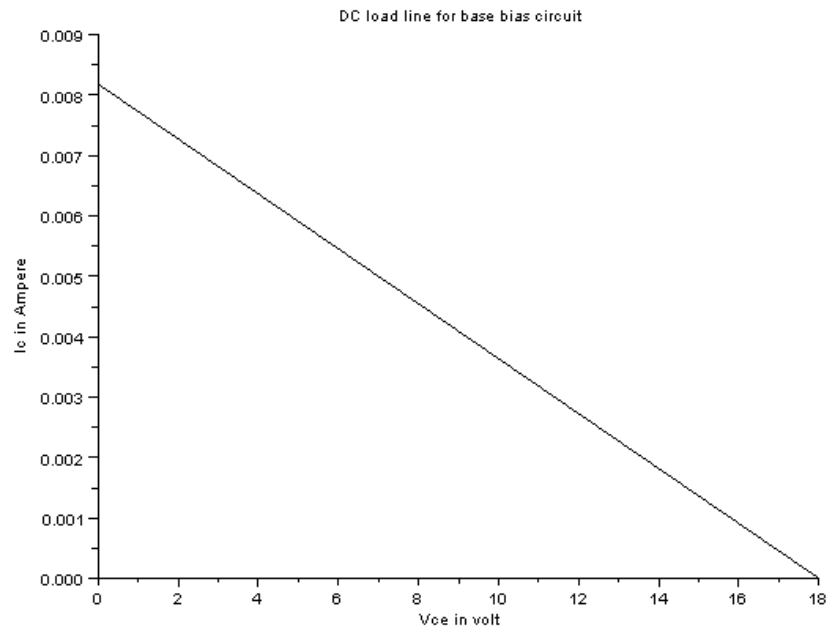


Figure 3.3: Draw a DC load line for the base bias circuit

```

6 //given
7 Rc=2.2*10^3
8 Rb=470*10^3
9 Vcc=18
10 Vbe=0.7
11 hFE1=50
12 hFE2=200
13 //find the Ib
14 Ib=(Vcc-Vbe)/Rb // from circuit
15 //find the Ic for hFE1
16 Icq1=hFE1*Ib
17 //find the Vceq1
18 Vceq1=Vcc-(Icq1*Rc)
19 //find the Ic for hFE2
20 Icq2=hFE2*Ib
21 //find the Vceq2
22 Vceq2=Vcc-(Icq2*Rc)
23 //to draw Dc load line
24 Ic1=Vcc/Rc
25 Vce1=Vcc
26 Vce=[Vcc Vceq1 Vceq2 0]
27 Ic=[0 Icq1 Icq2 Ic1]
28 printf("Q1(%f volt ,%f ampere)\n",Vceq1,Icq1)
29 printf("Q2(%f volt ,%f ampere)\n",Vceq2,Icq2)
30 plot2d(Vce, Ic)
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 c

```

1 clc
2 disp(" Example 3.52")

```

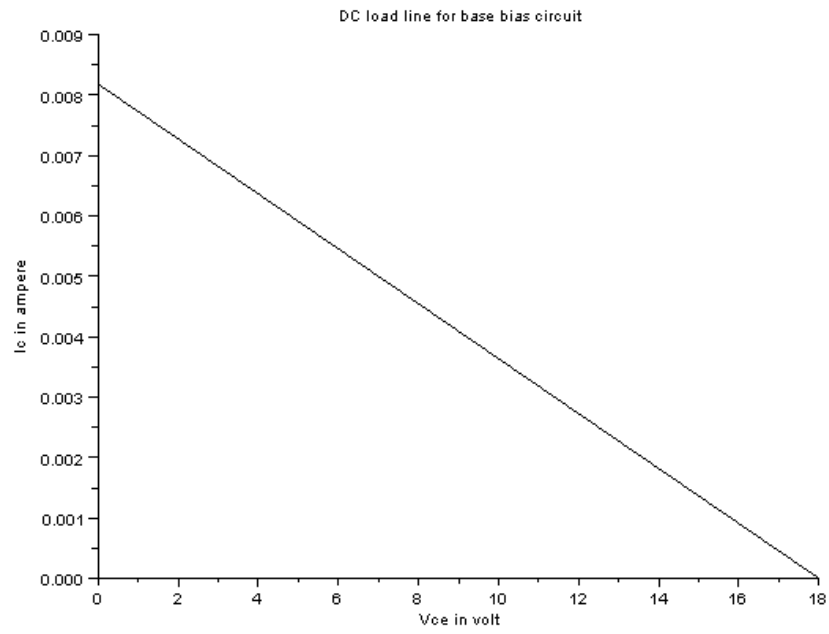


Figure 3.4: Draw a DC load line for the base bias circuit for different  $h_{FE}$



```

3 printf("\n")
4 disp(" Find Ic & Vce. Draw a DC load line for the
      base bias circuit")
5 printf("Given\n")
6 //given
7 betadc=100
8 Vbe=0.7
9 Rc=10^3
10 Rb=10^5
11 Vb=5
12 Vc=10
13 //to find Ib
14 Ib=(Vb-Vbe)/Rb //from circuit
15 //Ic value
16 Icq=betadc*Ib
17 //Vce value
18 Vceq=Vc-(Icq*Rc)
19 //to draw DC load line
20 Ic1=Vc/Rc
21 Vce1=Vc
22 Vce=[Vc Vceq 0]
23 Ic=[0 Icq Ic1]
24 printf("Q(%f volt ,%f ampere)\n",Vceq,Icq)
25 plot2d(Vce, Ic)
26 xlabel("Vce in volt")
27 ylabel("Ic in ampere")
28 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 c

```

1 clc
2 disp("Example 3.53")
3 printf("\n")

```

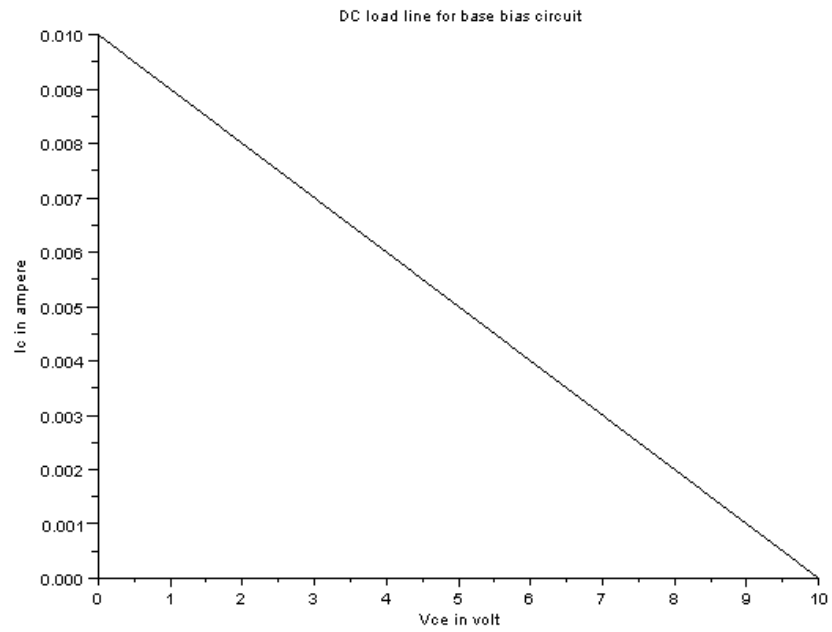


Figure 3.5: Find  $I_c$  and  $V_{ce}$  and Draw a DC load line for the base bias circuit

```

4 disp(" Find Ic & Vce. Draw a DC load line for the
      base bias circuit")
5 printf(" Given\n")
6 //given
7 betadc=50
8 Vbe=0.7
9 Rc=2.2*10^3
10 Rb=240*10^3
11 Vc=12
12 //to find Ib
13 Ib=(Vc-Vbe)/Rb //from circuit
14 //Ic value
15 Icq=betadc*Ib
16 //Vce value
17 Vceq=Vc-(Icq*Rc)
18 //to draw DC load line
19 Ic1=Vc/Rc
20 Vce1=Vc
21 Vce=[Vc Vceq 0]
22 Ic=[0 Icq Ic1]
23 printf("Q(%f volt ,%f ampere)\n",Vceq,Icq)
24 plot2d(Vce, Ic)
25 xlabel("Vce in volt")
26 ylabel("Ic in ampere")
27 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  $V_{be}$

```

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

```

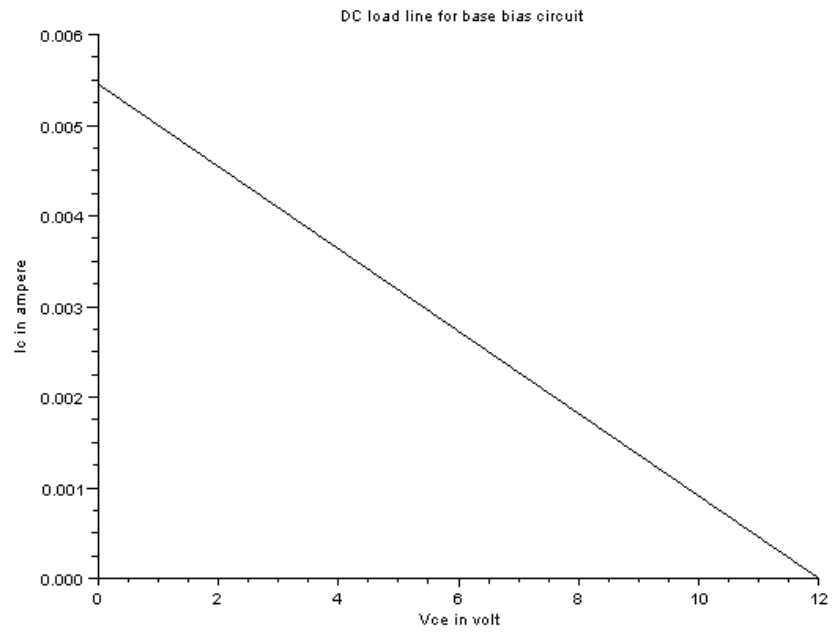


Figure 3.6: Find  $I_c$  and  $V_{ce}$  and Draw a DC load line for the base bias circuit

```

5 printf(" Given\n")
6 //given
7 betadc=100
8 Rc=5*10^3
9 Rb=1.5*10^6
10 Vc=30
11 //to find Ib
12 Ib=Vc/Rb //from circuit
13 //Ic value
14 Icq=betadc*Ib
15 //Vce value
16 Vceq=Vc-(Icq*Rc)
17 //to draw DC load line
18 Ic1=Vc/Rc
19 Vce1=Vc
20 Vce=[Vc 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 3.3.55** Calculate transistor hFE and new Vce level for hFE is 100 o

```

1 clc
2 disp(" Example 3.55")
3 printf("\n")
4 disp(" Calculate transistor hFE & new Vce level
      for hFE=100 of base bias circuit")
5 printf(" Given\n")
6 //given
7 Vcc=24

```

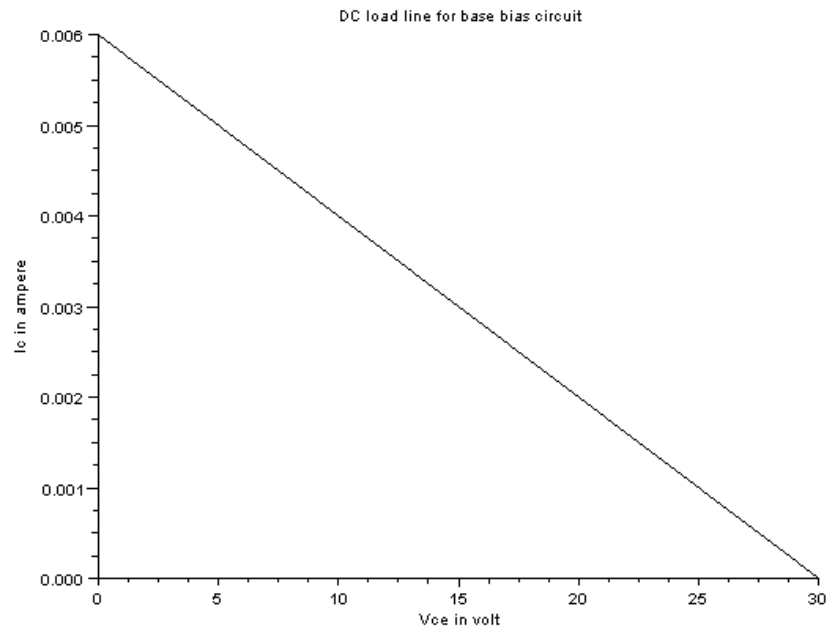


Figure 3.7: Draw a DC load line for the base bias circuit neglecting  $V_{be}$

```

8 Rb=390*10^3
9 Rc=3.3*10^3
10 Vce=10
11 //Find Ic
12 Ic=(Vcc-Vce)/Rc //from circuit
13 //find Ib
14 Ib=(Vcc-Vce)/Rb //from circuit
15 //the value of hFE
16 hFE=Ic/Ib
17 //to find Vce when hFE=100
18 hFE1=100
19 Ic1=hFE1*Ib
20 Vce1=Vcc-(Ic1*Rc)
21 printf("Value of hFE is \n%f\n",hFE)
22 printf("New value of Vce is \n%f volt\n",Vce1)

```

---

Scilab code Exa 3.3.57 Design a Base bias circuit

```

1 clc
2 disp("Example 3.57")
3 printf("\n")
4 disp("Design a Base bias circuit")
5 printf("Given\n")
6 //given
7 Vce=5
8 Ic=5*10^-3
9 Vcc=15
10 hFE=100
11 //Value of Rc
12 Rc=(Vcc-Vce)/Ic
13 Ib=Ic/hFE
14 //value of Rb
15 Vbe=0.7
16 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  $R_c$  for base bias circuit

```
1 clc
2 disp("Example 3.58")
3 printf("\n")
4 disp("Draw the DC load line & determine  $R_c$  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  $R_c$ 
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
2 disp("Example 3.59")
```



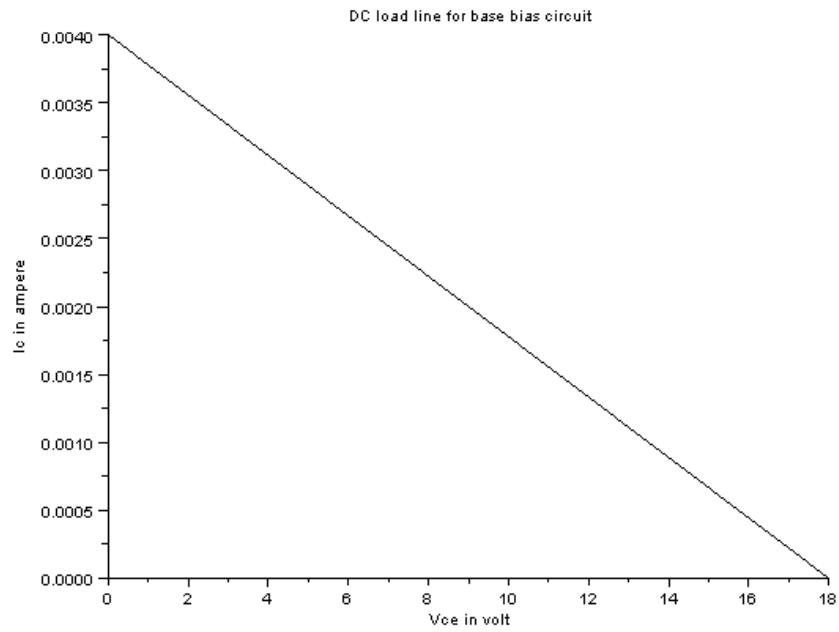


Figure 3.8: Draw the DC load line and determine  $R_c$  for base bias circuit

```

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  $I_c$  and  $V_{ce}$  levels and draw DC load line for C

```

1 clc
2 disp(" Example 3.61")
3 printf("\n")
4 disp(" Determine the  $I_c$  &  $V_{ce}$  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
15 hFE=((Vcc-Vbe)/(Ib*Rc))-(Rb/Rc)-1
16 //to find Vce for hFE=50
17 hFE1=50

```

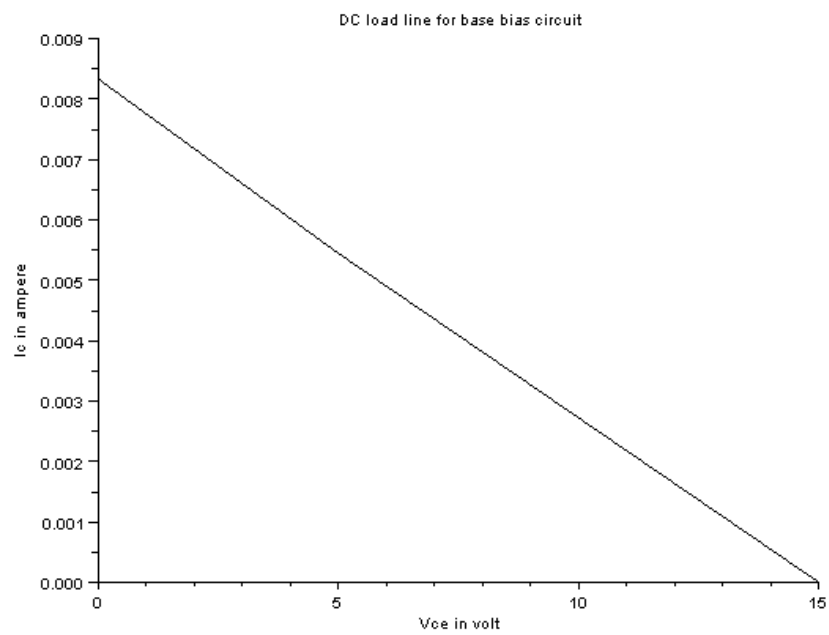


Figure 3.9: Determine the  $I_c$  and  $V_{ce}$  levels and draw DC load line for Collector to base bias

```

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

```

---

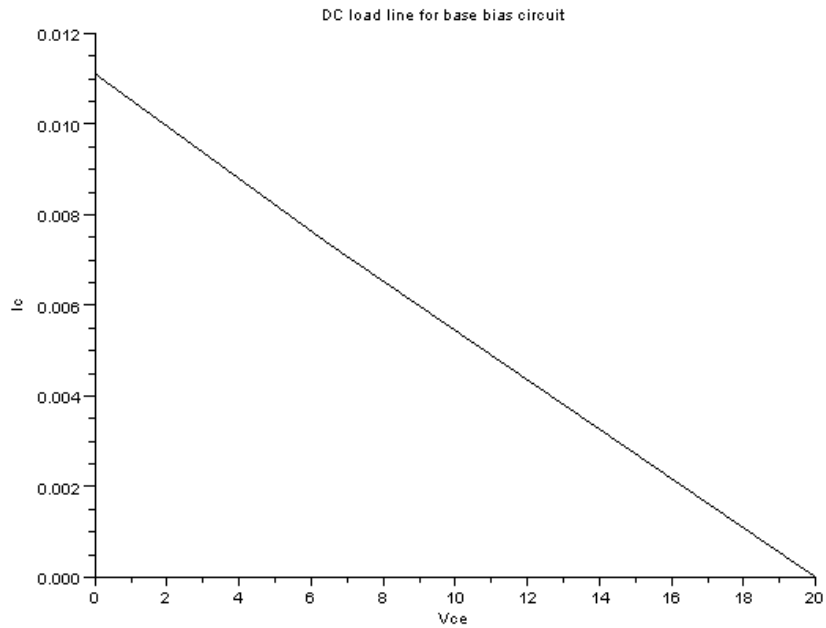


Figure 3.10: Draw a DC load line for Collector to base bias

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

```

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")
5  printf("Given\n")
6  //given
7  Vcc=18

```

```

8 Vbe=0.7
9 hFE1=50
10 hFE2=200
11 Rc=2.2*10^3
12 Rb=270*10^3
13 //for hFE=50
14 //base current
15 Ib1=(Vcc-Vbe)/(Rb+(1+hFE1)*Rc)
16 //collector current
17 Icq1=hFE1*Ib1
18 //to find Vce
19 Vceq1=(Ib1*Rb)+Vbe
20 //for hFE=200
21 //base current
22 Ib2=(Vcc-Vbe)/(Rb+(1+hFE2)*Rc)
23 //collector current
24 Icq2=hFE2*Ib2
25 //to find Vce
26 Vceq2=(Ib2*Rb)+Vbe
27 //to draw DC load line
28 Ic1=Vcc/Rc
29 Vce=[Vcc Vceq1 Vceq2 0]
30 Ic=[0 Icq1 Icq2 Ic1]
31 printf("Q1(%f volt ,%f ampere)\n",Vceq1,Icq1)
32 printf("Q2(%f volt ,%f ampere)\n",Vceq2,Icq2)
33 plot2d(Vce, Ic)
34 xlabel("Vce in volt")
35 ylabel("Ic in ampere")
36 xtitle("DC load line for base bias circuit")

```

---

Scilab code Exa 3.3.66 Design a Collector to base bias circuit

```
1 clc
```

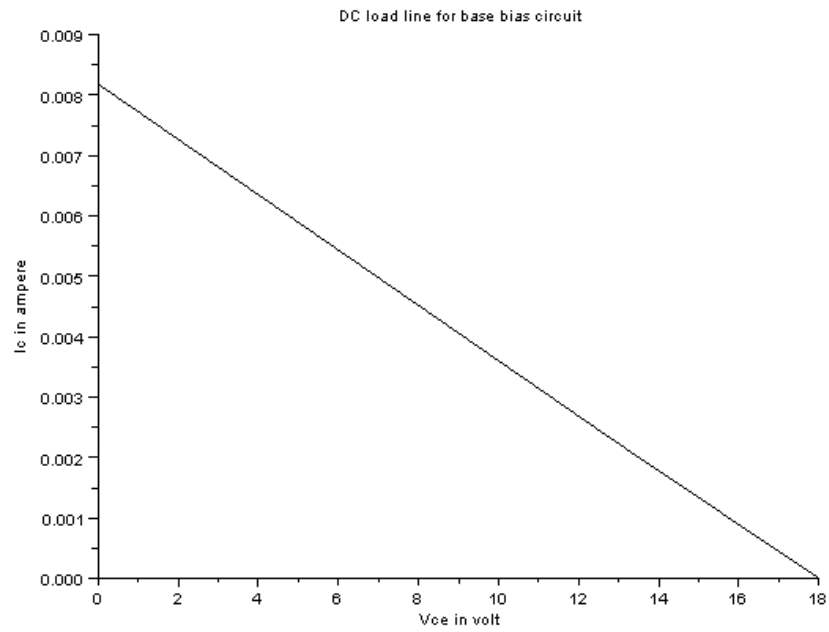


Figure 3.11: Draw a DC load line for Collector to base bias for different  $h_{FE}$



```

2 disp("Example 3.66")
3 printf("\n")
4 disp("Design a Collector to base bias circuit")
5 printf("Given\n")
6 //Given
7 Vce=5
8 Ic=5*10^-3
9 Vbe=0.7
10 Vcc=15
11 hFE=100
12 //base current
13 Ib=Ic/hFE
14 //collector resistance
15 Rc=(Vcc-Vce)/(Ic+Ib)
16 //base resistance
17 Rb=(Vce-Vbe)/Ib
18 printf("base current %f ampere \n",Ib)
19 printf("Collector resistance %f ohm \n",Rc)
20 printf("base resistance %f ohm \n",Rb)

```

---

**Scilab code Exa 3.3.67** Design a Collector to base bias circuit

```

1 clc
2 disp("Example 3.67")
3 printf("\n")
4 disp("Design a Collector to base bias circuit")
5 printf("Given\n")
6 //Given
7 Vce=10
8 Ic=3*10^-3
9 Vbe=0.7
10 Vcc=25
11 hFE=80
12 //base current
13 Ib=Ic/hFE

```

```

14 //collector resistance
15 Rc=(Vcc-Vce)/(Ic+Ib)
16 //base current
17 Rb=(Vce-Vbe)/Ib
18 printf("base current %f ampere \n",Ib)
19 printf("Collector resistance %f ohm \n",Rc)
20 printf("base resistance %f ohm \n",Rb)

```

---

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

```

1 clc
2 disp("Example 3.68")
3 printf("\n")
4 disp("Calculate required base resistance for
      Collector to base bias circuit")
5 printf("Given\n")
6 //given
7 Vcc=30
8 Vce=7
9 Vbe=0.7
10 Rc=8.2*10^3
11 hFE=100
12 //base current
13 Ib=(Vcc-Vce)/(Rc*(1+hFE))
14 //base resistance
15 Rb=(Vce-Vbe)/Ib
16 printf("base resistance is \n%f ohm\n",Rb)

```

---

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

```

1 clc
2 disp("Example 3.72")
3 printf("\n")

```

```

4 disp("Draw a DC load line for Voltage divider
      circuit")
5 printf(" Given\n")
6 //given
7 Vcc=15
8 Rc=2.7*10^3
9 Re=2.2*10^3
10 R1=22*10^3
11 R2=12*10^3
12 Vbe=0.7
13 //base voltage
14 Vb=(Vcc*R2)/(R1+R2)
15 //emitter voltage
16 Ve=Vb-Vbe
17 //emitter current
18 Ie=Ve/Re
19 //collector current
20 Icq=Ie
21 //collector to emitter voltage
22 Vceq=Vcc-(Icq*(Rc+Re));
23 Vce=[Vcc Vceq 0];
24 //collector voltage
25 Vc=Vce+Ve
26 //to draw DC load line
27 Ic1=Vcc/(Rc+Re)
28 Ic=[0 Icq Ic1]
29 printf("Q(%f volt ,%f ampere)\n",Vceq,Icq)
30 plot2d(Vce, Ic)
31 xlabel("Vce in volt")
32 ylabel("Ic in ampere")
33 xtitle("DC load line for base bias circuit")

```

---

Scilab code Exa 3.3.73 Find the  $V_e$   $I_c$   $V_{ce}$  and  $V_c$  and Draw a DC load line for Volta

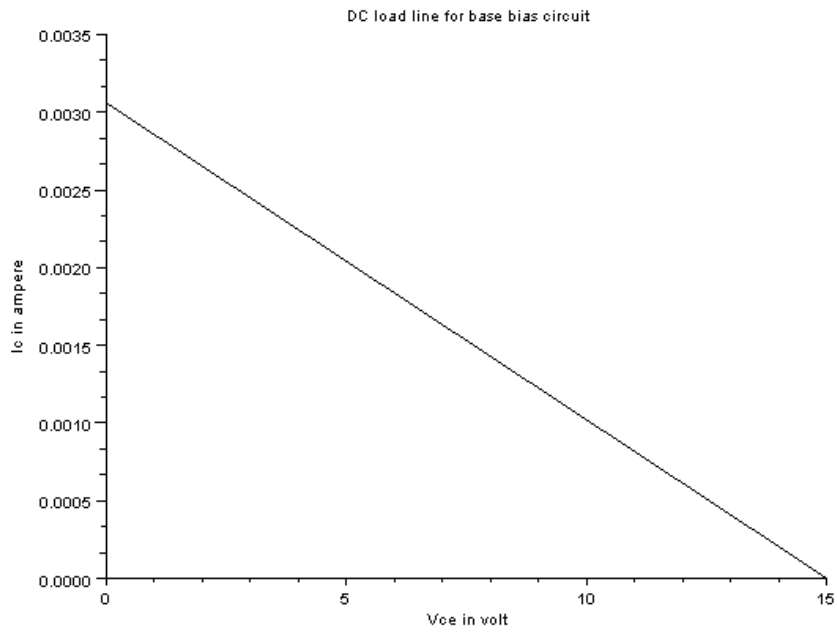


Figure 3.12: Draw a DC load line for Voltage divider circuit

```

1  clc
2  disp(" Example 3.73")
3  printf("\n")
4  disp(" Find the  $V_e$ ,  $I_c$ ,  $V_{ce}$  &  $V_c$ . Draw a DC load
      line for Voltage divider circuit")
5  printf(" Given\n")
6  //given
7  Vcc=18
8  Vbe=0.7
9  hFE=50
10 R1=33*10^3
11 R2=12*10^3
12 Rc=1.2*10^3
13 Re=10^3
14 //thevenin voltage
15 Vt=(Vcc*R2)/(R1+R2)
16 //thevenin resistance
17 Rt=(R1*R2)/(R1+R2)
18 //base current
19 Ib=(Vt-Vbe)/(Rt+(1+hFE)*Re)
20 //collector current
21 Icq=hFE*Ib
22 //emitter current
23 Ie=Ib+Icq
24 //emitter voltage
25 Ve=Ie*Re
26 //collector to emitter voltage
27 Vceq=Vcc-(Icq*Rc)-(Ie*Re);
28 Vce=[Vcc Vceq 0];
29 //collector voltage
30 Vc=Vce+Ve
31 //to draw DC load line
32 Ic1=Vcc/(Rc+Re)
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")

```

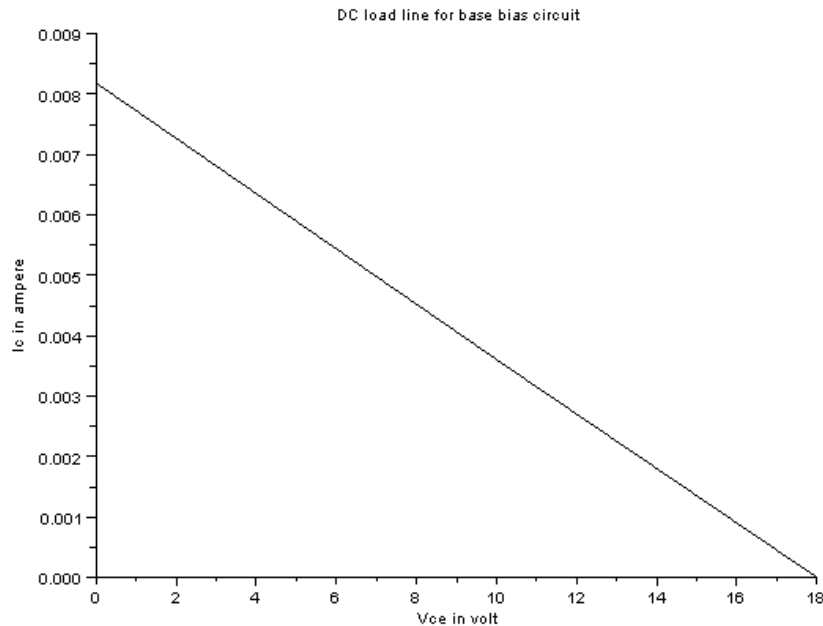


Figure 3.13: Find the  $V_e$ ,  $I_c$ ,  $V_{ce}$  and  $V_c$  and Draw a DC load line for Voltage divider circuit

```
38 xtitle("DC load line for base bias circuit")
```

---

**Scilab code Exa 3.3.74** Find the  $V_e$ ,  $I_c$ ,  $V_{ce}$  and  $V_c$  and Draw a DC load line for Voltage divider circuit

```
1 clc
2 disp(" Example 3.74")
3 printf("\n")
4 disp(" Find the  $V_e$ ,  $I_c$ ,  $V_{ce}$  &  $V_c$ . Draw a DC load
   line for Voltage divider circuit")
5 printf(" Given\n")
```

```

6 //given
7 Vcc=15
8 Vbe=0.7
9 hFE=50
10 R1=6.8*10^3
11 R2=3.3*10^3
12 Rc=0.9*10^3
13 Re=0.9*10^3
14 //thevenin voltage
15 Vt=(Vcc*R2)/(R1+R2)
16 //thevenin resistance
17 Rt=(R1*R2)/(R1+R2)
18 //base current
19 Ib=(Vt-Vbe)/(Rt+(1+hFE)*Re)
20 //collector current
21 Icq=hFE*Ib
22 //emitter current
23 Ie=Ib+Icq
24 //emitter voltage
25 Ve=Ie*Re
26 //collector to emitter voltage
27 Vceq=Vcc-(Icq*Rc)-(Ie*Re);
28 Vce=[Vcc Vceq 0];
29 //collector voltage
30 Vc=Vce+Ve
31 //to draw DC load line
32 Ic1=Vcc/(Rc+Re)
33 Ic=[0 Icq Ic1]
34 printf("Q(%f,%f)\n",Vceq,Icq)
35 plot2d(Vce, Ic)
36 xlabel("Vce")
37 ylabel("Ic")
38 xtitle("DC load line for base bias circuit")

```

---

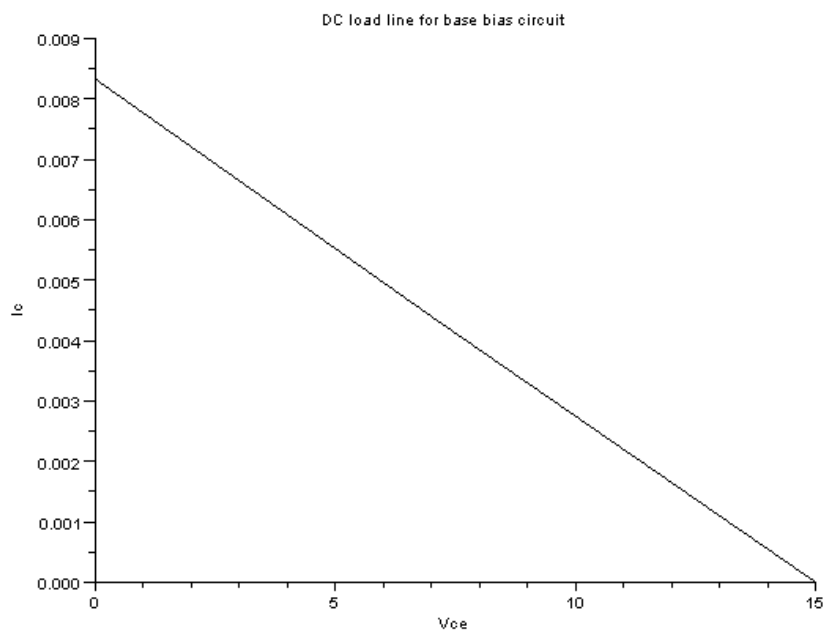


Figure 3.14: Find the  $V_e$   $I_c$   $V_{ce}$  and  $V_c$  and Draw a DC load line for Voltage divider circuit



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

```

1 clc
2 disp("Example 3.79")
3 printf("\n")
4 disp("Calculate the suitable resistor values for
Voltage divider bias circuit")

```

```

5 printf(" Given\n")
6 printf("1 Resistance are in ohms \n2 Current are in
    ampere \n3 voltage sources are in volt")
7 //given
8 Vcc=20
9 Vce=8
10 hFE=80
11 Vbe=0.7
12 Rc=6*10^3
13 //select Ve
14 Ve=5
15 //find collector resistor
16 Ic=(Vcc-Vce-Ve)/Rc
17 //find I2
18 I2=Ic/10
19 //emitter resistance
20 Re=Ve/Ic
21 //base voltage
22 Vb=Vbe+Ve
23 //resistance R1
24 R1=(Vcc-Vb)/I2
25 //resistance R2
26 R2=Vb/I2
27 printf(" Collector resistance %f ohm \n",Rc)
28 printf(" emitter resistance %f ohm \n",Re)
29 printf(" base voltage %f volt \n",Vb)
30 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  $I_c$  for increase in

```

1 clc
2 disp(" Example 3.85")
3 printf("\n")
4 disp(" Find the stability factor & change in  $I_c$  for

```

```

        increase in temperature of base bias circuit")
5  printf("Given\n")
6  //given
7  hFE=100
8  Rc=2.2*10^3
9  Rb=470*10^3
10 Icbo1=15*10^-9
11 T1=25
12 T2=105
13 //stability factor
14 S=1+hFE
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 is \n%f\n",S)
22 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  $I_c$  for increase in

```

1  clc
2  disp("Example 3.86")
3  printf("\n")
4  disp("Find the stability factor & change in Ic for
    increase in temperature of collector to base bias
    circuit")
5  printf("Given\n")
6  //given
7  hFE=100
8  Rc=2.2*10^3
9  Rb=270*10^3

```

```

10 Icbo1=15*10^-9
11 T1=25
12 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

```

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  $I_c$  produced by effect of  $V_{be}$  change

```

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  $I_c$  produced by effect of  $V_{be}$  change

```
1  clc
2  disp("Example 3.90")
3  printf("\n")
4  disp("Calculate the change in  $I_c$  produced by effect
      of  $V_{be}$  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  $V_{be}$ 
13 delVbe=delT*(-1.8*10^-3) //change in  $V_{be}$  for 1C
      raise in temperature=-1.8mV/C
14 //change in  $I_c$ 
15 delIc=-delVbe/Re
16 printf("The change in  $I_C$  is \n%f ampere\n",delIc)
```

---

# Chapter 4

## Other Devices

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

```
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 vol

```

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")
5 printf("Given\n")
6 //gate trigger voltage
7 Vgt=0.75
8 //load voltage maximum

```

```

9 VLmax=12
10 //Zener voltage is
11 Vz=VLmax-Vgt
12 //assume zener current(mini) as
13 Izmin=10^-3
14 R=Vgt/Izmin
15 printf("zener voltage \n%f volt\n",Vz)
16 printf("Resistance \n%f ohm\n",R)

```

---

**Scilab code Exa 4.4.41** Design the SCR crowbar circuit to protect the load from vol

```

1 clc
2 disp("Example 4.41")
3 printf("\n")
4 disp("Design the SCR crowbar circuit to protect the
      load from voltage levels greater than 7.5V")
5 printf("Given\n")
6 //gate trigger voltage
7 Vgt=0.7
8 //load voltage maximum
9 VLmax=7.5
10 //Zener voltage is
11 Vz=VLmax-Vgt
12 //assume zener current(mini) as
13 Izmin=10^-3
14 R=Vgt/Izmin
15 printf("zener voltage \n%f volt\n",Vz)
16 printf("Resistance \n%f ohm\n",R)

```

---

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

```

1 clc
2 disp("Example 4.49")

```

```

3 printf("\n")
4 disp("Determine the minimum & maximum triggering
      voltage for a UJT")
5 printf("Given\n")
6 Vbb=20
7 //intrinsic ratios
8 nmin=0.6
9 nmax=0.8
10 Vd=0.7
11 //minimum triggering voltage is
12 Vpmini=nmin*Vbb+Vd
13 //maximum 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 4.4.51** find maximum oscillating frequency of UJT

```

1 clc
2 disp("Example 4.51")
3 printf("\n")
4 disp("Calculate minimum & maximum values of Re for
      the relaxation oscillator & also find maximum
      oscillating frequency")
5 printf("Given\n")
6 Vbb=15
7 //the parameters of UJT
8 Ip=10^-6
9 Iv=2.5*10^-3
10 Vv=2.5
11 n=0.7
12 PRe=20*10^3
13 C=10^-6

```

```

14 Vp=12
15 Vd=0.7
16 Vp1=(n*Vbb)+Vd
17 //minimum Re
18 Remin=(Vbb-Vv)/Iv
19 //maximum Re
20 Remax=(Vbb-Vp1)/Ip
21 //to find maximum oscillating frequency
22 T=Pre*C*log((Vbb-Vv)/(Vbb-Vp))
23 f=1/T
24 printf("maximum Re \n%f ohm\n",Remax)
25 printf("minimum Re \n%f ohm\n",Remin)
26 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

```

1 clc
2 disp("Example 4.52")
3 printf("\n")
4 disp("Determine the minimum & maximum values of VEB1
      for a UJT")
5 printf("Given\n")
6 Vbb=15
7 //intrinsic ratios
8 nmin=0.68
9 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

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

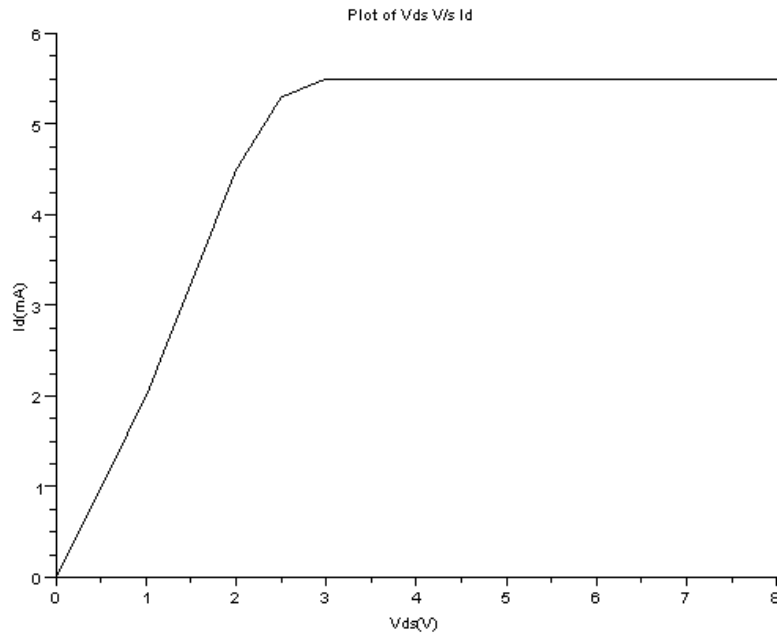


Figure 4.1: plot the drain characteristics of JFET

```

9 xlabel("Vds(V)")
10 ylabel("Id(mA)")
11 xtitle("Plot of Vds V/s Id")

```

---

**Scilab code Exa 4.4.77** calculate V<sub>ds</sub> at these gate source voltages and circuit vol

```

1 clc
2 disp("Example 4.77")
3 printf("\n")
4 disp("calculate Vds at these gate_source voltages &
      circuit voltage gain of JFET")

```



```

5 printf(" Given\n")
6 //drain current
7 Id=9*10^-3
8 //gate to source voltage
9 Vgs=(-2)
10 //when Vgs is reduced to -1V then Id is 12mA
11 Vgs1=-1
12 Id1=12*10^-3
13 //from circuit (fig 4.49)
14 Rd=1.5*10^3
15 Vdd=20
16 //to find Vds
17 //when Vgs=-2
18 Vds=Vdd-(Id*Rd)
19 //when Vgs=-1
20 Vds1=Vdd-(Id1*Rd)
21 //change in input voltage Vgs is
22 delVi=Vgs1-Vgs
23 //change in output voltage is
24 delVo=Vds-Vds1
25 //Voltage gain
26 Av=delVo/delVi
27 printf("The value of Vds at gate-source voltages is
        \n%f volt\n",Vds)
28 printf("The circuit voltage gain \n%f\n",Av)

```

---

Scilab code Exa 4.4.78 calculate the minimum and maximum variation in Vds and circ

```

1 clc
2 disp(" Example 4.78")
3 printf("\n")
4 disp(" calculate the minimum & maximum variation in
        the drain source voltage Vds produced by a change
        of 0.1V & circuit voltage gain of JFET")
5 printf(" Given\n")

```

```

6 //transconductance
7 gmmax=5000*10^-6
8 gmmin=1500*10^-6
9 //change in gate to source voltage
10 delVgs=0.1
11 Rd=1.5*10^3
12 //the maximum change in drain current
13 delIdmax=gmmax*delVgs
14 delVdsmax=delIdmax*Rd
15 //voltage gain
16 Av1=delVdsmax/delVgs
17 //the minimum change in drain current
18 delIdmin=gmmin*delVgs
19 delVdsmin=delIdmin*Rd
20 //voltage gain
21 Av2=delVdsmin/delVgs
22 printf("maximum change in drain voltage is %f volt\n
    ",delVdsmax)
23 printf("maximum voltage gain %f \n",Av1)
24 printf("minimum change in drain voltage is %f volt\n
    ",delVdsmin)
25 printf("minimum voltage gain %f \n",Av2)

```

---

**Scilab code Exa 4.4.79** calculate transconductance of JFET

```

1 clc
2 disp("Example 4.79")
3 printf("\n")
4 disp("calculate transconductance of JFET")
5 printf("Given\n")
6 //voltage gain
7 Av=20
8 //drain resistance
9 Rd=3.3*10^3
10 //transconductance

```

```
11 gm=Av/Rd
12 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

```
1 clc
2 disp("Example 4.80")
3 printf("\n")
4 disp("determine the suitable value of load resistor
      Rd of JFET")
5 printf("Given\n")
6 //voltage gain
7 Av=10
8 //transconductance
9 gm=4500*10^-6
10 //load resistance
11 Rd=Av/gm
12 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

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

---

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

```
1 clc
2 disp("Example 5.4")
```

```

3 printf("\n")
4 disp(" Calculate output power change in decibel of
      amplifier")
5 printf(" Given\n")
6 //output voltage of amplifier when frequency 3khz
7 V1=2
8 //output voltage of amplifier when frequency 50khz
9 V2=0.5
10 //output power change in decibel
11 delPo=20*log10(V2/V1)
12 printf("output power change \n%f dB\n",delPo)

```

---

**Scilab code Exa 5.5.5** Calculate power gain of amplifier

```

1 clc
2 disp(" Example 5.5")
3 printf("\n")
4 disp(" Calculate power gain of amplifier")
5 printf(" Given\n")
6 //have equal input & load resistance
7 //input voltage
8 Vi=100*10^-3
9 //output voltage
10 Vo=3
11 //power gain of amplifier
12 Apdb=20*log10(Vo/Vi)
13 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

```

1 clc
2 disp(" Example 5.6")
3 printf("\n")

```

```

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

```

---

**Scilab code Exa 5.5.10** Calculate overall voltage gain and output voltage when input

```

1 clc
2 disp(" Example 5.10")
3 printf("\n")
4 disp(" Calculate overall voltage gain in db & output
      voltage when input voltage is 1uV for cascaded
      amplifier")
5 printf(" Given\n")
6 //Voltage gain of amplifier
7 Av1=10
8 Av2=100
9 Av3=1000
10 //input voltage
11 Vi=10^-6
12 //overall voltage gain
13 Av=Av1*Av2*Av3
14 //in db
15 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 am

```
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 stag

```
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*103
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*103
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

```

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 amplif

```
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 Ac1=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 Ac11=Av2/(1+(B*Av2))
17 //voltage gain with feedback when Av changed by -50%
18 Av3=Av-Av1
19 Ac12=Av3/(1+(B*Av3))
20 printf("closed loop gain of negative feedback
      amplifier is \n %f \n",Ac12)
```

---

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

```
1 clc
2 disp(" Example 5.24")
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=1000
8 //feedback factor
9 B=0.1
10 //voltage gain with feedback
11 Acl=Av/(1+(B*Av))
12 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

```

1 clc
2 disp(" Example 5.27")
3 printf("\n")
4 disp(" calculate input 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=100000
10 //feedback network resistance
11 RF1=56*10^3
12 RF2=560
13 //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
18 Rp=(R1*R2)/(R1+R2)
19 Zin=(Zi*Rp)/(Zi+Rp)
20 //output impedance without feedback
21 Zc=50*10^3
22 Rc=3.9*10^3
23 //output impedance with feedback
24 Zo=Zc/(1+(B*Av))
25 //output impedance with feedback by considering Rc
26 Zout=(Rc*Zo)/(Rc+Zo)
27 printf("input impedance with negative feedback \n%f

```

```

    ohm\n",Zin)
28 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

```

1  clc
2  disp("Example 5.35")
3  printf("\n")
4  disp("Estimate the closed loop upper cut-off
    frequency & total harmonic distortion")
5  printf("Given\n")
6  //open loop gain
7  Av=60000
8  //closed loop gain
9  Ac1=300
10 //open loop upper cut-off frequency
11 F20L=15*10^3
12 //closed loop upper cut-off frequency & Av/Ac1=(1+
    BA_v)
13 F2CL=F20L*Av/Ac1
14 //total harmonic distortion with feedback if there
    is 10% distortion without feedback
15 HD=10/(Av/Ac1)
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

```

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 Ac1=250
10 //upper cut-off frequency with feedback
11 F2CL=4*10^6
12 //upper cut-off frequency without feedback
13 F2OL=F2CL/(Av/Ac1)
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 Ac1=300
12 //to calculate phase shift with feedback
13 AvB=(Av/Ac1)-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",Pc1)

---

**Scilab code Exa 5.5.38** calculate bandwidth and gain and harmonic distortion with f

```
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 BWo1=500*10^3
10 //feedback factor
11 B=0.1
12 //bandwidth with feedback
13 BWc1=BWo1*(1+(B*Av))
14 //closed loop gain
15 Ac1=Av/(1+(B*Av))
16 //harmonic distortion if 15% negative feedback used
17 HDc1=15/(1+(B*Av))
18 printf("bandwidth with feedback is \n %f hz \n",BWc1
      )
19 printf("closed loop gain \n %f \n",Ac1)
20 printf("Harmonic distortion with feedback \n %f \n",
      HDc1)
```

---

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

```
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 os

```

1  clc
2  disp("Example 5.43")
3  printf("\n")
4  disp("calculate the frequency of oscillation of RC
      phase shift oscillator")
5  printf(" Given\n")
6  R=500
7  C=0.1*10^-6
8  //frequency of oscillation
9  f=1/(2*%pi*R*C*sqrt(6))
10 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 oscil

```
1 clc
2 disp(" Example 5.44")
3 printf(" \n")
4 disp(" calculate the value of Capacitor for a RC
   phase shift oscillator")
5 printf(" Given \n")
6 R=1000
7 //frequency of oscillation
8 f=5000
9 //capacitor value
10 C=1/(2*%pi*R*f*sqrt(6))
11 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

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

---

**Scilab code Exa 5.5.49** calculate frequency of oscillation and feedback factor and

```
1 clc
2 disp(" Example 5.49")
3 printf(" \n")
4 disp(" calculate frequency of oscillation ,feedback
      factor & gain required for sustained oscillation
      of hartley oscillator")
5 printf(" Given\n")
6 //inductance
7 L1=5*10^-3
8 L2=10*10^-3
9 //capacitor
10 C=0.01*10^-6
11 //frequency of oscillation
12 f=1/(2*%pi*sqrt((L1+L2)*C))
13 //feedback factor
14 B=L1/L2
15 //gain required for sustained oscillation
16 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\n
nC=\t%e farad\n",L1,L2,C)

```

---

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

```
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

```
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\n
        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("frequency 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 C

```

1 clc
2 disp("Example 5.65")
3 printf("\n")
4 disp("calculate the Series & parallel resonant
      frequencies of Crystal")
5 printf("Given\n")
6 //indutance
7 L=3
8 //Capacitor due to mechanical mounting of crystal
9 Cm=10*10^-12
10 //electrical equivalent capacitance of crystal
    compliance
11 Cs=0.05*10^-12
12 //electrical equivalent resistance of crystal
    structure internal friction
13 R=2*10^3
14 //series resonant frequency
15 fs=1/(2*%pi*sqrt(L*Cs))
16 Cp=Cm*Cs/(Cm+Cs)
17 //parallel resonant frequency
18 fp=1/(2*%pi*sqrt(L*Cp))
19 printf("series resonant frequency \n%f hz\n",fs)
20 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

```
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")
3 printf("\n")
```

```

4 disp(" calculate common mode gain & output voltage")
5 printf(" Given")
6 disp(" differential gain=500")
7 disp("CMRR=80dB,Input signal is 2*sin100*%pi*t")
8 Ad=500
9 CMRR=80
10 t=1/200
11 Vc=2*sin(100*%pi*t)
12 //calculate common mode gain
13 Ac=Ad/(10^(CMRR/20))
14 //calculate common mode output voltage
15 Vcmov=Ac*Vc
16 printf("Common mode gain =%f\n",Ac)
17 printf("Common mode output voltage =%f volt\n",Vcmov
    )

```

---

**Scilab code Exa 6.6.20** Express CMRR in dB

```

1 clc
2 disp(" Example 6.20")
3 printf("\n")
4 disp("To express CMRR in dB")
5 printf(" given")
6 disp(" Ad=10^4,Ac=0.1")
7 Ad=10^4
8 Ac=0.1
9 //to find CMMR in dB
10 CMRR=20*log10(Ad/Ac)
11 printf("CMRR in dB=%d dB",CMRR)

```

---

**Scilab code Exa 6.6.24** Calculate and sketch the output

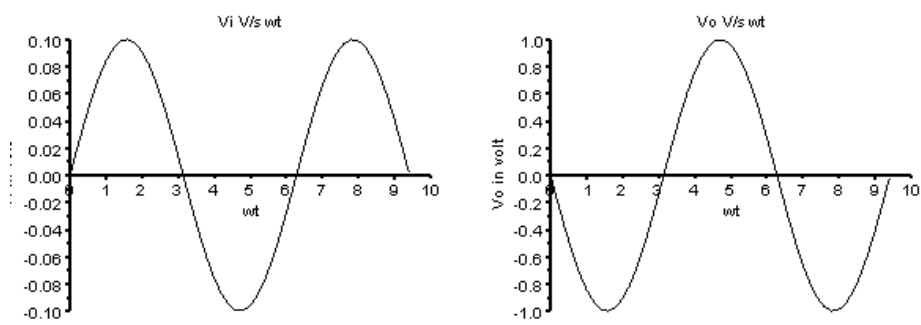


Figure 6.1: Calculate and sketch the output

```

1  clc
2  disp(" Example 6.24")
3  printf("\n")
4  disp(" calculate output voltage for inverting
        amplifier & sketch the waveform")
5  printf(" given")
6  disp(" Peak to peak input votage=200mV, Rf/R1=10")
7  Vpp=200*10^(-3)
8  Vm=Vpp/2
9  RfdivR1=10
10 wt=0:0.2:3*pi
11 Vi=Vm*sin(wt)
12 Vo=-(RfdivR1)*Vi
13 disp(Vo)
14 a= gca ();
15 subplot(221)
16 a= gca();
17 a. x_location = " origin";
18 a. y_location = " origin";
19 plot2d(wt,Vi)
20 xtitle(" Vi V/s wt", "wt", "Vi in volt")
21 a.thickness=2
22 subplot(222)
23 a= gca();
24 a. x_location = " origin";
25 a. y_location = " origin";
26 plot2d(wt,Vo)
27 xtitle(" Vo V/s wt", "wt", "Vo in volt")
28 a.thickness=2

```

---

**Scilab code Exa 6.6.25** Calculate design value of inverting amplifier

```

1  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=0.2,0.5 sin314t,-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 specifie

```

1 clc
2 disp("Example 6.27")
3 printf("\n")

```

```

4 disp(" Calculate closed loop gain & input voltage to
      get output voltage 2v")
5 printf(" given")
6 disp(" Rf=1M,R1=20K, output voltage=2V")
7 Rf=10^6
8 R1=20*10^3
9 Vo=2
10 //calculate closed loop gain
11 Af=(-Rf/R1)
12 //calculate input voltage
13 Vi=Vo/Af
14 printf("closed loop voltage gain=%f\n",Af)
15 printf("Input voltage=%f volt",Vi)

```

---

**Scilab code Exa 6.6.28** Calculate feedback resistor and closed loop gain

```

1 clc
2 disp(" Example 6.28")
3 printf("\n")
4 disp(" Calculate closed loop gain & input voltage
      to get output voltage 2v")
5 printf(" given")
6 disp(" Rf=1M,R1=20K, output voltage=2V")
7 Rf=10^6
8 R1=20*10^3
9 Vo=2
10 //calculate closed loop gain
11 Af=(-Rf/R1)
12 //calculate input voltage
13 Vi=Vo/Af
14 printf("closed loop voltage gain=%f\n",Af)
15 printf("Input voltage=%f",Vi)

```

---

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

```
1 clc
2 disp("Example 6.31")
3 printf("\n")
4 disp("calculate output voltage for given
      specification")
5 printf("given")
6 disp("Rf=360k,R1=120k,Vi=0.5,0.6 sin314t,-0.3")
7 Rf=360*10^3
8 R1=120*10^3
9 Af=1+(Rf/R1)
10 t=0 //initialise t value
11 Vi=[0.5, 0.6*cos(314*t),-0.3]
12 Vo=Af*Vi //calculate output voltage
13 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 specifie

```
1 clc
2 disp("Example 6.32")
3 printf("\n")
4 disp("Calculate Gain & input voltage")
5 printf("Given")
6 disp("Rf=100K,R1=10K")
7 Rf=100*10^3
8 R1=10^4
9 //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 vottage 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")
8  Rf=60*10^3; R1=10^4; R2=20*10^3; R3=30*10^3;
9  V1=-1; V2=-2; V3=3;
10 Vo=-[(Rf/R1)*V1+(Rf/R2)*V2+(Rf/R3)*V3]
11 printf(" The output voltage is %f volt",Vo)

```

---

**Scilab code Exa 6.6.55 Calculate bandwidth**

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

---

**Scilab code Exa 6.6.56 Calculate the design value of amplifier circuit**

```
1 clc
2 disp(" Example 6.56")
3 printf(" \n")
4 printf(" Given")
5 disp(" open loop gain is 100")
6 disp(" Gain Bandwidth Product is 1MHz")
7 Af=100
8 GBW=10^6
9 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

```

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

```

---

#### Scilab code Exa 7.7.28 Determine radiated power

```

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

```

---

#### Scilab code Exa 7.7.34 Calculate carrier power

```

1  clc
2  disp(" Example 7.34")
3  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
11 Pt=Vt^2/R
12 Pc=Vcar^2/R

```

```
13 Ma=sqrt(2*((Pt/Pc)-1))
14 printf("Modulation index =%f",Ma)
```

---

#### Scilab code Exa 7.7.38 Determine antenna current

```
1 clc
2 disp("Example 7.38")
3 printf("\n")
4 disp("Determine modulation index & Antenna current
      when MODulation index changes to 0.8")
5 printf("given\n")
6 disp("carrier current=8A, Modulated carrier current
      =8.93A")
7 Icar=8
8 It=8.93
9 //assume R=1
10 R=1
11 Pc=Icar^2*R
12 Pt=It^2*R
13 Ma=sqrt(2*((Pt/Pc)-1))
14 //Modulated carrier current when Ma changes to 8
15 Ma1=0.8
16 It1=Icar*sqrt(1+(Ma1^2/2))
17 printf("Modulation index =%f\n",Ma)
18 printf("Modulated carrier current when Ma changes to
      8 is =%f ampere",It1)
```

---

#### Scilab code Exa 7.7.39 Calculate transmission power efficiency and average power in

```
1 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")
4 disp(" sketch the frequency spectrum")
5 printf(" Given\n")

```

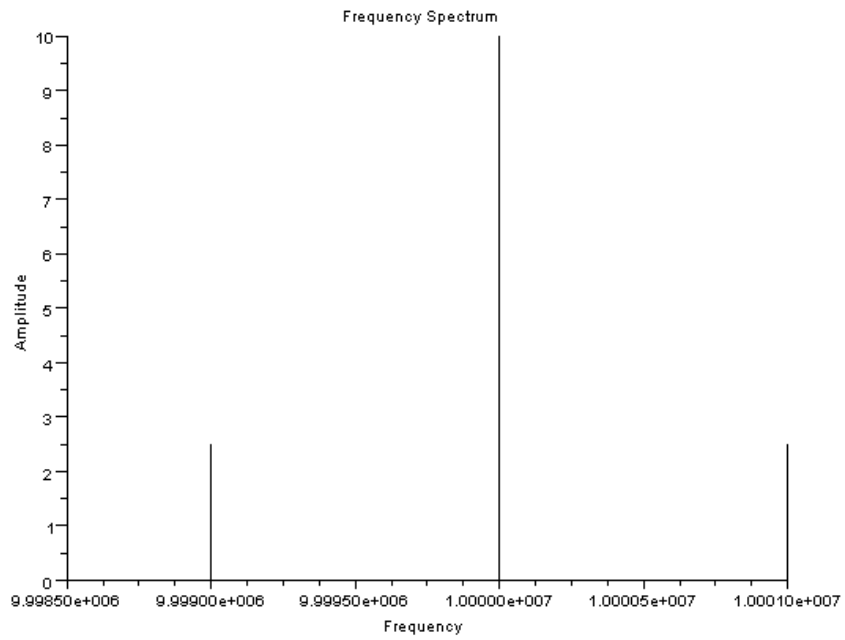


Figure 7.1: Sketch the frequency spectrum

```

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")
7  Pt=20*10^3
8  Ma=0.8

```

```

9 Pc=Pt/(1+(Ma^2/2))
10 Plsb=(Pt-Pc)/2
11 %Ps=((Pt-Plsb)/Pt)*100
12 printf("power in sideband=%f watt\n",Plsb)
13 printf("Saving in power=\n%f\n",%Ps)

```

---

**Scilab code Exa 7.7.55** Find maximum frequency deviation and modulation index

```

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

```

---

**Scilab code Exa 7.7.56** Calculate frequency deviation and modulation index

```

1 clc
2 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\

```

$n'' , V_{pp1} )$

---



# 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         //multiplying 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 //multiplying 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 //multiplying 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 //multiplying 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 //multiplying 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
8  i=1;w=1
9  oct=243

```

```

10 //separating integer part
11 IP=floor(oct)
12 IP1=IP
13 //separating decimal part
14 DP=modulo(oct,1)
15 DP1=DP
16 //converting decimal value to interger
17 p=2
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,10)
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<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 //multiplying 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 //multiplying 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 decimal numbers to Octal

```
1  clc
2  clear
3  disp("Example 8.13")
4  printf("\n")
5  disp("convert the following decimal numbers to
      Octal")
6  disp("a)283 b)847.951 c)0.728")
7  //given decimal number
8  i=1;x=1
9  dec=283
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),8))
18     IP=floor(IP)/8
19     i=i+1
20 end
21 if(IP1>0)
22 IP=0
23 for j=1:length(I)
24 //multiplying 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 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 //multiplying 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 //multiplying 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 //multiplying 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 //multiplying 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 //multiplying 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

```
1  clc
2  clear
3  disp("Example 8.15")
4  printf("\n")
5  disp("convert the following octal to binary number")
6  disp("a)724 b)365.217 c)0.506")
7  //Given binary number
8  i=1;w=1
9  bin=724
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=2
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,10)
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<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 //multiplying 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 //multiplying 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         //multiplying 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 //multiplying 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 hexadecimal numbers to decimal

```

1 clc
2 clear
3 disp(" Example 8.17")
4 printf("\n")
5 disp(" convert the following hexadecimal 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 decimal numbers to hexadecimal

```
1 clc
2 clear
3 disp("Example 8.17")
4 printf("\n")
5 disp("convert the following decimal numbers to
    hexadecimal")
6 disp("a)2146 b)843 c)2604")
7 //this program, converts only integer part to
    hexadecimal
8 dec=843
9 Hdec=dec2hex(dec);
10 printf("decimal=%s",Hdec)
```

---

Scilab code Exa 8.8.19 convert the binary numbers to hexadecimal

```
1 clc
2 clear
3 disp("Example 8.19")
4 printf("\n")
5 disp("convert the following binary numbers to
    hexadecimal")
6 disp("a)101110 b)11010 c)1011101")
7 //this program, converts only integer part to
    decimal
8 bin='101110'
9 dec=bin2dec(bin)
10 Hdec=dec2hex(dec)
11 printf("decimal=%s",Hdec)
```

---

Scilab code Exa 8.8.21 Add the binary numbers

```
1  clc
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)
```

```

31 while(DPa>0)
32     Da(w)=modulo(DPa,2)
33     DPa=(DPa/10)
34     DPa=floor(DPa)
35     w=w+1;
36 end
37 //to do zero padding of remaining erm of D(w)
38 if(DP1a<1)
39     if(DP1a>0)
40 if(length(Da)<p)
41     q=length(Da)
42     for f=q+1 :p
43         Da(f)=0
44     end
45 end
46 end
47 end
48
49 if(IP1a>0)
50 for i=1:length(Ia)//checking whether it is a binary
    number or not
51     if(Ia(i)>1) then
52         disp('not a binary number')
53         abort
54     end
55 end
56 end
57 if(IP1a>0)
58 IPa=0
59 for i=1:length(Ia)
60 //multiplying bits of integer part with their
    position values and adding
61     IPa=IPa+(Ia(i)*2^(i-1))
62 end
63 end
64 DPa=0
65 if(DP1a>0)
66     if(DP1a<1)

```

```

67 for z=1:length(Da)
68 //multiplying 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 //multiplying 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 //multiplying 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 //multiplying 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 //multiplying 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 //multiplying 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     //multiplying 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 //multiplying 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     //multiplying 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

```

```

169 for j=1:length(I)
170 //multiplying bits of integer part with their
      position values and adding
171     IP=IP+(I(j)*10^(j-1));
172 end
173 else
174     IP=0
175 end
176
177 //storing each decimal digit in D(x)
178 if(DP<1)
179     if(DP>0)
180 while(x<=4)
181     DP=DP*8
182     D(x)=floor(DP)
183     x=x+1
184     DP=modulo(DP,1)
185 end
186
187 DP=0
188 for j=1:length(D)
189 //multiplying bits of decimal part with their
      position values and adding
190     DP=DP+(10^(-1*j)*D(j))
191 end
192 end
193 end
194 octal=IP+DP
195 printf("Sum")
196 disp(octal)

```

---

Scilab code Exa 8.8.25 Add the hexadecimal numbers

```

1 clc
2 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 8.30 a")
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 subtraction using 1s complement

```

1  clc
2  clear
3  disp(" Example 8.31a")
4  printf("\n")
5  disp("perform the following binary subtraction
        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 subtraction using 2s complement

```

1 clc
2 clear
3 disp(" Example 8.31b")
4 printf("\n")
5 disp("perform the following binary subtraction

```



```

        using 2s 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 h=1
11 for i=1:length(b)
12     n(i)=b(length(b)+1-i)+h
13     if(n(i)==1)
14         h=0
15     end
16     if(n(i)==2)
17         h=1
18         n(i)=0
19     end
20
21 end
22 for i=1:length(a)
23     b(i)=n(i)
24 end
25
26
27 for i=1:length(a)
28     c(i)=a(length(a)+1-i)+b(length(a)+1-i)+d
29     if(c(i)==1)
30         d=0
31     end
32     if[c(i)==2]
33         d=1
34         c(i)=0
35     end
36 end
37
38
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 theorem

```

1  clc
2  clear
3  disp("Example 8.48a")
4  printf("\n")
5  disp("Prove the following boolean theorem")
6  disp("A+AB=A")
7  disp("A=a, B=b, AB=s, A+AB=d")
8  a=[0 0 1 1]
9  b=[0 1 0 1]
10 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     if(a(i)==d(i))
23         printf("")
24     else
25         printf(" not")
26         abort
27     end
28
29 end
30 printf(" yes")

```

---

Scilab code Exa 8.8.48b Prove the boolean theorem

```

1 clc
2 clear
3 disp(" Example 8.48b")
4 printf("\n")
5 disp(" Prove the following boolean theorem")
6 disp(" A+AB=A")
7 disp(" A=a , B=b , A1B=s , A+A1B=d")
8 a=[0 0 1 1]
9 b=[0 1 0 1]
10 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 8.49 a")
4  printf("\n")
5  disp(" Prove the following boolean identities")
6  disp(" A+BC=(A+B)(A+C)")
7  A=[0 0 0 0 1 1 1 1]
8  B=[0 0 1 1 0 0 1 1]
9  C=[0 1 0 1 0 1 0 1]

```

```

10 for i=1:length(A)
11     Y(i)=A(i)+(B(i)*C(i))
12     if(Y(i)==2)
13         Y(i)=1
14     end
15 end
16 for i=1:length(A)
17     Z(i)=(A(i)+B(i))*(A(i)+C(i))
18     if(Z(i)==2)
19         Z(i)=1
20     end
21     if(Z(i)==3)
22         Z(i)=1
23     end
24     if(Z(i)==4)
25         Z(i)=1
26     end
27 end
28 for i=1:length(A)
29     if(Z(i)==Y(i))
30         printf("_")
31     else
32         printf("NOT")
33         abort
34     end
35 end
36
37     printf(" proved")

```

---

**Scilab code Exa 8.8.49b** Prove the boolean identities

```

1 clc
2 clear
3 disp(" Example 8.49b")
4 printf("\n")

```

```

5 disp("Prove the following boolean identities")
6 disp("ABC+AB1C+ABC1=AB+AC")
7 A=[0 0 0 0 1 1 1 1]
8 B=[0 0 1 1 0 0 1 1]
9 C=[0 1 0 1 0 1 0 1]
10 for i=1:length(A)
11     Y(i)=(A(i)*B(i)*C(i))+(A(i)*(~B(i))*C(i))+(A(i)*B(
        i)*(~C(i)))
12     if(Y(i)==3)
13         Y(i)=1
14     end
15     if(Y(i)==2)
16         Y(i)=1
17     end
18 end
19 for i=1:length(A)
20     Z(i)=(A(i)*B(i))+A(i)*C(i)
21     if(Z(i)==2)
22         Z(i)=1
23     end
24 end
25 for i=1:length(A)
26     if(Z(i)==Y(i))
27         printf("_")
28     else
29         printf("NOT")
30         abort
31     end
32 end
33 printf(" proved")

```

---

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

```

1 clc
2 clear

```

```

3 disp("Example 8.50a")
4 printf("\n")
5 disp("Construct the Truth Table for logic expression
      ")
6 disp("AB1+C1")
7 A=[0 0 0 0 1 1 1 1]
8 B=[0 0 1 1 0 0 1 1]
9 C=[0 1 0 1 0 1 0 1]
10 for i=1:length(A)
11     f(i)=(A(i)*(~(B(i))))+(~C(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))

```

---

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

```

1 clc
2 clear
3 disp("Example 8.50b")
4 printf("\n")
5 disp("Construct the Truth Table for logic expression
      ")
6 disp("AB1+A1B")
7 A=[0 0 1 1]
8 B=[0 1 0 1]
9 for i=1:length(A)
10     f(i)=(A(i)*(~(B(i))))+(B(i)*(~(A(i))))
11     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 8.50 c")
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))
```

---