

Scilab Textbook Companion for
Basic Electronics Devices Circuits and Its
Fundamentals
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July 31, 2019

¹Funded 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: Basic Electronics Devices Circuits and Its Fundamentals

Author: S. Kal

Publisher: Phi Learning, New Delhi

Edition: 1

Year: 2013

ISBN: 978-81-203-1952-3

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 2

Semiconductor Materials And Junction Diode

Scilab code Exa 2.1 Electron and hole component of current density

```
1 // Exa 2.1
2 format('v',9)
3 clc;
4 clear;
5 close;
6 // Given data
7 n_i = 1.5 * 10^10; // in /cc
8 p = n_i; // in /cc
9 n = n_i; // in /cc
10 miu_n = 1400; // in cm^2/V-s
11 miu_p = 450; // in cm^2/V-s
12 q = 1.6 * 10^-19; // in C
13 E = 20; // in V/cm
14 a = 5; // cross section area of Si bar in cm^2
15 sigma_n = n*q*miu_n; // in mho/cm
16 sigma_p = p*q*miu_p; // in mho/cm
17 // Electron current density
18 Jn = sigma_n*E; // in A
19 Jn = Jn*10^6; // in A /cm^2
```



```

20 disp(Jn,"Electron current density in A /cm^2 is");
21 // The hole current density
22 Jp = sigma_p*E;// in A/cm^2
23 Jp= Jp*10^6;// in A /cm^2
24 disp(Jp,"The hole current density in A /cm^2 is");
25 //The total current in the bar
26 total = (Jn+Jp)*a;// A /cm^2
27 disp(total,"The total current in the bar in A /cm^2
    is");
28 format('e',8)
29 // The resistivity of the bar
30 rho = 1/(n_i*q*(miu_p+miu_n)*10^2);// in ohm-cm
31 disp(rho,"The resistivity of the bar in ohm-cm is");

```

Scilab code Exa 2.2 Peak output voltage

```

1 // Exa 2.2
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 V_F = 20;// in V
8 Vin = V_F;// in V
9 V_BE = 0.7;// in V
10 R1 = 500;//resistance in ohm
11 R2 = 10;// resistance in ohm
12 // Peak current though the diode
13 Ifpeak = (V_F-V_BE)/(R1+R2);// in A
14 Ifpeak = Ifpeak * 10^3;// in mA
15 disp(Ifpeak,"The peak current through the diode in
    mA is");
16 R_L = 500;// in ohm
17 // Peak output voltage
18 Vpeakout = Ifpeak*10^-3*R_L;// in V

```

```

19 disp(Vpeakout,"The peak out voltage in V is");
20 // For ideal diode
21 Ifpeak = V_F/R_L;// in A
22 Ifpeak = Ifpeak * 10^3;// in mA
23 // The peak output voltage for ideal diode
24 Vpeakout= Ifpeak*10^-3*R_L;// in V
25 disp(Ifpeak,"The peak current for ideal diode in mA
    is");
26 disp(Vpeakout,"The peak output voltage for ideal
    diode in V is");

```

Scilab code Exa 2.3 Increase in forward current

```

1 // Exa 2.3
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 t = 27;// in C
8 t= t+273;// in K
9 q= 1.6*10^-19;// electron charge in C
10 v = 200*10^-3;// in V
11 kt_by_q= 0.026;// in V
12 Io= 3*10^-7;// in A
13 // For large reverse bias I= Io*(%e^(q*v/(k*t)))
14 I= Io*(%e^(v/kt_by_q)-1);// in A
15 I= round(I*10^6);// in A
16 disp(I,"The current flowing through the diode in A
    is");
17 Idaso = Io*2^7;// in A
18 // r_ac = dv/di = 1/( Io*(1/kTdividedq)*(%e^(v/(
    kTdividedq))) );
19 r_ac = 1/( Io*(1/kt_by_q)*(%e^(v/(kt_by_q))) );
20 disp(r_ac,"The ac resistance in ohm is : ");

```

```

21 kt_by_q = 0.032; // in V
22 I1 = Idaso * ((%e^(v/(kt_by_q))) - 1); // in A
23 I1 = I1 * 10^3; // in mA
24 delI = I1 - (I * 10^-3); // in mA
25 disp(delI, "The increase in forward current in mA is"
    );

```

Scilab code Exa 2.4 Slope of the line

```

1 // Exa 2.4
2 format('e',9)
3 clc;
4 clear;
5 close;
6 // Given data
7 V = 30; // applied forward voltage in V
8 R_L = 3; // load resistance in k ohm
9 R_L = R_L * 10^3; // in ohm
10 Imax = V/R_L; // maximum diode current in A
11 Imax = Imax * 10^3; // in mA
12 slope = -1/R_L; // in mho
13 plot([V,0],[0,Imax]);
14 xlabel("V_F in volts");
15 ylabel("I_F in mA");
16 title("DC load line");
17 disp("DC load line shown in figure")
18 disp(slope, "The slope of the line in mho is");
19
20 // Note: There is calculation error to find the
    value of slope because  $-1/3k = -3.33 \times 10^{-4}$  mho,
    not  $= -3.33 \times 10^{-3}$  mho

```

Scilab code Exa 2.5 Maximum and minimum values of the instantaneous power

```

1 // Exa 2.5
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Vp= '[4+0.2*sin(omega*t)]'; // in V
8 Ip= '[4+0.3*sin(omega*t)]'; // in mA
9 //The instantaneous power dissipated , P= Vp*Ip =
   [4+0.2*sind(wt)]*[4+0.3*sind(wt)]
10 // and putting ,  $\sin^2(\omega t) = 1/2 - 1/2 \cos(2\omega t)$ 
   t)
11 P= '[16.03+2*sin(omega*t) - 0.03*cos(2*omega*t)]*10^-3
   '; // in W
12 disp(P,"The instantaneous power dissipated in the
   diode in W is : ")
13 // Pmax occurs when omega*t=90, so
14 omega_t= 90; // in
15 Pmax= [16.03+2*sind(omega_t)-0.03*cosd(2*omega_t)
   ]*10^-3; // in W
16 disp(Pmax,"The maximum value of instantaneous power
   dissipated in W is : ")
17 // Pmin occurs when omega*t=-90, so
18 omega_t= -90; // in
19 Pmin= [16.03+2*sind(omega_t)-0.03*cosd(2*omega_t)
   ]*10^-3; // in W
20 disp(Pmin,"The minimum value of instantaneous power
   dissipated in W is : ");
21 // The average power dissipated
22 Pav=(Pmax+Pmin)/2; // in W
23 disp(Pav,"The average power dissipated in the diode
   in W is : ")

```

Scilab code Exa 2.6 Load line

```

1 // Exa 2.6
2 format('v',9)
3 clc;
4 clear;
5 close;
6 // Given data
7 R_L = 50; // in ohm
8 V = 10; // in V
9 R = 5; // in ohm
10 V_D = (V*R)/(R_L+R); // in V
11 R_D = (R_L*R)/(R_L+R); // in ohm
12 I_D = V_D/R_D; // in A
13 I_D = I_D * 10^3; // in mA
14 plot([V_D,0],[0,I_D])
15 xlabel("V_D in volts");
16 ylabel("I_D in mA");
17 title("DC load line");
18 disp("DC load line shown in figure")
19 slope = -1/R_D;
20 disp(slope,"The slope of the dc load line is : ");

```

Scilab code Exa 2.7 Value of I_s

```

1 // Exa 2.7
2 format('e',8)
3 clc;
4 clear;
5 close;
6 // Given data
7 V_T= 26*10^-3; // in V
8 T = 300; // in K
9 V = 0.25; // in V
10 I= 10 * 10^-3; // in A
11 //  $I = I_S * ( \exp(V/(n*kTdividedq)) - 1 ) = I_S * ( \exp(V/V_T) - 1 )$ ;

```

```

12 I_S= I/(%e^(V/V_T)-1); // in A
13 disp(I_S,"The reverse saturate current in amp. is :
    ")
14 format('v',6)
15 // For 1 mA current
16 I = 1; // in mA
17 I = I*10^-3; // in A
18 V = (1/38.46)*log(I/I_S); // in V
19 disp(V,"The bias voltage needed for 1 mA in V is");
20 // For 100 mA current
21 I = 100; // in mA
22 I = I * 10^-3; // in A
23 V = (1/38.46)*log(I/I_S); // in V
24 disp(V,"The bias voltage needed for 100 mA in V is")
    ;
25
26 // Note: Answer in the book is not accurate.

```

Scilab code Exa 2.8 Reverse saturation current

```

1 // Exa 2.8
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 V_T= 25*10^-3; // in V
8 // I = Io*( (%e^(V/V_T))-1 );
9 I = 1; // in mA
10 I = I * 10^-3; // in A
11 V = 0.15; // in V
12 Io = I/( (%e^((1/V_T)*V))-1 ); // in A
13 Io = Io * 10^6; // in A
14 disp(Io,"The reverse saturation current at room
    temperature in A is");

```

```
15 // Io doubles for every 10 C -rise in temperature.
    Thus at 40 C
16 Io_new= 4*Io;//new value of reverse saturation
    current in A
17 disp(Io_new,"The reverse saturation current at 40
    C in A is");
18 I = 100;// in mA
19 I = I * 10^-3;// in A
20 // I = Io*( %e^((1/V-T)*V))-1 );
21 V = (1/40)*log( I/(Io*10^-6) );// in V
22 disp(V,"The forward bias voltage in V is");
```

Chapter 3

Junction Diode and Their Applications

Scilab code Exa 3.1 Im Idc Irms and Ripple factor

```
1 // Exa 3.1
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 // V = 50 * snid(omega*t);
8 Vm = 50; // in V
9 r_d = 20; // in ohm
10 R_L = 800; // in ohm
11 Im = Vm/(r_d+R_L); // in A
12 Im = Im * 10^3; // in mA
13 disp(Im,"The value of Im in mA is");
14 Idc = Im/%pi; // in mA
15 disp(Idc,"The value of Idc in mA is");
16 Irms = Im/2; // in mA
17 disp(Irms,"The value of Irms in mA is");
18 // The ac power input
19 P_ac_input = (Irms*10^-3)^2*(r_d+R_L); // in W
```



```

20 disp(P_ac_input,"The ac power input in W is");
21 P_dc_output = (Idc*10^-3)^2*R_L;// in W
22 // The dc power output
23 disp(P_dc_output,"The dc power output in W is");
24 // The dc output voltage
25 V_dc_out = Idc*10^-3*R_L;// in V
26 disp(V_dc_out,"The dc output voltage in V is");
27 //The Efficiency of rectification , Eta = ((Idc^2*R_L
      )*100)/(Irms^2*(R_L+r_d)) = (8/%pi) * ((R_L*100)
      /(R_L+r_d))
28 Eta = 8/%pi^2 * ((R_L*100)/(R_L+r_d));// in %
29 disp(Eta,"The Efficiency of rectification in % is");
30 ripplefactor = sqrt( (Irms/Idc)^2 -1 );
31 disp(ripplefactor,"The ripple factor is");
32
33 // Note: In the book, the calculation to evaluate
      the value of efficiency of rectification is wrong
      .

```

Scilab code Exa 3.2 Required PIV

```

1 // Exa 3.2
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Vdc = 120;// in V
8 Vm = (%pi/2)*Vdc;// in V
9 disp(Vm,"The peak value of output voltage in V is");
10 Vpeak = 2*Vm;// in V
11 disp(Vpeak,"The peak value of voltage at transformer
      secondary in volts is : ")
12 Vrms = Vpeak/sqrt(2);// in V
13 disp(Vrms,"The r.m.s. value of voltage at

```

```

        transformer secondary in V is");
14 R_L = 250; // in k ohm
15 R_L = R_L * 10^3; // in ohm
16 Idc = Vdc/R_L; // in A
17 Idc= Idc*10^6; // in A
18 disp(Idc,"The average current delivered to load in
        A is");
19 Io = Idc/2; // in A
20 disp(Io,"The average current through each of the
        diode in A is");
21 // Peak current through each of the diode in A
22 I_peak = Vm/R_L; // in A
23 I_peak= I_peak*10^3; // in mA
24 disp(I_peak,"The peak current through each of the
        diode in mA is");
25 PIV = 2*Vm; // in V
26 disp(PIV,"The PIV required for each of the diode in
        V is");

```

Scilab code Exa 3.3 Maximum and minimum value of zener diode current

```

1 // Exa 3.3
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 V = 120; // in V
8 Vz = 50; // in V
9 R = 5; // in k ohm
10 R = R * 10^3; // in ohm
11 I = (V-Vz)/R; // in A
12 R1 = 10; // in k ohm
13 R1 = R1 * 10^3; // in ohm
14 I_L = Vz/R1; // in A

```

```

15 // The maximum value of zener diode current
16 I_Zmax = I-I_L;// in A
17 I_Zmax= I_Zmax*10^3;// in mA
18 disp(I_Zmax,"The maximum value of zener diode
    current in mA is");
19 V2 = 80;// in V
20 I = (V2-Vz)/R;// in A
21 // The minimum value of zener diode current
22 I_Zmin = I-I_L;// in A
23 I_Zmin=I_Zmin*10^3;// in mA
24 disp(I_Zmin,"The minimum value of zener diode
    current in mA is");

```

Scilab code Exa 3.4 Value of R

```

1 // Exa 3.4
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 R_L = 18;// in ohm
8 Vz = 18;// in V
9 V1 = 22;// in V
10 V2 = 28;// in V
11 // Minimum voltage across R,
12 V = V1-Vz;// in V
13 Izmin = 200;// in mA
14 I_Lmax = Vz/R_L;// in A
15 I = I_Lmax+Izmin*10^-3;// in A
16 R =V/I;// in ohm
17 disp(R,"The value of R in ohm is : ")
18 I1 = (V2-Vz)/R;;// in A
19 // The maximum current through R
20 Izmax = I1 - 1;// in A

```

```

21 Izmax= Izmax*103; // in mA
22 disp(Izmax,"The maximum current through R in mA is")
   ;
23 disp("Which is within the limit of Iz (max) provided
   .")
24 pd = Vz*Izmax*10-3; // maximum power dissipated in W
25 disp(pd,"The maximum power dissipated in W is");

```

Scilab code Exa 3.5 Designing of the circuit

```

1 // Exa 3.5
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 V1 = 12; // in V
8 Vz = 10; // in V
9 V = V1-Vz; // in V
10 I_Lmax = 10; // in mA
11 I_Zmin = 0.2; // in mA
12 I = I_Lmax+I_Zmin; // in mA
13 R = V/I; // in k ohm
14 Vz1 = 5; // in V
15 // The maximum current through R
16 Imax = Vz1/R; // in mA
17 disp(Imax,"The maximum current through R in mA is");
18 // The power rating of zener
19 power = Vz*Imax; // in mW
20 disp(power,"The power rating of zener in mW is");

```

Scilab code Exa 3.6 Input and output waveform

```

1 // Exa 3.6
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Vo= -6;// in V      (for Vi<=-6.6 V)
8 Vo= 8;// in V      (for Vi>=8.8 V)
9 // Vi= 10000*i+100000*i or i= Vi/110000      (i)
10 Vi= -6.6:0.1:8.8;
11 // Vo= 100000*i
12 Vo= 100000*Vi/110000;//      (substituting i from eq(
    i))
13 plot(Vi,Vo);
14 xlabel("Vi in volts")
15 ylabel("Vo in volts")
16 title("The overall transfer characteristics")
17 disp("The overall transfer characteristics shown in
    figure.")

```

Scilab code Exa 3.7 Output dc voltage

```

1 // Exa 3.7
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Vm = 20;// in V
8 Idc = 100;// in mA
9 Idc = Idc * 10^-3;// in A
10 R_S = 5;// in ohm
11 R_F = 2;// in ohm
12 Vdc = ((2*sqrt(2)*Vm)/%pi) - Idc*(R_S+2*R_F);// in V
13 disp(Vdc,"The output dc voltage at dc load current

```

```

    of 100 mA in V is");
14 Idc = 200; // in mA
15 Idc = Idc * 10^-3; // in A
16 Vdc = ((2*sqrt(2)*Vm)/%pi) - Idc*(R_S+2*R_F); // in V
17 R_L = Vdc/Idc; // in ohm
18 // The percentage regulaiton
19 Per_reg = ((2*R_F+R_S)/R_L)*100; // in %
20 disp(Per_reg,"The percentage regulation for a full
    load dc current of 200 mA in % is");
21 Eta = round((8/(%pi^2)) * ( R_L/(2*R_F+R_S+R_L) )
    *100); // in %
22 disp(Eta,"The efficiency of the rectifier in % is");

```

Scilab code Exa 3.8 Designing of a zener voltage regulator

```

1 // Exa 3.8
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Vz = 20; // in V
8 R_L = 1; // in k ohm
9 R_L = R_L * 10^3; // in ohm
10 I_L = Vz/R_L; // in A
11 V1 = 30; // in V
12 R_S = (V1-Vz)/I_L; // in ohm
13 V2 = 50; // in V
14 // The maximum current through Rs resistor ,
15 I_S = (V2-Vz)/R_S; // in A
16 I_Smax = V1/R_S; // in A
17 I_Zmax = I_Smax-I_L; // in A
18 power = I_Zmax*Vz; // in W
19 disp(power,"The maximum power rating of the Zener
    diode in W is");

```

Scilab code Exa 3.9 Designing of a zener voltage regulator

```
1 // Exa 3.9
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Vz = 20; // in V
8 V1 = 30; // in V
9 V2 = 50; // in V
10 R_L = 2; // in k ohm
11 R_L = R_L * 10^3; // in ohm
12 I_L = Vz/R_L; // in A
13 I_ZK = 5*10^-3; // in mA
14 I_Smin = I_L+I_ZK; // in A
15 R_S = (V1-Vz)/I_Smin; // in ohm
16 I_Smax = (V2-Vz)/R_S; // in A
17 I_Zmax = I_Smax-(I_Smin+I_ZK); // in A
18 // The maximum power rating of the zener diode,
19 power = I_Zmax*Vz; // in W
20 disp(power,"The maximum power rating of the zener
    diode in W is");
```

Scilab code Exa 3.10 Value of limiting resistance R1 and R2

```
1 // Exa 3.10
2 format('v',6)
3 clc;
4 clear;
5 close;
```

```

6 // Given data
7 Vz1= 10; //voltage across zener diode , Z1 in V
8 Vz2= 5; // voltage across zener diode , Z2 in V
9 Iz1= 30*10^-3; // current through zener diode , Z1 in
  A
10 Iz2= 15*10^-3; // current through zener diode , Z1 in
  A
11 I_knee= 5*10^-3; //knee current of zener diode ,Z1 in
  A
12 R_L=500; //load resistance in ohm
13 R= 1*10^3; // in ohm
14 V_B= 25; // in V
15 // Current through RL,
16 I_RL= Vz2/R_L; // in A
17 // Current through R2,
18 I_R2= Iz2+Vz2/R_L; // in A
19 // Voltage across resistance R2,
20 V_R2= Vz1-Vz2; // in V
21 R2= V_R2/I_R2; // in ohm
22 disp(R2,"The value of resistance R2 in ohm is : ")
23 // Current through R1,
24 I_R1= Iz1+Vz1/R+I_R2; //in A
25 // Voltage across R1,
26 V_R1= V_B-Vz1; // in V
27 R1= V_R1/I_R1; // in ohm
28 disp(R1,"The value of resistance R1 in ohm is : ")
29 // Current through R1,
30 I_R1= I_knee+Vz1/R+I_R2; // in mA
31 // Voltage across R1,
32 V_R1= I_R1*R1; // in volts
33 V_Bmin= Vz1+V_R1; // in V
34 disp(V_Bmin,"The lowest power supply voltage in
  volts is : ")

```

Chapter 4

BJTs and FETs

Scilab code Exa 4.1 DC load line

```
1 // Exa 4.1
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 V_CC = 18; // in V
8 V_BB = 6; // in V
9 Beta = 75;
10 I_CO = 100; // in nA
11 I_CO = I_CO * 10^-9; // in A
12 R_C = 1; // in k ohm
13 R_C = R_C * 10^3; // in ohm
14 V_CE = 9; // in V
15 I_C = 9; // in mA
16 I_C = I_C * 10^-3; // in A
17 // I_C = Beta*I_B + (1+Beta)*I_CO;
18 I_B = (I_C - ((1+Beta)*I_CO))/Beta; // in A
19 I_B = I_B * 10^3; // in mA
20 disp(I_B, "The value of I_B in mA is");
21 V_BE = 0.7; // in V assumed
```

```

22 R_B = (V_BB-V_BE)/(I_B*10^-3); // in ohm
23 R_B = R_B * 10^-3; // in k ohm
24 disp(R_B,"The value of R_B for Si transistor in k
    ohm is");
25 V_BE = 0.3; // in V
26 R_B = (V_BB-V_BE)/(I_B*10^-3); // in ohm
27 R_B= R_B*10^-3; // in k ohm
28 disp(R_B,"The value of R_B for Ge transistor in k
    ohm is");
29 V_CEQ= V_CC-I_C*R_C; // in V
30 I_CQ= round(Beta*I_B); // in mA
31 I_C= V_CC/R_C; // in A
32 I_C= I_C*10^3; // in mA
33 plot([V_CC,0],[0,I_C]);
34 xlabel("V_CC in volts ");
35 ylabel("I_C in mA")
36 title("DC load line ")
37 disp("DC load line shown in figure")
38 disp("Q point : "+string(V_CEQ)+" volts , "+string(
    I_CQ)+" mA")

```

Scilab code Exa 4.2 Value of RB RC and IC

```

1 // Exa 4.2
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 V_BB = 15; // in V
8 V_CC = 15; // in V
9 I_C0 = 0.1; // in A
10 I_C0 = I_C0 * 10^-6; // in A
11 Beta = 60;
12 I_B = 50; // in A

```

```

13 I_B = I_B * 10^-6; // in A
14 V_CE = 8; // in V
15 I_C = (Beta*I_B)+((1+Beta)*I_C0); // in A
16 I_C = round(I_C * 10^3); // in mA
17 disp("Part (i) : ")
18 disp(I_C,"The value of I_C in mA is");
19 R_C = (V_CC-V_CE)/(I_C*10^-3); // in ohm
20 R_C = R_C * 10^-3; // in k ohm
21 disp(R_C,"The value of R_C in k ohm is");
22 V_BE = 0.3; // in V
23 R_BGe = (V_BB-V_BE)/I_B; // in ohm
24 R_BGe = R_BGe * 10^-3; // in k ohm
25 disp(R_BGe,"The value of R_B for Ge in k ohm is");
26 V_BE = 0.7; // in V
27 R_BSi = (V_BB-V_BE)/I_B; // in ohm
28 R_BSi = R_BSi * 10^-3; // in k ohm
29 disp(R_BSi,"The value of R_B for Si in k ohm is");
30 P_RC = ((I_C*10^-3)^2)*(7/3)*10^3; // in W
31 P_RC = P_RC * 10^3; // in mW
32 disp("Part (ii) : ")
33 disp(P_RC,"The power dissipations in RC in mW is");
34 // The power dissipations in the transistor
35 P_TRANS = V_CE*I_C; // in mW
36 disp(P_TRANS,"The power dissipations in the
    transistor in mW is");
37 disp("Part (iii) : For RC= 1 k , V_CE increase ,
    shifting the Q-point ot right and I_C increase
    slightly")

```

Scilab code Exa 4.3 NEW value of VCE

```

1 // Exa 4.3
2 format('v',6)
3 clc;
4 clear;

```

```

5 close;
6 // Given data
7 V_CE = 9; // in V
8 R_C = 10; // in Mohm
9 R_C = R_C * 10^6; // in ohm
10 V = 10; // in V
11 I_CEO = (V - V_CE)/R_C; // in A
12 // When R_C is changed to 10 k ohm
13 R_C = 10; // in k ohm
14 R_C = R_C * 10^3; // in ohm
15 V_CE = (V - (I_CEO*R_C)); // in V
16 disp(V_CE, "The new value of V_CE in V is");

```

Scilab code Exa 4.4 DC load line

```

1 // Exa 4.4
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 V_CC = 20; // in V
8 V_BB = 10; // in V
9 V_BE = 0.7; // in V
10 V_CEsat = 0.3; // in V
11 R_B = 47; // in k ohm
12 R_B = R_B * 10^3; // in ohm
13 R_C = 1; // in k ohm
14 R_C = R_C * 10^3; // in ohm
15 I_C = V_CC/R_C; // in A
16 I_C = I_C * 10^3; // in mA
17 plot([V_CC,0],[0,I_C]);
18 xlabel("V_CE in volts");
19 ylabel("I_C in mA");
20 title("DC load line")

```

```

21 I_BQ = (V_BB-V_BE)/R_B;// in A
22 Beta = 80;
23 I_CQ = Beta*I_BQ*10^3;// in mA
24 V_CEQ = V_CC - (I_CQ*10^-3*R_C);// in V
25 disp("DC load line shown in figure")
26 disp("Q points : "+string(V_CEQ)+" volts , "+string(
    I_CQ)+" mA")
27 I_Csat = (V_CC-V_CEsat)/R_C;// in A
28 I_B = I_Csat/Beta;// in A
29 V_BE = 0.7;// in V
30 R_B = (V_BB-V_BE)/I_B;// in ohm
31 disp(R_B*10^-3,"The value of R_B in k ohm is");
32 R_C = 500;// in ohm
33 V_CE = V_CC - (I_Csat*R_C);// in V
34 disp(V_CE,"The value of V_CE in volts is : ")
35 disp("The transistor will come out of saturation and
    enter the active region of the transistors.");

```

Scilab code Exa 4.5 Value of bita dc

```

1 // Exa 4.5
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Beta_dc = 80;
8 V_CC = 25;// in V
9 V_BE = 0.7;// in V
10 R_B = 180;// in k ohm
11 R_B = R_B * 10^3;// in ohm
12 R_E = 200;// in ohm
13 R_C = 820;// in ohm
14 I_B = (V_CC-V_BE)/(R_B+((Beta_dc+1)*R_E));// in A
15 I_C = Beta_dc*I_B;// in A

```

```

16 V_CG = V_CC - (I_C*R_C); // in V
17 disp(V_CG,"The voltage between collector and ground
    in volts is : ")
18 V_CEsat = 0.3; // in V
19 // V_CC - V_CEsat = I_Csat*R_C + I_Csat/Beta_dc*(
    Beta_dc+1)*R_E;
20 I_C = (V_CC-V_CEsat)/(R_C+R_E); // in A
21 //I_B = V_CC - ((I_E*R_E)+V_BE)/R_B = V_CC - ((I_C*
    R_E)+V_BE)/R_B;
22 I_B = (V_CC-I_C*R_E+V_BE)/R_B; // in A
23 Beta_dc = I_C/I_B;
24 disp(Beta_dc,"The value of Beta_dc on which
    transistor is saturate is");
25
26 // Note: There is some difference between the value
    of Beta_dc in the book and coding output because
    the correct values of I_C and I_B are 24.215 mA
    and 0.1158

```

Scilab code Exa 4.7 Value of Beta dc

```

1 // Exa 4.7
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Beta_dc = 80;
8 V_CC = 25; // in V
9 V_BE = 0.7; // in V
10 R_B = 180; // in k ohm
11 R_B = R_B * 10^3; // in ohm
12 R_E = 200; // in ohm
13 R_C = 820; // in ohm
14 I_B = (V_CC-V_BE)/(R_B+((Beta_dc+1)*R_E)); // in A

```

```

15 I_C = Beta_dc*I_B; // in A
16 V_CG = V_CC - (I_C*R_C); // in V
17 disp(V_CG,"The voltage between collector and ground
    in volts is : ")
18 V_CEsat = 0.3; // in V
19 // V_CC - V_CEsat = I_Csat*R_C + I_Csat/Beta_dc*(
    Beta_dc+1)*R_E;
20 I_C = (V_CC-V_CEsat)/(R_C+R_E); // in A
21 //I_B = V_CC - ((I_E*R_E)+V_BE)/R_B = V_CC - ((I_C*
    R_E)+V_BE)/R_B;
22 I_B = (V_CC-I_C*R_E+V_BE)/R_B; // in A
23 Beta_dc = I_C/I_B;
24 disp(Beta_dc,"The value of Beta_dc on which
    transistor is saturate is");
25
26 // Note: There is some difference between the value
    of Beta_dc in the book and coding output because
    the correct values of I_C and I_B are 24.215 mA
    and 0.1158

```

Scilab code Exa 4.8 New operating point

```

1 // Exa 4.8
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 V_CE = 8; // in V
8 I_C = 1; // in mA
9 I_C = I_C * 10^-3; // in A
10 V_CC = 12; // in V
11 Beta = 100;
12 R_C = (V_CC-V_CE)/I_C; // in ohm
13 I_B = I_C/Beta; // in A

```

```

14 V_BE = 0.3; // in V
15 R_B = ((V_CC-(I_C*R_C))-V_BE)/I_B; // in ohm
16 // For Beta= 50;
17 V_CE= 9.6; // in V
18 I_C= 0.6; // in mA
19 R_C= R_C*10^-3; // in k ohm
20 R_B= R_B*10^-3; // in k ohm
21 disp(R_C,"The value of R_C in k ohm is");
22 disp(R_B,"The value of R_B in k ohm is");
23 disp("New Q point : "+string(V_CE)+" volts , "+string
      (I_C)+" mA")

```

Scilab code Exa 4.9 Value of R1 and R2

```

1 // Exa 4.9
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 V_BE= 0.7;
8 bita = 100;
9 V_CC = 20; // in V
10 R_E = 1 * 10^3; // in ohm
11 V_CEQ = 10; // in V
12 I_CQ = 2* 10^-3; // in A
13 S_ICO = 10;
14 I_BQ = I_CQ/bita; // in A
15 // R_B= R1*R2/(R1+R2) (i)
16 // V_B= R2*V_CC/(R1+R2) (ii)
17 R_B= (S_ICO-1)*R_E; // in ohm
18 // V_CC= I_CQ*R_C+V_CEQ+(1+bita)*I_C/bita*R_E
19 R_C= (V_CC-V_CEQ-I_CQ*R_E)/I_CQ; // in ohm
20 I_B= I_CQ/bita; // in A
21 V_B= I_B*R_B+V_BE+(1+bita)*R_E*I_B; // in V

```



```

22 // From eq (i) and (ii)
23 R2= (V_B*R_B+R_B*(V_CC-V_B))/(V_CC-V_B); // in ohm
24 R1= R2*R_B/(R2-R_B); // in ohm
25 R1= R1*10^-3; // in k ohm
26 R2= R2*10^-3; // in k ohm
27 disp(R1,"The value of R1 in k ohm is : ")
28 disp(R2,"The value of R2 in k ohm is : ")

```

Scilab code Exa 4.10 DC load line

```

1 // Exa 4.10
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 V_CC = 18; // in V
8 V_BB = 6; // in V
9 Beta = 75;
10 I_CO = 100; // in nA
11 I_CO = I_CO * 10^-9; // in A
12 R_C = 1; // in k ohm
13 R_C = R_C * 10^3; // in ohm
14 V_CE = 9; // in V
15 I_C = 9; // in mA
16 I_C = I_C * 10^-3; // in A
17 // I_C = Beta*I_B + (1+Beta)*I_CO;
18 I_B = (I_C-((1+Beta)*I_CO))/Beta; // in A
19 I_B = I_B * 10^3; // in mA
20 disp(I_B,"The value of I_B in mA is");
21 V_BE = 0.7; // in V assumed
22 R_B = (V_BB-V_BE)/(I_B*10^-3); // in ohm
23 R_B = R_B * 10^-3; // in k ohm
24 disp(R_B,"The value of R_B for Si transistor in k
    ohm is");

```

```

25 V_BE = 0.3; // in V
26 R_B = (V_BB-V_BE)/(I_B*10^-3); // in ohm
27 R_B= R_B*10^-3; // in k ohm
28 disp(R_B,"The value of R_B for Ge transistor in k
    ohm is");
29 V_CEQ= V_CC-I_C*R_C; // in V
30 I_CQ= round(Beta*I_B); // in mA
31 I_C= V_CC/R_C; // in A
32 I_C= I_C*10^3; // in mA
33 plot([V_CC,0],[0,I_C]);
34 xlabel("V_CC in volts ");
35 ylabel("I_C in mA")
36 title("DC load line ")
37 disp("DC load line shown in figure")
38 disp("Q point : "+string(V_CEQ)+" volts , "+string(
    I_CQ)+" mA")

```

Scilab code Exa 4.11 Base current

```

1 // Exa 4.11
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 alpha = 0.9;
8 I_E = 1; // mA
9 I_C = alpha * I_E; // in mA
10 // The base current ,
11 I_B = I_E - I_C; // in mA
12 disp(I_B,"The value of base current in mA is");

```

Scilab code Exa 4.12 Emitter current

```

1 // Exa 4.12
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 bita = 50;
8 I_B= 20; // in A
9 I_B=I_B*10^-6; // in A
10 I_C= bita*I_B; // in A
11 // The emitter current ,
12 I_E= I_C+I_B; // in A
13 I_E = I_E * 10^3; // in mA
14 disp(I_E,"The Emitter current in mA is");

```

Scilab code Exa 4.13 Base current and emitter current

```

1 // Exa 4.13
2 format('v',7)
3 clc;
4 clear;
5 close;
6 // Given data
7 beta_dc = 90;
8 // The base current ,
9 I_C = 15; // in mA
10 I_C = I_C * 10^-3; // in A
11 I_B = I_C/beta_dc; // in A
12 I_B= I_B*10^6; // in A
13 disp(I_B,"The base current in A is");
14 I_B= I_B*10^-6; // in A
15 // The emitter current ,
16 I_E = I_C + I_B; // in A
17 I_E = I_E * 10^3; // in mA
18 disp(I_E,"The Emitter current in mA is");

```

```
19 alpha_dc = beta_dc/(1+beta_dc);
20 disp(alpha_dc,"The value of alpha_dc is");
```

Scilab code Exa 4.14 Change in base current

```
1 // Exa 4.14
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 del_ic = 1.8; // in mA
8 del_ie = 1.89; // in mA
9 alpha = del_ic / del_ie;
10 bita = alpha/(1 - alpha);
11 // Change in base current ,
12 del_ib = del_ic/bita; // in mA
13 del_ib = del_ib * 10^3; // in A
14 disp(del_ib,"The change in I_B in A is");
```

Scilab code Exa 4.15 Collector current

```
1 //Exa 4.15
2 format('v',7)
3 clc;
4 clear;
5 close;
6 // Given data
7 bita = 100;
8 I_CBO = 4; // in A
9 I_B = 40; // in A
10 // The collector current ,
11 I_C = (bita * I_B) + ((1+bita) * I_CBO); // in A
```

```
12 I_C = I_C * 10^-3; // in mA
13 disp(I_C, "The collector current in mA is");
```

Scilab code Exa 4.16 Alphadc and beta dc

```
1 //Exa 4.16
2 format('v',7)
3 clc;
4 clear;
5 close;
6 //Given data
7 I_CEO = 21; // in A
8 I_CBO = 1.1; // in A
9 // Value of beta_dc
10 beta_dc = round((I_CEO/I_CBO) - 1);
11 disp(beta_dc, "Value of beta_dc is");
12 // The value of alpha_dc
13 alpha_dc = beta_dc/(1 + beta_dc);
14 disp(alpha_dc, "The value of alpha_dc is");
```

Scilab code Exa 4.17 Alphadc and emitter current

```
1 // Exa 4.17
2 format('v',7)
3 clc;
4 clear;
5 close;
6 // Given data
7 I_CBO = 3; // in A
8 I_CBO = I_CBO * 10^-3; // in mA
9 I_C = 15; // in mA
10 // But it is given that I_C = 99.5% of I_E, SO
11 I_E = I_C / 0.995; // in mA
```

```
12 alpha_dc= I_C/I_E;
13 disp(alpha_dc,"The value of alpha_dc is : ")
14 disp(I_E,"The value of I_E in mA is : ")
```

Scilab code Exa 4.18 IC and IB

```
1 //Exa 4.18
2 format('v',5)
3 clc;
4 clear;
5 close;
6 //Given data
7 alpha_dc = 0.99;
8 I_CBO = 10; // in A
9 I_CBO= I_CBO*10^-6; // in A
10 I_E = 10; // in mA
11 I_E= I_E*10^-3; // in A
12 // The collector current ,
13 I_C = (alpha_dc * I_E) + I_CBO; // in A
14 I_C=I_C*10^3; // in mA
15 disp(I_C,"The value of I_C in mA is");
16 I_C=I_C*10^-3; // in A
17 // The base current ,
18 I_B = I_E - I_C; // in A
19 I_B = I_B * 10^6; // in A
20 disp(I_B,"The value of I_B in A is");
```

Scilab code Exa 4.19 Base current

```
1 // Exa 4.19
2 format('v',5)
3 clc;
4 clear;
```

```

5 close;
6 format('v',9)
7 // Given data
8 alpha_dc = 0.99;
9 I_C = 6; // in mA
10 I_C= I_C*10^-3; // in A
11 I_CBO = 15; // in A
12 I_CBO= I_CBO*10^-6; // in A
13 // The emitter current,
14 I_E = (I_C - I_CBO)/alpha_dc; // in A
15 // The base current,
16 I_B = I_E - I_C; // in A
17 I_B= I_B*10^6; // in A
18 I_B= round(I_B)
19 disp(I_B,"The value of I_B in A is");

```

Scilab code Exa 4.20 Emitter current

```

1 //Exa 4.20
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 alpha_dc = 0.98;
8 I_CBO = 12; // in A
9 I_CBO = I_CBO * 10^-6; // in A
10 I_B = 120; // in A
11 I_B = I_B * 10^-6; // in A
12 beta_dc = alpha_dc/(1-alpha_dc);
13 // The emitter current,
14 I_E = ((1 + beta_dc) * I_B) + ((1 + beta_dc) * I_CBO
    ); //in A
15 I_E = I_E * 10^3; // in mA
16 disp(I_E,"The value of I_E in mA is");

```

Scilab code Exa 4.21 Base and emitter current

```
1 // Exa 4.21
2 format('v',7)
3 clc;
4 clear;
5 close;
6 // Given data
7 beta_dc = 90;
8 // The base current ,
9 I_C = 15; // in mA
10 I_C = I_C * 10^-3; // in A
11 I_B = I_C/beta_dc; // in A
12 I_B=I_B*10^6; // in A
13 disp(I_B,"The base current in A is");
14 I_B=I_B*10^-6; // in A
15 // The emitter current ,
16 I_E = I_C + I_B; // in A
17 I_E = I_E * 10^3; // in mA
18 disp(I_E,"The Emitter current in mA is");
19 alpha_dc = beta_dc/(1+beta_dc);
20 disp(alpha_dc,"The value of alpha_dc is");
21
22 // Note: There is printing mistake in the book in
    this example.
```

Chapter 5

Transistor Biasing and Small Signal Amplifiers

Scilab code Exa 5.1 h parameters

```
1 // Exa 5.1
2 format('v',6)
3 clc;
4 clear;
5 close;
6 R1= 10; // in ohm
7 R2= 20; // in ohm
8 R3=30; // in ohm
9 v2= 50; // in V
10 v1= 20; // in V
11 i1= -2.5; //in V
12 i2= 1; // in A
13 h11= R1+(R2*R3/(R2+R3)); // in ohm
14 // h-parameters
15 disp("h-parameters : ")
16 disp(h11,"The value of h11 in ohm is : ")
17 // From  $v_i = h_{11}i_1 + h_{12}V_1$  and  $i_2 = h_{21}i_1 + h_{22}v_2$ 
18 h12= v1/v2;
19 disp(h12,"The value of h12 is : ")
```

```

20 h21= i2/i1;
21 disp(h21,"The value of h21 is : ")
22 h22= i2/v2;// in mho
23 disp(h22,"The value of h22 in mho is : ")

```

Scilab code Exa 5.2 h parameters

```

1 // Exa 5.2
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 R1 = 30;// in ohm
8 R2 = 40;// in ohm
9 R3 = 60;// in ohm
10 R4 = 40;// in ohm
11 R5 = 70;// in ohm
12 h11 = (R1+(R2*R5/(R2+R5)));// in ohm
13 disp(h11,"The numericals values of h11 in ohm is");
14 h12 =R2*R4/(R4+R5)*1/(R3+R4*R5/(R4+R5))
15 disp(h12,"The numericals values of h12 is");
16 h21 =-R4*R2/(R5+R2)*1/(R3+R5*R2/(R5+R2))
17 disp(h21,"The numericals values of h21 is");
18 h22 = 1/(R3+(R2*R5/(R2+R5)))
19 disp(h22,"The numericals values of h22 in mho is");
20
21 // Note : In the book the calculated value of h11 i.
    e 30+(40 || 70) = 53 is wrong. correct value is
    55.45 so the answer in the book is wrong.

```

Scilab code Exa 5.3 z parameter

```

1 // Exa 5.3
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 R1 = 30; // in ohm
8 R2 = 40; // in ohm
9 R3 = 60; // in ohm
10 R4 = 40; // in ohm
11 R5 = 70; // in ohm
12 // z-parameters
13 z11= R1+(R2*(R1+R2)/(R2+(R1+R2)))
14 disp(z11,"The value of z11 in ohm is : ");
15 z22= R3+R4*R5/(R4+R5);
16 disp(z22,"The value of z22 is : ");
17 z12= R2*R4/(R1+R2+R4);
18 disp(z12,"The value of z12 is : ");
19 z21= R2*R4/(R1+R2+R4);
20 disp(z21,"The value of z21 in mho is : ");

```

Scilab code Exa 5.4 External voltage gain

```

1 // Exa 5.4
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Avint = 100;
8 Ri = 1; // in k ohm
9 Ro = 200; // in ohm
10 Ro = Ro * 10^-3; // in k ohm
11 R_S = 50; // in ohm
12 R_S = R_S * 10^-3; // in k ohm

```

```

13 R_L = 2; // in k ohm
14 // Avext = V_L/V_S = Avint*(Ri/(RiR_S))*(R_L/(R_L+Ro)
    );
15 Avext = Avint*(Ri/(Ri+R_S))*(R_L/(R_L+Ro));
16 disp(Avext,"The external voltage gain is");

```

Scilab code Exa 5.5 External current gain

```

1 // Exa 5.5
2 format('v',7)
3 clc;
4 clear;
5 close;
6 // Given data
7 Ri = 1; // in k ohm
8 Ro = 80; // in k ohm
9 Aiint = 150;
10 R_S = 5; // in k ohm
11 R_L = 1; // in k ohm
12 // Aiext = i1/i2 = (R_S/(R_S+Ri)) * (Ro/(Ro+R_L))*
    Aiint;
13 Aiext = (R_S/(R_S+Ri)) * (Ro/(Ro+R_L))*Aiint;
14 disp(Aiext,"The external current gain is");

```

Scilab code Exa 5.6 Lower 3 dB frequency

```

1 // Exa 5.6
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data

```

```

7 // Vo = -R_L*Io = ( (-R_L*Rc)/(Rc+R_L+(1/SC)) ) * h_fe
  *Ib;
8 R_C = 4; // in k ohm
9 R_L = 2; // in k ohm
10 R = R_C+R_L; // in k ohm
11 R= R*10^3; // in ohm
12 C_L = 10; // in F
13 C_L = C_L * 10^-6; // in F
14 // Vo/Ib =Aos/(S+(1/R*C_L));
15 f_L = 1/(2*%pi*R*C_L); // in Hz
16 disp(f_L,"The lower 3-dB frequency in Hz is");

```

Scilab code Exa 5.7 Ai Av Ri Ais and Avs

```

1 // Exa 5.7
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // GIVen data
7 R_L= 10*10^3; // in ohm
8 h_ie = 1.1; // in k ohm
9 h_ie = h_ie * 10^3; // in ohm
10 h_re = 2.5*10^-4;
11 h_fe = 50;
12 h_oe = 24; // in A/V
13 h_oe = h_oe * 10^-6; // in A/V
14 R_S = 1; // in k ohm
15 R_S = R_S * 10^3; // in ohm
16 Rc = 10; // in k ohm
17 Rc = Rc * 10^3; // in ohm
18 Ai = round(-h_fe/(1+(h_oe*R_L)));
19 disp(Ai,"The value of Ai is");
20 Ri = h_ie+(h_re*Ai*R_L); // in ohm
21 Ri= Ri*10^-3; // k ohm

```

```

22 disp(Ri,"The value of Ri in k ohm is");
23 Ri= Ri*10^3; // ohm
24 Av = (Ai*R_L)/Ri;
25 disp(Av,"The value of Av is");
26 Avs = (Av*Ri)/(Ri+R_S);
27 disp(Avs,"The value of Avs is");
28 Ais = (Ai*R_S)/(Ri+R_S);
29 disp(Ais,"The value of Ais is");

```

Scilab code Exa 5.8 Cut off frequency

```

1 // Exa 5.8
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 I_C = 1 ; // in A
8 bita= 200;
9 h_fe = bita;
10 R_C = 5*10^3; // in ohm
11 R_E = 2*10^3; // in ohm
12 R_S = 600; // in ohm
13 R_L = 600; // in ohm
14 C1=10*10^-6; // in F
15 C2= C1; // in F
16 f_L= 20; // in Hz (lower cut-off frequency)
17 // R1||R2= 6; // in k ohm
18 r_e = 25/I_C; // in ohm
19 h_i = bita*r_e; // in ohm
20 // R_B= R1||R2=6; // in k ohm
21 R_B= 6*10^3; // in ohm
22 r_i = 5*10^3; // in ohm
23 Ri = (R_B*r_i)/(R_B+r_i); // in ohm
24 // The cut off frequency due to C1

```

```

25 f1= 1/(2*%pi*(Ri+R_S)*C1); // in Hz
26 disp(f1,"The cut-off frequency due to C1 in Hz is :
    ")
27 // The cut off frequency due to C2
28 f2= 1/(2*%pi*(R_C+R_L)*C2); // in Hz
29 disp(f2,"The cut-off frequency due to C1 in Hz is :
    ")
30 // The cut off frequency due to C_E, f_L= (1+h_fe)
    /(2*%pi*C_E*(R_S+h_ie)) or
31 C_E = (1+h_fe)/(2*%pi*f_L*(R_S+h_i)); // in F
32 C_E = round(C_E * 10^6); // in F
33 disp(C_E,"The value of C_E in F is");

```

Scilab code Exa 5.9 Mid band voltage gain and input impedance

```

1 // Exa 5.9
2 format('v',9)
3 clc;
4 clear;
5 close;
6 // Given data
7 h_fe = 100;
8 h_ie = 1; // in k ohm
9 h_ie = h_ie * 10^3; // in ohm
10 vo_by_I= -100*10^3; // in ohm
11 vi_by_I= 1100+101*0.1*10^3; // in ohm
12 Av= vo_by_I/vi_by_I;
13 Av= round(Av);
14 Av= abs(Av);
15 disp(Av,"The mid-band voltage gain is");
16 //Ri =Vi/Ii;
17 Ri= vi_by_I; // in ohm
18 Ri= Ri*10^-3; // in k ohm
19 disp(Ri,"The input impedance in k ohm is");

```

Scilab code Exa 5.10 Value of r_E A_i and R_{in}

```
1 // Exa 5.10
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 V = 5.7; // in V
8 V_BE = 0.7; // in V
9 R1 = 10 * 10^3; // in ohm
10 R2 = 100 * 10^3; // in ohm
11 I_BQ = (V-V_BE)/(R1+R2); // in A
12 I_BQ = I_BQ * 10^3; // in mA
13 I_EQ = 100*I_BQ; // in mA
14 R1 = 2; // in k ohm
15 R_L = 100*10^-3; // in k ohm
16 disp(I_EQ,"The value of I_EQ in mA is");
17 V_T = 0.026; // in V assumed
18 r_E = V_T/(I_EQ*10^-3); // in ohm
19 disp(r_E,"The value of r_E in ohm is");
20 Beta = 100;
21 h_fe = Beta;
22 r_pi = Beta*r_E; // in ohm
23 disp(r_pi,"The value of r_pi in ohm is : ")
24 ib = poly(0,'ib');
25 vb_by_ib = 0.572+101*1; // in k ohm
26 Ri = 10; // in k ohm
27 i1_by_ib = vb_by_ib/Ri;
28 is_by_ib = 1+i1_by_ib;
29 iL_by_ib = -h_fe*R1/(R1+R_L);
30 // Ai = iL/is = iL_by_ib/is_by_ib;
31 Ai = iL_by_ib/is_by_ib;
32 Rin = vb_by_ib/is_by_ib; // in k ohm
```



```
33 disp(Ai,"The value of Ai is : ")
34 disp(Rin,"The value of Rin in k ohm is : ")
```

Chapter 6

Feedback Amplifiers and Oscillations

Scilab code Exa 6.1 New gain after feedback

```
1 // Exa 6.1
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 BWf = 5; // in MHz
8 BWf = BWf * 10^6; // in Hz
9 Av = 100;
10 BW = 500; // in kHz
11 BW = BW * 10^3; // in Hz
12 // BWf = (1+(B*Av))*BW;
13 B = ((BWf/BW)-1)/Av;
14 disp(B,"The amount of negative feed back is");
15 Avf = Av/(1+(Av*B));
16 disp(Avf,"The new gain after negative feed back is")
    ;
```

Scilab code Exa 6.2 Av of the basic amplifier

```
1 // Exa 6.2
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 h11 = 2; // in k ohm
8 h11 = h11 * 10^3; // in ohm
9 h12 = 0;
10 h21 = 80;
11 h22= 1*10^-3; // in mho
12 R_L= 10*10^3; // in ohm
13 B= 10/100;
14 Ri= 2; // in k ohm
15 R_Ldesh= (R_L*1/h22)/(R_L+1/h22); // in ohm
16 Av= h21*R_Ldesh/h11;
17 disp(Av,"Part (a) : The value of Av of the basic
    amplifier is : ")
18 D= 1+Av*B;
19 disp(D,"The value of densitivity factor is : ")
20 Avf= Av/(1+B*Av);
21 disp(Avf,"The value of Avf is : ")
22 Rif= (1+Av*B)*Ri; // in k ohm
23 disp(Rif,"The value of Rif in k ohm is : ")
```

Scilab code Exa 6.3 Value of RC

```
1 // Exa 6.3
2 format('e',8)
3 clc;
```

```

4 clear;
5 close;
6 // Given data
7 f_osc = 6.5; // in kHz
8 f_osc = f_osc * 10^3; // in Hz
9 // f_osc = 1/(2*pi*sqrt(6)*RC);
10 RC = 1/(2*pi*sqrt(6)*f_osc); // in sec
11 disp(RC,"The value of RC in sec is : ")
12 format('v',5)
13 // Possible selection of R and C may be
14 R= 1; // in k ohm
15 C= RC/R; // in mF
16 C= C*10^3; // in F
17 disp("The possible selection of R and C : ")
18 disp("(a) : "+string(R)+" k and "+string(C)+" F ")
19 )
19 format('v',6)
20 R= 10; // in k ohm
21 C= RC/R; // in mF
22 C= C*10^3; // in F
23 disp("The possible selection of R and C : ")
24 disp("(a) : "+string(R)+" k and "+string(C)+" F ")
25 )

```

Scilab code Exa 6.4 Reverse transmission factor

```

1 // Exa 6.4
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 A= 1000;
8 dA= 100;
9 dAbyAf= 0.1/100;

```

```

10 // dAf/Af = 1/|1+B*A| * dA/A or
11 B= (dA-dAbyAf*A)/(dAbyAf*A^2)
12 disp(B,"The reverse transmission factor of the
    feedback networks used is : ");
13 Af = A/(1+(B*A));
14 disp(Af,"The gain with feed back is");

```

Scilab code Exa 6.5 Output voltage and input voltage

```

1 // Exa 6.5
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Vout = 36; // in V
8 Vs = 0.028; // in V
9 B = 1.2/100;
10 A = Vout/Vs;
11 Af = A/(1+(B*A));
12 Vo =Af*Vs; // in V
13 disp(Vo,"The output voltage in V is");
14 // 1+BA = 7 or
15 BA= 6;
16 Af= A/(1+BA);
17 Vin = Vout/Af; // in V
18 disp(Vin,"The input voltage in V is");

```

Scilab code Exa 6.6 Value of fLF

```

1 // Exa 6.6
2 format('v',6)
3 clc;

```

```

4 clear;
5 close;
6 // Given data
7 f_L = 20; // in Hz
8 f_H = 50; // in kHz
9 f_H = f_H * 10^3; // in Hz
10 Ao = 1000;
11 B = 10/100;
12 f_HF = f_H*(1+(B*Ao)); // in Hz
13 f_HF = f_HF * 10^-6; // in MHz
14 disp(f_HF,"The value of f_HF in MHz is");
15 f_LF = f_L/(1+(B*Ao)); // in Hz
16 disp(f_LF,"The value of f_LF in Hz is");

```

Scilab code Exa 6.7 Wien bridge oscillation

```

1 // Exa 6.7
2 format('e',9)
3 clc;
4 clear;
5 close;
6 // Given data
7 f_o = 1; // in kHz
8 f_o = f_o * 10^3; // in Hz
9 // f_o = 1/(2*pi*Rc);
10 RC = 1/(2*pi*f_o);
11 disp(RC,"The value of RC is : ")
12 disp("So R and C can be choosen as 15.9 k and 0.01
      F respectively.")

```

Scilab code Exa 6.8 Av of the basic amplifier

```

1 // Exa 6.8

```

```

2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 h11 = 2; // in k ohm
8 h11 = h11 * 10^3; // in ohm
9 h12 = 0;
10 h21 = 80;
11 h22= 1*10^-3; // in mho
12 R_L= 10*10^3; // in ohm
13 B= 10/100;
14 Ri= 2; // in k ohm
15 R_Ldesh= (R_L*1/h22)/(R_L+1/h22); // in ohm
16 Av= h21*R_Ldesh/h11;
17 disp(Av,"Part (a) : The value of Av of the basic
    amplifier is : ")
18 D= 1+Av*B;
19 disp(D,"The value of densitivity factor is : ")
20 Avf= Av/(1+B*Av);
21 disp(Avf,"The value of Avf is : ")
22 Rif= (1+Av*B)*Ri; // in k ohm
23 disp(Rif,"The value of Rif in k ohm is : ")

```

Scilab code Exa 6.9 Value of v_o by vs R_i and R_o

```

1 // Exa 6.9
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 h_ie = 1.5 * 10^3; // in ohm
8 h_fe = 100;
9 // R = R1 || R2 = 20; // in k ohm

```

```

10 R = 20 * 10^3; // in ohm
11 R_E = 560; // in ohm
12 R_S = 600; // in ohm
13 Avf = (h_fe*R_E)/(h_ie+(h_fe*R_E));
14 VoByVs = Avf;
15 disp(VoByVs,"The value of midband voltage gain (vo/
    vs) is :");
16 Ri = h_ie + ((1+h_fe)*R_E); // in ohm
17 Ri= Ri*10^-3; // in k ohm
18 disp(Ri,"The value of input impedance (Ri) in k ohm
    is : ")
19 Ri= Ri*10^3; // in ohm
20 Ro = (R_S+h_ie)/(1+h_fe); // in ohm
21 disp(Ro,"The value of output impedance (Ro) in ohm
    is : ")
22 R_desh_i = (R*Ri)/(R+Ri); // in ohm
23 R_desh_i=R_desh_i*10^-3; // in k ohm
24 disp(R_desh_i,"The value of R''i in k ohm is");
25 // For load resistance of 10 k ohm
26 R_L = 10; // in k ohm
27 R_L = R_L * 10^3; // in ohm
28 R_desh_o = (Ro*R_L)/(Ro+R_L); // in ohm
29 disp(R_desh_o,"The value of R''o for load resistance
    of 10 k ohm in ohm is");
30 // For load resistance of 220 ohm
31 R_L = 220; // in ohm
32 R_desh_o = (Ro*R_L)/(Ro+R_L); // in ohm
33 disp(R_desh_o,"The value of R''o for load resistance
    of 220 ohm in ohm is");
34
35 // Note: There is a calculation mistake to evaluate
    the value of R_desh_i (R'i)

```

Scilab code Exa 6.10 Voltage gain input resistance


```

1 // Exa 6.10
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 h_fe = 50;
8 h_ie = 1.2; // in k ohm
9 h_ie = h_ie * 10^3; // in ohm
10 R_C = 1; // in k ohm
11 R_C = R_C * 10^3; // in ohm
12 R_E = 200; // in ohm
13 R_B = 2; // in k ohm
14 R_B = R_B * 10^3; // in ohm
15 Av = (-h_fe*R_C)/h_ie;
16 disp(Av,"The voltage gain (Av) is");
17 Ri = (h_ie*R_B)/(h_ie+R_B); // in ohm
18 disp(Ri,"The input resistance (Ri) in ohm is");
19 // vi= vs (on neglecting Rs), hence i_E= i_B+h_fe*
      i_B = (1+h_fe)*i_B (i)
20 // vo= -i_C*R_C = -h_fe*i_B*R_C (As i_C=
      h_fe*i_B) (ii)
21 // From eq (i) : vi= i_B*h_ie+i_E*R_E= i_B*(h_ie+(1+
      h_fe)*R_E) (iii)
22 // i_L= i_B
      (iv)
23 // Avf = (h_fe*i_B*R_C)/(i_B*(h_ie+(1+h_fe)*R_E));
24 Avf = (-h_fe*R_C)/(h_ie+(1+h_fe)*R_E);
25 disp(Avf,"The voltage gain (Avf) is");
26 Rif = (R_B*(h_ie + ((1+h_fe)*R_E)))/(R_B+(h_ie +
      ((1+h_fe)*R_E))); // in ohm
27 Rif= Rif*10^-3; // in k ohm
28 disp(Rif,"The input resistance (Rif) in k ohm is");

```

Chapter 7

Operational Amplifiers

Scilab code Exa 7.1 Output voltage

```
1 // Exa 7.1
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Ac = 35; //common mode gain in dB
8 Ac = 10^(Ac/20);
9 CMRR = 72; // in dB
10 CMRR = 10^(CMRR/20);
11 // CMRR = Ad/Ac
12 Ad = CMRR*Ac;
13 V1 = 0.16; // in mV
14 V2 = 0.18; // in mV
15 // Common mode signal
16 Vc = 1/2*(V1+V2); // in mV
17 // Difference mode signal
18 Vd = V2-V1; // in mV
19 // The output voltage
20 Vo = Ac*Vc+Ad*Vd; // in mV
21 Vo= Vo*10^-3; // in V
```

```
22 disp(Vo,"The output voltage in V is");
```

Scilab code Exa 7.6 Output voltage

```
1 // Exa 7.6
2 format('v',5)
3 clc;
4 clear;
5 close;
6 // Given data
7 Ro = 10; // in k ohm
8 R1 = 10; // in k ohm
9 R2 = 2.2; // in k ohm
10 R3 = 3.3; // in k ohm
11 V1 = 6; // in V
12 V2 = -3; // in V
13 V3 = -0.75; // in V
14 // Output voltage ,
15 Vo = -((Ro/R1)*V1) + ((Ro/R2)*V2) + ((Ro/R3)*V3) )
    ; // in V
16 disp(Vo,"The value of Vo in V is");
```

Scilab code Exa 7.8 Open loop voltage gain

```
1 // Exa 7.8
2 format('v',7)
3 clc;
4 clear;
5 close;
6 // Given data
7 R = 100; // in k ohm
8 R = R * 10^3; // in ohm
9 C = 2; // in F
```

```

10 C = C * 10^-6; // in F
11 f = 10; // in kHz
12 f = f * 10^3; // in Hz
13 omega = 2*pi*f; // in Krad
14 // The open loop voltage gain ,
15 A = R*omega*C;
16 disp(A,"The open loop voltage gain is");
17 format('e',9)
18 //The feedback function , B is evaluated as, A_F = -R
    /Z_C*( 1/(1+(1/(A*B))) );
19 B = 1/( sqrt( 1+((R*omega*C)^2) ) );
20 disp(B,"The feed back function is");
21 format('v',7)
22 //A_F = -R/Z_C*(1/( 1+(1/(A*B)) ));
23 Av = 10^3;
24 A_F = round(A*(1/(1+(1/(Av*B)))));
25 disp(A_F,"The overall gain is");
26
27 // Note: The open loop voltage gain in the book is
    not accurate.

```

Scilab code Exa 7.9 Value of constant A1 and A2

```

1 // Exa 7.9
2 format('v',7)
3 clc;
4 clear;
5 close;
6 // GIven data
7 R1 = 10; // in k ohm
8 R2 = 100; // in k ohm
9 R3 = 10.1; // in k ohm
10 R4 = 99; // in k ohm
11 // Vdaso = Vo2 = V2*(-R2/R1)
12 //Vdaso = Vo1 = V1*(R4/(R3+R4))*(1+(R2/R1))

```

```

13 //Vo = Vo1+Vo2 = (V1*(R4/(R3+R4))*(1+(R2/R1))) - (V2
    *(-R2/R1))
14 //Vo = (R2/R1) * ( -V2 + ( 1+(R1/R2) )/(1+(R3/R4))*
    V1 )
15 A1 = (1+(R1/R2))/(1+(R3/R4))*(R2/R1); // (on
    comparing vo= A1*V1+A2*V2)
16 disp(A1,"The value of A1 is");
17 A2 = -R2/R1;
18 disp(A2,"The value of A2 is");

```

Scilab code Exa 7.10 CMRR in dB

```

1 // Exa 7.10
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 Ad = 100000;
8 Ac = 25;
9 CMRR = Ad/Ac;
10 CMRR_indB= 20*log10(CMRR); // in dB
11 disp(CMRR_indB,"Part (a) : The value of CMRR in dB
    is");
12 format('e',8)
13 R2 = 100; // in k ohm
14 R1 = 10; // in k ohm
15 V_B = 0.18; // in mV
16 V_A = 0.16; // in mV
17 // The output from the amplifier ,
18 Vo = ((R2/R1)*(V_B-V_A)*10^-3) + ((R2/R1)*V_B
    *10^-3*(1/CMRR)); // in V
19 disp(Vo,"Part (b) : The output from the amplifier in
    V is");
20 V_B = 2.00018; // in V

```

```

21 V_A = 2.00016; // in V
22 // The output from the amplifier ,
23 Vo = ((R2/R1)*(V_B-V_A)) + ((R2/R1)*V_B*(1/CMRR)); //
    in V
24 disp(Vo,"Part (c) : The output from the amplifier in
    V is");

```

Scilab code Exa 7.12 Output voltage

```

1 // Exa 7.12
2 format('v',9)
3 clc;
4 clear;
5 close;
6 // Given data
7 R1 = 10; // in k ohm
8 Rf = 30; // in k ohm
9 Vs = 4; // in V
10 V_A = 2; // in V
11 V_B = 2; // in V
12 I = (Vs-V_B)/(R1); // in mA
13 Vo = (-I*Rf)+V_B; // in V
14 // The output voltage ,
15 disp(Vo,"The value of Vo in V is");

```

Scilab code Exa 7.13 Voltage gain and input resistance

```

1 // Exa 7.13
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data

```

```

7 h_fe = 50;
8 h_ie = 1.2; // in k ohm
9 h_ie = h_ie * 10^3; // in ohm
10 R_C = 1; // in k ohm
11 R_C = R_C * 10^3; // in ohm
12 R_E = 200; // in ohm
13 R_B = 2; // in k ohm
14 R_B = R_B * 10^3; // in ohm
15 Av = (-h_fe*R_C)/h_ie;
16 disp(Av,"The voltage gain (Av) is");
17 Ri = (h_ie*R_B)/(h_ie+R_B); // in ohm
18 disp(Ri,"The input resistance (Ri) in ohm is");
19 // vi= vs (on neglecting Rs), hence i_E= i_B+h_fe*
    i_B = (1+h_fe)*i_B (i)
20 // vo= -i_C*R_C = -h_fe*i_B*R_C (As i_C=
    h_fe*i_B) (ii)
21 // From eq (i) : vi= i_B*h_ie+i_E*R_E= i_B*(h_ie+(1+
    h_fe)*R_E) (iii)
22 // i_L= i_B

(iv)
23 // Avf = (h_fe*i_B*R_C)/(i_B*(h_ie+(1+h_fe)*R_E));
24 Avf = (-h_fe*R_C)/(h_ie+(1+h_fe)*R_E);
25 disp(Avf,"The voltage gain (Avf) is");
26 Rif = (R_B*(h_ie + ((1+h_fe)*R_E)))/(R_B+(h_ie +
    ((1+h_fe)*R_E))); // in ohm
27 Rif= Rif*10^-3; // in k ohm
28 disp(Rif,"The input resistance (Rif) in k ohm is");

```

Chapter 8

Digital Logic and Combinational Circuits

Scilab code Exa 8.1 Hexadecimal number 3BF into binary

```
1 // Exa 8.1
2 format('v',9)
3 clc;
4 clear;
5 close;
6 // Given data
7 str= '3BF';// given number in hexadecimal to convert
      into binary
8 str_in_dec= hex2dec(str);// decimal equivalent
9 str_in_bin= dec2bin(str_in_dec);// binary equivalent
10 disp(str_in_bin,"The binary equivalent of 3BF is : "
      )
11
12 // Note : The answer in the book is wrong because
      binary equivalent of B = 1011 and in the book
      they used 1101 which is wrong.
```

Scilab code Exa 8.2 Convert octal into binary

```
1 // Exa 8.2
2 format('v',9)
3 clc;
4 clear;
5 close;
6 // Given data
7 str= '527';// given number in octal to convert into
   binary
8 str_in_dec= oct2dec(str);// decimal equivalent
9 str_in_bin= dec2bin(str_in_dec);// binary equivalent
10 disp(str_in_bin,"The binary equivalent of 527 is : ")
   )
```

Scilab code Exa 8.3 Convert octal into hexadecimal number

```
1 // Exa 8.3
2 format('v',9)
3 clc;
4 clear;
5 close;
6 // Given data
7 str= '256';// given number in octal to convert into
   hexadecimal
8 str_in_dec= oct2dec(str);// decimal equivalent
9 str_in_hex= dec2hex(str_in_dec);// hexadecimal
   equivalent
10 disp(str_in_hex,"The hexadecimal equivalent of 256
   is : ")
```

Scilab code Exa 8.4 Convert decimal into octal

```

1 // Exa 8.4
2 format('v',9)
3 clc;
4 clear;
5 close;
6 // Given data
7 str= 450; // given number in decimal to convert into
           octal
8 str_in_oct= dec2oct(str); // octal equivalent
9 disp(str_in_oct,"The octal equivalent of 450 is : ")

```

Scilab code Exa 8.9 Maximum permissible value of RB

```

1 // Exa 8.9
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 R_C= 1; // in k ohm
8 V_CC= 5; // in V
9 V_CEsat= 0; // in V
10 V_BE= 0.7; // in V
11 bita_min= 50;
12 bita_max= 100;
13 // For the transistor to go to saturation ,
14 I_C= (V_CC-V_CEsat)/R_C; // in mA
15 bita= bita_min; // for driving the transistor into
           saturation
16 I_Bmin= I_C/bita; //minimum base current in mA
17 // So, (V_CC-V_BE)/R_B >= I_B or
18 R_B= (V_CC-V_BE)/I_Bmin; // in k ohm
19 disp(R_B,"The maximum permissible value of R_B in k
           ohm is : ")
20 // For actual calculation one may take V_CEsat= 0.3

```

```

      V
21 V_CEsat= 0.3; // in V
22 I_C= (V_CC-V_CEsat)/R_C; // in mA
23 bita= bita_min; // for driving the transistor into
      saturation
24 I_Bmin= I_C/bita; //minimum base current in mA
25 // So, (V_CC-V_BE)/R_B >= I_B or
26 R_B= (V_CC-V_BE)/I_Bmin; // in k ohm
27 disp("For actual calculation at V_CE(sat) = 0.3 V,
      the maximum value ")
28 disp(R_B," of R_B in k ohm is : ")

```

Chapter 12

Memory Systems

Scilab code Exa 12.1 Capacity of memory chip

```
1 // Exa 12.1
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 RAMbit= 2*4;//K bit RAM IC chip
8 // The capacity of the memory chip ,
9 Capacity = RAMbit*2^10;// in bits
10 disp(Capacity,"The capacity (or density) of the
    memory chip in bits is");
```

Scilab code Exa 12.2 Required address bits

```
1 // Exa 12.2
2 format('v',6)
3 clc;
4 clear;
```

```

5 close;
6 // Given data
7 // (a) For 1024 number of bits
8 No_of_bits= 1024;// bits
9 Req_add_bits= log(No_of_bits)/log(2);
10 disp(Req_add_bits,"Address bits required for a
    memory that has 1024 number of bits");
11
12 // (b) For 256 number of bits
13 No_of_bits= 256;// bits
14 Req_add_bits= log(No_of_bits)/log(2);
15 disp(Req_add_bits,"Address bits required for a
    memory that has 256 number of bits");
16
17 // (c) For 4098 number of bits
18 No_of_bits= 4096;// bits
19 //  $2^{12} = 4096$ ,  $2^{13} = 8192$ , where  $4096 < 4098 < 8192$  or
     $2^{12} < 4098 < 2^{13}$ , hence
20 Req_add_bits= 13;
21 disp(Req_add_bits,"Address bits required for a
    memory that has 4098 number of bits");
22
23 // d) For 16384 number of bits
24 No_of_bits= 16384;// bits
25 Req_add_bits= log(No_of_bits)/log(2);
26 disp(Req_add_bits,"Address bits required for a
    memory that has 16384 number of bits");

```

Scilab code Exa 12.3 Bits of storage and lines in address bus

```

1 // Exa 12.3
2 format('v',6)
3 clc;
4 clear;
5 close;

```

```

6 // Given data
7 memory = 16; // in K
8 memory= memory*1024; // in bits
9 // Number of bits of storage ,
10 Req_add_bits= log(memory)/log(2);
11 disp(Req_add_bits,"Number of bits of storage is : ")
12 disp(Req_add_bits,"Number of lines in address bus is
   : ")

```

Scilab code Exa 12.4 Number of address line

```

1 // Exa 12.4
2 format('v',6)
3 clc;
4 clear;
5 close;
6 // Given data
7 memory= 16; // in K
8 wordBit= 8;
9 // Number of address
10 N= log((memory/wordBit)*1024)/log(2);
11 disp(N,"The number of address lines is : ")

```

Scilab code Exa 12.5 Memory cell

```

1 // Exa 12.5
2 format('v',8)
3 clc;
4 clear;
5 close;
6 // Given data
7 memory= 16; // in K
8 memory= memory*1024; // in bits

```

```
9 // Number of words
10 N1= memory;
11 disp(N1,"The number of words is : ")
12 N2= 32;// number of bits per word
13 disp(N2,"The number of bits per word is : ")
14 // Number of memory cell
15 N3= N2*memory;
16 disp(N3,"The number of memory cell is : ")
```

Scilab code Exa 12.6 Total number of memory cells

```
1 // Exa 12.6
2 format('v',9)
3 clc;
4 clear;
5 close;
6 // Given data
7 N1= 16;// address input
8 inputs= 4;
9 outputs= 4;
10 // Total number of memory cells
11 N2= 2^N1*2^inputs;
12 disp(N2,"Total number of memory cells is : ")
```
