

Scilab Textbook Companion for
Principles Of Electronics , Vol. II
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Book Description

Title: Principles Of Electronics , Vol. II

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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

Operating Point

Scilab code Exa 1.1 To find dc load points

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX1.1.sce
9
10 clc;
11 clear;
12 Vcc=10;//dc supply voltage in V
13 Rc=2e3;//collector resiatance in ohm
14 //Vce=Vcc+(Ic*Rc)
15 //To find the coordinates of the load line first put
    Ic=0 in the following equation
16 Ic=0;
```

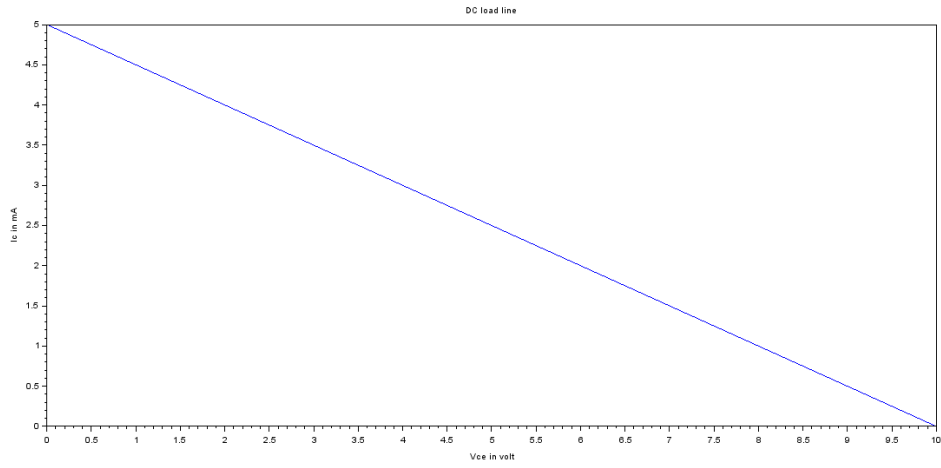


Figure 1.1: To find dc load points

```
Scilab 6.0.0 Console
The coordinates of one end point B of the load line is (10 V,0)
The coordinates of other end point A of the load line is (0,5 mA)
--> |
```

Figure 1.2: To find dc load points

```
Scilab 6.0.0 Console
The operating point is (5 V;1 mA)
-->
```

Figure 1.3: determination of operating points

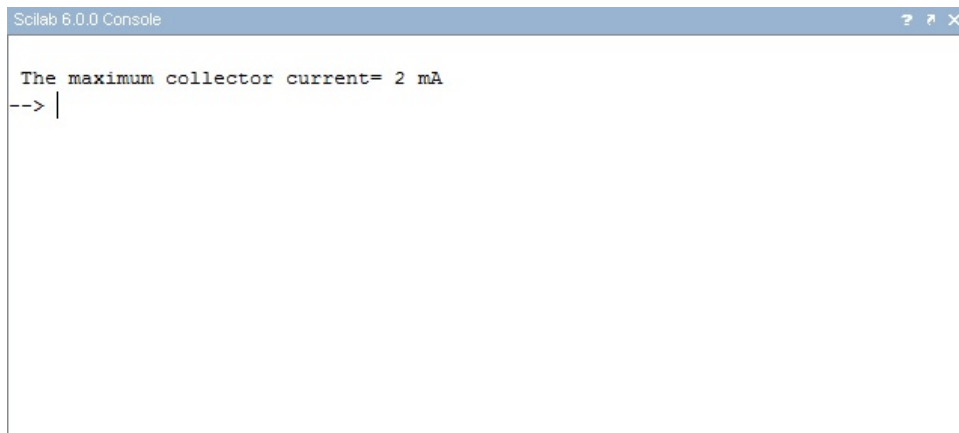
```
17 Vce=Vcc-(Ic*Rc);
18 printf("\n The coordinates of one end point B of the
    load line is (%1.0f V,0)",Vce)
19 //To find the coordinates of the load line then put
    Vce=0 in the following equation
20 Vce=0;
21 Ic=(Vcc-Vce)/Rc;
22 printf("\n The coordinates of other end point A of
    the load line is (0,%1.0f mA)",Ic*1e3)
23
24 vce=0:10;
25 for i=1:11
26     ic(i)=(10-vce(i))/2;
27 end
28 plot(vce,ic)
29 xlabel("Vce in volt")
30 ylabel("Ic in mA")
31 title("DC load line")
```

Scilab code Exa 1.2 determination of operating points

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX1_2.sce
9
10 clc;
11 clear;
12 Rc=5e3;//collector load resistance in ohm
13 Vcc=10;//dc supply voltage in V
14 Ib=20e-6;//base current in A
15 beta=50;
16
17 Ic=beta*Ib;//collector current in A
18 Vce=Vcc-(Ic*Rc);
19 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

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



```
Scilab 6.0.0 Console
The maximum collector current= 2 mA
--> |
```

Figure 1.4: determination of maximum collector current

```
6 //Scilab version: Scilab 6.0.0
7
8 //EX1_3.sce
9
10 clc;
11 clear;
12 Vcc=5;//dc supply voltage in V
13 Rc=2e3;//collector load resistance in ohm
14 Vce=1;//knee voltage in V
15
16 Ic=(Vcc-Vce)/Rc;
17 printf("\n The maximum collector current= %1.0f mA",
        Ic*1e3)
```

Scilab code Exa 1.4 determination maximum input current

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

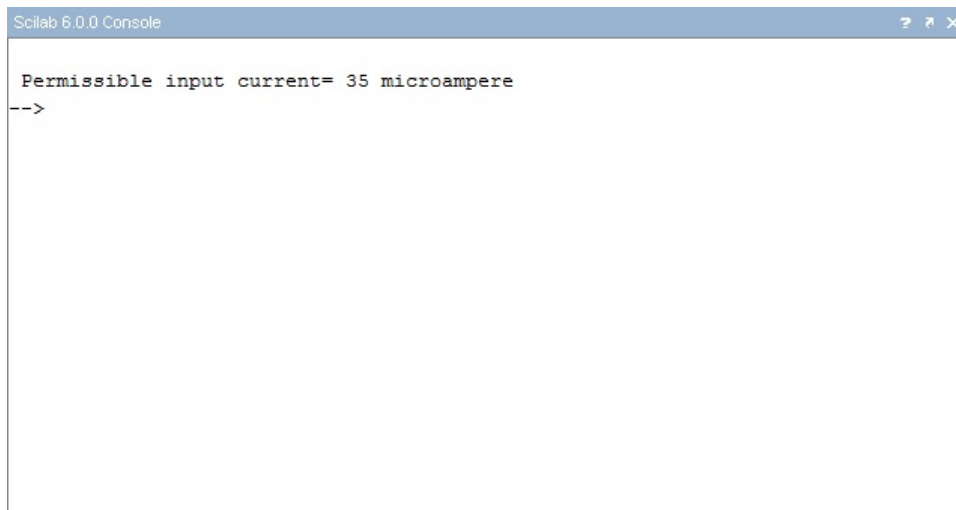


Figure 1.5: determination maximum input current

```
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX1_4.sce
9
10 clc;
11 clear;
12 Rc=4e3;//collector load resistance in ohm
13 Vcc=15;//dc supply voltage in V
14 Vce=1;//knee voltage in V
15 beta=100;
16
17 Ie=(Vcc-Vce)/(beta*Rc);
18 printf("\\n Permissible input current= %1.0 f
        microampere",Ie*1e6)
19
20 //There is a mistake in the book final answer
21 //the book answer is 30 microampere insteadof 35
    microampere
```

Chapter 2

Transistor Biasing Techniques

Scilab code Exa 2.1 Determination of operating point

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX2_1.sce
9
10 clc;
11 clear;
12 Vcc=10;//dc supply voltage in V
13 Rc=2e3;//Collector resistance in ohm
14 Rb=300e3;//base resistance in ohm
15 beta=75;
16 Vbe=1;//voltage across base emitter terminal in V
17
18 Ib=(Vcc-Vbe)/Rb;
19 Ic=beta*Ib;
```

```
Scilab 6.0.0 Console ? ↗ ✕

The operating point is (2.25 mA;5.5 V)


The operating point is in active region

-->
```

Figure 2.1: Determination of operating point

```
20 Vce=Vcc-(Ic*Rc);
21
22 printf("\n The operating point is (%0.2 f mA;%0.1 f V)
    \n",Ic*1e3,Vce)
23
24 Icsat=Vcc/Rc;
25 if Ic<Icsat then
26     printf("\n The operating point is in active
        region \n")
27 else
28     printf("\n The operating point is not in active
        region")
29 end
30
31 //There is a error in the Vce answer
32 //from the given data Vce=5.5V and it is mistakenly
    given as 3.5V
33 //and also Icsat=5mA not 4mA
```

Scilab code Exa 2.2 Calculation of base resistance



```
Scilab 6.0.0 Console
Base resistance Rb=553.3 kohm
-->
```

Figure 2.2: Calculation of base resistance

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX2_2.sce
9
10 clc;
11 clear;
12 Vcc=9;//dc supply voltage in V
13 Rc=3e3;//Collector resistance in ohm
14 beta=100;
15 Vbe=0.7;//voltage across base emitter terminal in V
16
17 Ic_top=Vcc/Rc;
18 Ic_mid=Ic_top/2;
19 Ib=Ic_mid/beta;
20 Rb=(Vcc-Vbe)/Ib;
21 printf("\n Base resistance Rb=%0.1f kohm \n",Rb*1e
```



```
Scilab 6.0.0 Console
Emitter resistance= 300 ohm
--> |
```

Figure 2.3: Calculation of emitter resistance

-3)

Scilab code Exa 2.3 Calculation of emitter resistance

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX2_3.sce
```

```
Scilab 6.0.0 Console

Base current Ib= 9.17 micro ampere
Collector current Ic= 0.91 mA
Emitter current Ie= 1 mA

-->
```

Figure 2.4: Calculation of currents

```
9
10 clc;
11 clear;
12 Vcc=9; //dc supply voltage in V
13 Ib=20e-6; //Base current in A
14 Rb=400e3; //base resistance in ohm
15 beta=50;
16 Vbe=0.7; //voltage across base emitter terminal in V
    for silicon transistor
17
18 Re=((Vcc-Vbe)/(Ib*beta))-(Rb/beta);
19 printf(" \n Emitter resistance= %1.0f ohm \n",Re)
```

Scilab code Exa 2.4 Calculation of currents

```

1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX2_4.sce
9
10 clc;
11 clear;
12 Vcc=12;//dc supply voltage in V
13 Re=1e3;//emitter resistance in ohm
14 Rb=1.1e6;//base resistance in ohm
15 beta=99;
16 Vbe=1;//voltage across base emitter terminal in V
17
18 Ib=(Vcc-Vbe)/(Rb+(beta+1)*Re);
19 Ic=beta*Ib;
20 Ie=Ic+Ib;
21 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)
22
23 //The answer for Ib given in the book has error; Ib
    =9.166 micro ampere
24 //Hence the answer is different from book answer

```

Scilab code Exa 2.5 Calculation of base resistance

```

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

```

```
Scilab 6.0.0 Console
Base resistor Rb= 94 kohm
--> |
```

Figure 2.5: Calculation of base resistance

```
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX2_5.sce
9
10 clc;
11 clear;
12 Vcc=12;//dc supply voltage in V
13 Ic=6e-3;//collector current in A
14 Vce=6;//collector emitter voltage in V
15 beta=100;
16 Vbe=0.3;//voltage across base emitter terminal in V
17
18 Rc=(Vcc-Vce)/Ic;
19 Ib=Ic/beta;
20 //Vcc=(Rc*Ic)+((Rb+Rc)*Ib)+Vbe;
21 Rb=(Vcc-Vbe-(Ic*Rc)-(Ib*Rc))/(Ib);
22 printf("\n Base resistor Rb= %1.0f kohm \n",Rb*1e-3)
```

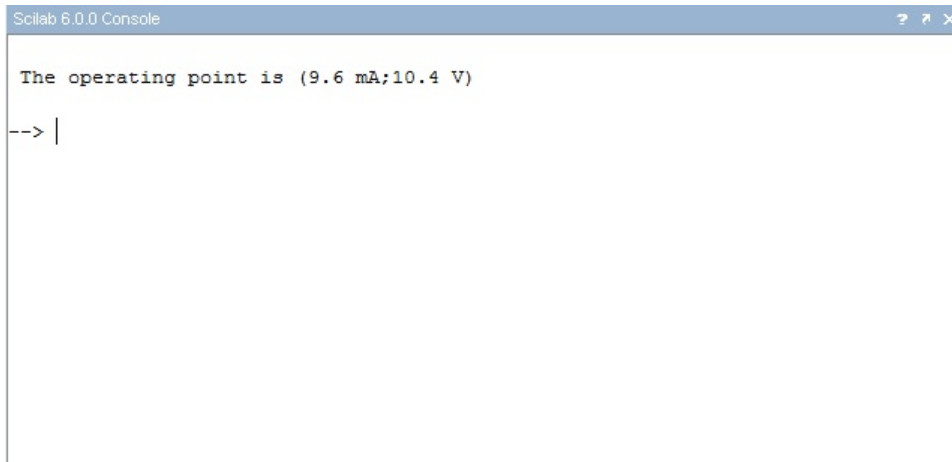
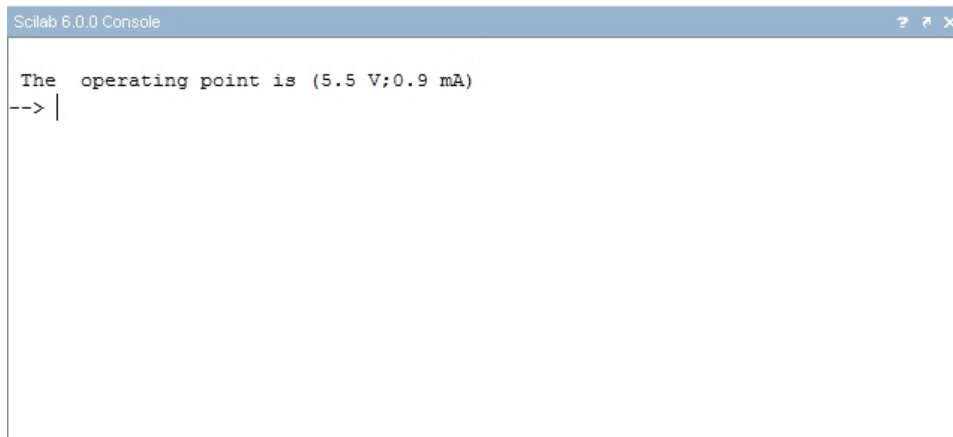


Figure 2.6: Determination of operating point

Scilab code Exa 2.6 Determination of operating point

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX2_6.sce
9
10 clc;
11 clear;
12 Vcc=20;//dc supply voltage in V
13 Rb=100e3;//base resistance in ohm
14 beta=100;
15 Rc=1e3;//collector resistor in ohm
16 Vbe=0.7;//voltage across base emitter terminal in V
    for silicon transistor
```

```
Scilab 6.0.0 Console
The operating point is (5.5 V;0.9 mA)
--> |
```

Figure 2.7: To find dc load points

```
17
18 Ib=(Vcc-Vbe)/(Rb+(1+beta)*Rc);
19 Ic=beta*Ib;
20 Vce=Vcc-(Ic*Rc);
21 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

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX2_7.sce
9
10 clc;
```

```

11 clear;
12 Rc=2e3; //collector resistance in ohm
13 Re=3e3; //emitter resistance in ohm
14 R1=14e3;
15 R2=6e3;
16 Vcc=10; //dc supply voltage in V
17 Vbe=0.3; //Base emitter voltage for Germanium
18
19 //To get the end point B of the load line ,Ic is 0
20 Ic=0;
21 Vce=Vcc-(Ic*(Rc+Re));
22
23 //To get the end point A of the load line , Vce is 0
24 Ic=Vcc/(Rc+Re);
25
26 V2=Vcc*(R2/(R1+R2));
27 Ic=(V2-Vbe)/Re;
28 Vce=Vcc-(Ic*(Rc+Re));
29 printf("\n The operating point is (%0.1f V;%0.1f mA
    )",Vce,Ic*1e3)

```

Scilab code Exa 2.8 Calculation of percentage error

```

1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX2_8.sce
9
10 clc;

```

```

Scilab 6.0.0 Console
The operating point by approximate method is (0.3 mA;7.5 V)
The operating point by using Thevenins Theorem is (0.3168 mA;7.248 v)
Current error= -5.6 percentage
Voltage error= 3.36 percentage
--> |

```

Figure 2.8: Calculation of percentage error

```

11 clear;
12 Rc=6e3; // collector resistance in ohm
13 Re=9e3; // emitter resistance in ohm
14 R1=150e3;
15 R2=50e3;
16 Vcc=12; // dc supply voltage in V
17 Vbe=0.3; // Base emitter voltage in V for Germanium
18 beta=99;
19
20 V2=Vcc*(R2/(R1+R2));
21 Ic1=(V2-Vbe)/Re;
22 Vce1=Vcc-(Ic1*(Rc+Re));
23 printf("\n The operating point by approximate method
        is (%0.1 f mA;%0.1 f V)",Ic1*1e3,Vce1)
24
25 Vth=Vcc*(R2/(R1+R2));
26 Rth=(R1*R2)/(R1+R2);
27 Ic2=(beta*Vth)/(Rth+(beta+1)*Re);
28 Vce2=Vcc-(Rc+Re)*Ic2;
29 printf("\n The operating point by using Thevenins
        Theorem is (%0.4 f mA;%0.3 f v)",Ic2*1e3,Vce2)
30

```

```
31 CE=((Ic1-Ic2)/Ic1)*100;
32 VE=((Vce1-Vce2)/Vce1)*100;
33 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

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX3_1.sce
9
10 clc;
11 clear;
12 //collector current in A
13 Ic1=2e-3;
14 Ic2=2.5e-3;
15 Ic3=6e-3;
16 Ic4=9.5e-3;
17 //collector-emitter voltage in V
18 Vce1=4;
19 Vce2=6;
```

```
Scilab 6.0.0 Console

hoe= 250 micro-mho
hre= 0.000357
hfe= 175
hie= 2.5 kohm

-->
```

Figure 3.1: Calculation of hybrid parameters

```
20 Vce3=6;
21 Vce4=20;
22 //base current in A
23 Ib1=20e-6;
24 Ib2=20e-6;
25 Ib3=40e-6;
26 Ib4=40e-6;
27 //voltage across base and emitter in V
28 Vbe1=0.65;
29 Vbe2=0.65;
30 Vbe3=0.7;
31 Vbe4=0.705;
32
33 delIc=Ic2-Ic1;
34 delVce=Vce2-Vce1;
35 hoe=delIc/delVce;//at constant Ib
36
37
38 delVbe=Vbe4-Vbe3;
```

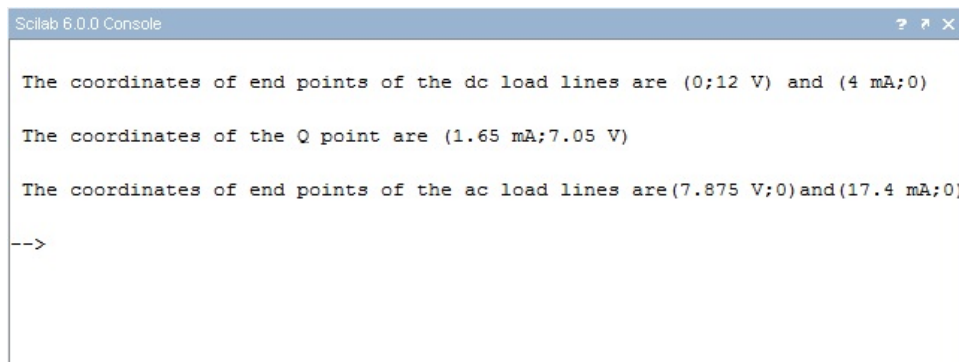
```
39 delVce=Vce4-Vce3;
40 hre=delVbe/delVce;//at constant Ib
41
42 delIc=Ic3-Ic2;
43 delIb=Ib3-Ib2;
44 hfe=delIc/delIb;//at constant Vce
45
46 delVbe=Vbe3-Vbe2;
47 delIb=Ib3-Ib2;
48 hie=delVbe/delIb;//at constant Vce
49 printf("\n hoe= %1.0f micro-mho \n hre= %f \n hfe=
    %1.0f \n hie= %0.1f kohm \n",hoe*1e6,hre,hfe,hie
    *1e-3)
```

Chapter 4

Small Signal BJT Amplifiers

Scilab code Exa 4.1 Determination of DC load line

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



```
Scilab 6.0.0 Console
The coordinates of end points of the dc load lines are (0;12 V) and (4 mA;0)
The coordinates of the Q point are (1.65 mA;7.05 V)
The coordinates of end points of the ac load lines are(7.875 V;0)and(17.4 mA;0)
-->
```

Figure 4.1: Determination of DC load line


```

7
8 //EX4_1.sce
9
10 clc;
11 clear;
12 //following are the values of resistors used in a CE
    amplifier in ohm
13 R1=10e3;
14 R2=5e3;
15 Rc=1e3;
16 Re=2e3;
17 Rl=1e3;
18 Vcc=12; //supply voltage in V
19 //from figure 4.2
20 Vce=Vcc;
21 Icmx=Vcc/(R1+Re); //Maximum collector current in A
22 printf("\n The coordinates of end points of the dc
    load lines are (0;%d V) and (%d mA;0)\n",Vce,
    Icmx*1e3)
23
24 V2=(R2*Vcc)/(R1+R2); //voltage across R2 in V
25 Vbe=0.7; //for silicon Vbe is 0.7 in V
26 Ie=(V2-Vbe)/Re; //emitter current in A
27 Ic=Ie; //collector current in A
28 Vce=Vcc-(Ic*(Rc+Re));
29 printf("\n The coordinates of the Q point are (%0.2 f
    mA;%0.2 f V)\n",Ic*1e3,Vce)
30
31 Rac=(Rc*Rl)/(Rc+Rl); //effective load resistance in
    ohm
32 Vcemax=Vce+(Ic*Rac);
33 Icmx=Ic+(Vcemax/Rac);
34 printf("\n The coordinates of end points of the ac
    load lines are(%0.3 f V;0) and(%0.1 f mA;0)\n",
    Vcemax,Icmx*1e3)

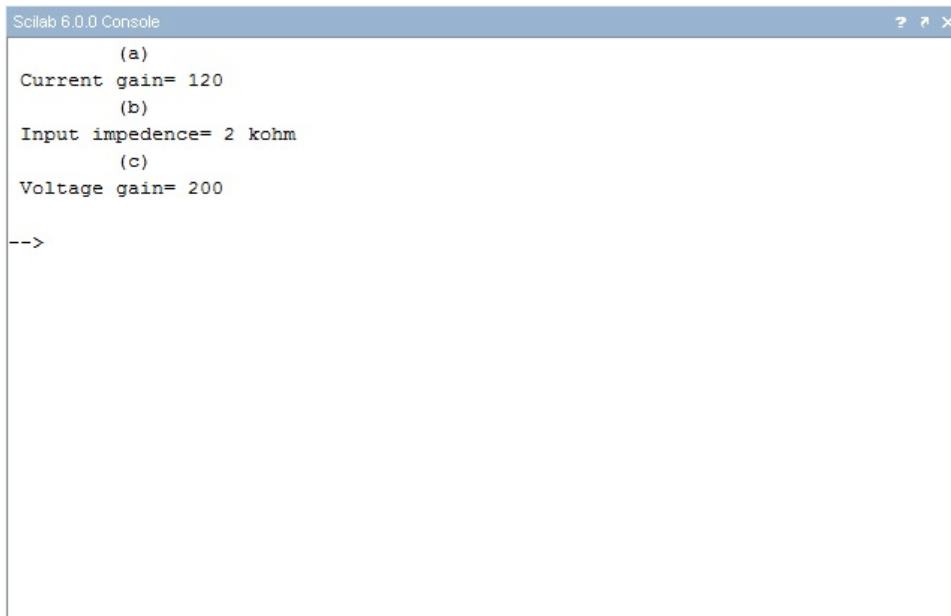
```



Figure 4.2: Determination of voltage gain

Scilab code Exa 4.2 Determination of voltage gain

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX4_2.sce
9
10 clc;
11 clear;
12 Rin=1e3;//input resistance in ohm
13 Rc=2e3;//collector resistance in ohm
14 Rl=1e3;//load resistance in ohm
```



```
Scilab 6.0.0 Console
(a)
Current gain= 120
(b)
Input impedance= 2 kohm
(c)
Voltage gain= 200
-->
```

Figure 4.3: Calculation of current gain voltage gain input impedance

```
15 beta=75;
16
17 Rac=(Rc*Rl)/(Rc+Rl);
18 //Av=(Ic*Rac)/(Ib*Rin);
19 //beta=Ic/Ib;
20 Av=(beta*Rac)/Rin;
21 printf("\n Voltage gain= %d \n",Av)
```

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

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

```

5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX4_3.sce
9
10 clc;
11 clear;
12 delIb=15e-6;//signal(input) current changes in A
13 delIc=1.8e-3;//Collector current changes in A
14 delVi=0.03;//change in signal voltage in V
15 Rc=5e3;//collector resistance in ohm
16 Rl=10e3;//load resistance in ohm
17
18 printf("\t (a)")
19 Ai=delIc/delIb;
20 printf("\n Current gain= %d \n",Ai)
21
22 printf("\t (b)")
23 Rin=delVi/delIb;
24 printf("\n Input impedance= %1.0f kohm \n",Rin*1e-3)
25
26 printf("\t (c)")
27 Rac=(Rc*Rl)/(Rc+Rl);
28 Av=(delIc*Rac)/(delIb*Rin);
29 printf("\n Voltage gain= %d \n",Av)

```

Scilab code Exa 4.4 Calculation of impedance and gain

```

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

```

```
Scilab 6.0.0 Console

Current gain= 297.9

Voltage gain= -321.8

Input impedance= 4.628 kohm

Output impedance= 25.4 kohm

--> |
```

Figure 4.4: Calculation of impedance and gain

```
6 //Scilab version: Scilab 6.0.0
7
8 //EX4_4.sce
9
10 clc;
11 clear;
12 //the following are the h parameters values given
13 hfe=350;
14 hie=5e3;
15 hre=2.5e-4;
16 hoe=35e-6;
17 Rl=5e3;//load resistance in ohm
18 Rs=15e3;//source resistance in ohm
19
20 Ai=hfe/(1+(hoe*Rl));
21 printf("\n Current gain= %0.1f \n",Ai)
22 Av=-(hfe*Rl)/(hie+((hie*hoe)-(hre*hfe))*Rl);
23 printf("\n Voltage gain= %0.1f \n",Av)
24 Zie=hie-((hre*hfe*Rl)/(1+(hoe*Rl)));
25 printf("\n Input impedance= %0.3f kohm \n",Zie*1e-3)
```

```
26 Zo=(hie+Rs)/((hre*hfe)+(hoe*(hie+Rs)));
27 printf("\n Output impedance= %0.1f kohm \n",Zo*1e-3)
28
29 //There is a error in the book for calculation of
    current gain
30 //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

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX5_1.sce
9
10 clc;
11 clear;
12 Vp=-3.5;//pinchoff voltage in V
13 Idss=5e-3;
14 Vgs=-2;//gate-source voltage in V
15 Id=Idss*(1-(Vgs/Vp))^2;
16 printf("\n The drain current= %0.3 f mA",Id*1e3)
```

```
Scilab 6.0.0 Console
The drain current= 0.918 mA
-->
```

Figure 5.1: Calculation of drain current

```
Scilab 6.0.0 Console
(a)
The drain current= 1 mA
The drain voltage= 14 V

(b)
The drain current= 1.25 mA
The drain voltage= 13 V
--> |
```

Figure 5.2: Calculation of drain current and voltage

Scilab code Exa 5.2 Calculation of drain current and voltage

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX5_2.sce
9
10 clc;
11 clear;
12 //From figure 5.4(a) the following values are taken
13 R1=1e6;
14 R2=0.5e6;
15 Rd=4e3;
16 Rs=8e3;
17 Vdd=18;
18
19 Vg=(Vdd*R2)/(R1+R2); //Gate to ground voltage in V
20
21 printf("\t (a)")
22 Vgs=-2; //gate-source voltage in V
23 Id=(Vg-Vgs)/Rs;
24 Vd=Vdd-(Id*Rd);
25 printf("\n The drain current= %d mA",Id*1e3)
26 printf("\n The drain voltage= %d V \n",Vd)
27
28 printf("\n\t (b)")
29 Vgs=-4; //gate-source voltage in V
30 Id=(Vg-Vgs)/Rs;
31 Vd=Vdd-(Id*Rd);
32 printf("\n The drain current= %0.2 f mA",Id*1e3)
```

```
33 printf("\n The drain voltage= %d V \n",Vd)
34
35 //There is a mistake in the book
36 //Rd value is substituted as 8 kohm insteadof 4 kohm
    in Vd formula
37 //hence the output value of Vd get changed
```

Chapter 6

Power Amplifiers

Scilab code Exa 6.1 Determination of turns ratio

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX6_1.sce
9
10 clc;
11 clear;
12 Rldash=100e3;//load impedance in ohm
13 Rl=25;//reflected load impedance in ohm
14 //Rl_dash=(N1/N2)^2*Rl;
15 //a=(N1/N2)^2
16 a=Rldash/Rl;
17 b=sqrt(a);
18 printf("\\n Turns ratio of the transformer = %d:1 \\n"
    ,b)
```

```
Scilab 6.0.0 Console
Turns ratio of the transformer = 63:1
-->
```

Figure 6.1: Determination of turns ratio

```
19
20 //there is a error in the book
21 //both resistance values substituted incorrectly ,
    turns ratio is lessthan one if book value is
    substituted
22 //above resistance value gives the turns ratio
    correctly
```

Scilab code Exa 6.2 Calculation of efficiency of the amplifiers

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

```
Scilab 6.0.0 Console ? ? X
Efficiency of the amplifier = 21.3 percentage
--> |
```

Figure 6.2: Calculation of efficiency of the amplifiers

```

5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX6_2.sce
9
10 clc;
11 clear;
12 Vmax=15;//maximum value of collector_emitter voltage
    in V
13 Vmin=3;//minimum value of collector_emitter voltage
    in V
14 Imax=250e-3;//maximum collector current in A
15 Imin=20e-3;//Minimum collector current in A
16 Icq=135e-3;//Quiescent collector current in A
17 Vcc=12;//DC Power supply in V
18
19 Po=(1/8)*(Vmax-Vmin)*(Imax-Imin)
20 Pi=Vcc*Icq;
21 eta=(Po/Pi)*100;
22 printf("\n Efficiency of the amplifier = %0.1f
    percentage",eta)

```

Scilab code Exa 6.3 Determination of increase in power

```

1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX6_3.sce
9

```

```
Scilab 6.0.0 Console
Percentage increase in power due to distortion =1.723 percentage
--> |
```

Figure 6.3: Determination of increase in power

```
10 clc;
11 clear;
12 //from the given output equation of the amplifier
13 A0=16;
14 A1=1.6;
15 A2=1.3;
16 A3=0.4;
17
18 D2=A1/A0;
19 D3=A2/A0;
20 D4=A3/A0;
21 D=sqrt(D2^2+D3^2+D4^2);
22 //power with distrotion=(1+D^2)*P1 .
23 //P1 is the power due to distortion
24 Pincrease=D^2*100;
25 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

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX6_4.sce
9
```



```
Scilab 6.0.0 Console ? ? x
Ambient temperature =40 degree celcius
--> |
```

Figure 6.5: Calculation of maximum ambient temperature

```
10 clc;
11 clear;
12 Rl=100; //load of power amplifier in ohm
13 a=12; //let a=(N1/N2)
14 Ic=100e-3; //collector current in A
15
16 Rldash=(a^2)*Rl; //reflected impedance in ohm
17 Po=(1/2)*Ic^2*Rldash;
18
19 printf(" \n Maximum ac power output =%d W" ,Po)
```

Scilab code Exa 6.5 Calculation of maximum ambient temperature

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX6_5.sce
9
10 clc;
11 clear;
12 Tc=80;//case temperature in degree celcius
13 Pd=5;//power dissipation of the transistor in W
14 theta=8;//thermal resistance in degree Celcius per
    watt
15
16 Ta=Tc-(Pd*theta);
17 printf("\n Ambient temperature =%d degree celcius",
    Ta)
```

Scilab code Exa 6.6 Calculation of power dissipation

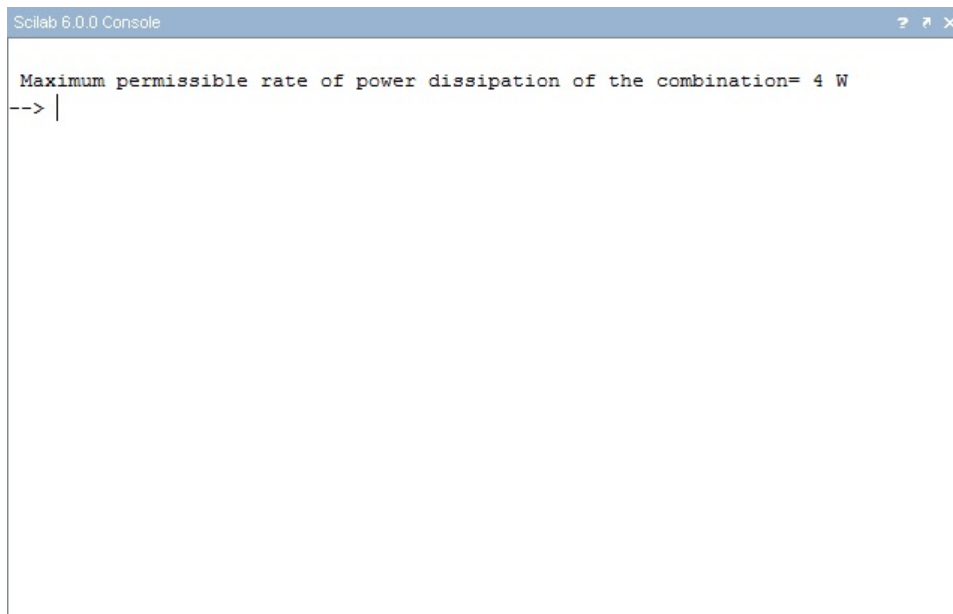
```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX6_6.sce
9
```

```
Scilab 6.0.0 Console
Power dissipation at 50 degree celcius =4 W
--> |
```

Figure 6.6: Calculation of power dissipation

```
10 clc;
11 clear;
12 //from figure 6.17
13
14 CB=100-50;
15 DB=100-25;
16 AD=6;
17 //EC/AD=CB/DB (Similar triangles)
18 EC=AD*(CB/DB);
19 printf("\\n Power dissipation at 50 degree celcius =
    %d W",EC)
```

Scilab code Exa 6.7 Calculation permissible power dissipation



```
Scilab 6.0.0 Console
Maximum permissible rate of power dissipation of the combination= 4 W
--> |
```

Figure 6.7: Calculation permissible power dissipation

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX6_7.sce
9
10 clc;
11 clear;
12 Tj=90;//maximum junction temperature in degree
    celcius
13 Ta=30;//ambient temperature in degree celcius
14 thetaJA=15;//thermal resistance between junction and
    ambient in degree celcius per watt
15 //thetaJA=thetaSC+thetaCS+thetaSA;
16
```

```
Scilab 6.0.0 Console ? ? X

Turns ratio of the transformer= 2:1

Collector current= 500 mA

Collector dissipation= 4 W

--> |
```

Figure 6.8: Calculation of turns ratio and collector current

```
17 Pc=(Tj-Ta)/thetaJA;
18 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

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

```

6 //Scilab version: Scilab 6.0.0
7
8 //EX6_8.sce
9
10 clc;
11 clear;
12 P1=4; //load power in W
13 R1=8; //load resistance in ohm
14 Vcc=16; //dc supply in V
15
16 //P1=(Vmax/sqrt(2))^2/R1;
17 Vmax=sqrt(2*P1*R1);
18 a=Vcc/Vmax;
19 printf("\\n Turns ratio of the transformer= %d:1 \\n",
    a)
20
21 Pdc=2*P1;
22 Ic=(Pdc/Vcc);
23 printf("\\n Collector current= %d mA \\n",Ic*1e3)
24
25 Pc=Pdc-P1;
26 printf("\\n Collector dissipation= %d W \\n", Pc)

```

Scilab code Exa 6.9 Calculation of input power and efficiency

```

1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX6_9.sce

```

```
Scilab 6.0.0 Console ? ? x

Input power= 19.1 W

Efficiency= 49.09 percentage

-->
```

Figure 6.9: Calculation of input power and efficiency

```
9
10 clc;
11 clear;
12 Vpeak=15; //peak volatge across the load in V
13 Rl=12; //load impedence in ohm
14 Vcc=24; //dc supply voltage in V
15 Ipeak=Vpeak/Rl; //Peak value of load current in A
16 Idc=(2/%pi)*Ipeak; //DC current drawn from the
    battery in A
17
18 Pi=Vcc*Idc; //input power in W
19 printf(" \n Input power= %0.1 f W \n", Pi)
20
21 Po=Vpeak^2/(2*Rl); //Output power in W
22 eta=(Po/Pi)*100;
23 printf(" \n Efficiency= %0.2 f percentage \n", eta)
24 //answer in the book was wrong
25 //efficiency formula given in the book was wrong
```

A screenshot of a Scilab 6.0.0 Console window. The window title bar reads "Scilab 6.0.0 Console" and has standard window control buttons (minimize, maximize, close) on the right. The main area of the console displays the text "Power dissipated by each transistor= 213 mW" followed by a prompt "-->" on the next line.

Figure 6.10: Calculation of power dissipation

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

Scilab code Exa 6.10 Calculation of power dissipation

```
1 //Book Name:Principles of Electronics , Vol.II  
2 //Author:B.V.Narayana Rao  
3 //Publisher:New Age International Private Limited  
4 //Edition:Second Edition ,1996  
5 //Operating system: Windows 10  
6 //Scilab version: Scilab 6.0.0  
7
```



```

8 //EX6_10.sce
9
10 clc;
11 clear;
12
13 Vcc=15; //dc supply in V
14 Vpeak_peak=24; //peak to peak maximum voltage in V
15 Rl=100; //load resistance in ohm
16
17 Vpeak=Vpeak_peak/2; //peak voltage across the load in
    V
18 Ipeak=(Vpeak)/Rl; //Peak value of load current in A
19 Idc=(2/%pi)*Ipeak; //DC power drawn from the battery
    in A
20
21 Pdc=Vcc*Idc; //Power drawn from the battery in W
22 P1=(1/2)*(Vpeak^2/Rl); //Power delivered to the load
    in W
23 Pd=Pdc-P1; //power dissipated in the two transistors
    in W
24 Pt=Pd/2;
25 printf("\n Power dissipated by each transistor= %1.0
    f mW",Pt*1e3)

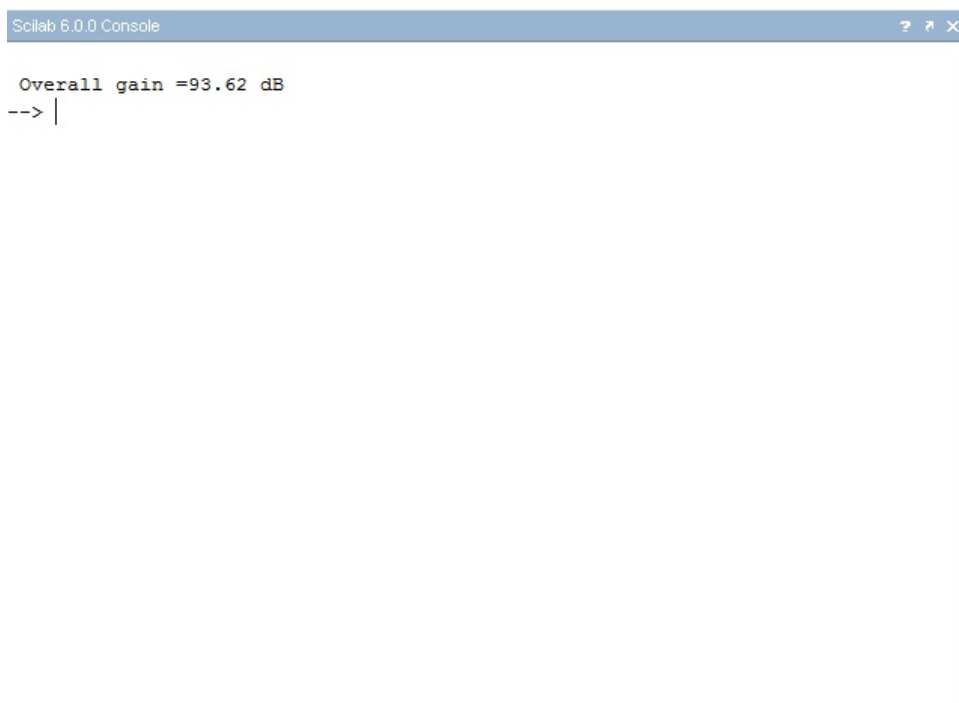
```

Chapter 8

Multistage Amplifiers

Scilab code Exa 8.1 Calculation of over all gain

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX8_1.sce
9
10 clc;
11 clear;
12 Gv1=20;
13 Gv2=40;
14 Gv3=60;
15 //Gv1,Gv2,Gv3 are tha voltage gains of multistage
    amplifiers
16 G=Gv1*Gv2*Gv3;
17 dB=20*log10(G);
18 printf("\n Overall gain =%0.2f dB",dB)
```



```
Scilab 6.0.0 Console ? ? X  
  
Overall gain =93.62 dB  
--> |
```

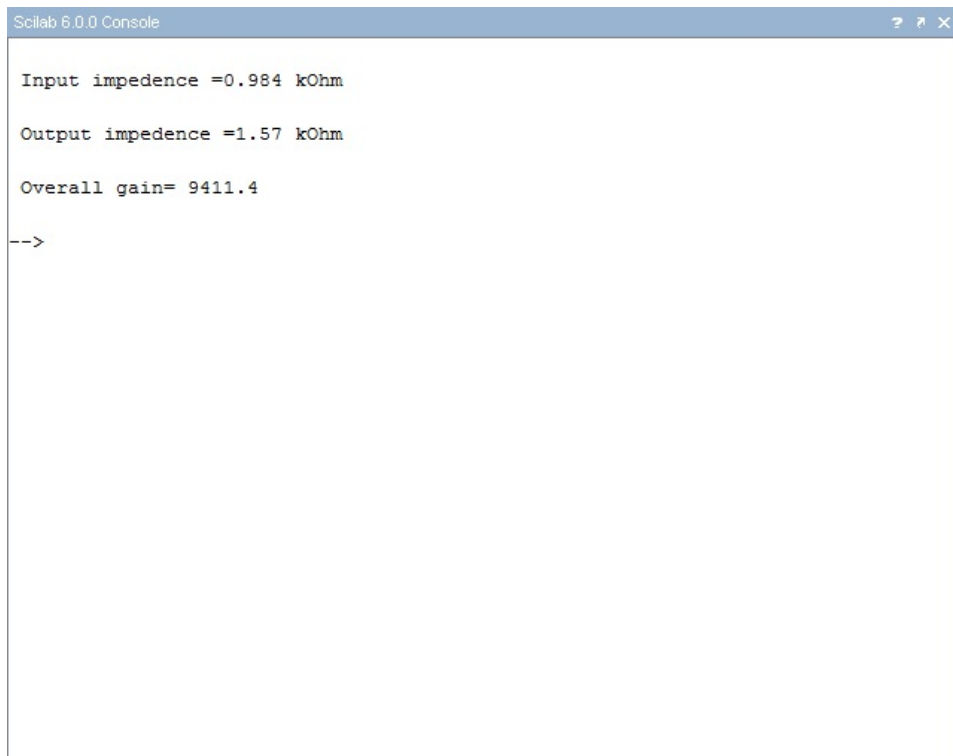
Figure 8.1: Calculation of over all gain



Figure 8.2: Calculation of gain at cutoff frequency

Scilab code Exa 8.2 Calculation of gain at cutoff frequency

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX8_2.sce
9
10 clc;
```



```
Scilab 6.0.0 Console

Input impedance =0.984 kOhm

Output impedance =1.57 kOhm

Overall gain= 9411.4

-->
```

Figure 8.3: Calculation of impedance and gain

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

Scilab code Exa 8.3 Calculation of impedance and gain

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

```

3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX8_3.sce
9
10 clc;
11 clear;
12 hfe=100;
13 hie=1.2e3;
14 //Z1,Z2,Z3,Z4,Z5,Z6,Z7,Z8 are the resistance values(
    Ohm) of the figure(8.13) given
15 Z1=60e3;
16 Z2=6e3;
17 Zi1=(Z1*Z2)/(Z1+Z2);
18 Zi=(Zi1*hie)/(Zi1+hie);
19 printf("\\n Input impedance =%0.3 f kOhm \\n",Zi*1e-3)
20
21 Z3=3e3;
22 Z4=3.3e3;
23 Zo=(Z4*Z3)/(Z4+Z3);
24 printf("\\n Output impedance =%0.2 f kOhm \\n",Zo*1e-3)
25
26 Av2=- (hfe*Zo)/hie; //voltage gain of second stage
27
28 Z6=7e3;
29 Z7=60e3;
30 Z8=6e3;
31 Zf=(Z6*Z7)/(Z6+Z7);
32 Zs=(Z8*hie)/(Z8+hie);
33 Zo1=(Zf*Zs)/(Zf+Zs);
34
35 Av1=- (hfe*Zo1)/hie; //voltage gain of first stage
36
37 A=Av1*Av2;
38 printf("\\n Overall gain= %0.1 f \\n",A)
39

```



Figure 8.4: Determination of turns ratio

```
40  
41 //Answer vary dueto roundoff error
```

Scilab code Exa 8.4 Determination of turns ratio

```
1 //Book Name:Principles of Electronics , Vol.II  
2 //Author:B.V.Narayana Rao  
3 //Publisher:New Age International Private Limited  
4 //Edition:Second Edition ,1996  
5 //Operating system: Windows 10  
6 //Scilab version: Scilab 6.0.0  
7
```

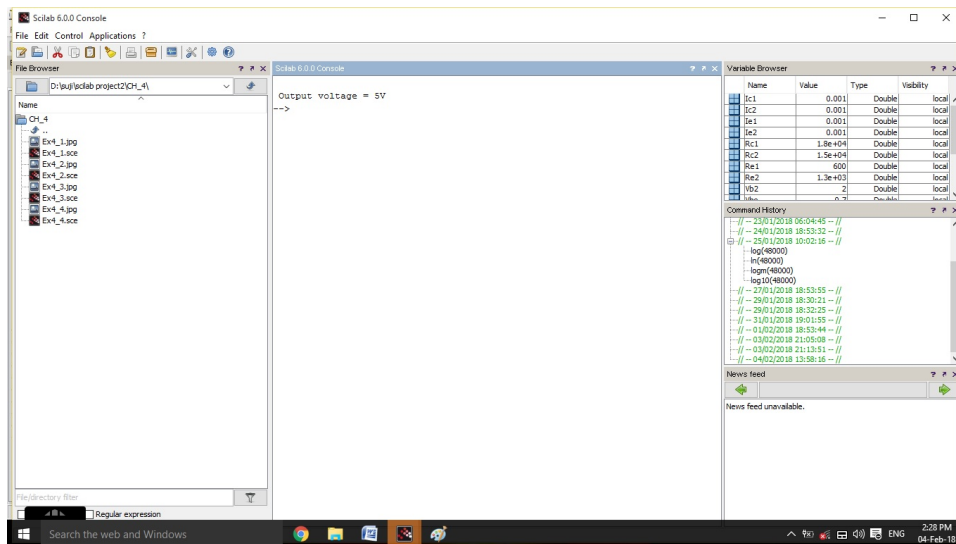


Figure 8.5: Determination of output voltage

```

8 //EX8_4.sce
9
10 clc;
11 clear;
12 Zp=1.5e3;//output impedance of the transistor in ohm
13 Zs=15;//impedence of the speaker in ohm
14 a=(Zp/Zs);
15 //a=(Np/Ns)^2
16 //Np=primary number of turns
17 //Ns=secondary number of turns
18 t=sqrt(a);
19 printf("\n Turns ratio= %d:1",t)

```

Scilab code Exa 8.5 Determination of output voltage

```

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

```



```

2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX8_5.sce
9
10 clc;
11 clear;
12 //from the given circuit 8.15 the following values
    are taken
13 Rc1=18e3;
14 Re1=600;
15 Rc2=15e3;
16 Re2=1.3e3;
17 //resiatance in ohm
18 Vin=1.3;//input voltage in V
19 Vbe=0.7;
20 Vcc=20;
21
22 Ve1=Vin-Vbe;//volatage of emitter terminal of
    transistor1
23 Ie1=Ve1/Re1;
24 Ic1=Ie1;
25 Vc1=Vcc-(Ic1*Rc1);
26
27 Vb2=Vc1;//the base volatge of second stage =
    collector voltage of first stage
28 Ve2=Vb2-Vbe;
29 Ie2=Ve2/Re2;
30 Ic2=Ie2;
31 Vc2=Vcc-(Ic2*Rc2);
32
33 printf("\n Output voltage = %dV",Vc2)

```

Chapter 9

Feedback in Amplifiers

Scilab code Exa 9.1 Calculation of overall gain

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX9_1.sce
9
10 clc;
11 clear;
12 A=90;//open loop gain
13 beta=-0.6;//negative feedback factor
14 Af=A/(1-(beta*A));
15 printf("\n Overall gain =%0.2 f \n",Af)
```

```
Scilab 6.0.0 Console
Overall gain =1.64
--> |
```

Figure 9.1: Calculation of overall gain

```
Scilab 6.0.0 Console
Open loop gain =750
Feedback factor =-0.009778
-->
```

Figure 9.2: Calculation of feedback factor and open loop gain

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

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX9_2.sce
9
10 clc;
11 clear;
12 Af=90;//negative feedback gain
13 Vi1=0.5;//input voltage with feedback in V
14 Vi2=60e-3;//amplitude of input signal without
    feedback in V
15 Vo1=Af*Vi1;//output voltage with feedback in V
16 Vo2=Vo1;
17 A=Vo2/Vi2;//open loop gain
18 beta=(Af-A)/(Af*A);//Feedback factor
19 printf("\n Open loop gain =%d \n Feedback factor =%f
    \n",A,beta)
20
21 //Answer given in the book is wrong
```

Scilab code Exa 9.3 Calculation of change in overall gain

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



```
Scilab 6.0.0 Console
The change in overall gain=-0.0044
-->
```

Figure 9.3: Calculation of change in overall gain

```

3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX9_3.sce
9
10 clc;
11 clear;
12 Ao=50;//open loop gain in dB
13 beta=-0.004;//Negative feedback factor
14
15 //20 log(V0/Vi)=A0
16 //let V0/Vi=A
17 A=10^(Ao/20);
18 //Let B=dA/A
19 B=0.01;//10% decreased overall gain
20 //let C=dAf/Af
21 C=B/(1-(beta*A));
22
23 printf("\\n The change in overall gain=%0.4f",-C)

```

Scilab code Exa 9.4 Determination of input impedance

```

1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX9_4.sce
9

```

```
Scilab 6.0.0 Console ? ↗ ✕  
  
Input impedance with feedback=31.5 kohm  
-->
```

Figure 9.4: Determination of input impedance

```
Scilab 6.0.0 Console ? ? x
Feedback factor=-0.02
--> |
```

Figure 9.5: Determination of negative feedback factor

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

Scilab code Exa 9.5 Determination of negative feedback factor


```

1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX9_5.sce
9
10 clc;
11 clear;
12 Zo=10e3;//output impedance without feedback in ohm
13 Zof=500;//output impedance with feedback in ohm
14 A=1000;//open loop gain is 60 dB
15 //60 dB=10^(60/20)=1000
16 beta=(Zof-Zo)/(Zof*A); //obtained from the equation
    Zof=(Zo/(1-(B*A)))
17 printf("\\n Feedback factor=%0.2 f",beta)
18
19 //Answer vary dueto roundoff error

```

Scilab code Exa 9.6 Calculation of gain and distortion

```

1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX9_6.sce
9
10 clc;

```

```
Scilab 6.0.0 Console ? ? x
Overall gain with feedback =4.62
Distortion with feedback =3.69 percentage
--> |
```

Figure 9.6: Calculation of gain and distortion

```
Scilab 6.0.0 Console
Percentage gain in overall gain=1.4 percentage
-->
```

Figure 9.7: Calculation of percentage change in gain

```
11 clear;
12 A=15; //gain of amplifier
13 D=12; //Distortion without feedback
14 beta=-0.15; //negative feedback factor
15 Af=A/(1-(beta*A));
16 Df=D/(1-(beta*A));
17 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

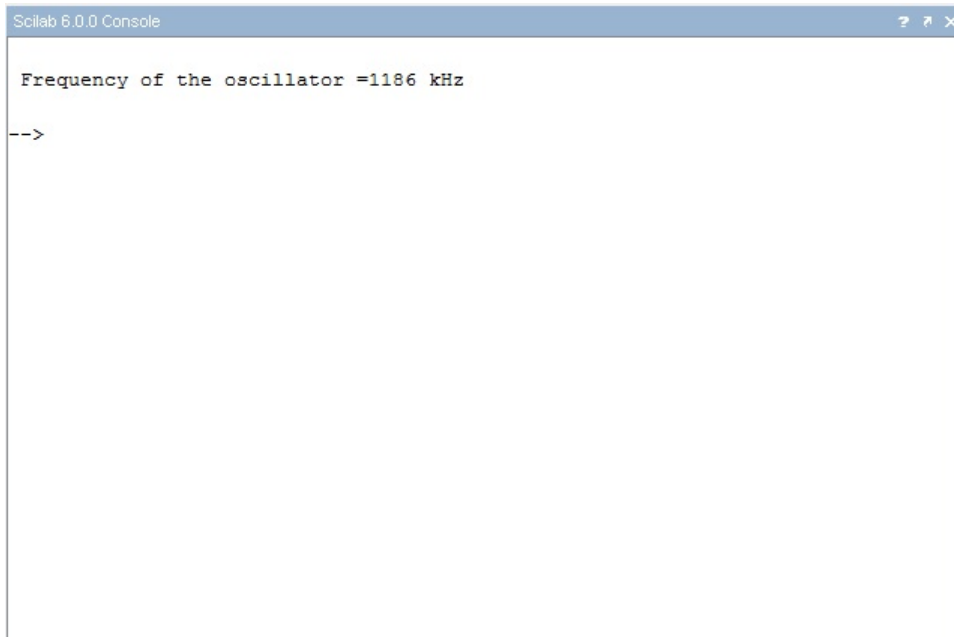
```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX9_7.sce
9
10 clc;
11 clear;
12 A=25;// open loop gain
13 beta=-0.1;//negative feedback factor
14 Af=A/(1-(beta*A));//overall gain
15 A0=A*(5/100);//increased open loop gain by 5%
16 A1=A+A0;//new open loop gain value after the
    increase
17 Afnew=A1/(1-(beta*A1));//new overall gain value
18 Afper=((Afnew-Af)/(Af))*100;
19 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

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX10_1.sce
9
10 clc;
11 clear;
12 L=60e-6;//inductor value in H
13 C=300e-12;//capacitor value in F
14 f=1/(2*%pi*sqrt(L*C));
15 printf("\n Frequency of the oscillator =%d kHz \n",f
    *1e-3)
```



```
Scilab 6.0.0 Console
Frequency of the oscillator =1186 kHz
-->
```

Figure 10.1: Calculation of frequency of oscillator

Scilab code Exa 10.2 Calculation of frequency of oscillator

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX10_2.sce
9
10 clc;
11 clear;
12 L1=0.3e-3;//value of inductor1 in H
13 L2=0.2e-3;//value of inductor2 in H
```

```
Scilab 6.0.0 Console ? ↗ ✕  
  
Frequency of Hartley oscillator =129.95 kHz  
  
-->
```

Figure 10.2: Calculation of frequency of oscillator



Figure 10.3: Calculation of frequency of oscillator

```
14 C=0.003e-6; //capacitor value in F
15 f=1/(2*pi*sqrt((L1+L2)*C)); //equation of frequency
    for Hartley oscillator
16 printf("\n Frequency of Hartley oscillator =%0.2f
    kHz \n",f*1e-3)
17
18 //Note:There is a error in the book for calculating
    frequency
19 // Answer given in the book was wrong
```

Scilab code Exa 10.3 Calculation of frequency of oscillator

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



```
Scilab 6.0.0 Console ? ↗ ✕

Frequency of the phase shift oscillator =956 Hz

-->
```

Figure 10.4: Calculation of frequency of oscillator

```
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX10_3.sce
9
10 clc;
11 clear;
12 C1=0.16e-6;//value of capacitor1 in F
13 C2=0.018e-6;//value of capacitor2 in F
14 L=15.8e-3;//value of inductor in H
15 f=(1/(2*%pi))*sqrt((C1+C2)/(L*C1*C2));//Equation of
    frequency for Colpitts oscillator
16 printf("\n Frequency of Colpitts oscillator =%0.3f
    kHz \n",f*1e-3)
```

Scilab code Exa 10.4 Calculation of frequency of oscillator

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX10_4.sce
9
10 clc;
11 clear;
12 R=680e3;//given R1=R2=R3=680 kHz
13 C=100e-12;//given C1=C2=C3=100 pF
14 f=1/(2*%pi*R*C*sqrt(6));//equation of frequency for
    phase-shift oscillator
15 printf("\\n Frequency of the phase shift oscillator =
    %1.0 f Hz \\n",f)
```

Scilab code Exa 10.5 Determination of value of capacitors

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX10_5.sce
```

```
Scilab 6.0.0 Console
The value of capacitance =265.3 pF
--> |
```

Figure 10.5: Determination of value of capacitors

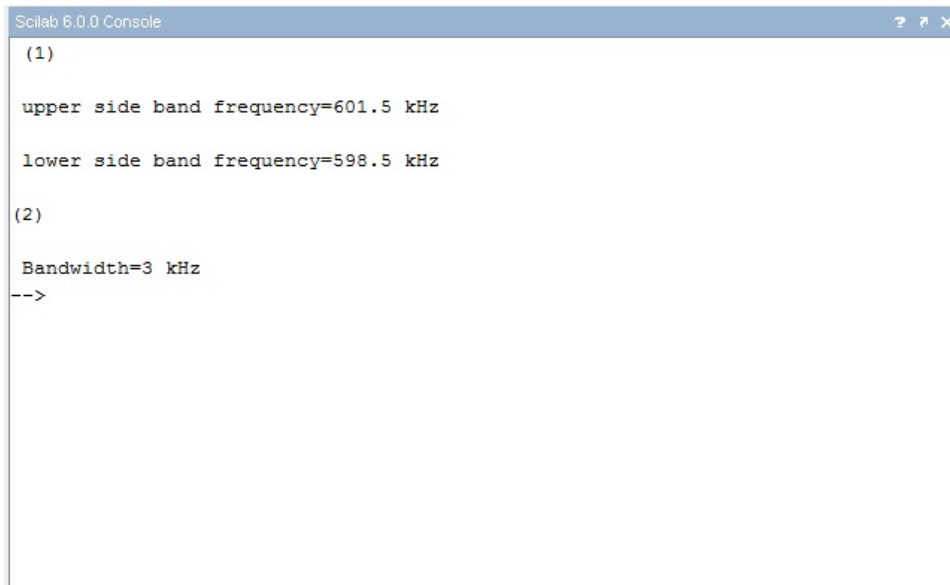
```
9
10 clc;
11 clear;
12 f=3e3; //frequency of the Wiens bridge oscillator in
    Hz
13 R=200e3; //resistors value in ohm
14 //equation of frequency for Wiens bridge oscillator
    is  $f=1/(2*\%pi*C*R)$ 
15 C=1/(2*%pi*f*R);
16 printf(" \n The value of capacitance =%0.1f pF",C*1
    e12)
17
18 //Answer given in the book is vary
19 //C=265.5 pF is slightly wrong(point variation)
20 //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

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX11_1.sce
9
10 clc;
11 clear;
12 fc=600;//carrier frequency in kHz
13 fm=1.5;//modulating frequency in kHz
14
15 printf("(1)\n")
16 usf=fc+fm;
17 lsf=fc-fm;
18 printf("\n upper side band frequency=%0.1f kHz \n ",
    usf)
```



```
Scilab 6.0.0 Console
(1)
upper side band frequency=601.5 kHz
lower side band frequency=598.5 kHz
(2)
Bandwidth=3 kHz
-->
```

Figure 11.1: Calculation of side band frequencies and bandwidth

```
19 printf("\n lower side band frequency=%0.1f kHz \n ",
    lsf)
20
21 printf("\n(2)\n")
22 BW=2*fm;
23 printf("\n Bandwidth=%0d kHz" ,BW)
```

Scilab code Exa 11.2 Calculation of developed power

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

```
Scilab 6.0.0 Console
Total power=45 W
-->
```

Figure 11.2: Calculation of developed power

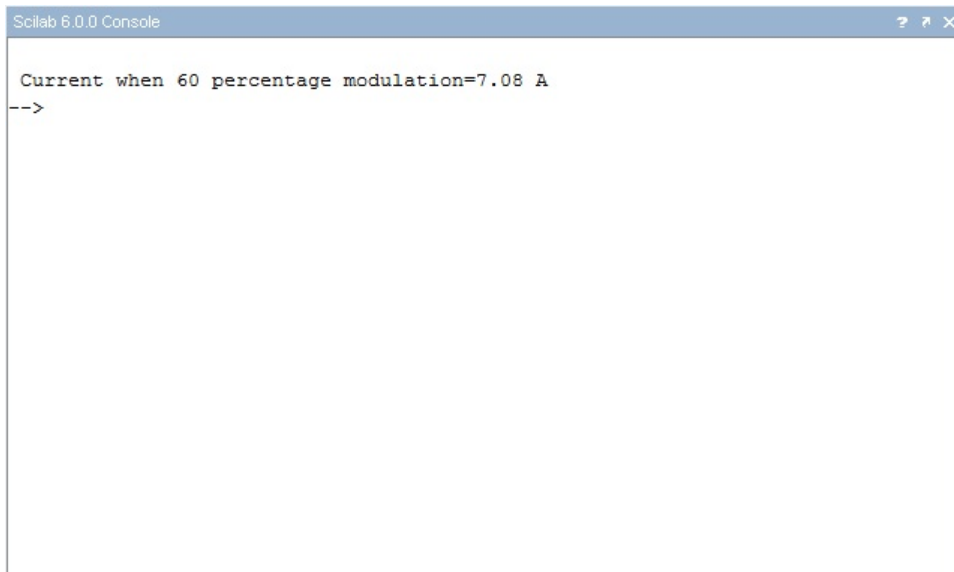
```
7
8 //EX11-2.sce
9
10 clc;
11 clear;
12 Ec=80; //peak voltage of carrier in V
13 R=80; //Load resistance in ohm
14 m=0.5; //modulation index
15
16 Pc=((Ec/sqrt(2))^2)/R;
17 Pt=Pc*(1+(m^2)/2);
18 printf("\n Total power=%1.0 f W \n",Pt)
```

```
Scilab 6.0.0 Console
(1)
Total power=600 W
(2)
Power in side bands=200 W
--> |
```

Figure 11.3: Calculation of modulated power and side band power

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

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX11_3.sce
9
10 clc;
11 clear;
12 Pc=400; //carrier power in W
13 m=1; //modulation index
14
15 printf(" \n(1) ")
16 Pt=Pc*(1+(m^2)/2);
17 printf(" \n Total power=%1.0 f W" ,Pt)
18
```



The image shows a Scilab 6.0.0 Console window. The title bar reads "Scilab 6.0.0 Console". The main area of the window contains the text "Current when 60 percentage modulation=7.08 A" followed by a prompt "-->".

Figure 11.4: Calculation of current

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

Scilab code Exa 11.4 Calculation of current

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX11_4.sce
9
```



```
Scilab 6.0.0 Console
Modulation Index=0.33

Upper side band frequency=10.006 MHz
Lower side band frequency=9.994 MHz

Amplitude of side bands=2.5 V
--> |
```

Figure 11.5: Determination of Modulation index

```
10 clc;
11 clear;
12 Ic=6; //load current in A
13 m=0.6; //modulation is 60 percentage
14 It=(Ic)*(1+(m^2)/2);
15
16 printf("\n Current when 60 percentage modulation=%1
    .2 f A",It)
```

Scilab code Exa 11.5 Determination of Modulation index

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

```

6 //Scilab version: Scilab 6.0.0
7
8 //EX11_5.sce
9
10 clc;
11 clear;
12 Va=5; //amplitude of audio signal in V
13 Vp=15; //peak voltage of carrier in V
14 fm=6e3; //carrier frequency in Hz
15 fc=10e6; //modulating frequency in Hz
16 m=Va/Vp;
17 printf("\n Modulation Index=%1.2 f \n",m)
18 USF=fc+fm;
19 LSF=fc-fm;
20 printf("\n Upper side band frequency=%0.3 f MHz",USF
    *1e-6)
21 printf("\n Lower side band frequency=%0.3 f MHz \n",
    LSF*1e-6)
22 Vs=(1/2)*(m*Vp); //amplitude of side bands in V
23 printf("\n Amplitude of side bands=%0.1 f V",Vs)

```

Scilab code Exa 11.6 Calculation of number of stations

```

1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX11_6.sce
9
10 clc;

```

```
Scilab 6.0.0 Console ? ? X
Number of stations that can be accommodated in the available BW = 400
-->
```

Figure 11.6: Calculation of number of stations

```
11 clear;
12 fm=12.5e3;//maximum modulating frequency in Hz
13 BW=10e6;//available bandwidth in Hz
14 BWreq=fm*2;//required bandwidth of each stations in
    Hz
15 Ns=BW/BWreq;
16 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

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

```
Scilab 6.0.0 Console

The upper sideband extends from 1000.05 kHz to 1004.5 kHz

The lower sideband extends from 999.95 kHz to 995.5 kHz

Width of channel=9 kHz
-->
```

Figure 11.7: Calculation of width of channel and side band

```
6 //Scilab version: Scilab 6.0.0
7
8 //EX11_7.sce
9
10 clc;
11 clear;
12 fc=1e6;//carrier frequency in Hz
13 fmin=50;//minimum range of frequency in Hz
14 fmax=4500;//maximum range of frequency in Hz
15 USFmin=fc+fmin;
16 USFmax=fc+fmax;
17 printf("\n The upper sideband extends from %4.2 f kHz
    to %4.1 f kHz \n",USFmin*1e-3,USFmax*1e-3)
18 LSFmin=fc-fmin;
19 LSFmax=fc-fmax;
20 printf("\n The lower sideband extends from %3.2 f kHz
    to %3.1 f kHz \n",LSFmin*1e-3,LSFmax*1e-3)
21 W=USFmax-LSFmax;
22 printf("\n Width of channel=%d kHz",W*1e-3)
```

```
Scilab 6.0.0 Console ? ? x

Power contained in the carrier=800 W

Upper side band =200 W
Lower side band =200 W

-->
```

Figure 11.8: Calculation of power contained in the carrier

Scilab code Exa 11.8 Calculation of power contained in the carrier

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX11-8.sce
9
10 clc;
11 clear;
12 Pt=1200;//total power content of AM in W
13 m=1;//100 percentage modulation index
14 Pc=(Pt*2)/(2+m^2);
15 Pusb=(m^2/4)*Pc;
16 Plsb=Pusb;
17 printf("\\n Power contained in the carrier=%d W \\n",
    Pc)
18 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

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

```
Scilab 6.0.0 Console ? ? x
Percentage savings =83.33 percentage
-->
```

Figure 11.9: Calculation of saved power

```

6 //Scilab version: Scilab 6.0.0
7
8 //EX11_9.sce
9
10 clc;
11 clear;
12 m=1;
13 A=(1+(1/2)*m^2);
14 //The constant A denotes the ratio of PT and Pc
15 B=(m^2)/4;
16 //The constant B denotes the ratio of Pusb and Pc
17 //Pusb=Plsb
18 Psaved=A-B;; // saving in power when the carrier and
    one side band are suppressed
19 %saving=(Psaved/A)*100;
20 printf("\\n Percentage savings =%2.2f percentage ",
    %saving)

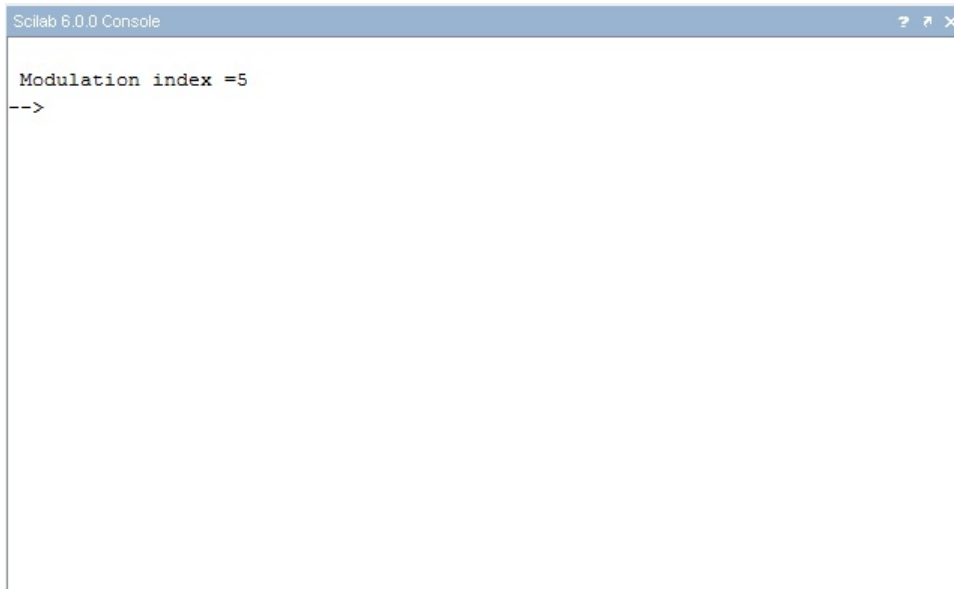
```

Scilab code Exa 11.10 Calculation of modulation index

```

1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX11_10.sce
9
10 clc;
11 clear;
12 CS=80e3;//carrier swing of an FM wave in Hz
13 f=8e3;//siganl frequency in Hz

```

```
Scilab 6.0.0 Console
Modulation index =5
-->
```

Figure 11.10: Calculation of modulation index

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

Scilab code Exa 11.11 Calculation of modulation index

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX11_11.sce
9
```

```
Scilab 6.0.0 Console ? ? x
Modulation index =5
--> |
```

Figure 11.11: Calculation of modulation index

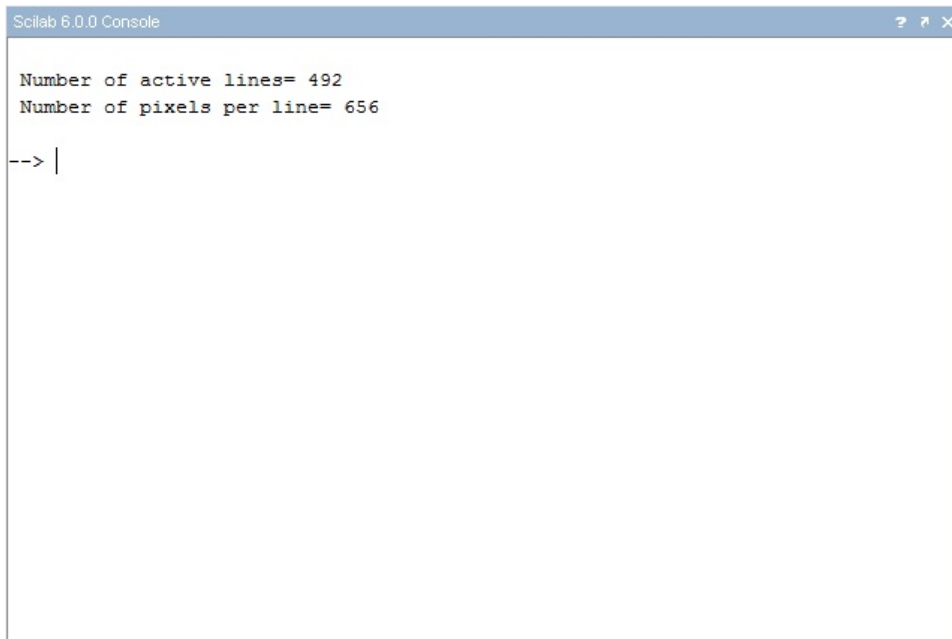
```
10 clc;
11 clear;
12 fc=105e6; //centre frequency of an FM carrier in Hz
13 fmhigh=105.04e6; //highest frequency of the
    modulating signal in Hz
14 fs=8e3; //sigantl frequency in Hz
15 Fd=fmhigh-fc;
16 m=Fd/fs;
17 printf(" \n Modulation index =%d" ,m)
```

Chapter 12

Television

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

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX12_1.sce
9
10 clc;
11 clear;
12 N1=525;//number of lines per frame
13 R=4/3;//aspect raion
14 Ns=33;//number of suppressed lines
15 Na=N1-Ns;
16 Nh=R*Na;
17 printf("\\n Number of active lines= %1.0f \\n Number
    of pixels per line= %1.0f \\n",Na,Nh)
```

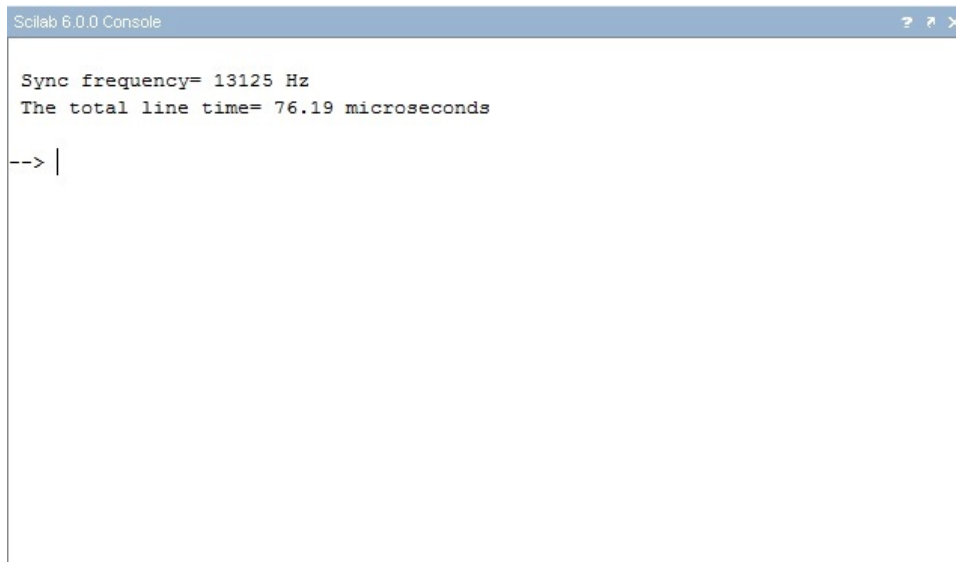


```
Scilab 6.0.0 Console
Number of active lines= 492
Number of pixels per line= 656
--> |
```

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

Scilab code Exa 12.2 Calculation of sync frequency and line time

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX12_2.sce
9
10 clc;
11 clear;
```



```
Scilab 6.0.0 Console
Sync frequency= 13125 Hz
The total line time= 76.19 microseconds
--> |
```

Figure 12.2: Calculation of sync frequency and line time

```
12 Nt=525; //total number of lines
13 Prr=25; //picture repetition rate
14
15 fh=Nt*Prr;
16 Th=1/fh;
17 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

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



```
Scilab 6.0.0 Console
The bandwidth=3.64 MHz
-->
```

Figure 12.3: Calculation of bandwidth

```
6 //Scilab version: Scilab 6.0.0
7
8 //EX12_3.sce
9
10 clc;
11 clear;
12 Ts=12e-6; //supression period in seconds
13 Kf=0.7; //Kell factor
14 Nl=525; //total number of lines
15 Ns=25; //number of suppressed lines
16 a=4/3; //aspect ratio
17 Th=76.19e-6; //total line time in seconds
18
19 BW=(Kf*a*(Nl-Ns))/(2*(Th-Ts));
20 printf(" \n The bandwidth=%0.2 f MHz \n",BW*1e-6)
21
22 //There is a error in the book for calculation of
    bandwidth
23 //In the book BW=364 MHz insteadof 3.64 MHz
```

Chapter 13

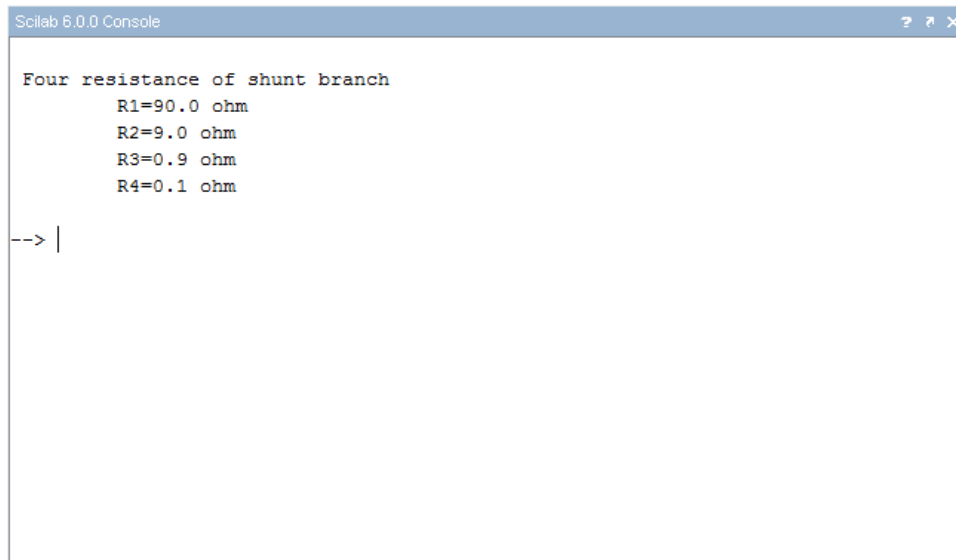
Electronic Instruments

Scilab code Exa 13.1 Calculation of shunt resistance

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX13_1.sce
9
10 clc;
11 clear;
12 Imax=10e-3;//Maximum reading current of ammeter in A
13 CS=100e-6;//Current sensitivity in A
14 Rm=50;//Resistance in ohm
15
16 Ishunt=Imax-CS;
17 Rshunt=(Rm*CS)/Ishunt;
18 printf("\\n Required shunt resistance=%1.3f ohm \\n",
    Rshunt)
```

```
Scilab 6.0.0 Console
Required shunt resistance=0.505 ohm
-->
```

Figure 13.1: Calculation of shunt resistance



The image shows a Scilab 6.0.0 Console window with a blue title bar. The text inside the window is as follows:

```
Four resistance of shunt branch
    R1=90.0 ohm
    R2=9.0 ohm
    R3=0.9 ohm
    R4=0.1 ohm
--> |
```

Figure 13.2: Calculation of shunt resistances

Scilab code Exa 13.2 Calculation of shunt resistances

```
1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX13_2.sce
9
10 clc;
11 clear;
12 Rm=150; //Resistance of d'Arsonval movement in ohm
```

```

13 CS=0.001; //Current sensitivity in A
14 //CS=Ia1=Ib1=Ic1=Id1
15 R_shunt=(CS*Rm)/(0.001-0.0001); //Total shunt
    resistance required
16 R=750; //The sum shunt resistance that have included
    in the shunt branch is not feasible to prepare
    resistors. Therefore 750 ohm resistance is
    connected in series with the movement
17
18 //case (a): Range(0-1)mA
19 Ia=0.001; //Current Range of the switch in A
20 Ia1=0.0001; //Current through the switch in A
21 Ia2=Ia-Ia1; //Current through the shunt branch in A
22 Rma=Rm+R; //Resistance of the meter branch in ohm
23 Rsa=(Rma*Ia1)/Ia2; //Resistance of the shunt branch
24
25
26 //Casec(b): Range(0-10)mA
27 //When the range of switch is 10 mA, position R1
    goes into series
28 Ib=0.01; //Current Range of the switch in A
29 Ib1=0.0001; //Current through the switch in A
30 Ib2=Ib-Ib1; //Current through the shunt branch in A
31 Rmb=Rm+R; //Resistance of the meter branch without R1
    in ohm
32 R1=((Rsa*Ib2)-(Rmb*Ib1))/(Ib1+Ib2);
33
34 //Casec(c): Range(0-100)mA
35 //When the range of switch is 100 mA, position R1
    and R2 goes into series
36 Ic=0.1; //Current Range of the switch in A
37 Ic1=0.0001; //Current through the switch in A
38 Ic2=Ic-Ic1; //Current through the shunt branch in A
39 Rmc=Rma+R1; //Resistance of the meter branch without
    R2 in ohm
40 Rsc=Rsa-R1; //Resistance of the shunt branch except
    R2
41 R2=((Rsc*Ic2)-(Rmc*Ic1))/(Ic1+Ic2);

```

```

42
43
44 //Casec(d): Range(0-1)A
45 //When the range of switch is 1 A, position R1, R2
    and R3 goes into series
46 Id=1;//Current Range of the switch in A
47 Id1=0.0001;//Current through the switch in A
48 Id2=Id-Id1;//Current through the shunt branch in A
49 Rmd=Rma+R1+R2;//Resistance of the meter branch
    without R3 in ohm
50 Rsd=Rsa-R1-R2;//Resistance of the shunt branch
    except R3
51 R3=((Rsd*Id2)-(Rmd*Id1))/(Id1+Id2);
52 R4=1-R3;
53
54 printf("\n Four resistance of shunt branch\n\t R1=%0
    .1 f ohm \n\t R2=%0.1 f ohm \n\t R3=%0.1 f ohm \n\t
    R4=%0.1 f ohm\n",R1,R2,R3,R4)

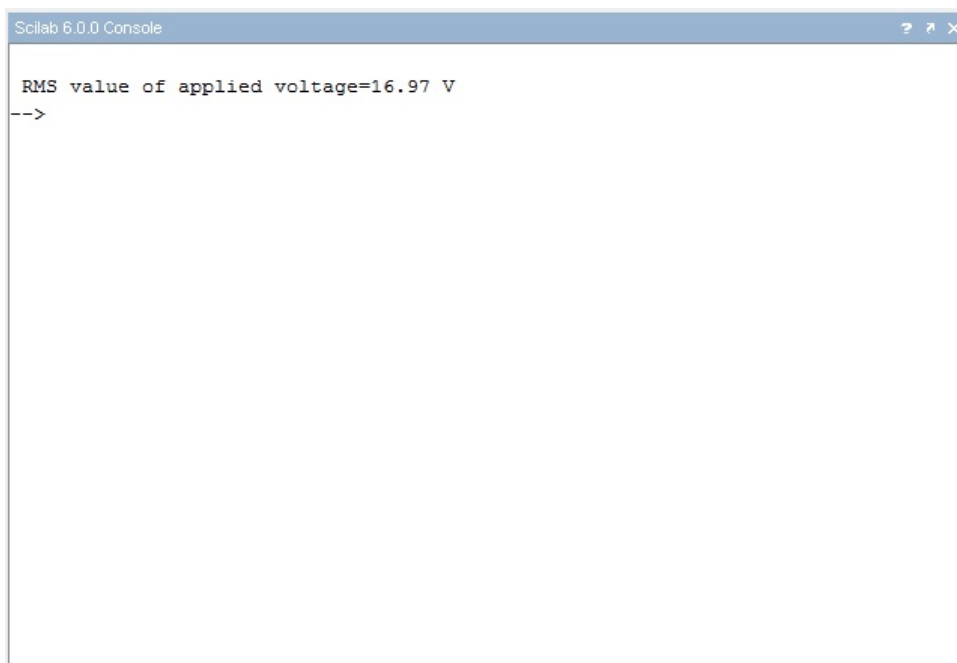
```

Scilab code Exa 13.3 Calculation of applied AC voltage

```

1 //Book Name:Principles of Electronics , Vol.II
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX13_3.sce
9
10 clc;
11 clear;
12

```



```
Scilab 6.0.0 Console
RMS value of applied voltage=16.97 V
-->
```

Figure 13.3: Calculation of applied AC voltage

```
Scilab 6.0.0 Console
Frequency of ac voltage=666.7 Hz
-->
```

Figure 13.4: Calculation of frequency

```
13 deflectionsensitivity=4; //unit is V/cm
14 lengthoftrace=12; //unit is cm
15
16 Vpp=deflectionsensitivity*lengthoftrace; //peak to
    peak value of applied voltage in V
17 Vp=Vpp/2; //peak value of applied voltage in V
18 Vrms=Vp/sqrt(2);
19 printf("\n RMS value of applied voltage=%2.2f V",
    Vrms)
```

Scilab code Exa 13.4 Calculation of frequency

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

```
2 //Author:B.V.Narayana Rao
3 //Publisher:New Age International Private Limited
4 //Edition:Second Edition ,1996
5 //Operating system: Windows 10
6 //Scilab version: Scilab 6.0.0
7
8 //EX13_4.sce
9
10 clc;
11 clear;
12 Tc=0.2;//Time control of CRO in ms per cm
13 D=7.5;//Distance in cm
14
15 T=(Tc*D);//period of ac voltage in s
16 f=1/T;
17 printf("\\n Frequency of ac voltage=%3.1f Hz",f*1e3)
```
