Scilab Textbook Companion for Principles Of Electronics , Vol. II by B. V. Narayana Rao[1]

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April 9, 2019

[1]Funded by a grant from the National Mission on Education through ICT, http://spoken-tutorial.org/NMEICT-Intro. This Textbook Companion and Scilab codes written in it can be downloaded from the "Textbook Companion Project" section at the website http://scilab.in

Book Description

Title: Principles Of Electronics , Vol. II

Author: B. V. Narayana Rao

Publisher: New Age International (p) Ltd.,Publishers

Edition: 2

Year: 1992

ISBN: 81-224-0768-4

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.

Contents

List of Scilab Codes

List of Figures

Chapter 1

Operating Point

Scilab code Exa 1.1 To find dc load points

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX1_1.sce

clc;
clear;
Vcc=10;//dc supply voltage in V
Rc=2e3;//collector resiatance in ohm
//Vce=Vcc+(Ic*Rc)
//To find the coordinates of the load line first put Ic=0 in the following equation
Ic=0;
```

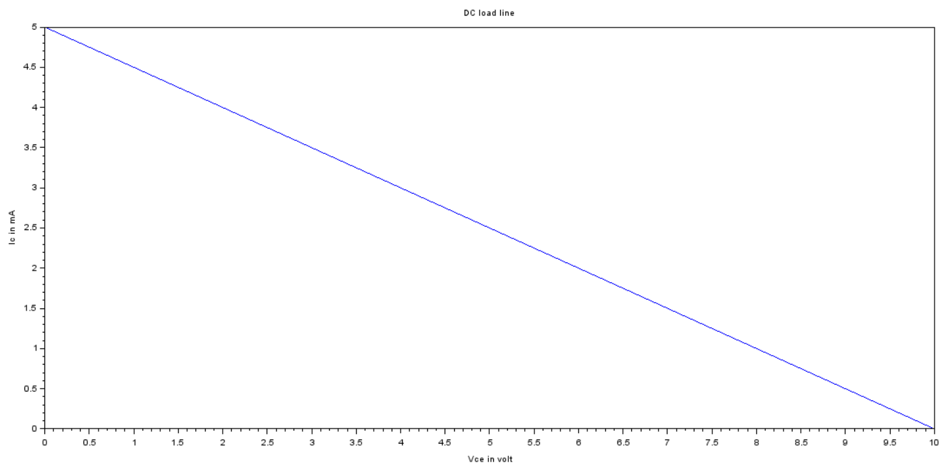

Figure 1.1: To find dc load points

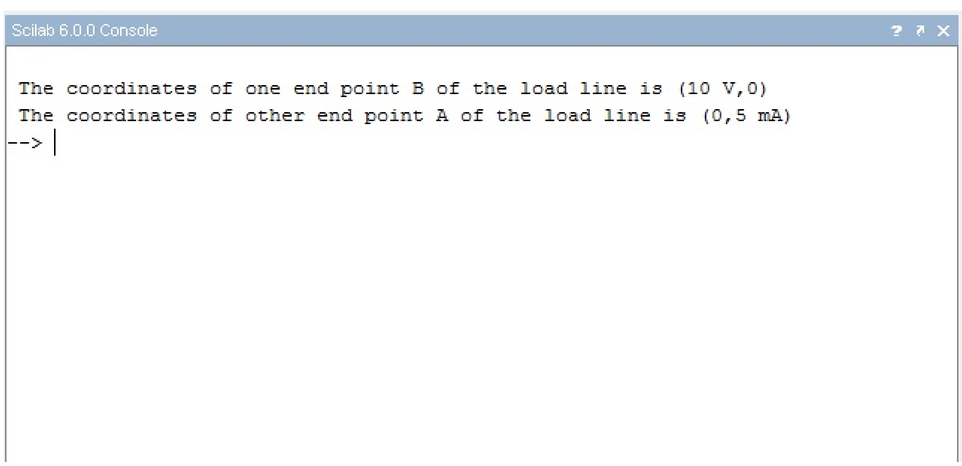

Figure 1.2: To find dc load points

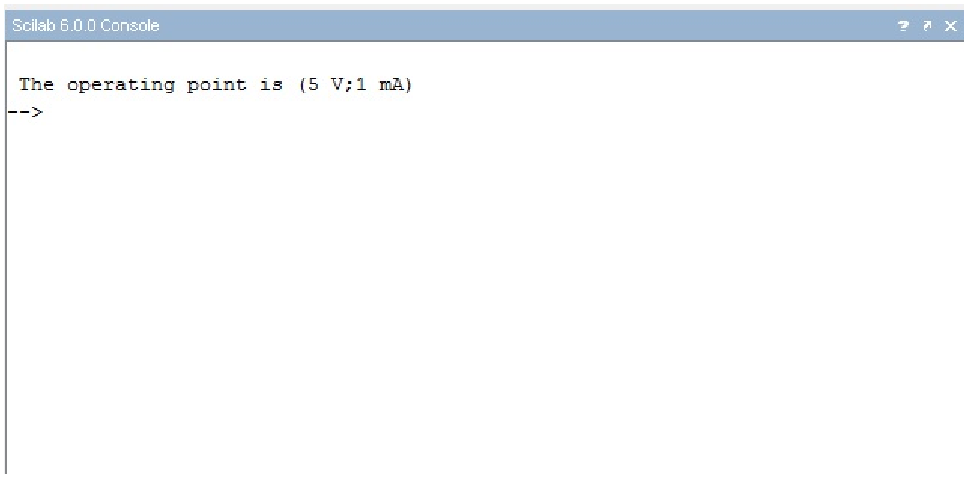

Figure 1.3: determination of operating points

```
Vce=Vcc-(Ic*Rc);
printf("\n The coordinates of one end point B of the
    load line is (%1.0f V,0)",Vce)
//To find the coordinates of the load line then put
   Vce=0 in the following equation
Vce=0;
Ic=(Vcc-Vce)/Rc;
printf("\n The coordinates of other end point A of
   the load line is (0,%1.0f mA)",Ic*1e3)

vce=0:10;
for i=1:11
    ic(i)=(10-vce(i))/2;
end
plot(vce,ic)
xlabel("Vce in volt")
ylabel("Ic in mA")
title("DC load line")
```

Scilab code Exa 1.2 determination of operating points

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX1_2.sce

clc;
clear;
Rc=5e3;//collector load resistance in ohm
Vcc=10;//dc supply voltage in V
Ib=20e-6;//base current in A
beta=50;

Ic=beta*Ib;//collector current in A
Vce=Vcc-(Ic*Rc);
printf("\n The operating point is (%1.0f V;%1.0f mA)
   ",Vce,Ic*1e3)
```

Scilab code Exa 1.3 determination of maximum collector current

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
```

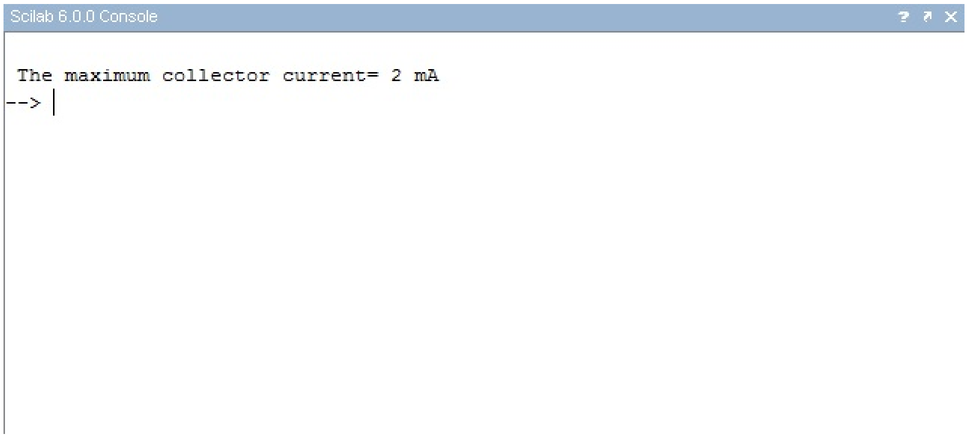

Figure 1.4: determination of maximum collector current

```
//Scilab version: Scilab 6.0.0

//EX1_3.sce

clc;
clear;
Vcc=5;//dc supply voltage in V
Rc=2e3;//collector load resistance in ohm
Vce=1;//knee voltage in V

Ic=(Vcc-Vce)/Rc;
printf("\n The maximum collector current= %1.0f mA",
   Ic*1e3)
```

Scilab code Exa 1.4 determination maximum input current

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
```

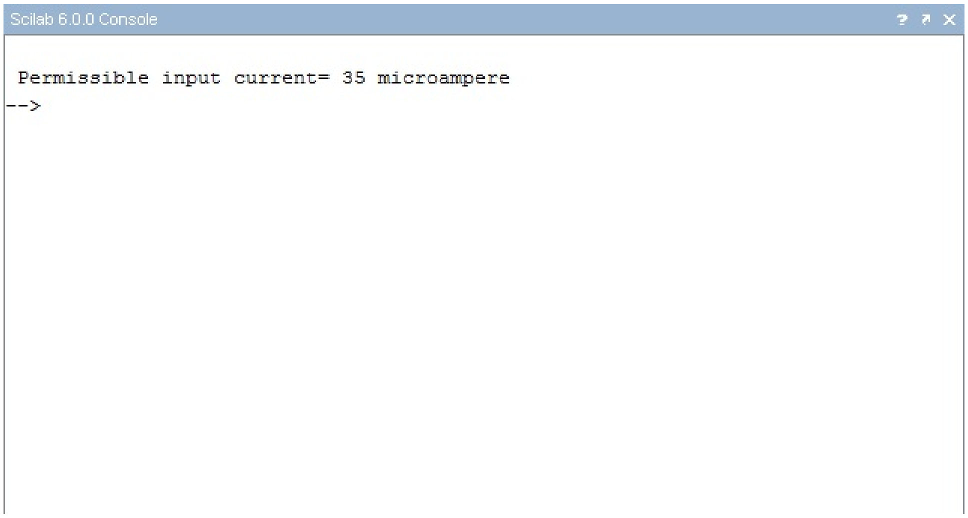

Figure 1.5: determination maximum input current

```
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX1_4.sce

clc;
clear;
Rc=4e3;//collector load resistance in ohm
Vcc=15;//dc supply voltage in V
Vce=1;//knee voltage in V
beta=100;

Ie=(Vcc-Vce)/(beta*Rc);
printf("\n Permissible input current= %1.0f
    microampere",Ie*1e6)

//There is a mistake in the book final answer
//the book answer is 30 microampere insteadof 35
    microampere
```

Chapter 2

Transistor Biasing Techniques

Scilab code Exa 2.1 Determination of operating point

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX2_1.sce

clc;
clear;
Vcc=10;//dc supply voltage in V
Rc=2e3;//Collector resistance in ohm
Rb=300e3;//base resistance in ohm
beta=75;
Vbe=1;//voltage across base emitter terminal in V

Ib=(Vcc-Vbe)/Rb;
Ic=beta*Ib;
```

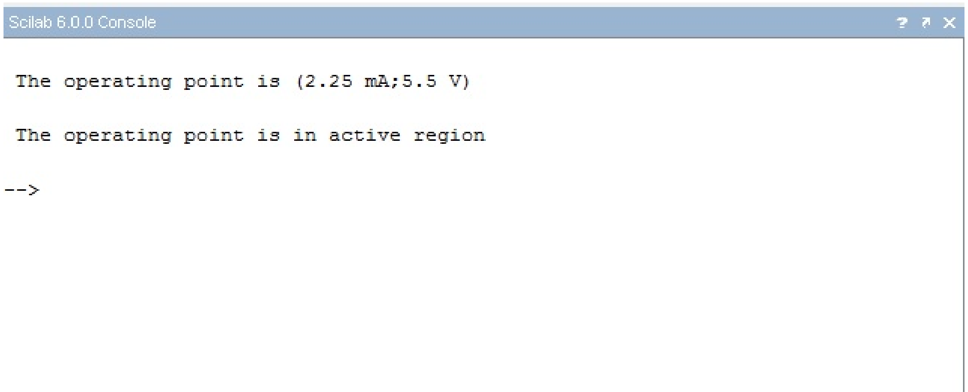

Figure 2.1: Determination of operating point

```
Vce=Vcc-(Ic*Rc);

printf("\n The operating point is (%0.2f mA;%0.1f V)\n",Ic*1e3,Vce)

Icsat=Vcc/Rc;
if Ic<Icsat then
    printf("\n The operating point is in active region \n")
else
    printf("\n The operating point is not in active region")
end

//There is a error in the Vce answer
//from the given data Vce=5.5V and it is mistakenly given as 3.5V
//and also Icsat=5mA not 4mA
```

Scilab code Exa 2.2 `Calculation of base resistance`

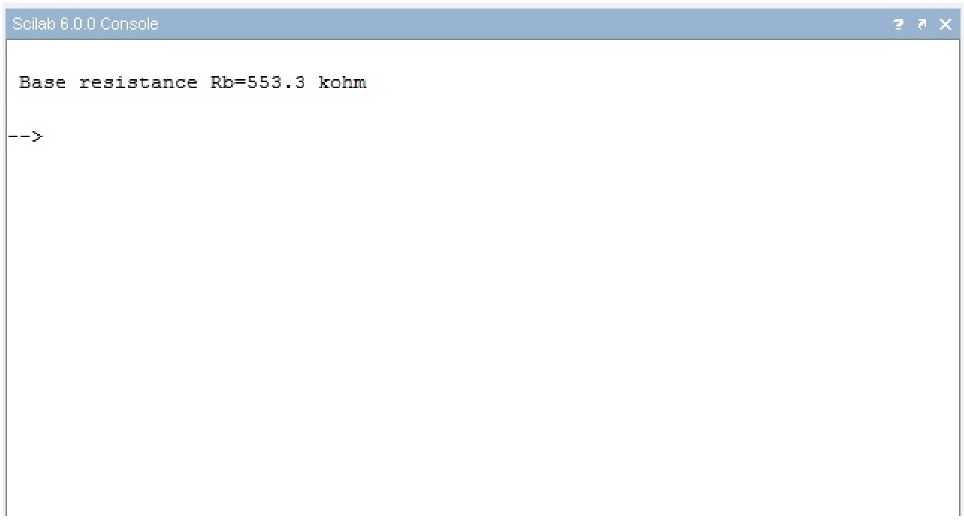

Figure 2.2: Calculation of base resistance

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX2_2.sce

clc;
clear;
Vcc=9;//dc supply voltage in V
Rc=3e3;//Collector resistance in ohm
beta=100;
Vbe=0.7;//voltage across base emitter terminal in V

Ic_top=Vcc/Rc;
Ic_mid=Ic_top/2;
Ib=Ic_mid/beta;
Rb=(Vcc-Vbe)/Ib;
printf("\n Base resistance Rb=%0.1f kohm \n",Rb*1e
```

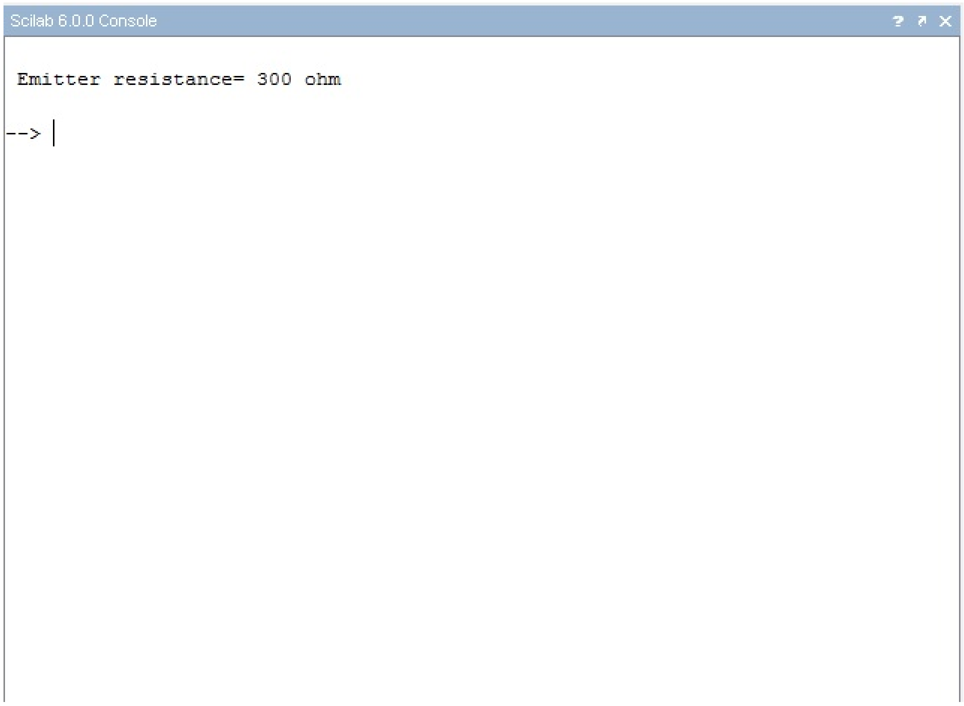

Figure 2.3: Calculation of emitter resistance

```
-3)
```

Scilab code Exa 2.3 `Calculation of emitter resistance`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX2_3.sce
```

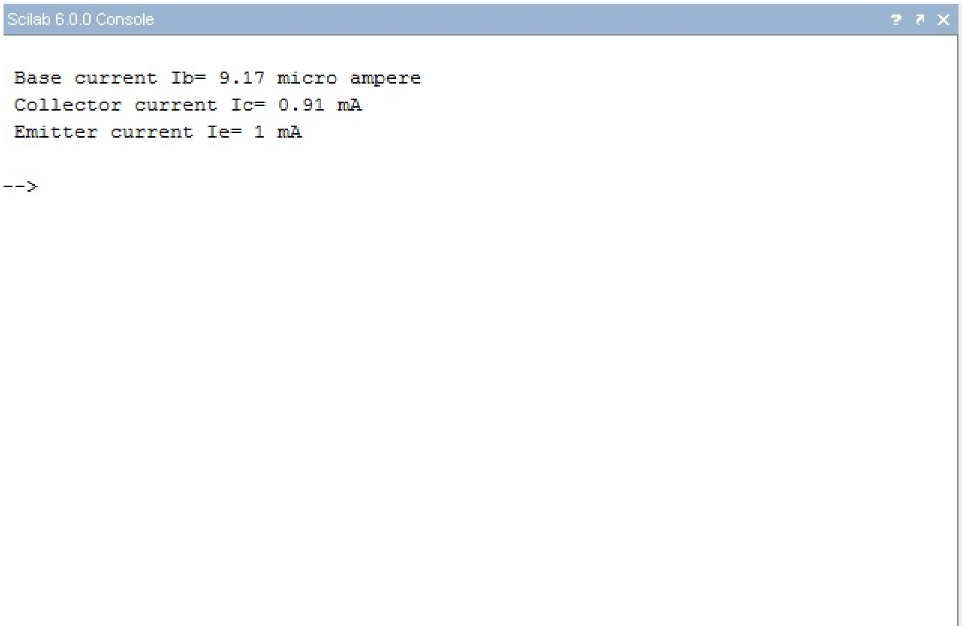

Figure 2.4: Calculation of currents

```

clc;
clear;
Vcc=9;//dc supply voltage in V
Ib=20e-6;//Base current in A
Rb=400e3;//base resistance in ohm
beta=50;
Vbe=0.7;//voltage across base emitter terminal in V
   for silicon transistor

Re=((Vcc-Vbe)/(Ib*beta))-(Rb/beta);
printf("\n Emitter resistance= %1.0f ohm \n",Re)
```

Scilab code Exa 2.4 `Calculation of currents`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX2_4.sce

clc;
clear;
Vcc=12;//dc supply voltage in V
Re=1e3;//emitter resistance in ohm
Rb=1.1e6;//base resistance in ohm
beta=99;
Vbe=1;//voltage across base emitter terminal in V

Ib=(Vcc-Vbe)/(Rb+(beta+1)*Re);
Ic=beta*Ib;
Ie=Ic+Ib;
printf("\n Base current Ib= %1.2f micro ampere \n
    Collector current Ic= %0.2f mA \n Emitter current
     Ie= %1.0f mA \n",Ib*1e6,Ic*1e3,Ie*1e3)

//The answer for Ib given in the book has error; Ib
    =9.166 micro ampere
//Hence the answer is different from book answer
```

Scilab code Exa 2.5 Calculation of base resistance

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
```

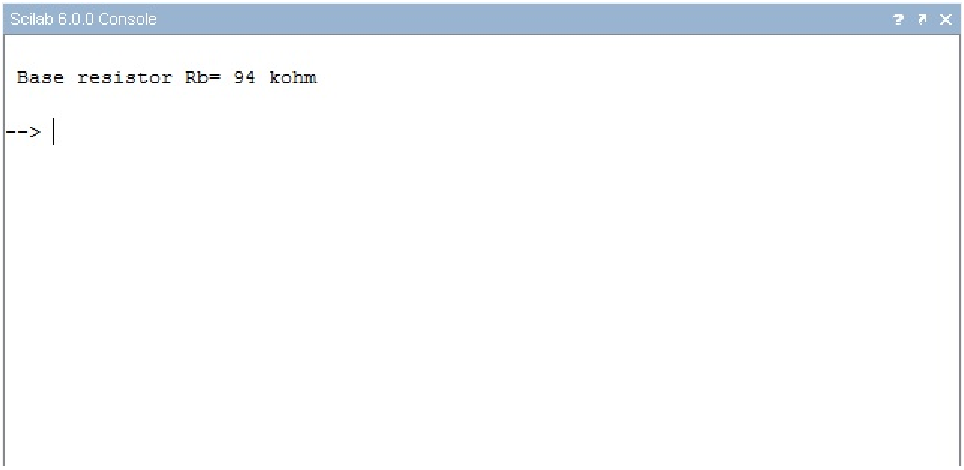

Figure 2.5: Calculation of base resistance

```
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX2_5.sce

clc;
clear;
Vcc=12;//dc supply voltage in V
Ic=6e-3;//collector current in A
Vce=6;//collector emitter voltage in V
beta=100;
Vbe=0.3;//voltage across base emitter terminal in V

Rc=(Vcc-Vce)/Ic;
Ib=Ic/beta;
//Vcc=(Rc*Ic)+((Rb+Rc)*Ib)+Vbe;
Rb=(Vcc-Vbe-(Ic*Rc)-(Ib*Rc))/(Ib);
printf("\n Base resistor Rb= %1.0f kohm \n",Rb*1e-3)
```

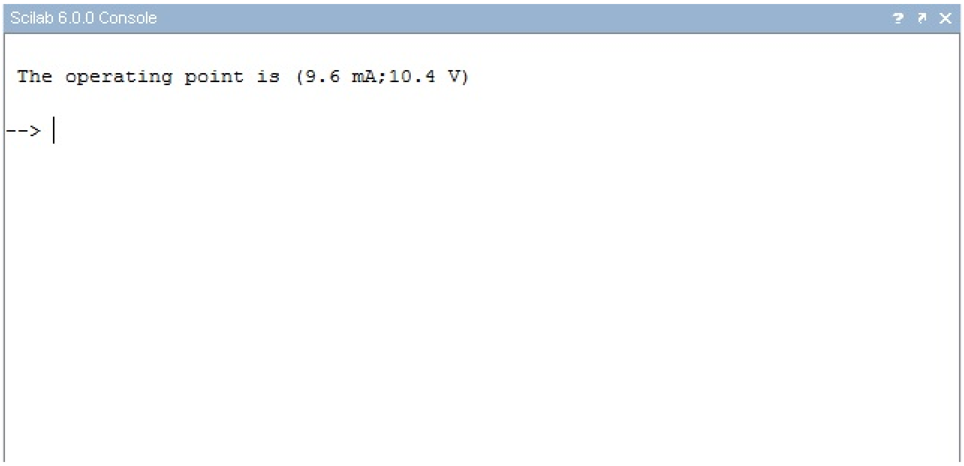

Figure 2.6: Determination of operating point

Scilab code Exa 2.6 `Determination of operating point`

```
//Book Name: Principles of Electronics , Vol. II
//Author:B.V. Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX2_6.sce

clc;
clear;
Vcc=20;//dc supply voltage in V
Rb=100e3;//base resistance in ohm
beta=100;
Rc=1e3;//collector resistor in ohm
Vbe=0.7;//voltage across base emitter terminal in V
    for silicon transistor
```

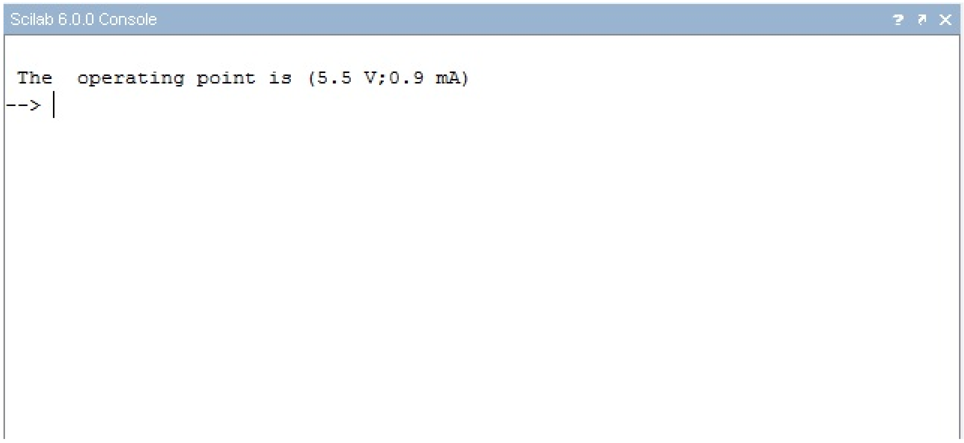

Figure 2.7: To find dc load points

```

Ib=(Vcc-Vbe)/(Rb+(1+beta)*Rc);
Ic=beta*Ib;
Vce=Vcc-(Ic*Rc);
printf("\n The operating point is (%0.1f mA;%1.1f V)
    \n",Ic*1e3,Vce)
```

Scilab code Exa 2.7 `To find dc load points`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX2_7.sce

clc;
```

```
clear;
Rc=2e3;//collector resiatance in ohm
Re=3e3;//emitter resistance in ohm
R1=14e3;
R2=6e3;
Vcc=10;//dc supply voltage in V
Vbe=0.3;//Base emitter voltage for Germanium

//To get the end point B of the load line ,Ic is 0
Ic=0;
Vce=Vcc-(Ic*(Rc+Re));

//To get the end point A of the load line, Vce is 0
Ic=Vcc/(Rc+Re);

V2=Vcc*(R2/(R1+R2));
Ic=(V2-Vbe)/Re;
Vce=Vcc-(Ic*(Rc+Re));
printf("\n The  operating point is (%0.1f V;%0.1f mA
    )",Vce,Ic*1e3)
```

Scilab code Exa 2.8 Calculation of percentage error

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX2_8.sce

clc;
```

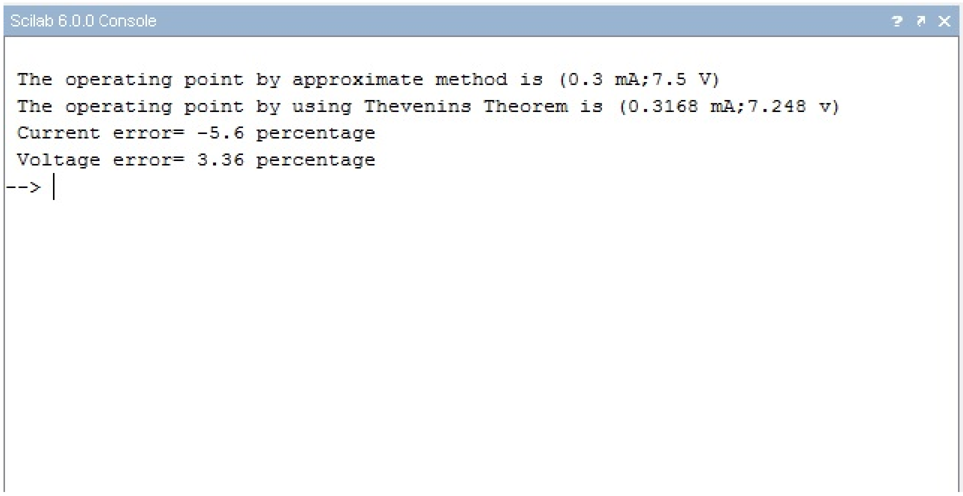

Figure 2.8: Calculation of percentage error

```
clear;
Rc=6e3;//collector resistance in ohm
Re=9e3;//emitter resistance in ohm
R1=150e3;
R2=50e3;
Vcc=12;//dc supply voltage in V
Vbe=0.3;//Base emitter voltage in V for Germanium
beta=99;

V2=Vcc*(R2/(R1+R2));
Ic1=(V2-Vbe)/Re;
Vce1=Vcc-(Ic1*(Rc+Re));
printf("\n The operating point by approximate method
    is (%0.1f mA;%0.1f V)",Ic1*1e3,Vce1)

Vth=Vcc*(R2/(R1+R2));
Rth=(R1*R2)/(R1+R2);
Ic2=(beta*Vth)/(Rth+(beta+1)*Re);
Vce2=Vcc-(Rc+Re)*Ic2;
printf("\n The operating point by using Thevenins
   Theorem is (%0.4f mA;%0.3f v)",Ic2*1e3,Vce2)

```

```
CE=((Ic1-Ic2)/Ic1)*100;
VE=((Vce1-Vce2)/Vce1)*100;
printf("\n Current error= %0.1f percentage \n
   Voltage error= %0.2f percentage",CE,VE)
```

Chapter 3

Hybrid Parameters

Scilab code Exa 3.1 Calculation of hybrid parameters

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX3_1.sce

clc;
clear;
//collector current in A
Ic1=2e-3;
Ic2=2.5e-3;
Ic3=6e-3;
Ic4=9.5e-3;
//collector-emitter voltage in V
Vce1=4;
Vce2=6;
```

Figure 3.1: Calculation of hybrid parameters

```
Vce3=6;
Vce4=20;
//base current in A
Ib1=20e-6;
Ib2=20e-6;
Ib3=40e-6;
Ib4=40e-6;
//voltage across base and emitter in V
Vbe1=0.65;
Vbe2=0.65;
Vbe3=0.7;
Vbe4=0.705;

delIc=Ic2-Ic1;
delVce=Vce2-Vce1;
hoe=delIc/delVce;//at constant Ib


delVbe=Vbe4-Vbe3;
```

```
delVce=Vce4-Vce3;
hre=delVbe/delVce;//at constant Ib

delIc=Ic3-Ic2;
delIb=Ib3-Ib2;
hfe=delIc/delIb;//at constant Vce

delVbe=Vbe3-Vbe2;
delIb=Ib3-Ib2;
hie=delVbe/delIb;//at constant Vce
printf("\n hoe= %1.0f micro-mho \n hre= %f \n hfe=
   %1.0f \n hie= %0.1f kohm \n",hoe*1e6,hre,hfe,hie
   *1e-3)
```

Chapter 4

Small Signal BJT Amplifiers

Scilab code Exa 4.1 `Determination of DC load line`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0
```

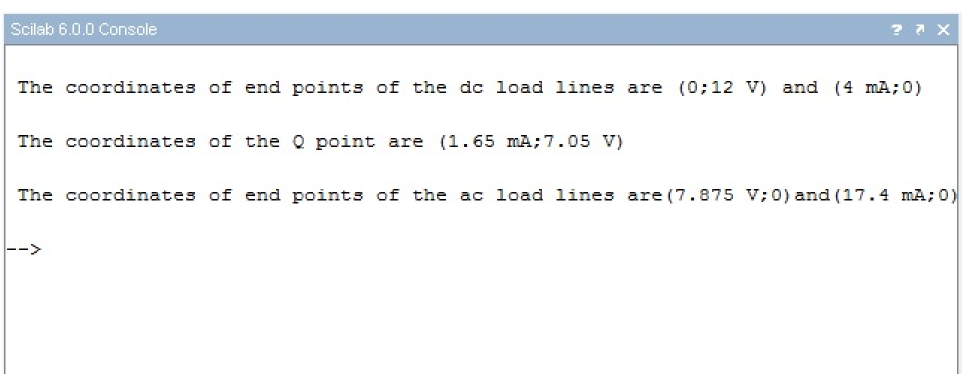

Figure 4.1: Determination of DC load line

```
//EX4_1.sce

clc;
clear;
//following are the values of resistors used in a CE
    amplifier in ohm
R1=10e3;
R2=5e3;
Rc=1e3;
Re=2e3;
Rl=1e3;
Vcc=12;//supply voltage in V
//from figure 4.2
Vce=Vcc;
Icmax=Vcc/(Rl+Re);//Maximum collector current in A
printf("\n The coordinates of end points of the dc
   load lines are (0;%d V) and (%d mA;0)\n",Vce,
   Icmax*1e3)

V2=(R2*Vcc)/(R1+R2);//voltage across R2 in V
Vbe=0.7;//for silicon Vbe is 0.7 in V
Ie=(V2-Vbe)/Re;//emitter current in A
Ic=Ie;//collector current in A
Vce=Vcc-(Ic*(Rc+Re));
printf("\n The coordinates of the Q point are (%0.2f
    mA;%0.2f V)\n",Ic*1e3,Vce)

Rac=(Rc*Rl)/(Rc+Rl);//effective load resistance in
   ohm
Vcemax=Vce+(Ic*Rac);
Icmax=Ic+(Vcemax/Rac);
printf("\n The coordinates of end points of the ac
   load lines are(%0.3f V;0)and(%0.1f mA;0)\n",
   Vcemax,Icmax*1e3)
```

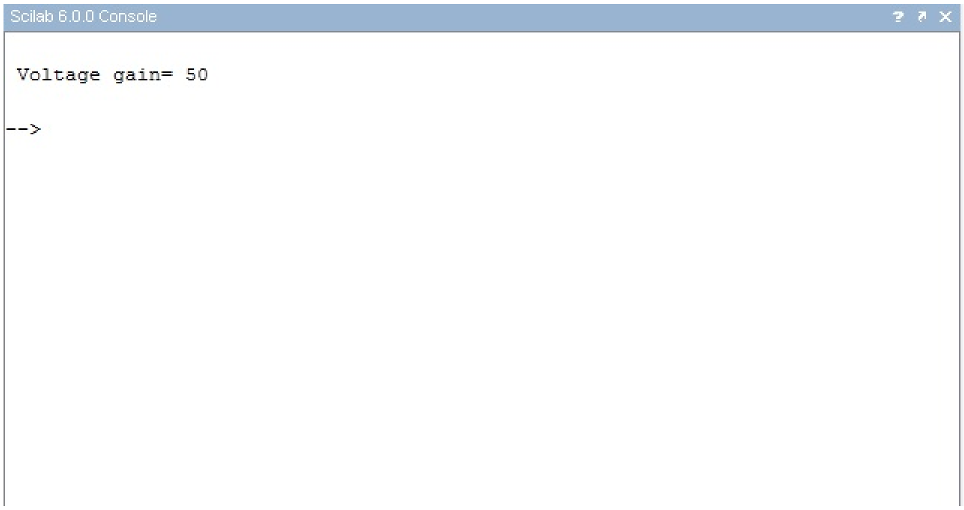

Figure 4.2: Determination of voltage gain

Scilab code Exa 4.2 `Determination of voltage gain`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX4_2.sce

clc;
clear;
Rin=1e3;//input resistance in ohm
Rc=2e3;//collector resistance in ohm
Rl=1e3;//load resistance in ohm
```

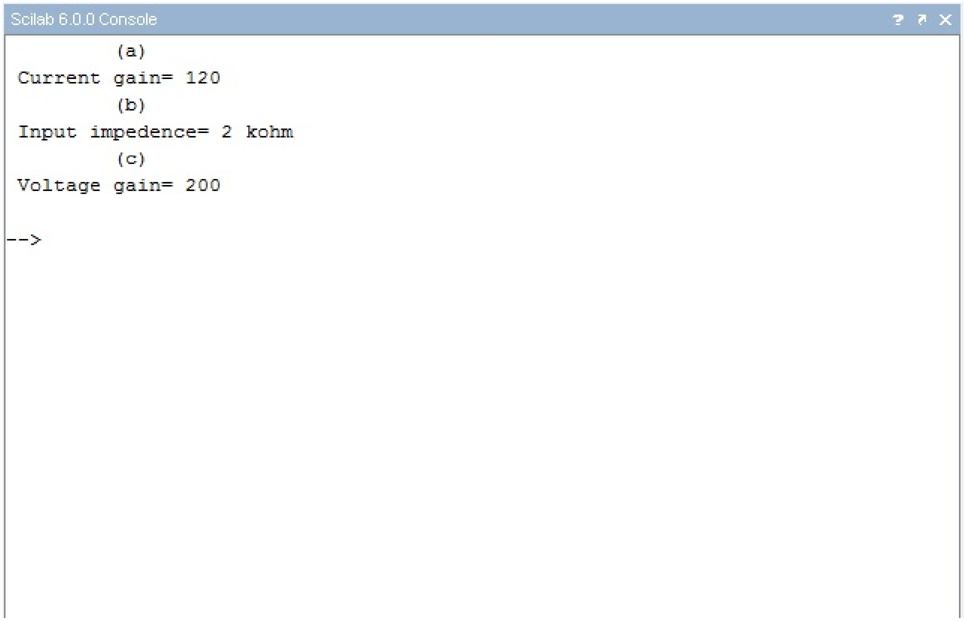

Figure 4.3: Calculation of current gain voltage gain input impedence

```
beta=75;

Rac=(Rc*Rl)/(Rc+Rl);
//Av=(Ic*Rac)/(Ib*Rin);
//beta=Ic/Ib;
Av=(beta*Rac)/Rin;
printf("\n Voltage gain= %d \n",Av)
```

Scilab code Exa 4.3 Calculation of current gain voltage gain input impedence

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
```

```
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX4_3.sce

clc;
clear;
delIb=15e-6;//signal(input) current changes in A
delIc=1.8e-3;//Collector current changes in A
delVi=0.03;//change in signal voltage in V
Rc=5e3;//collector resistance in ohm
Rl=10e3;//load resistance in ohm

printf("\t (a)")
Ai=delIc/delIb;
printf("\n Current gain= %d \n",Ai)

printf("\t (b)")
Rin=delVi/delIb;
printf("\n Input impedence= %1.0f kohm \n",Rin*1e-3)

printf("\t (c)")
Rac=(Rc*Rl)/(Rc+Rl);
Av=(delIc*Rac)/(delIb*Rin);
printf("\n Voltage gain= %d \n",Av)
```

Scilab code Exa 4.4 Calculation of impedance and gain

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
```

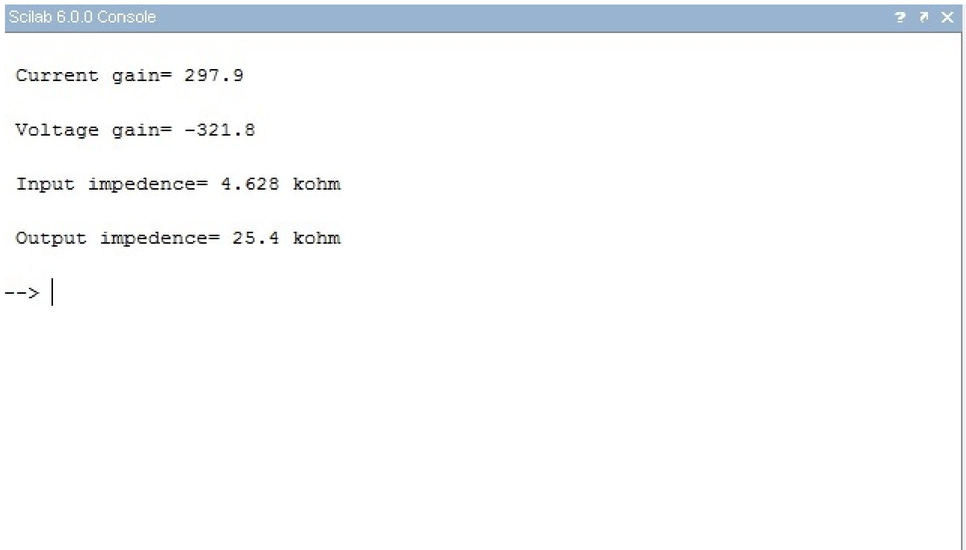

Figure 4.4: Calculation of impedance and gain

```
//Scilab version: Scilab 6.0.0

//EX4_4.sce

clc;
clear;
//the following are the h parameters values given
hfe=350;
hie=5e3;
hre=2.5e-4;
hoe=35e-6;
Rl=5e3;//load resistance in ohm
Rs=15e3;//source resistance in ohm

Ai=hfe/(1+(hoe*Rl));
printf("\n Current gain= %0.1f \n",Ai)
Av=-(hfe*Rl)/(hie+((hie*hoe)-(hre*hfe))*Rl);
printf("\n Voltage gain= %0.1f \n",Av)
Zie=hie-((hre*hfe*Rl)/(1+(hoe*Rl)));
printf("\n Input impedence= %0.3f kohm \n",Zie*1e-3)
```

```
Zo=(hie+Rs)/((hre*hfe)+(hoe*(hie+Rs)));
printf("\n Output impedence= %0.1f kohm \n",Zo*1e-3)

//There is a error in the book for calculation of
   current gain
//In the book current gain value is 279.9 insteadof
   297.9
```

Chapter 5

Small Signal JFET Amplifiers

Scilab code Exa 5.1 Calculation of drain current

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX5_1.sce

clc;
clear;
Vp=-3.5;//pinchoff voltage in V
Idss=5e-3;
Vgs=-2;//gate-source voltage in V
Id=Idss*(1-(Vgs/Vp))^2;
printf("\n The drain current= %0.3f mA",Id*1e3)
```

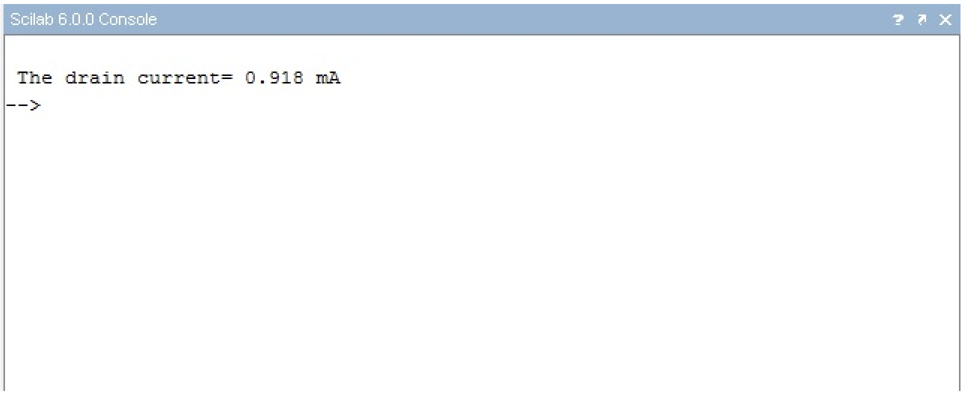

Figure 5.1: Calculation of drain current

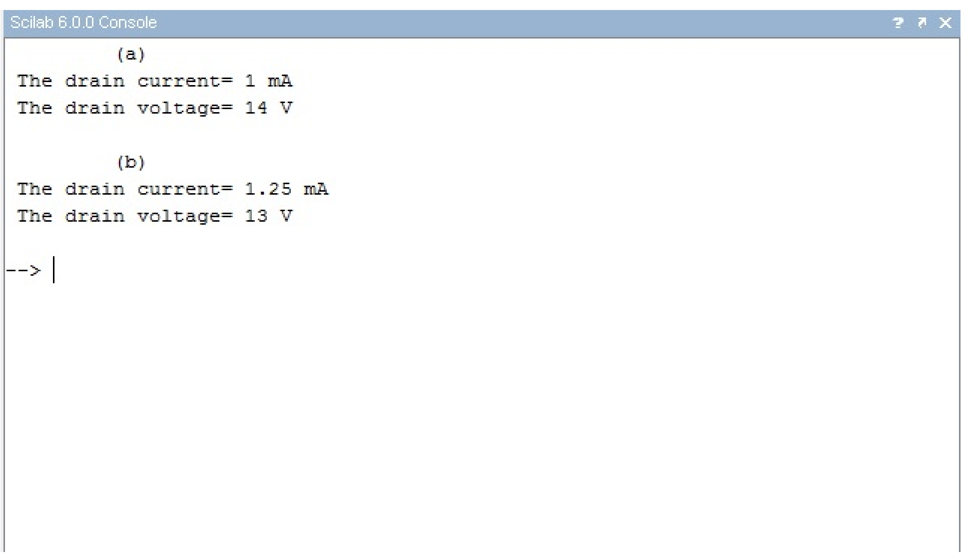

Figure 5.2: Calculation of drain current and voltage

Scilab code Exa 5.2 Calculation of drain current and voltage

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX5_2.sce

clc;
clear;
//From figure 5.4(a) the following values are taken
R1=1e6;
R2=0.5e6;
Rd=4e3;
Rs=8e3;
Vdd=18;

Vg=(Vdd*R2)/(R1+R2);//Gate to ground voltage in V

printf("\t (a)")
Vgs=-2;//gate-source voltage in V
Id=(Vg-Vgs)/Rs;
Vd=Vdd-(Id*Rd);
printf("\n The drain current= %d mA",Id*1e3)
printf("\n The drain voltage= %d V  \n",Vd)

printf("\n\t (b)")
Vgs=-4;//gate-source voltage in V
Id=(Vg-Vgs)/Rs;
Vd=Vdd-(Id*Rd);
printf("\n The drain current= %0.2f mA",Id*1e3)
```

```
printf("\n The drain voltage= %d V \n",Vd)

//There is a mistake in the book
//Rd value is substituted as 8 kohm insteadof 4 kohm
    in Vd formula
//hence the output value of Vd get changed
```

Chapter 6

Power Amplifiers

Scilab code Exa 6.1 Determination of turns ratio

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX6_1.sce

clc;
clear;
Rldash=100e3;//load impedence in ohm
Rl=25;//reflected load impedence in ohm
//Rl_dash=(N1/N2)^2*Rl;
//a=(N1/N2)^2
a=Rldash/Rl;
b=sqrt(a);
printf("\n Turns ratio of the transformer = %d:1 \n"
   ,b)
```

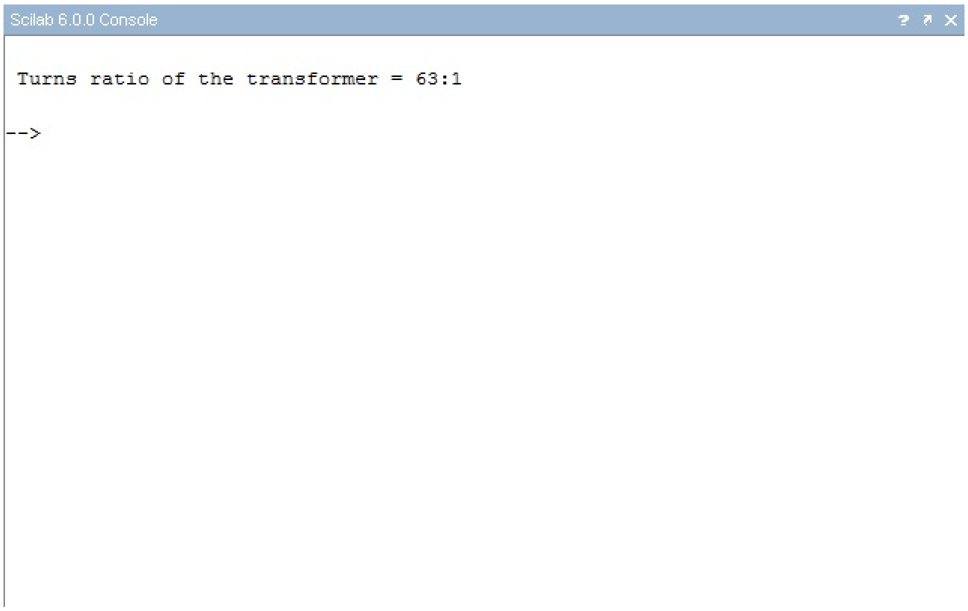

Figure 6.1: Determination of turns ratio

```

//there is a error in the book
//both resistance values substituted incorrectly , turns ratio is lessthan one if book value is substituted
//above resistance value gives the turns ratio correctly
```

Scilab code Exa 6.2 `Calculation of efficiency of the amplifiers`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
```

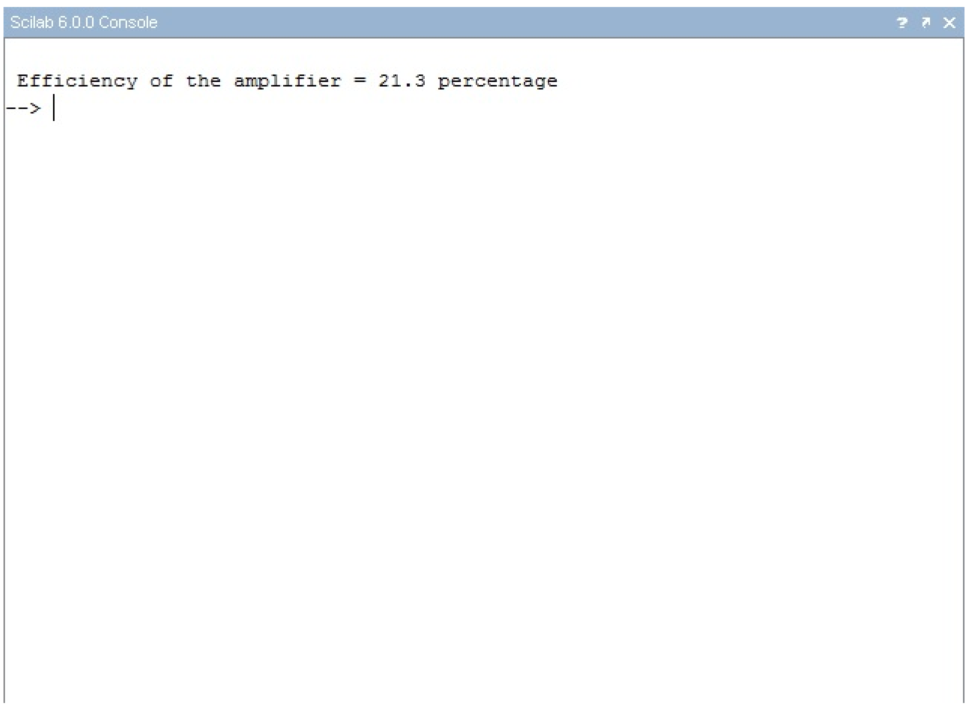

Figure 6.2: Calculation of efficiency of the amplifiers

```
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX6_2.sce

clc;
clear;
Vmax=15;//maximum value of collector_emitter voltage
    in V
Vmin=3;//minimum value of collector_emitter voltage
    in V
Imax=250e-3;//maximum collector current in A
Imin=20e-3;//Minimum collector current in A
Icq=135e-3;//Quiescent collector current in A
Vcc=12;//DC Power supply in V

Po=(1/8)*(Vmax-Vmin)*(Imax-Imin)
Pi=Vcc*Icq;
eta=(Po/Pi)*100;
printf("\n Efficiency of the amplifier = %0.1f
   percentage",eta)
```

Scilab code Exa 6.3 Determination of increase in power

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX6_3.sce

```

Figure 6.3: Determination of increase in power

```
clc;
clear;
//from the given output equation of the amplifier
A0=16;
A1=1.6;
A2=1.3;
A3=0.4;

D2=A1/A0;
D3=A2/A0;
D4=A3/A0;
D=sqrt(D2^2+D3^2+D4^2);
//power with distrotion=(1+D^2)*P1 .
//P1 is the power due to distortion
Pincrease=D^2*100;
printf("\n Percentage increase in power due to
    distortion =%0.3f percentage",Pincrease)
```

Figure 6.4: Calculation of maximum power output

Scilab code Exa 6.4 `Calculation of maximum power output`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX6_4.sce

```

Figure 6.5: Calculation of maximum ambient temperature

```
clc;
clear;
Rl=100;//load of power amplifier in ohm
a=12;//let a=(N1/N2)
Ic=100e-3;//collector current in A

Rldash=(a^2)*Rl;//reflected impedence in ohm
Po=(1/2)*Ic^2*Rldash;

printf("\n Maximum ac power output =%d W",Po)
```

Scilab code Exa 6.5 Calculation of maximum ambient temperature

```
//Book Name: Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX6_5.sce

clc;
clear;
Tc=80;//case temperature in degree celcius
Pd=5;//power dissipation of the transistor in W
theta=8;//thermal resistance in degree Celcius per
    watt

Ta=Tc-(Pd*theta);
printf("\n Ambient temperature =%d degree celcius",
    Ta)
```

Scilab code Exa 6.6 Calculation of power dissipation

```
//Book Name: Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX6_6.sce

```

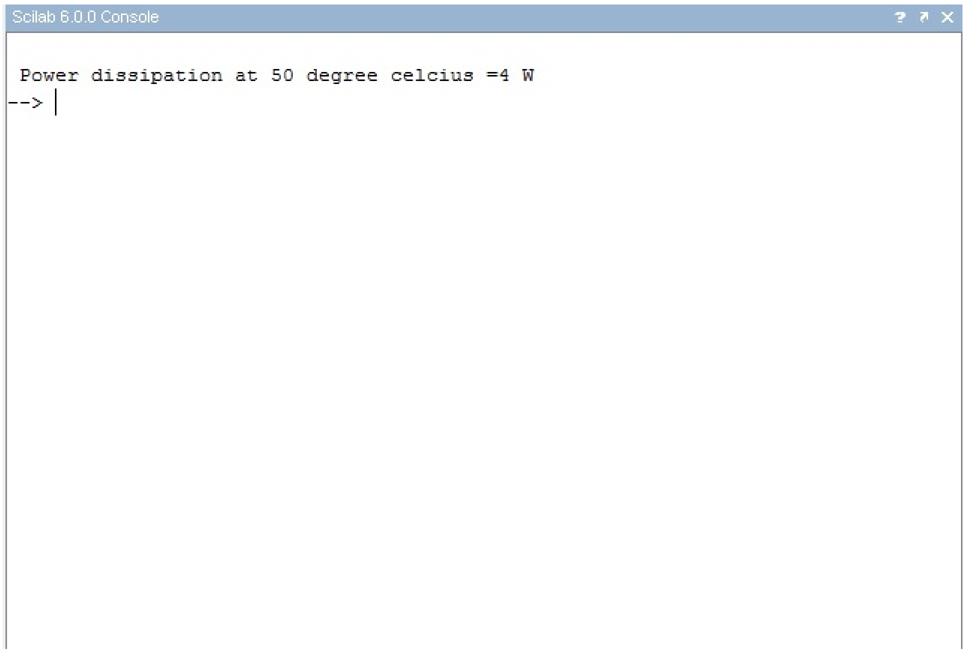

Figure 6.6: Calculation of power dissipation

```
clc;
clear;
//from figure 6.17

CB=100-50;
DB=100-25;
AD=6;
//EC/AD=CB/DB (Similar triangles)
EC=AD*(CB/DB);
printf("\n Power dissipation at 50 degree celcius =
    %d W",EC)
```

Scilab code Exa 6.7 `Calculation permissible power dissipation`

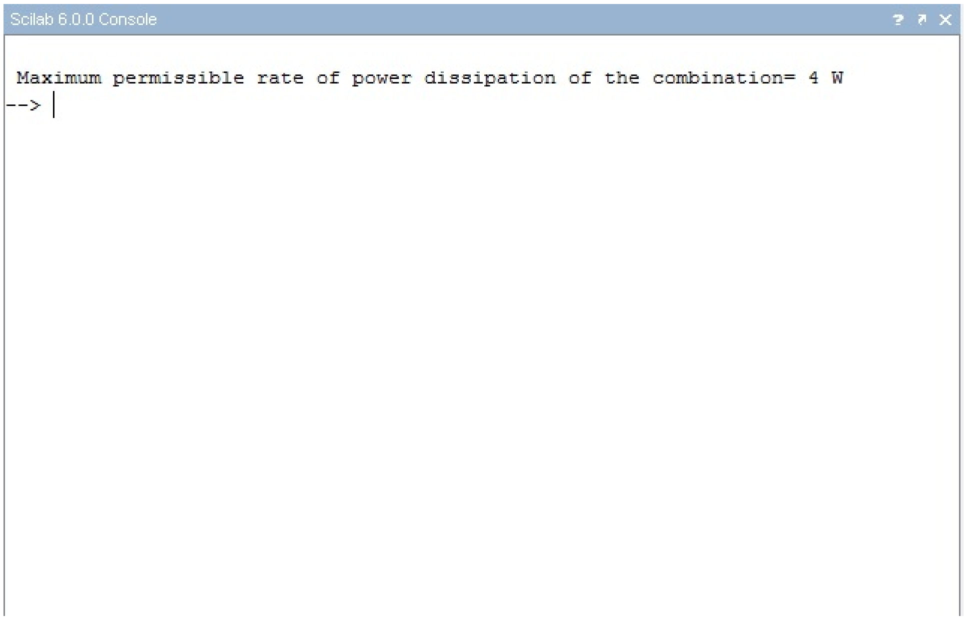

Figure 6.7: Calculation permissible power dissipation

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX6_7.sce

clc;
clear;
Tj=90;//maximum junction temperature in degree
    celcius
Ta=30;//ambient temperature in degree celcius
thetaJA=15;//thermal resistance between junction and
     ambient in degree celcius per watt
//thetaJA=thetaSC+thetaCS+thetaSA;

```

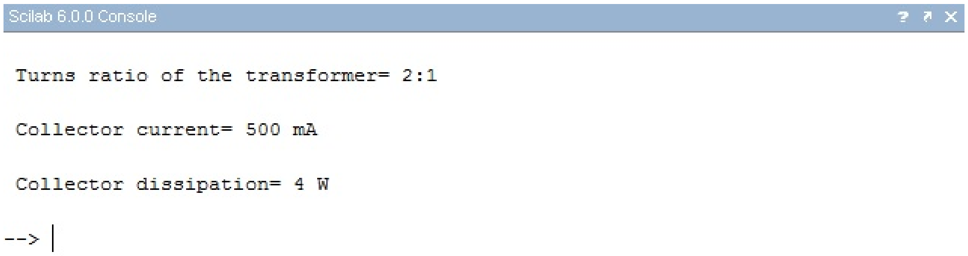

Figure 6.8: Calculation of turns ratio and collector current

```
Pc=(Tj-Ta)/thetaJA;
printf("\n Maximum permissible rate of power
    dissipation of the combination= %d W",Pc)
```

Scilab code Exa 6.8 Calculation of turns ratio and collector current

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
```

```
//Scilab version: Scilab 6.0.0

//EX6_8.sce

clc;
clear;
Pl=4;//load power in W
Rl=8;//load resistance in ohm
Vcc=16;//dc supply in V

//Pl=(Vmax/sqrt(2))^2/Rl;
Vmax=sqrt(2*Pl*Rl);
a=Vcc/Vmax;
printf("\n Turns ratio of the transformer= %d:1 \n",
    a)

Pdc=2*Pl;
Ic=(Pdc/Vcc);
printf("\n Collector current= %d mA \n",Ic*1e3)

Pc=Pdc-Pl;
printf("\n Collector dissipation= %d W \n", Pc)
```

Scilab code Exa 6.9 Calculation of input power and efficiency

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX6_9.sce
```

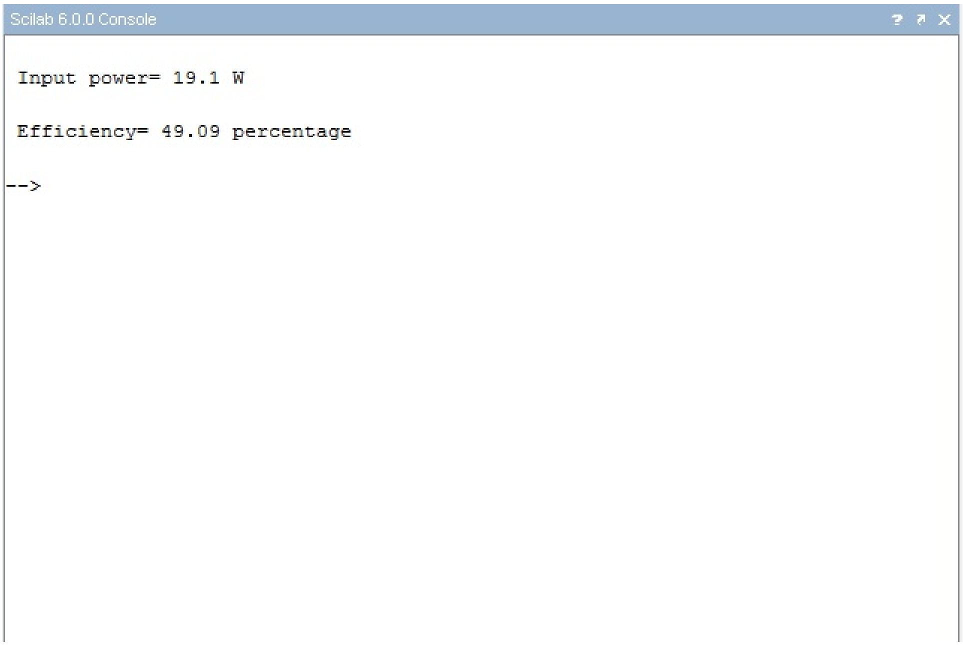

Figure 6.9: Calculation of input power and efficiency

```

clc;
clear;
Vpeak=15;//peak volatge across the load in V
Rl=12;//load impedence in ohm
Vcc=24;//dc supply voltage in V
Ipeak=Vpeak/Rl;//Peak value of load current in A
Idc=(2/%pi)*Ipeak;//DC current drawn from the
    battery in A

Pi=Vcc*Idc;//input power in W
printf("\n Input power= %0.1f W \n",Pi)

Po=Vpeak^2/(2*Rl);//Output power in W
eta=(Po/Pi)*100;
printf("\n Efficiency= %0.2f percentage \n",eta)
//answer in the book was wrong
//efficiency formula given in the book was wrong
```

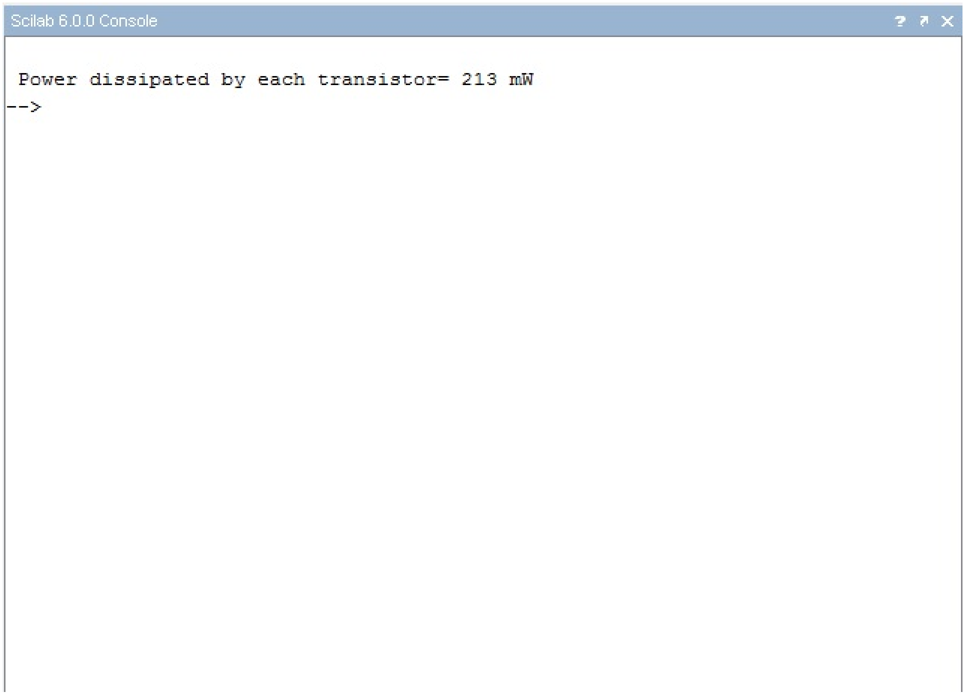

Figure 6.10: Calculation of power dissipation

```
//there is a error in the substitution of Vpeak
    value in output power equation
```

Scilab code Exa 6.10 `Calculation of power dissipation`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

```

```
//EX6_10.sce

clc;
clear;

Vcc=15;//dc supply in V
Vpeak_peak=24;//peak to peak maximum voltage in V
Rl=100;//load resistance in ohm

Vpeak=Vpeak_peak/2;//peak voltage across the load in V
Ipeak=(Vpeak)/Rl; //Peak value of load current in A
Idc=(2/%pi)*Ipeak;//DC power drawn from the battery in A

Pdc=Vcc*Idc;//Power drawn from the battery in W
Pl=(1/2)*(Vpeak^2/Rl);//Power delivered to the load in W
Pd=Pdc-Pl;//power dissipated in the two transistors in W
Pt=Pd/2;
printf("\n Power dissipated by each transistor= %1.0f mW",Pt*1e3)
```

Chapter 8

Multistage Amplifiers

Scilab code Exa 8.1 Calculation of over all gain

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX8_1.sce

clc;
clear;
Gv1=20;
Gv2=40;
Gv3=60;
//Gv1,Gv2,Gv3 are tha voltage gains of multistage
    amplifiers
G=Gv1*Gv2*Gv3;
dB=20*log10(G);
printf("\n Overall gain =%0.2f dB",dB)
```

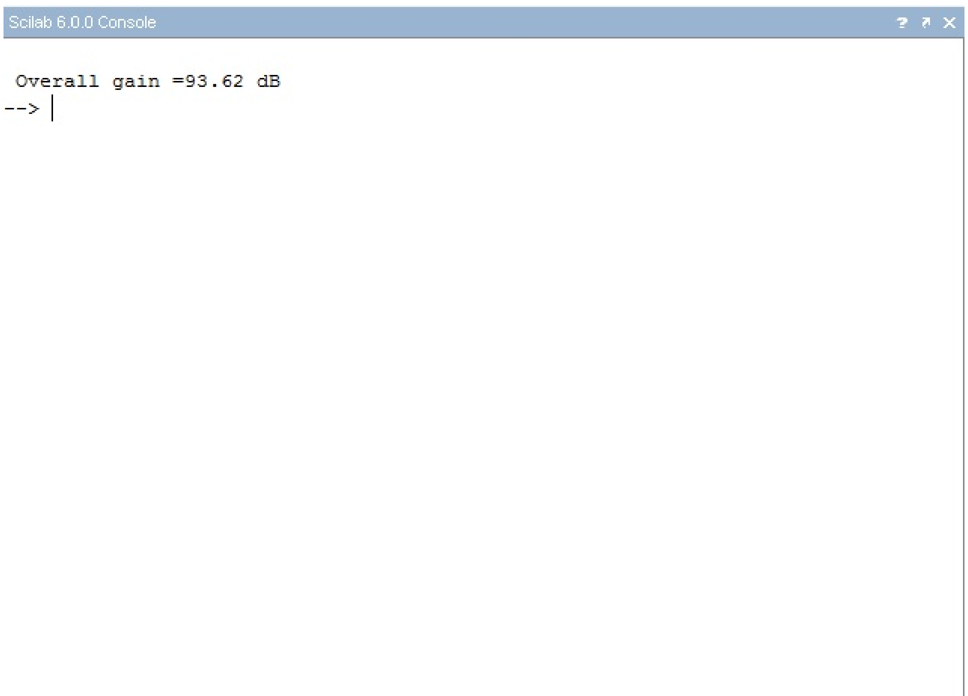

Figure 8.1: Calculation of over all gain

Figure 8.2: Calculation of gain at cutoff frequency

Scilab code Exa 8.2 `Calculation of gain at cutoff frequency`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX8_2.sce

clc;
```

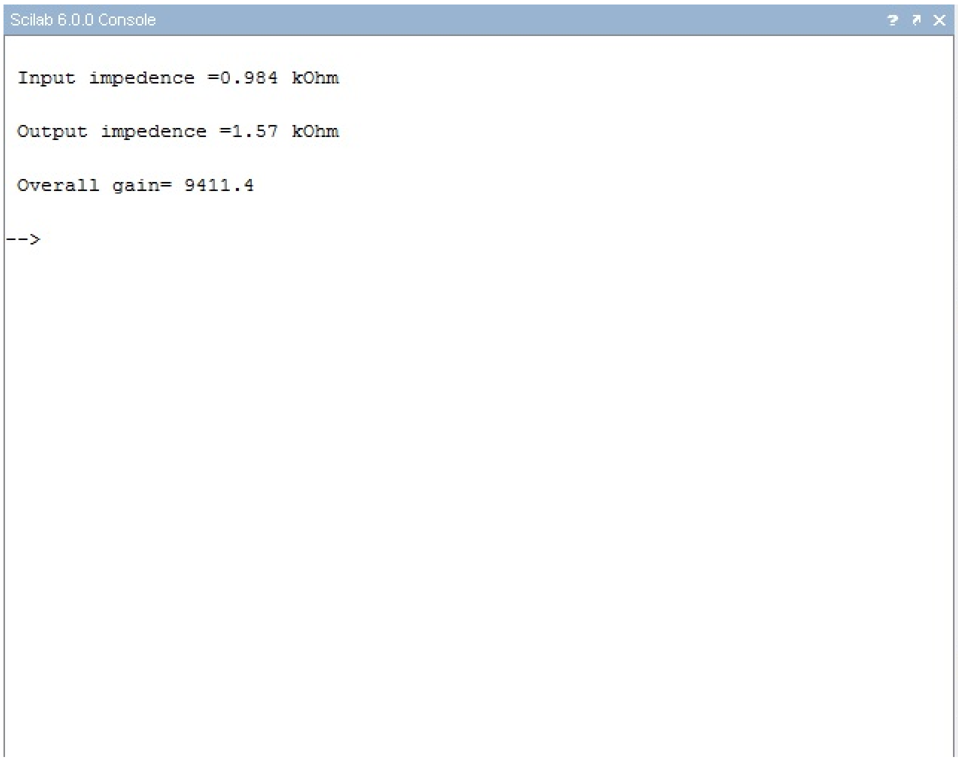

Figure 8.3: Calculation of impedance and gain

```
clear;
A=80;//voltage gain
Am=20*log10(A);//midfrequency gain
Af=3;//gain falls at cutoff frequencies in dB
Ac=Am-Af;
printf("\n Gain at cutoff frequencies =%0.2f dB",Ac)
```

Scilab code Exa 8.3 `Calculation of impedance and gain`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
```

```
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX8_3.sce

clc;
clear;
hfe=100;
hie=1.2e3;
//Z1,Z2,Z3,Z4,Z5,Z6,Z7,Z8 are the resistance values(
    Ohm) of the figure(8.13) given
Z1=60e3;
Z2=6e3;
Zi1=(Z1*Z2)/(Z1+Z2);
Zi=(Zi1*hie)/(Zi1+hie);
printf("\n Input impedence =%0.3f kOhm \n",Zi*1e-3)

Z3=3e3;
Z4=3.3e3;
Zo=(Z4*Z3)/(Z4+Z3);
printf("\n Output impedence =%0.2f kOhm \n",Zo*1e-3)

Av2=-(hfe*Zo)/hie;//voltage gain of second stage

Z6=7e3;
Z7=60e3;
Z8=6e3;
Zf=(Z6*Z7)/(Z6+Z7);
Zs=(Z8*hie)/(Z8+hie);
Zo1=(Zf*Zs)/(Zf+Zs);

Av1=-(hfe*Zo1)/hie;//voltage gain of first stage

A=Av1*Av2;
printf("\n Overall gain= %0.1f \n",A)

```

Figure 8.4: Determination of turns ratio

```

//Answer vary dueto roundoff error
```

Scilab code Exa 8.4 `Determination of turns ratio`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

```

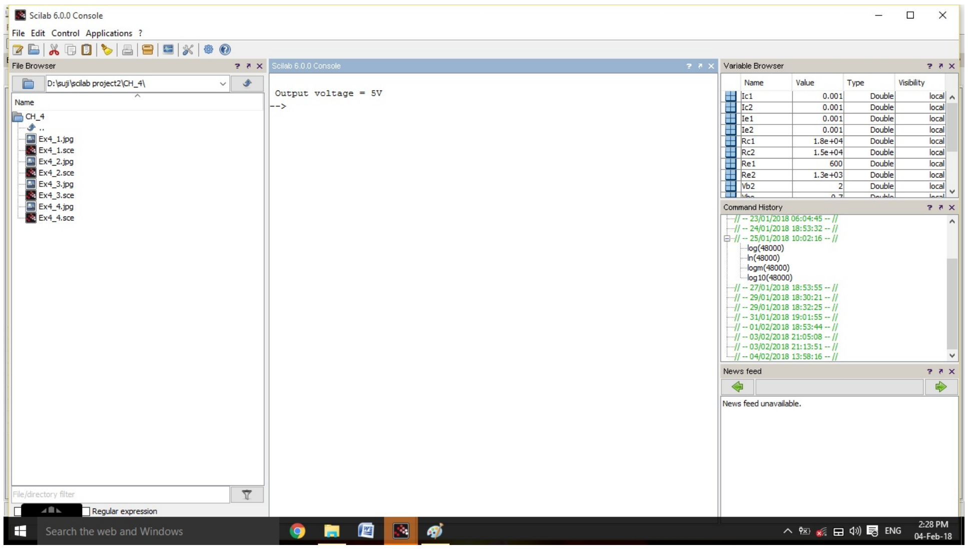

Figure 8.5: Determination of output voltage

```
//EX8_4.sce

clc;
clear;
Zp=1.5e3;//output impedence of the transistor in ohm
Zs=15;//impedence of the speaker in ohm
a=(Zp/Zs);
//a=(Np/Ns)^2
//Np=primary number of turns
//Ns=secondary number of turns
t=sqrt(a);
printf("\n Turns ratio= %d:1",t)
```

Scilab code Exa 8.5 Determination of output voltage

```
//Book Name:Principles of Electronics , Vol.II
```

```
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX8_5.sce

clc;
clear;
//from the given circuit 8.15 the following values
    are taken
Rc1=18e3;
Re1=600;
Rc2=15e3;
Re2=1.3e3;
//resiatance in ohm
Vin=1.3;//input voltage in V
Vbe=0.7;
Vcc=20;

Ve1=Vin-Vbe;//volatage of emitter terminal of
    transistor1
Ie1=Ve1/Re1;
Ic1=Ie1;
Vc1=Vcc-(Ic1*Rc1);

Vb2=Vc1;//the base volatge of second stage =
    collector voltage of first stage
Ve2=Vb2-Vbe;
Ie2=Ve2/Re2;
Ic2=Ie2;
Vc2=Vcc-(Ic2*Rc2);

printf("\n Output voltage = %dV",Vc2)
```

Chapter 9

Feedback in Amplifiers

Scilab code Exa 9.1 Calculation of overall gain

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX9_1.sce

clc;
clear;
A=90;//open loop gain
beta=-0.6;//negative feedback factor
Af=A/(1-(beta*A));
printf("\n Overall gain =%0.2f \n",Af)
```

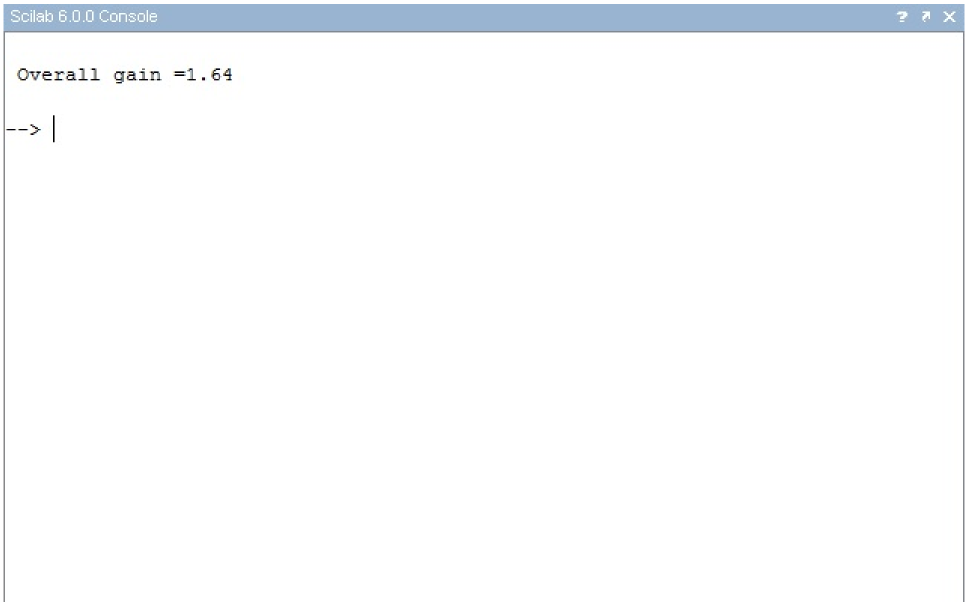

Figure 9.1: Calculation of overall gain

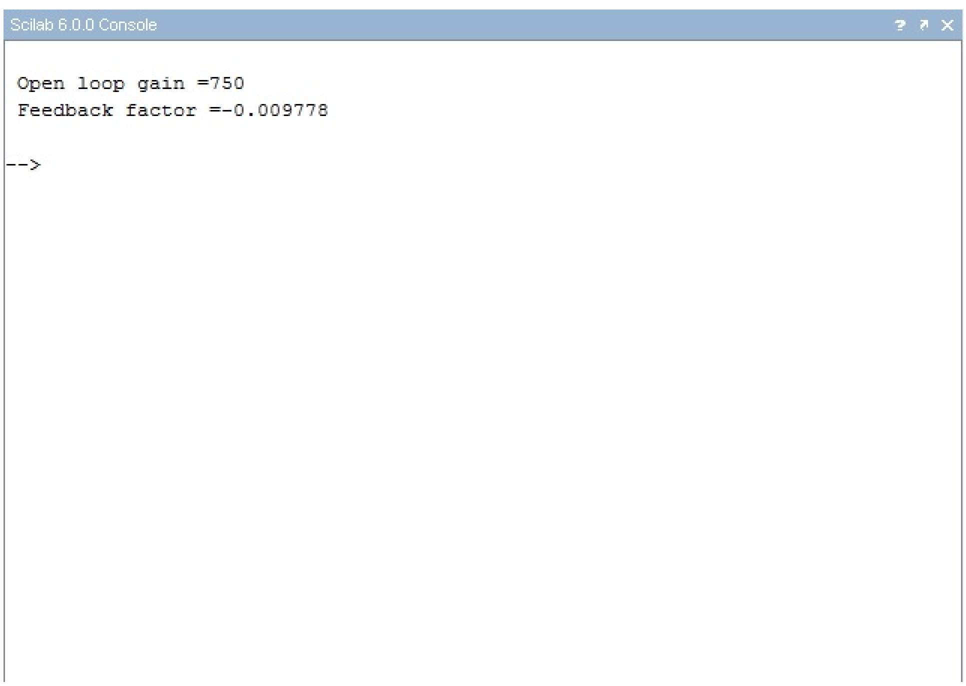

Figure 9.2: Calculation of feedback factor and open loop gain

Scilab code Exa 9.2 Calculation of feedback factor and open loop gain

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX9_2.sce

clc;
clear;
Af=90;//negative feedback gain
Vi1=0.5;//input voltage with feedback in V
Vi2=60e-3;//amplitude of input signal without feedback in V
Vo1=Af*Vi1;//output voltage with feedback in V
Vo2=Vo1;
A=Vo2/Vi2;//open loop gain
beta=(Af-A)/(Af*A);//Feedback factor
printf("\n Open loop gain =%d \n Feedback factor =%f \n",A,beta)

//Answer given in the book is wrong
```

Scilab code Exa 9.3 Calculation of change in overall gain

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
```

Figure 9.3: Calculation of change in overall gain

```
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX9_3.sce

clc;
clear;
Ao=50;//open loop gain in dB
beta=-0.004;//Negative feedback factor

//20 log(V0/Vi)=A0
//let V0/Vi=A
A=10^(Ao/20);
//Let B=dA/A
B=0.01;//10% decreased overall gain
//let C=dAf/Af
C=B/(1-(beta*A));

printf("\n The change in overall gain=%0.4f",-C)
```

Scilab code Exa 9.4 Determination of input impedance

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX9_4.sce

```

Figure 9.4: Determination of input impedance

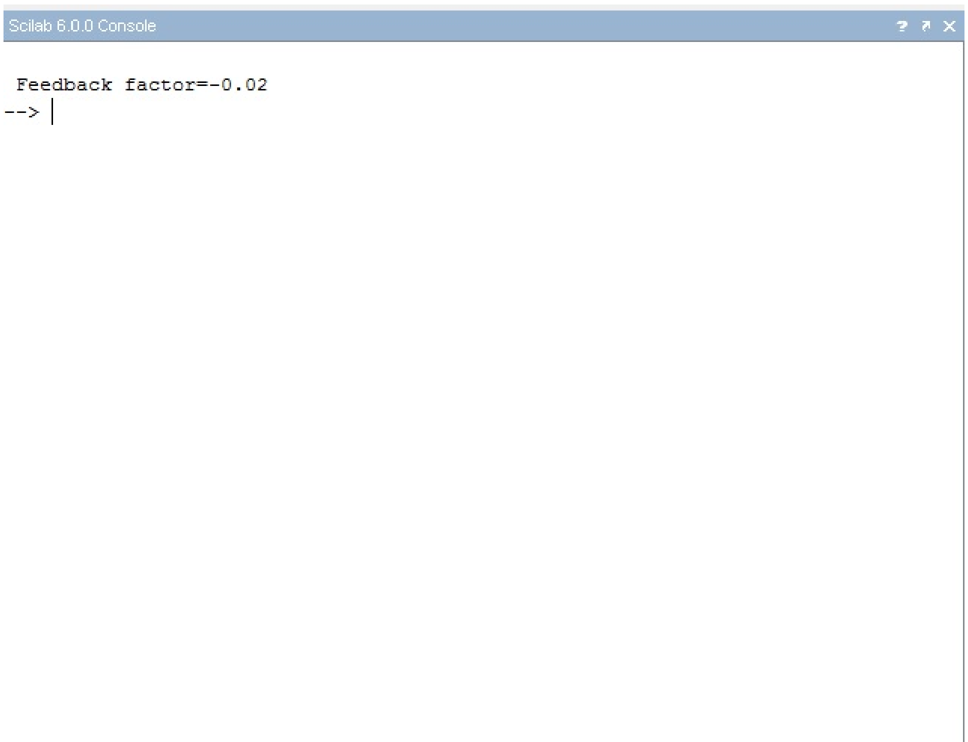

Figure 9.5: Determination of negative feedback factor

```
clc;
clear;
A=1000;//open loop gain
beta=-0.02;//negative feedback factor
Zi=1.5e3;//input impedence in ohm
Zif=Zi*(1-(beta*A));
printf("\n Input impedence with feedback=%0.1f kohm"
    ,Zif*1e-3)
```

Scilab code Exa 9.5 Determination of negative feedback factor

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX9_5.sce

clc;
clear;
Zo=10e3;//output impedence without feedback in ohm
Zof=500;//output impedence with feedback in ohm
A=1000;//open loop gain is 60 dB
//60 dB=10^(60/20)=1000
beta=(Zof-Zo)/(Zof*A); //obtained from the equation Zof=(Zo/(1-(B*A))
printf("\n Feedback factor=%0.2f",beta)

//Answer vary dueto roundoff error
```

Scilab code Exa 9.6 Calculation of gain and distortion

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX9_6.sce

clc;
```

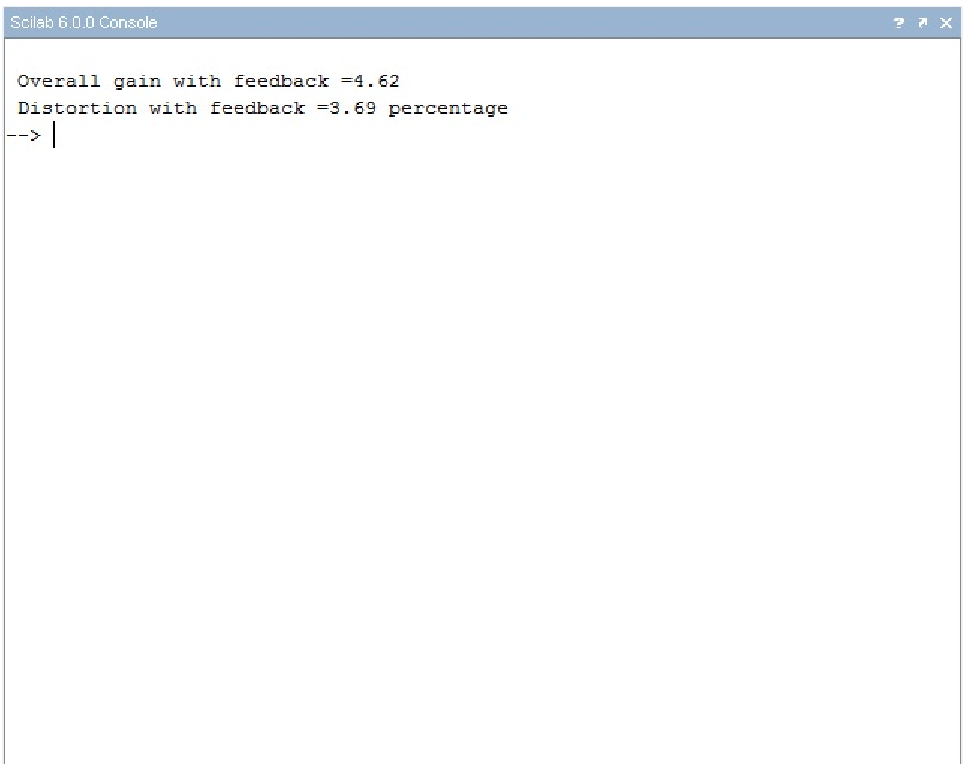

Figure 9.6: Calculation of gain and distortion

Figure 9.7: Calculation of percentage change in gain

```
clear;
A=15;//gain of amplifier
D=12;//Distortion without feedback
beta=-0.15;//negative feedback factor
Af=A/(1-(beta*A));
Df=D/(1-(beta*A));
printf("\n Overall gain with feedback =%0.2f \n
   Distortion with feedback =%0.2f percentage",Af,Df
   )
```

Scilab code Exa 9.7 `Calculation of percentage change in gain`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX9_7.sce

clc;
clear;
A=25;// open loop gain
beta=-0.1;//negative feedback factor
Af=A/(1-(beta*A));//overall gain
A0=A*(5/100);//increased open loop gain by 5%
A1=A+A0;//new open loop gain value after the
    increase
Afnew=A1/(1-(beta*A1));//new overall gain value
Afper=((Afnew-Af)/(Af))*100;
printf("\n Percentage gain in overall gain=%0.1f
    percentage",Afper)
```

Chapter 10

Electronic Oscillators

Scilab code Exa 10.1 Calculation of frequency of oscillator

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX10_1.sce

clc;
clear;
L=60e-6;//inductor value in H
C=300e-12;//capacitor value in F
f=1/(2*%pi*sqrt(L*C));
printf("\n Frequency of the oscillator =%d kHz \n",f
   *1e-3)
```

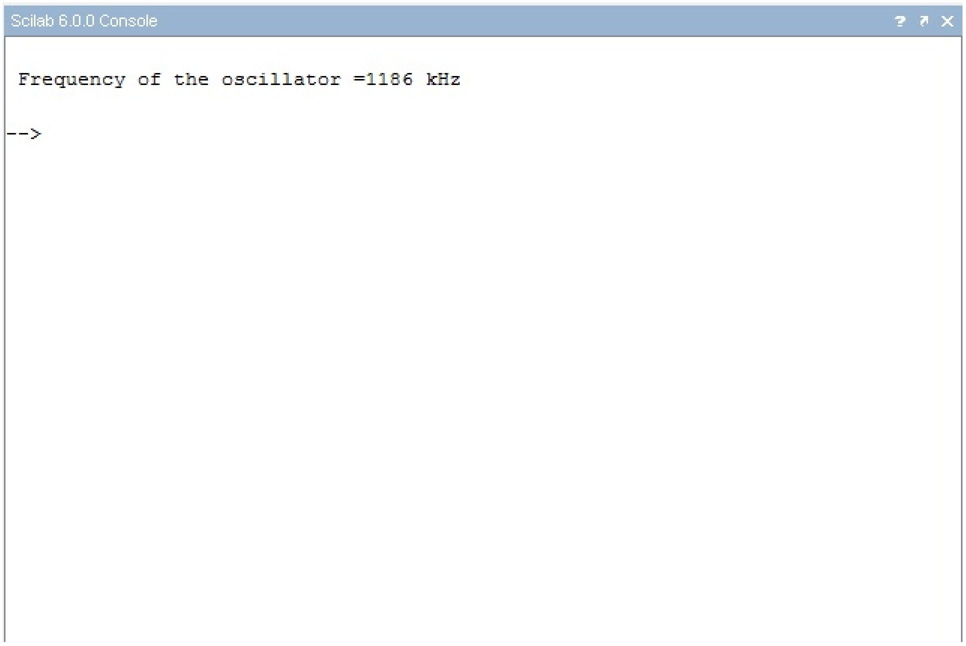

Figure 10.1: Calculation of frequency of oscillator

Scilab code Exa 10.2 `Calculation of frequency of oscillator`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX10_2.sce

clc;
clear;
L1=0.3e-3;//value of inductor1 in H
L2=0.2e-3;//value of inductor2 in H
```

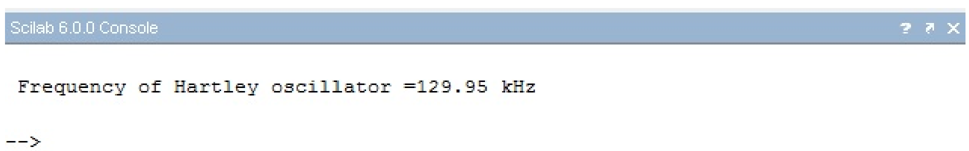

Figure 10.2: Calculation of frequency of oscillator

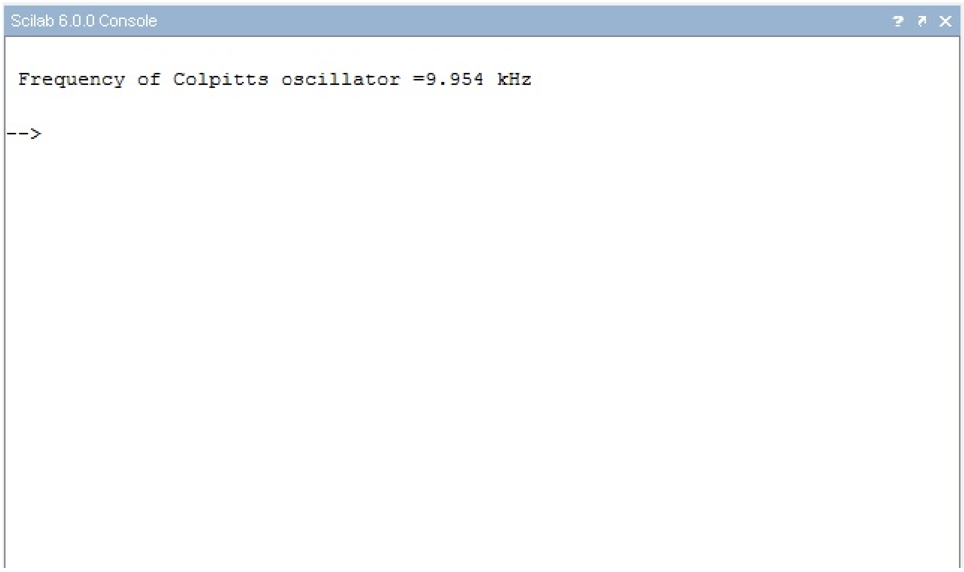

Figure 10.3: Calculation of frequency of oscillator

```
C=0.003e-6;//capacitor value in F
f=1/(2*%pi*sqrt((L1+L2)*C));//equation of frequency
   for Hartley oscillator
printf("\n Frequency of Hartley oscillator =%0.2f
   kHz \n",f*1e-3)

//Note:There is a error in the book for calculating
   frequency
      // Answer given in the book was wrong
```

Scilab code Exa 10.3 `Calculation of frequency of oscillator`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
```

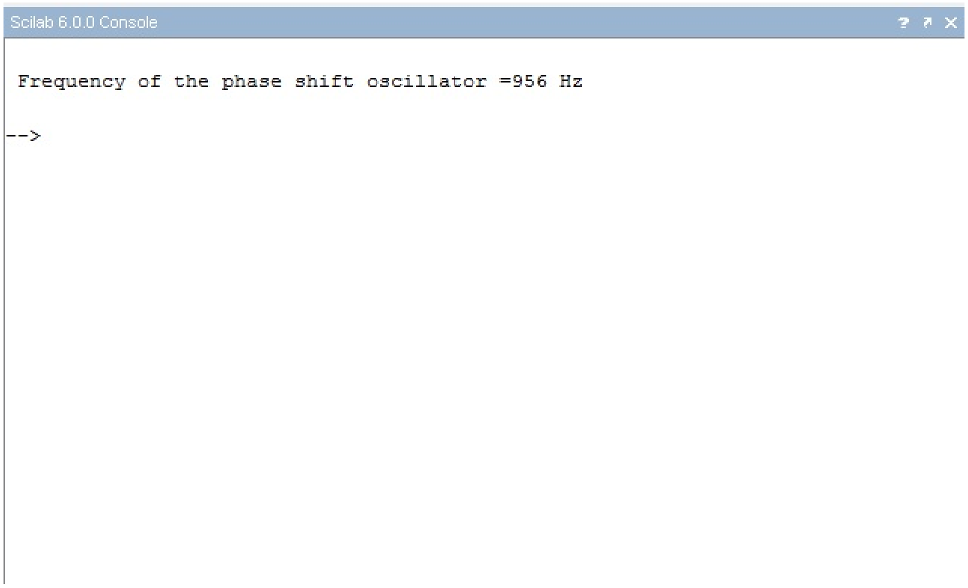

Figure 10.4: Calculation of frequency of oscillator

```
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX10_3.sce

clc;
clear;
C1=0.16e-6;//value of capacitor1 in F
C2=0.018e-6;//value of capacitor2 in F
L=15.8e-3;//value of inductor in H
f=(1/(2*%pi))*sqrt((C1+C2)/(L*C1*C2));//Equation of frequency for Colpitts oscillator
printf("\n Frequency of Colpitts oscillator =%0.3f kHz \n",f*1e-3)
```

Scilab code Exa 10.4 Calculation of frequency of oscillator

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX10_4.sce

clc;
clear;
R=680e3;//given R1=R2=R3=680 kHz
C=100e-12;//given C1=C2=C3=100 pF
f=1/(2*%pi*R*C*sqrt(6));//equation of frequency for
    phase-shift oscillator
printf("\n Frequency of the phase shift oscillator =
    %1.0f Hz \n",f)
```

Scilab code Exa 10.5 Determination of value of capacitors

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX10_5.sce
```

Figure 10.5: Determination of value of capacitors

```

clc;
clear;
f=3e3;//frequency of the Wiens bridge oscillator in Hz
R=200e3;//resistors value in ohm
//equation of frequency for Wiens bridge oscillator is f=1/(2*%pi*C*R)
C=1/(2*%pi*f*R);
printf("\n The value of capacitance =%0.1f pF",C*1e12)

//Answer given in the book is vary
//C=265.5 pF is slightly wrong(point variation)
//There is a calculation error in the book
```

Chapter 11

Modulation and Demodulation

Scilab code Exa 11.1 Calculation of side band frequencies and bandwidth

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX11_1.sce

clc;
clear;
fc=600;//carrier frequency in kHz
fm=1.5;//modulating frequency in kHz

printf("(1)\n")
usf=fc+fm;
lsf=fc-fm;
printf("\n upper side band frequency=%0.1f kHz \n ",usf)
```

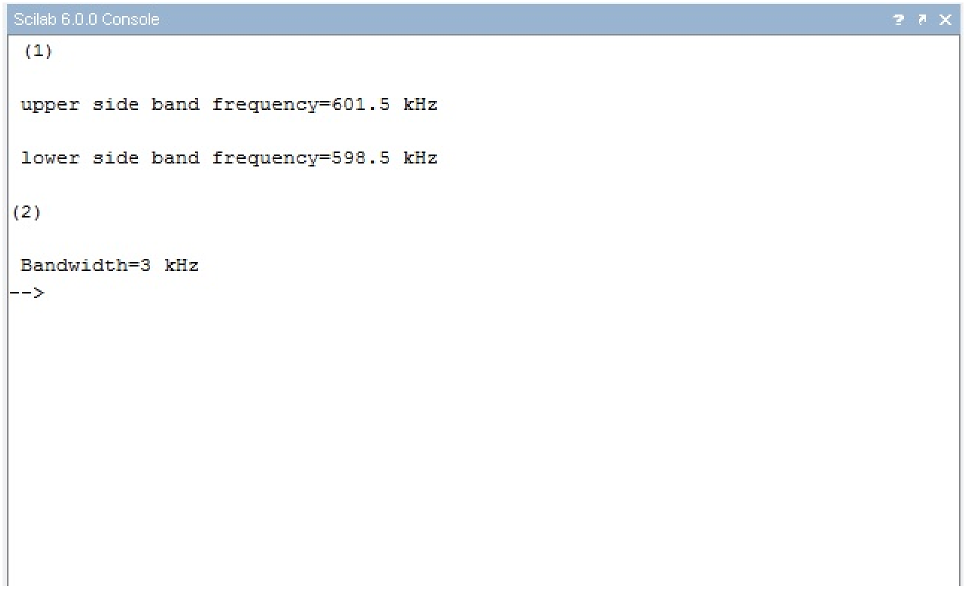

Figure 11.1: Calculation of side band frequencies and bandwidth

```
printf("\n lower side band frequency=%0.1f kHz \n ",lsf)

printf("\n(2)\n")
BW=2*fm;
printf("\n Bandwidth=%d kHz",BW)
```

Scilab code Exa 11.2 `Calculation of developed power`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0
```

Figure 11.2: Calculation of developed power

```

//EX11_2.sce

clc;
clear;
Ec=80;//peak voltage of carrier in V
R=80;//Load resistance in ohm
m=0.5;//modulation index

Pc=((Ec/sqrt(2))^2)/R;
Pt=Pc*(1+(m^2)/2);
printf("\n Total power=%1.0f W \n",Pt)
```

Figure 11.3: Calculation of modulated power and side band power

Scilab code Exa 11.3 Calculation of modulated power and side band power

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX11_3.sce

clc;
clear;
Pc=400;//carrier power in W
m=1;//modulation index

printf("\n(1)")
Pt=Pc*(1+(m^2)/2);
printf("\n Total power=%1.0f W",Pt)

```

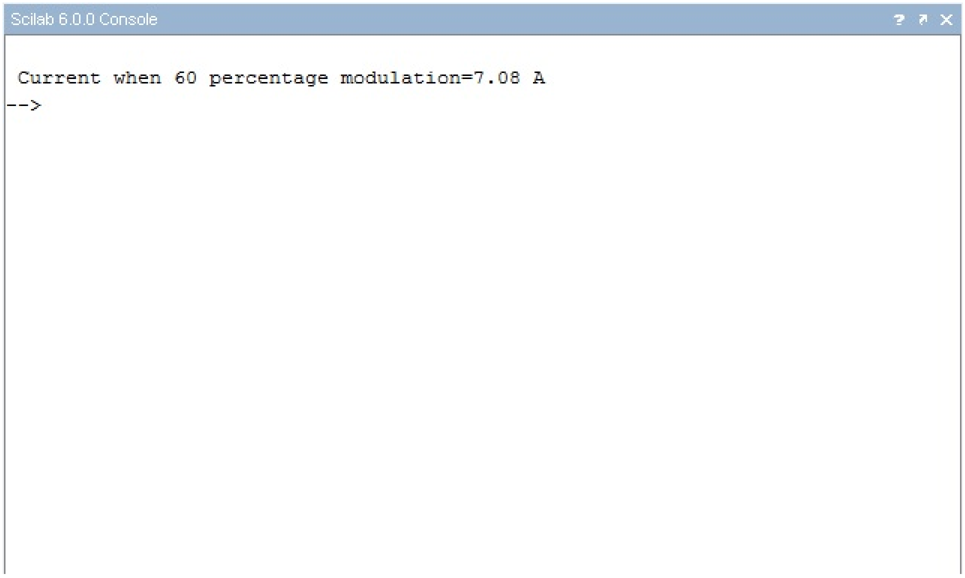

Figure 11.4: Calculation of current

```
printf("\n (2)")
Ps=(Pt*m^2)/(2+m^2);
printf("\n Power in side bands=%1.0f W",Ps)
```

Scilab code Exa 11.4 Calculation of current

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX11_4.sce

```

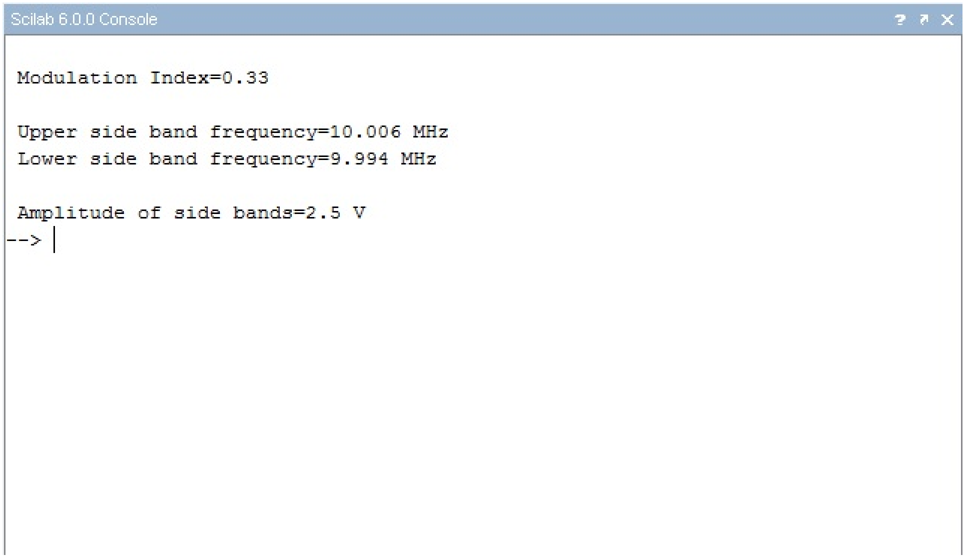

Figure 11.5: Determination of Modulation index

```
clc;
clear;
Ic=6;//load current in A
m=0.6;//modulation is 60 percentage
It=(Ic)*(1+(m^2)/2);

printf("\n Current when 60 percentage modulation=%1
    .2f A",It)
```

Scilab code Exa 11.5 Determination of Modulation index

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
```

```
//Scilab version: Scilab 6.0.0

//EX11_5.sce

clc;
clear;
Va=5; //amplitude of audio signal in V
Vp=15; //peak voltage of carrier in V
fm=6e3;//carrier frequency in Hz
fc=10e6;//modulating frequency in Hz
m=Va/Vp;
printf("\n Modulation Index=%1.2f \n",m)
USF=fc+fm;
LSF=fc-fm;
printf("\n Upper side band frequency=%0.3f MHz",USF
    *1e-6)
printf("\n Lower side band frequency=%0.3f MHz \n",
    LSF*1e-6)
Vs=(1/2)*(m*Vp);//amplitude of side bands in V
printf("\n Amplitude of side bands=%0.1f V",Vs)
```

Scilab code Exa 11.6 Calculation of number of stations

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX11_6.sce

clc;
```

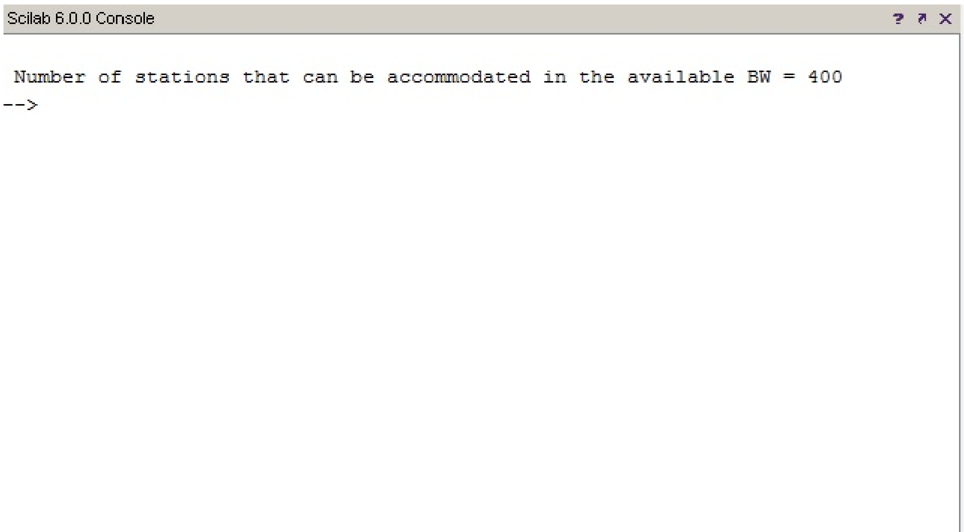

Figure 11.6: Calculation of number of stations

```
clear;
fm=12.5e3;//maximum modulating frequency in Hz
BW=10e6;//available bandwidth in Hz
BWreq=fm*2;//required bandwidth of each stations in
   Hz
Ns=BW/BWreq;
printf("\n Number of stations that can be
   accommodated in the available BW = %d ",Ns)
```

Scilab code Exa 11.7 Calculation of width of channel and side band

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
```

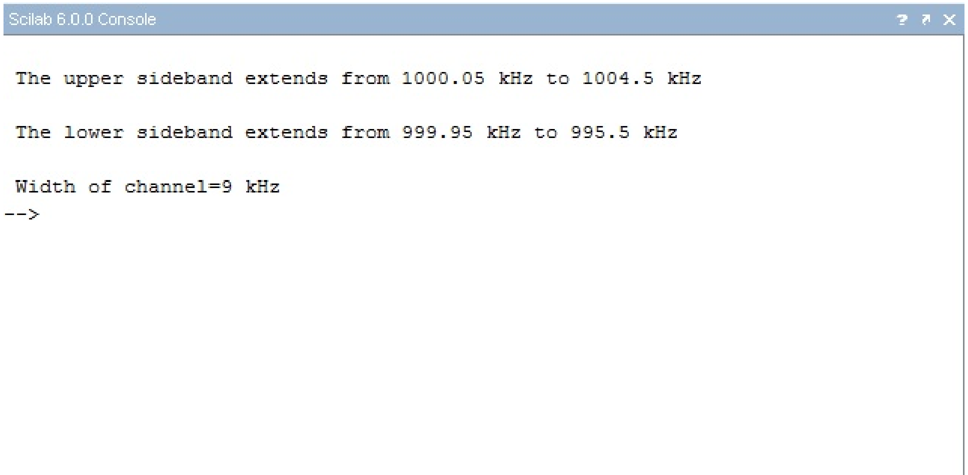

Figure 11.7: Calculation of width of channel and side band

```
//Scilab version: Scilab 6.0.0

//EX11_7.sce

clc;
clear;
fc=1e6;//carrier frequency in Hz
fmin=50;//minimum range of frequency in Hz
fmax=4500;//maximum range of frequency in Hz
USFmin=fc+fmin;
USFmax=fc+fmax;
printf("\n The upper sideband extends from %4.2f kHz to %4.1f kHz \n",USFmin*1e-3,USFmax*1e-3)
LSFmin=fc-fmin;
LSFmax=fc-fmax;
printf("\n The lower sideband extends from %3.2f kHz to %3.1f kHz \n",LSFmin*1e-3,LSFmax*1e-3)
W=USFmax-LSFmax;
printf("\n Width of channel=%d kHz",W*1e-3)
```

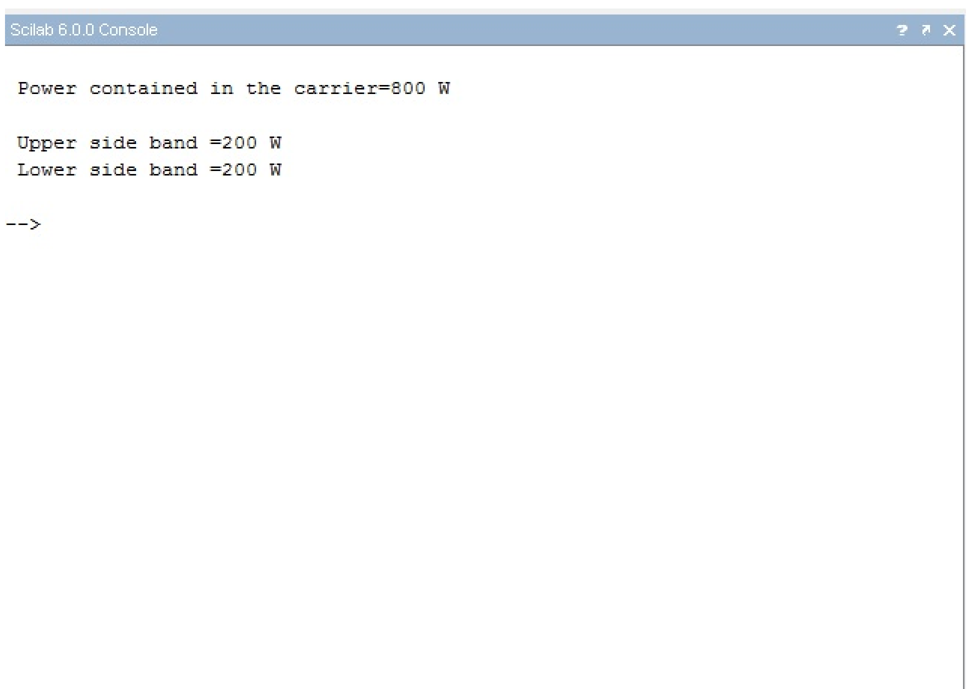

Figure 11.8: Calculation of power contained in the carrier

Scilab code Exa 11.8 `Calculation of power contained in the carrier`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX11_8.sce

clc;
clear;
Pt=1200;//total power content of AM in W
m=1;//100 percentage modulation index
Pc=(Pt*2)/(2+m^2);
Pusb=(m^2/4)*Pc;
Plsb=Pusb;
printf("\n Power contained in the carrier=%d W \n",Pc)
printf("\n Upper side band =%d W \n Lower side band =%d W \n",Pusb,Plsb)
```

Scilab code Exa 11.9 `Calculation of saved power`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
```

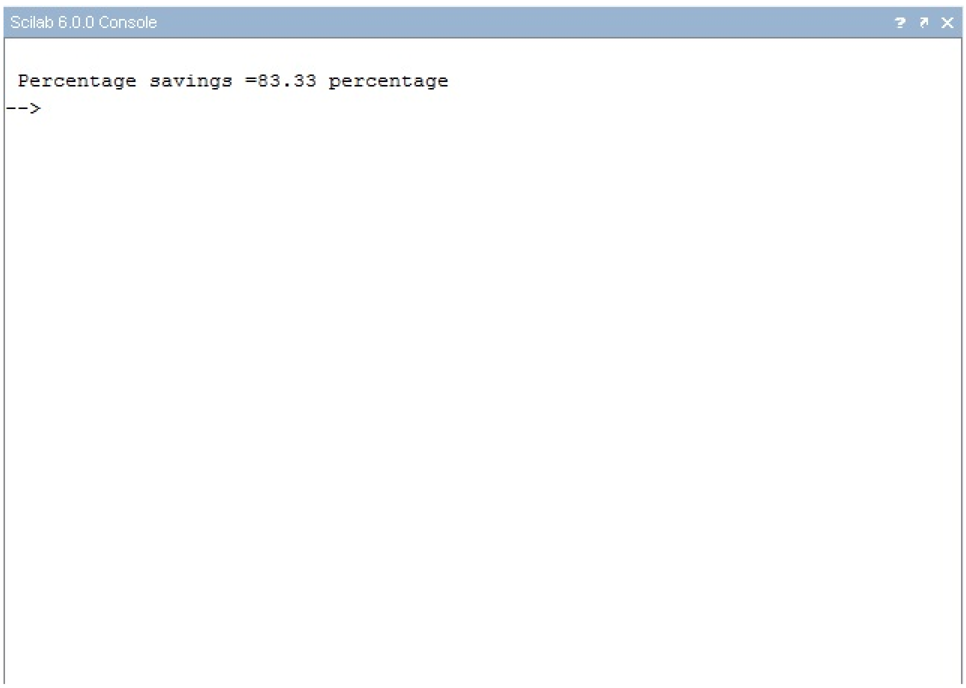

Figure 11.9: Calculation of saved power

```
//Scilab version: Scilab 6.0.0

//EX11_9.sce

clc;
clear;
m=1;
A=(1+(1/2)*m^2);
//The constant A denotes the ratio of PT and Pc
B=(m^2)/4;
//The constant B denotes the ratio of Pusb and Pc
//Pusb=Plsb
Psaved=A-B;; // saving in power when the carrier and
    one side band are suppressed
%saving=(Psaved/A)*100;
printf("\n Percentage savings =%2.2f percentage ",
   %saving)
```

Scilab code Exa 11.10 Calculation of modulation index

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX11_10.sce

clc;
clear;
CS=80e3;//carrier swing of an FM wave in Hz
f=8e3;//siganl frequency in Hz
```

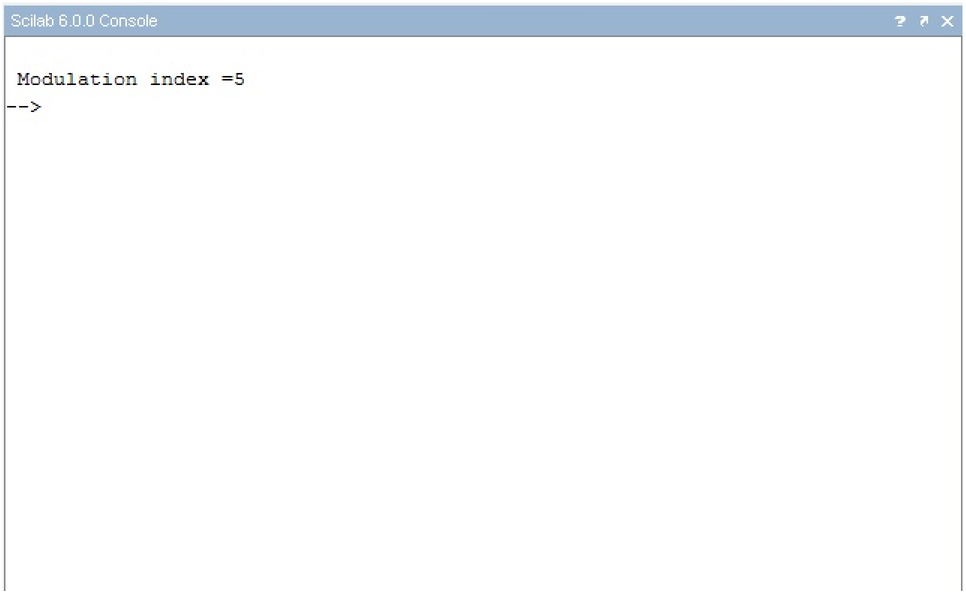

Figure 11.10: Calculation of modulation index

```
Fd=CS/2;//frequency deviation in Hz
m=Fd/f;
printf("\n Modulation index =%d",m)
```

Scilab code Exa 11.11 `Calculation of modulation index`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX11_11.sce

```

Figure 11.11: Calculation of modulation index

```
clc;
clear;
fc=105e6;//centre frequency of an FM carrier in Hz
fmhigh=105.04e6;//highest frequency of the
    modulating signal in Hz
fs=8e3;//siganl frequency in Hz
Fd=fmhigh-fc;
m=Fd/fs;
printf("\n Modulation index =%d",m)
```

Chapter 12

Television

Scilab code Exa 12.1 Calculation of number of active lines and pixel lines

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX12_1.sce

clc;
clear;
Nl=525;//number of lines per frame
R=4/3;//aspect raion
Ns=33;//number of suppressed lines
Na=Nl-Ns;
Nh=R*Na;
printf("\n Number of active lines= %1.0f \n Number
   of pixels per line= %1.0f \n",Na,Nh)
```

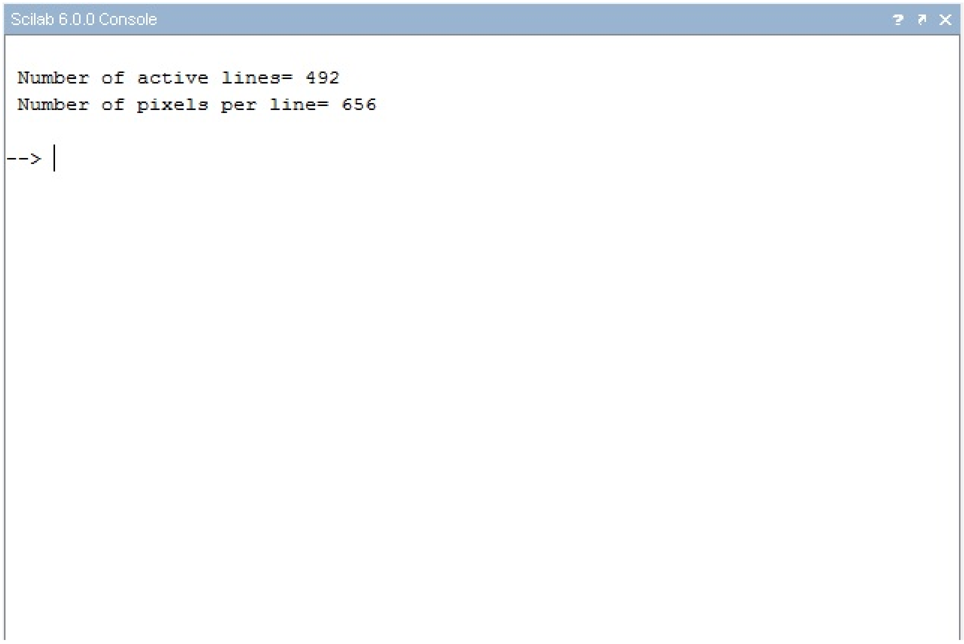

Figure 12.1: Calculation of number of active lines and pixel lines

Scilab code Exa 12.2 `Calculation of sync frequency and line time`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX12_2.sce

clc;
clear;
```

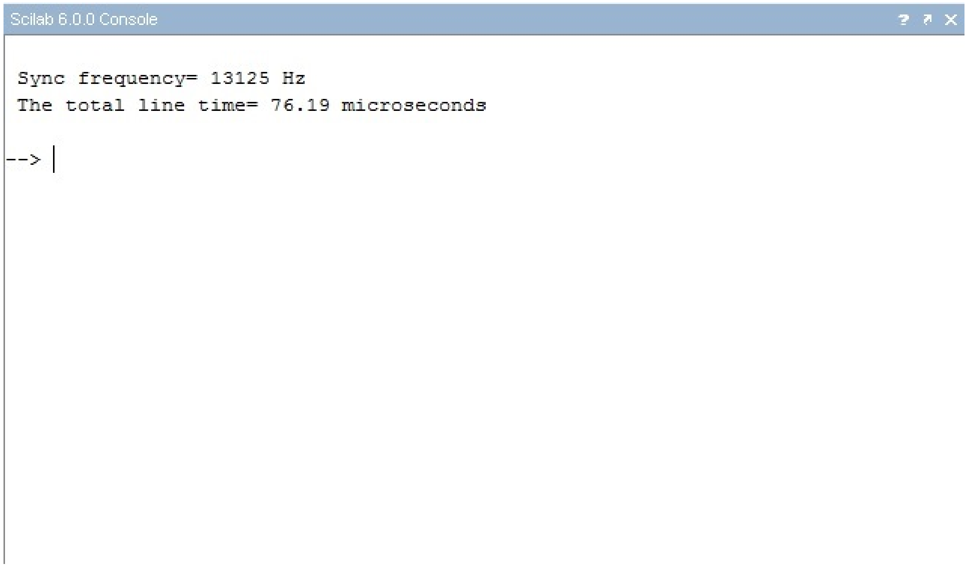

Figure 12.2: Calculation of sync frequency and line time

```
Nt=525;//total number of lines
Prr=25;//picture repetition rate

fh=Nt*Prr;
Th=1/fh;
printf("\n Sync frequency= %1.0f Hz \n The total
    line time= %0.2f microseconds \n",fh,Th*1e6)
```

Scilab code Exa 12.3 `Calculation of bandwidth`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
```

Figure 12.3: Calculation of bandwidth

```
//Scilab version: Scilab 6.0.0

//EX12_3.sce

clc;
clear;
Ts=12e-6;//supression period in seconds
Kf=0.7;//Kell factor
Nl=525;//total number of lines
Ns=25;//number of suppressed lines
a=4/3;//aspect ratio
Th=76.19e-6;//total line time in seconds

BW=(Kf*a*(Nl-Ns))/(2*(Th-Ts));
printf("\n The bandwidth=%0.2f MHz \n",BW*1e-6)

//There is a error in the book for calculation of
    bandwidth
//In the book BW=364 MHz insteadof 3.64 MHz
```

Chapter 13

Electronic Instruments

Scilab code Exa 13.1 Calculation of shunt resistance

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX13_1.sce

clc;
clear;
Imax=10e-3;//Maximum reading current of ammeter in A
CS=100e-6;//Current sensitivity in A
Rm=50;//Resistance in ohm

Ishunt=Imax-CS;
Rshunt=(Rm*CS)/Ishunt;
printf("\n Required shunt resistance=%1.3f ohm \n",
   Rshunt)
```

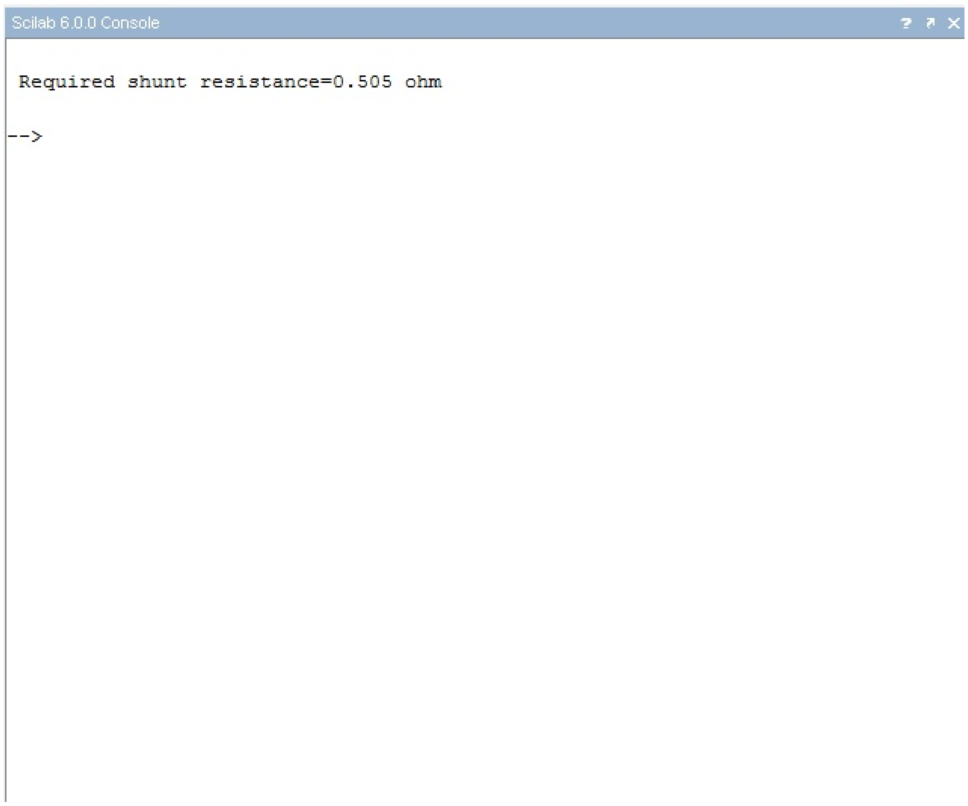

Figure 13.1: Calculation of shunt resistance

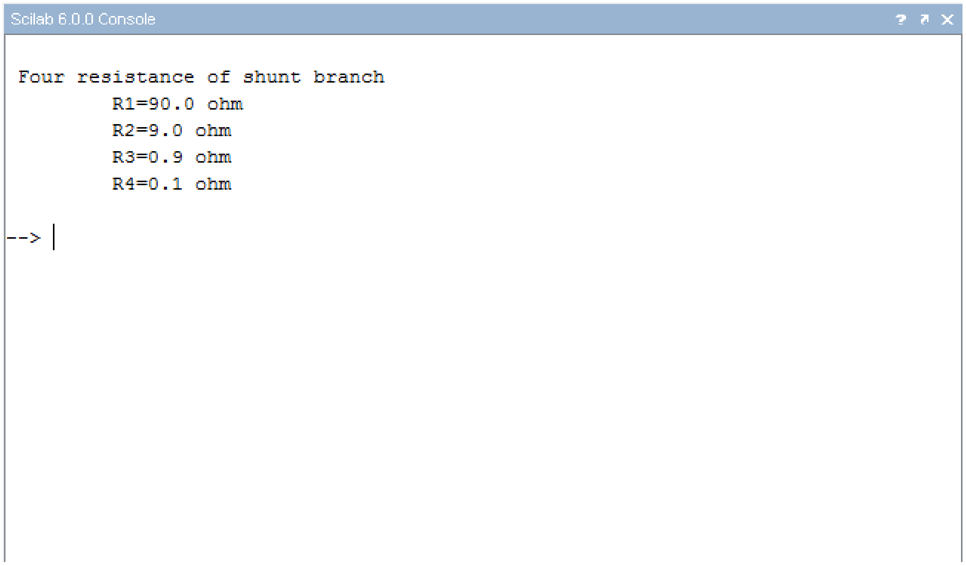

Figure 13.2: Calculation of shunt resistances

Scilab code Exa 13.2 `Calculation of shunt resistances`

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX13_2.sce

clc;
clear;
Rm=150;//Resistance of d'Arsonval movement in ohm
```

```
CS=0.001;//Current sensitivity in A
//CS=Ia1=Ib1=Ic1=Id1
R_shunt=(CS*Rm)/(0.001-0.0001);//Total shunt resistance required
R=750;//The sum shunt resistance that have included in the shunt branch is not feasible to prepare resistors. Therefore 750 ohm resistanceis connected in series with the movement
//case (a): Range(0-1)mA
Ia=0.001;//Current Range of the switch in A
Ia1=0.0001;//Current through the switch in A
Ia2=Ia-Ia1;//Current through the shunt branch in A
 Rma=Rm+R;//Resistance of the meter branch in ohm
 Rsa=(Rma*Ia1)/Ia2;//Resistance of the shunt branch
 //Casec(b): Range(0-10)mA
 //When the range of switch is 10 mA, position R1 goes into series
Ib=0.01;//Current Range of the switch in A
Ib1=0.0001;//Current through the switch in A
Ib2=Ib-Ib1;//Current through the shunt branch in A
Rmb=Rm+R;//Resistance of the meter branch without R1 in ohm
R1=((Rsa*Ib2)-(Rmb*Ib1))/(Ib1+Ib2);
//Casec(c): Range(0-100)mA
//When the range of switch is 100 mA, position R1 and R2 goes into series
Ic=0.1;//Current Range of the switch in A
Ic1=0.0001;//Current through the switch in A
Ic2=Ic-Ic1;//Current through the shunt branch in A
Rmc=Rma+R1;//Resistance of the meter branch without R2 in ohm
Rsc=Rsa-R1;//Resistance of the shunt branch except R2
R2=((Rsc*Ic2)-(Rmc*Ic1))/(Ic1+Ic2);
```

```
//Casec(d): Range(0-1)A
//When the range of switch is 1 A, position R1, R2
    and R3 goes into series
Id=1;//Current Range of the switch in A
Id1=0.0001;//Current through the switch in A
Id2=Id-Id1;//Current through the shunt branch in A
Rmd=Rma+R1+R2;//Resistance of the meter branch
    without R3 in ohm
Rsd=Rsa-R1-R2;//Resistance of the shunt branch
    except R3
R3=((Rsd*Id2)-(Rmd*Id1))/(Id1+Id2);
R4=1-R3;

printf("\n Four resistance of shunt branch\n\t R1=%0
    .1f ohm \n\t R2=%0.1f ohm \n\t R3=%0.1f ohm \n\t
    R4=%0.1f ohm\n",R1,R2,R3,R4)
```

Scilab code Exa 13.3 Calculation of applied AC voltage

```
//Book Name:Principles of Electronics , Vol.II
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX13_3.sce

clc;
clear;

```

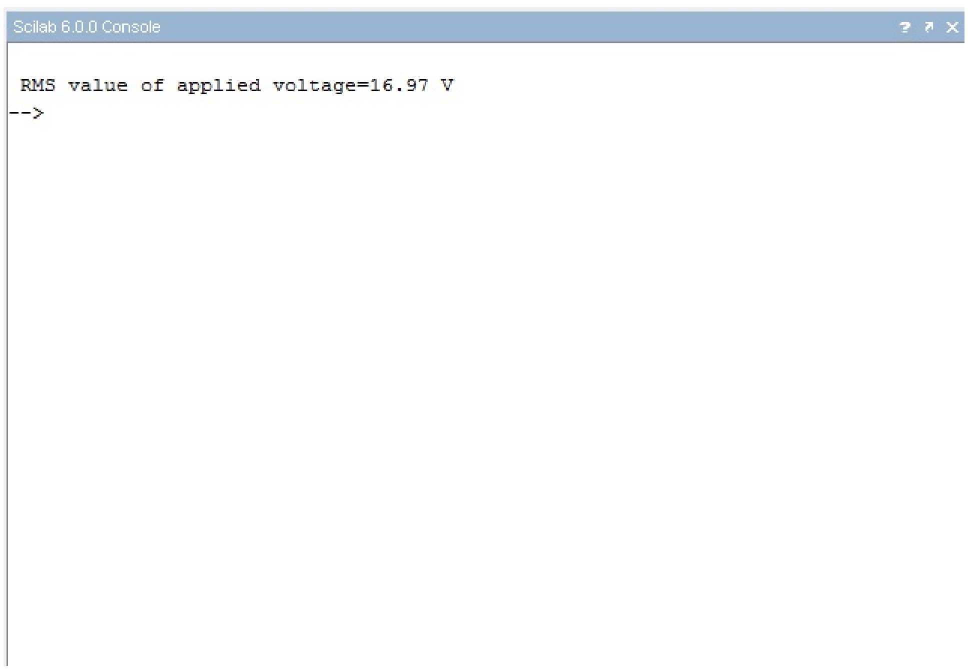

Figure 13.3: Calculation of applied AC voltage

Figure 13.4: Calculation of frequency

```
deflectionsensitivity=4;//unit is V/cm
lengthoftrace=12;//unit is cm

Vpp=deflectionsensitivity*lengthoftrace;//peak to
    peak value of applied voltage in V
Vp=Vpp/2;//peak value of applied voltage in V
Vrms=Vp/sqrt(2);
printf("\n RMS value of applied voltage=%2.2f V",
    Vrms)
```

Scilab code Exa 13.4 `Calculation of frequency`

```
//Book Name:Principles of Electronics , Vol.II
```

```
//Author:B.V.Narayana Rao
//Publisher:New Age International Private Limited
//Edition:Second Edition ,1996
//Operating system: Windows 10
//Scilab version: Scilab 6.0.0

//EX13_4.sce

clc;
clear;
Tc=0.2;//Time control of CRO in ms per cm
D=7.5;//Distance in cm

T=(Tc*D);//period of ac voltage in s
f=1/T;
printf("\n Frequency of ac voltage=%3.1f Hz",f*1e3)
```