Scilab Textbook Companion for A Textbook Of Engineering Physics by M. N. Avadhanulu, And P. G. Kshirsagar[1]

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Book Description

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

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

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

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

Contents

List of Scilab Codes

Chapter 4

Electron Ballistics

Scilab code Exa 4.1 Calculation of acceleration time taken and distance covered and kinetic energy of an accelerating proton

```
clc;clear;
//Example 4.1
//Calculation of acceleration ,time taken ,distance
   covered and kinetic energy of an accelerating
   proton

//given values
 m=1.67*10^-27;//mass of proton in kg
 q=1.602*10^-19;//charge of proton in Coulomb
 v1=0;//initial velocity in m/s
 v2=2.5*10^6;//final velocity in m/s
 E=500;//electric field strength in V/m
 //calculation
 a=E*q/m;//acceleration
disp(a,'acceleration of proton in (m/s^2) is:');
t=v2/a;//time
disp(t,'time(in s) taken by proton to reach the
   final velocity is:');
x=a*t^2/2;//distance
disp(x,'distance (in m)covered by proton in this
```

```
    time is:');
KE=E*q*x;//kinetic energy
disp(KE,'kinetic energy(in J) at the time is:');
```

Scilab code Exa 4.2 electrostatic deflection

```
clc;clear;
//Example 4.2
//electrostatic deflection
//given values
V1=2000;//in volts,potential difference through
    which electron beam is accelerated
l=.04;//length of rectangular plates
d=.015;//distance between plates
V=50;//potential difference between plates
//calculations
alpha=atan(l*V/(2*d*V1))*(180/%pi);//in degrees
disp(alpha,'angle of deflection of electron beam is:
    ');
v=5.93*10^5*sqrt(V1);//horizontal velocity in m/s
t=l/v;//in s
disp(t,'transit time through electric field is:')
```

Scilab code Exa 4.3 electron projected at an angle into a uniform electric field

```
clc;clear;
//Example 4.3
//electron projected at an angle into a uniform
    electric field
//given values
v1=4.5*10^5;//initial speed in m/s
alpha=37*%pi/180;//angle of projection in degrees
```

```
E=200;//electric field intensity in N/C
e=1.6*10^-19;//in C
m=9.1*10^-31;//in kg
a=e*E/m;//acceleration in m/s^2
t=2*v1*sin(alpha)/a;//time in s
disp(t,'time taken by electron to return to its
    initial level is:')
H=(v1^2*sin(alpha)*sin(alpha))/(2*a);//height in m
disp(H,'maximum height reached by electron is:')
s=(v1^2)*(2*sin(alpha)*cos(alpha))/(2*a);//
    displacement in m
disp(s,'horizontal displacement(in m)when it reaches
     maximum height is:')
```

Scilab code Exa 4.4 motion of an electron in a uniform magnetic field

```
clc;clear;
//Example 4.4
//motion of an electron in a uniform magnetic field
//given values
V=200;//potential difference through which electron
    is accelerated in volts
B=0.01;//magnetic field in wb/m^2
e=1.6*10^-19;//in C
m=9.1*10^-31;//in kg
v=sqrt(2*e*V/m);//electron velocity in m/s
disp(v,'electron velocity is:')
r=m*v/(e*B);//in m
disp(r,'radius of path (in m)is:')
```

Scilab code Exa 4.5 motion of an electron in a uniform magnetic field acting at an angle

```
clc;clear;
//Example 4.5
//motion of an electron in a uniform magnetic field acting at an angle
//given values
v=3*10^7;//electron speed
B=.23;//magnetic field in wb/m^2
q=45*%pi/180;//in degrees,angle in which electron enter field
e=1.6*10^-19;//in C
m=9.1*10^-31;//in kg
R=m*v*sin(q)/(e*B);//in m
disp(R,'radius of helical path is:')
p=2*%pi*m*v*cos(q)/(e*B);//in m
disp(p,'pitch of helical path(in m) is:')
```

Scilab code Exa 4.6 Magnetostatic deflection

```
clc;clear;
//Example 4.6
//Magnetostatic deflection
//given values
D=.03;//deflection in m
m=9.1*10^-31;//in kg
e=1.6*10^-19;//in C
L=.15;//distance between CRT and anode in m
l=L/2;
V=2000;//in voltsin wb/
B=D*sqrt(2*m*V)/(L*l*sqrt(e));//in wb/m^2
disp(B,'transverse magnetic field acting (in wb/m^2) is:')
```

Scilab code Exa 4.7 electric and magnetic fields in crossed configuration

```
clc;clear;
//Example 4.7
//electric and magnetic fields in crossed
    configuration
//given values
B=2*10^-3;//magnetic field in wb/m^2
E=3.4*10^4;//electric field in V/m
m=9.1*10^-31;//in kg
e=1.6*10^-19;//in C
v=E/B;//in m/s
disp(v,'electron speed is:')
R=m*v/(e*B);//in m
disp(R,'radius of circular path (in m) when electric
    field is switched off')
```

Chapter 5

Electron Optics

Scilab code Exa 5.1 Electron refraction calculation of potential difference

```
clc;clear;
//Example 5.1
//Electron refraction, calculation of potential
   difference

//given values
 V1=250;//potential by which electrons are
    accelerated in Volts
 alpha1=50*%pi/180;//in degree
 alpha2=30*%pi/180;//in degree
b=sin(alpha1)/sin(alpha2);
 //calculation
V2=(b^2)*V1;
a=V2-V1;
disp(a,'potential difference(in volts) is:');
```

Scilab code Exa 5.2 Cyclotron

```
clc;clear;
//Example 5.2&5.3
//Cyclotron, calculation of magnetic induction,
   maximum energy

//given values
 f=12*(10^6);//oscillator frequency in Hertz
 r=.53;//radius of the dee in metre
 q=1.6*10^-19;//Deuteron charge in C
 m=3.34*10^-27;//mass of deuteron in kg
 //calculation
B=2*%pi*f*m/q;//
disp(B,'magnetic induction (in Tesla) is:');
E=B^2*q^2*r^2/(2*m);
disp(E,'maximum energy to which deuterons can be
   accelerated (in J) is')
E1=E*6.24*10^18/10^6;//conversion of energy into MeV
disp(E1,'maximum energy to which deuterons can be
   accelerated (in MeV) is');
```

Scilab code Exa 5.4 calculation of linear separation of lines formed on photographic plates

```
clc;clear;
//Example 5.4
//Mass spectrograph, calculation of linear
   separation of lines formed on photographic plates

//given values
 E=8*10^4;//electric field in V/m
 B=.55//magnetic induction in Wb/m*2
 q=1.6*10^-19;//charge of ions
 m1=20*1.67*10^-27;//atomic mass of an isotope of
    neon
 m2=22*1.67*10^-27;//atomic mass of other isotope of
```

```
    neon
 //calculation
x=2*E*(m2-m1)/(q*B^2);//
disp(x,'separation of lines (in metre) is:')
```

Chapter 6

Properties of Light

Scilab code Exa 6.1 Optical path calculation

```
clc;clear;
//Example 6.1
//Optical path calculation

//given values
n=1.33;//refractive index of medium
x=.75;//geometrical path in micrometre
 //calculation
y=x*n;//
disp(y,'optical path  (in micrometre) is:')
```

Scilab code Exa 6.2 Coherence length calculation

```
clc;clear;
//Example 6.2
//Coherence length calculation

//given values
```

```
l=1*10^-14;//line width in metre
x=10.6*10^-6;//IR emission wavelength in metre
 //calculation
y=x^2/l;//
disp(y,'coherence length(in metre) is:')
```

Chapter 7

Interference and Diffraction

Scilab code Exa 7.1 plane parallel thin film

```
clc;clear;
//Example 7.1
//plane parallel thin film

//given values
x=5890*10^-10;//wavelength of light in metre
n=1.5;//refractive index
r=60*%pi/180;//angle of refraction in degree
 //calculation
t=x/(2*n*cos(r));
disp(t*10^6,'thickness of plate (in micrometre) is:'
   );
```

Scilab code Exa 7.2 wedge shaped thin film

```
clc;clear;
//Example 7.2
//wedge shaped thin film
```

```
//given values
x=5893*10^-10;//wavelength of light in metre
n=1.5;//refractive index
y=.1*10^-3;//fringe spacing
 //calculation
z=x/(2*n*y);//angle of wedge
alpha=z*180/%pi;//conversion of radian into degree
disp(alpha,'angle of wedge (in degree) is:');
```

Scilab code Exa 7.3 Newtons ring experiment

```
clc;clear;
//Example 7.3
//Newton's ring experiment- calculation of
   refractive index

//given values
D1=1.5;//diametre (in cm)of tenth dark ring in air
D2=1.27;//diametre (in cm)of tenth dark ring in
   liquid


 //calculation
n=D1^2/D2^2;
disp(n,'refractive index of liquid  is');
```

Scilab code Exa 7.4 nonreflecting film

```
clc;clear;
//Example 7.4
//nonreflecting film

```

```
//given values
l=5500*10^-10;//wavelength of light
n1=1.33;//refractive index of water
n2=1.52;//refractive index of glass window pane
x=sqrt(n1);//to check if it is nonreflecting

 //calculation
t=l/(4*n1);//thickness of water film required
disp(t*10^6,'minimum thickness of film (in metre) is
   ');
```

Chapter 8

Polarization

Scilab code Exa 8.2 Polarizer

```
clc;clear;
//Example 8.2
//Polarizer,calculation of angle

//given values
Io=1;//intensity of polarised light
I1=Io/2;//intensity of beam polarised by first by
    first polariser
I2=Io/3;//intensity of light polarised by second
    polariser


 //calculation
a=acos(sqrt(I2/I1));
alpha=a*180/%pi;//conversion of angle into degree
disp(alpha,'angle between characteristic directions
     (in degree) is');
```

Scilab code Exa 8.3 calculation of birefringence

```
clc;clear;
//Example 8.3
//calculation of birefringence

//given values

l=6*10^-7;//wavelength of light in metre
d=3*10^-5;//thickness of crystal


 //calculation
 x=l/(4*d);
disp(x,'the birefringance of the crystal is');
```

Chapter 11

Architectural Acoustics

Scilab code Exa 11.1 calculation of total absorption and average absorption coefficient

```
clc;clear;
//Example 11.1
//calculation of total absorption and average
    absorption coefficient

//given values

V=20*15*5;//volume of hall in m^3
t=3.5;//reverberation time of empty hall in sec


//calculation
a1=.161*V/t;//total absorption of empty hall
k=a1/(2*(20*15+15*5+20*5));
disp(k,'the average absorption coefficient is');
```

Scilab code Exa 11.2 calculation of average absorption coefficient

```
clc;clear;
//Example 11.2
//calculation of average absorption coefficient

//given values

V=10*8*6;//volume of hall in m^3
t=1.5;//reverberation time of empty hall in sec
A=20;//area of curtain cloth in m^2
t1=1;//new reverberation time in sec

//calculation
a1=.161*V/t;//total absorption of empty hall
a2=.161*V/t1;//total absorption after a curtain
    cloth is suspended

k=(a2-a1)/(2*20);
disp(k,'the average absorption coefficient is');
```

Scilab code Exa 11.3 calculation of average absorption coefficient and area

```
clc;clear;
//Example 11.3
//calculation of average absorption coefficient and
    area

//given values

V=20*15*10;//volume of hall in m^3
t=3.5;//reverberation time of empty hall in sec
t1=2.5;//reduced reverberation time
k2=.5;//absorption coefficient of curtain cloth
//calculation
a1=.161*V/t;//total absorption of empty hall
k1=a1/(2*(20*15+15*10+20*10));
```

```
disp(k1,'the average absorption coefficient is');
a2=.161*V/t1;//total absorption when wall is covered
    with curtain
a=t1*(a2-a1)/(t1*k2);
disp(a,'area of wall to be covered with curtain(in m
   ^2)is:')
```

Chapter 12

Ultrasonics

Scilab code Exa 12.1 calculation of natural frequency

```
clc;clear;
//Example 12.1
//calculation of natural frequency,magnetostriction

//given values

l=40*10^-3;//length of pure iron rod
d=7.25*10^3;//density of iron in kg/m^3
Y=115*10^9;//Young's modulus in N/m^2

//calculation
f=(1*sqrt(Y/d))/(2*l);
disp(f*10^-3,'the natural frequency(in kHz) is');
```

Scilab code Exa 12.2 calculation of natural frequency

```
clc;clear;
//Example 12.2
```

```
//calculation of natural frequency

//given values

t=5.5*10^-3;//thickness in m
d=2.65*10^3;//density in kg/m^3
Y=8*10^10;//Young's modulus in N/m^2


//calculation
f=(sqrt(Y/d))/(2*t);//frequency in hertz
disp(f*10^-3,'the natural frequency(in kHz) is');
```

Scilab code Exa 12.3 calculation of depth and wavelength

```
clc;clear;
//Example 12.3
//calculation of depth and wavelength

//given values

f=.07*10^6;//frequency in Hz
t=.65;//time taken for pulse to return
v=1700;//velocity of sound in sea water in m/s

//calculation
d=v*t/2;//
disp(d,'the depth of sea(in m) is');
l=v/f;//wavelenght of pulse in m
disp(l*10^2,'wavelength of pulse (in cm)is');
```

Chapter 13

Atomic Physics

Scilab code Exa 13.1 calculation of rate of flow of photons

```
clc;clear;
//Example 13.1
//calculation of rate of flow of photons

//given values

l=5893*10^-10;//wavelength of light in m
P=40;//power of sodium lamp in W
d=10;//distance from the source in m
s=4*%pi*d^2;//surface area of radius in m^2
c=3*10^8;//velocity of light in m/s
h=6.626*10^-34;//Planck's constant in Js
//calculation
E=P*1;//
disp(E,'total energy emitted per second(in Joule)is'
   );
n=E*l/(c*h);//total no of photons
R=n/s;
disp(R,'rate of flow of photons per unit area (in /m
   ^2) is')
```

Scilab code Exa 13.2 calculation of threshold wavelength and stopping potential

```
clc;clear;
//Example 13.2
//calculation of threshold wavelength and stopping
   potential

//given values

l=2000;//wavelength of light in armstrong
e=1.6*10^-19;//charge of electron
W=4.2;//work function in eV
c=3*10^8;//velocity of light in m/s
h=6.626*10^-34;//Planck's constant in Js
//calculation
x=12400/(W);//h*c=12400 eV
disp(x,'threshold wavelength(in Armstrong)is');
Vs=(12400/l-W);//
disp(Vs,'stopping potential (in VOLTS) is')
```

Scilab code Exa 13.3 calculation of momentum of Xray photon undergoing scattering

```
clc;clear;
//Example 13.3
//calculation of momentum of X-ray photon undergoing
    scattering

//given values

alpha=60*%pi/180;//scattering angle in radian
```

```
e=1.6*10^-19;//charge ofelectrone
W=12273;//work function in eV
c=3*10^8;//velocity of light in m/s
h=6.626*10^-34;//Planck's constant in Js
hc=12400;//in eV
m=9.1*10^-31//restmass of photon in kg
//calculation
x=hc/(W);//wavelength of photon undergoing modofied
    scattering in armstrong
y=x-(h/(m*c))*(1-cos(alpha));
p=h/y*10^10;
disp(p,'momentum of photon(in kg-m/s) is');
```

Scilab code Exa 13.4 calculation of wavelength of scattered radiation and velocity of recoiled electrone

```
clc;clear;
//Example 13.4
//calculation of wavelength of scattered radiation
    and velocity of recoiled electron

//given values

alpha=30*%pi/180;//scattering angle in radian
e=1.6*10^-19;//charge ofelectron
x=1.372*10^-10;//wavelength of incident radiation in
    m
c=3*10^8;//velocity of light in m/s
h=6.626*10^-34;//Planck's constant in Js
m=9.1*10^-31//rest mass of photon in kg
hc=12400;//in eV
//calculation

y=((x+(h/(m*c))*(1-cos(alpha))))*10^10;
disp(y,'wavelength of scattered radiation(in
```

```
armstrong)is');
x1=x*10^10;//converting incident wavelength into armstrong
KE=hc*e*((1/x1)-(1/y));//kinetic energy in Joule
disp(KE,'kinetic energy in joule is ');
v=sqrt(2*KE/m);
disp(v,'velocity of recoiled electron (in m/s^2)is');
```

Scilab code Exa 13.5 calculation of wavelength of light emitted

```
clc;clear;
//Example 13.5
//calculation of wavelength of light emitted

//given values
e=1.6*10^-19;//charge of electrone
c=3*10^8;//velocity of light
h=6.626*10^-34;//Planck's constant in Js
E1=5.36;//energy of first state in eV
E2=3.45;//energy of second state in eV


//1)calculation

l=h*c*10^10/((E1-E2)*e);
disp(l,'wavelength of scattered light(in Armstrong) is');
```

Scilab code Exa 13.6 calculation of de Broglie wavelength

```
clc;clear;
//Example 13.6
```

```
//calculation of de Broglie wavelength

//1)given values
e=1.6*10^-19;
h=6.626*10^-34;//Planck's constant in Js
V=182;//potential difference in volts
m=9.1*10^-31;//mass of e in kg


//1)calculation

l=h/sqrt(2*e*m*V);
disp(l,'de Brogliewavelength (in m)is');


//2)given values
m1=1;//mass of object in kg
v=1;//velocity of object in m/s
l1=h/(m1*v);
disp(l1,'debrogie wavelength of object in m) is');
```

Scilab code Exa 13.7 calculation of uncertainty in position

```
clc;clear;
//Example 13.7
//calculation of uncertainty in position

//1)given values

h=6.626*10^-34;//Planck's constant in Js
v1=220;//velocity of e in m/s
m=9.1*10^-31;//mass of e in kg
A=0.065/100;//accuracy


```

```
//1)calculation
v2=v1*A;//uncertainty in speed
x1=h/(2*%pi*m*v2);//
disp(x1,'uncertainty in position of e (in m)is');


//2)given values
m1=150/1000;//mass of object in kg
x2=h/(2*%pi*m1*v2);
disp(x2,'uncertainty in position of baseball(in m)
    is');
```

Scilab code Exa 13.8 Energy states of an electron and grain of dust

```
clc;clear;
//Example 13.8
//calculation of energy states of an electron and
    grain of dust and comparing

//1)given values
L1=10*10^-10;//width of potential well in which e is
     confined
L2=.1*10^-3;//width of potential well in which grain
     of dust is confined
h=6.626*10^-34;//Planck's constant in Js
v1=10^6;//velocity of garin of dust in m/s
m1=9.1*10^-31;//mass of e in kg
m2=10^-9;//mass of grain in kg

//1)calculation

Ee1=1^2*h^2/(8*m1*L1^2);//first energy state of
    electron
disp(Ee1,'first energy state of e is ');
Ee2=2^2*h^2/(8*m1*L1^2);//second energy state of
```

```
electron
disp(Ee2,'second energy state of e is ');
Ee3=3^2*h^2/(8*m1*L1^2);//third energy state of electron
disp(Ee3,'third energy state of e is ');
disp('Energy levels of an electron in an infinite potential well are quantised and the energy difference between the successive levels is quite large.Electron cannot jump from one level to other on strength of thermal energy.Hence quantization of energy plays a significant role in case of electron')

Eg1=1^2*h^2/(8*m2*L2^2);//first energy state of grain of dust
disp(Eg1,'first energy state of grain of dust is ');
Eg2=2^2*h^2/(8*m2*L2^2);//second energy state of grain of dust
disp(Eg2,'second energy state of grain of dust is ');
Eg3=3^2*h^2/(8*m2*L2^2);//third energy state of grain of dust
disp(Eg3,'third energy state of  grain of dust is ');
KE=m2*v1^2/2;//kinetic energy of grain of dust;
disp(KE,'kinetic energy of grain of dust is');
disp('The energy levels of a grain of dust are so near to each other that they constitute a continuum.These energy levels are far smaller than the kinetic energy possessed by the grain of dust.It can move through all these energy levels without an external supply of energy.Thus quantization of energy levels is not at all significant in case of macroscopic bodies.')
```

Chapter 14

Lasers

Scilab code Exa 14.1 calculation of intensity of laser beam

```
clc;clear;
//Example 14.1
//calculation of intensity of laser beam

//given values
P=10*10^-3;//Power in Watt
d=1.3*10^-3;//diametre in m
A=%pi*d^2/4;//area in m^2


//calculation
I=P/A;
disp(I,'intensity (in W/m^2) is');
```

Scilab code Exa 14.2 calculation of intensity of laser beam

```
clc;clear;
//Example 14.2
```

```
//calculation of intensity of laser beam

//given values
P=1*10^-3;//Power in Watt
l=6328*10^-10;//wavelength in m
A=l^2;//area in m^2


//calculation
I=P/A;
disp(I,'intensity (in W/m^2) is');
```

Scilab code Exa 14.3 calculation of coherence length bandwidth and line width

```
clc;clear;
//Example 14.3
//calculation of coherence length,bandwidth and line width

//given values
c=3*10^8;//velocity of light in m/s
t=.1*10^-9;//timedivision in s
l=6238*10^-10;//wavelength in m

//calculation
x=c*t;
disp(x,'coherence length (in m) is');
d=1/t;
disp(d,'bandwidth (in Hz) is');
y=l^2*d/c;//line width in m
disp(y*10^10,'line width(in armstrong )is');
```

Scilab code Exa 14.4 calculation of frequency difference

```
clc;clear;
//Example 14.4
//calculation of frequency difference

//given values
c=3*10^8;//velocity of light in m/s
l=.5;//distance in m

//calculation
f=c/(2*l);//in hertz
disp(f/10^6,'frequency difference (in MHz) is');
```

Scilab code Exa 14.5 calculation of frequency difference

```
clc;clear;
//Example 14.5
//calculation of no of cavity modes

//given values
c=3*10^8;//velocity of light in m/s
n=1.75;//refractive index
l=2*10^-2;//length of ruby rod in m
x=6943*10^-10;//wavelength in m
y=5.3*10^-10;//spread of wavelength in m

//calculation
d=c/n/l;
f=c*y/x^2;
m=f/d;
disp(m,'no of modes is');
```

Chapter 15

Atomic nucleus and nuclear energy

Scilab code Exa 15.1 calculation of binding energy per nucleon

```
clc;clear;
//Example 15.1
//calculation of binding energy per nucleon

//given values
Mp=1.00814;//mass of proton in amu
Mn=1.008665;//mass of nucleon in amu
M=7.01822;//mass of Lithium nucleus in amu
amu=931;//amu in MeV
n=7-3;//no of neutrons in lithium nucleus

//calculation
ET=(3*Mp+4*Mn-M)*amu;//total binding energy in MeV
E=ET/7;//7 1s the mass number
disp(E,'Binding energy per nucleon in MeV is');
```

Scilab code Exa 15.2 calculation of energy

```
clc;clear;
//Example 15.2
//calculation of energy

//given values
M1=15.00001;//atomic mass of N15 in amu
M2=15.0030;//atomic mass of O15 in amu
M3=15.9949;//atomic mass of O16 in amu
amu=931.4;//amu in MeV
mp=1.0072766;//restmass of proton
mn=1.0086654;//restmass of neutron

//calculation
Q1=(M3-mp-M1)*amu;
disp(Q1,'energy required to remove one proton from
    O16 is');
Q2=(M3-mn-M2)*amu;
disp(Q2,'energy required to remove one neutron from
    O16 is');
```

Scilab code Exa 15.3 calculation of binding energy

```
clc;clear;
//Example 15.3
//calculation of binding energy

//given values
Mp=1.00758;//mass of proton in amu
Mn=1.00897;//mass of nucleon in amu
M=4.0028;//mass of Helium nucleus in amu
amu=931.4;//amu in MeV

//calculation
```

```
E1=(2*Mp+2*Mn-M)*amu;//total binding energy
disp(E1,'Binding energy in MeV is');
E2=E1*10^6*1.6*10^-19;
disp(E2,'binding energy in Joule is');
```

Scilab code Exa 15.4 calculation of binding energy

```
clc;clear;
//Example 15.4
//calculation of amount of unchanged material

//given values
T=2;//half life in years
k=.6931/T;//decay constant
M=4.0028;//mass of Helium nucleus in amu
amu=931.4;//amu in MeV
No=1;//initial amount in g

//calculation
N=No*(%e^(-k*2*T));
disp(N,'amount of material remaining unchanged after
    four years(in gram) is');
```

Scilab code Exa 15.5 calculation of halflife

```
clc;clear;
//Example 15.5
//calculation of amount of halflife

//given values
t=5;//time period in years
amu=931.4;//amu in MeV
No=5;//initial amount in g
```

```
N=5-(10.5*10^-3);//amount present after 5 years


//calculation
k=log(N/No)/t;//decay constant
T=-.693/k;
disp(T,'halflife in years is');
```

Scilab code Exa 15.6 calculation of activity

```
clc;clear;
//Example 15.6
//calculation of activity

//given values
t=28;//half life in years
m=10^-3;//mass of sample
M=90;//atomic mass of strontium
NA=6.02*10^26;//avogadro's number


//calculation
n=m*NA/M;//no of nuclei in 1 mg sample
k=.693/(t*365*24*60*60);//decay constant
A=k*n;
disp(A,'activity of sample(in disintegrations per
   second) is');
```

Scilab code Exa 15.7 calculation of age of mineral

```
clc;clear;
//Example 15.7
//calculation of age of mineral
```

```

//given values
t=4.5*10^9;//half life in years
M1=238;//atomic mass of Uranium in g
m=.093;//mass of lead in 1 g of uranium in g
NA=6.02*10^26;//avogadro's number
M2=206;//atomic mass of lead in g

//calculation
n=NA/M1;//no of nuclei in 1 g of uranium sample
n1=m*NA/M2;//no of nuclei in m mass of lead
c=n1/n;
k=.693/t;//decay constant
T=(1/k)*log(1+c);
disp(T,'age of mineral in years is');
```

Scilab code Exa 15.8 calculation of age of wooden piece

```
clc;clear;
//Example 15.8
//calculation of age of wooden piece

//given values
t=5730;//half life of C14 in years
M1=50;//mass of wooden piece in g
A1=320;//activity of wooden piece (disintegration
   per minute per g)
A2=12;//activity of living tree

//calculation
k=.693/t;//decay constant
A=A1/M1;//activity after death

T=(1/k)*log(A2/A);
disp(T,'age of mineral in years is');
```

Scilab code Exa 15.9 calculation of energy released

```
clc;clear;
//Example 15.9
//calculation of energy released

//given values
M1=10.016125;//atomic mass of Boron in amu
M2=13.007440;//atomic mass of C13 in amu
M3=4.003874;//atomic mass of Helium in amu
mp=1.008146;//mass of proton in amu
amu=931;//amu in MeV

//calculation
Q=(M1+M3-(M2+mp))*amu;//total binding energy in M
disp(Q,'Binding energy per nucleon in MeV is');
```

Scilab code Exa 15.10 calculation of crossection

```
clc;clear;
//Example 15.10
//calculation of crosssection

//given values
t=.01*10^-3;//thickness in m
n=10^13;//no of protons bombarding target per s
NA=6.02*10^26;//avogadro's number
M=7;//atomic mass of lithium in kg
d=500;//density of lithium in kg/m^3
n0=10^8;//no of neutrons produced per s
//calculation
```

```
n1=d*NA/M;//no of target nuclei per unit volume
n2=n1*t;//no of target nuclei per area
A=n0/(n*n2);
disp(A,'crosssection(in m^2) for this reaction is');
```

Scilab code Exa 15.11 calculation of final energy

```
clc;clear;
//Example 15.11
//calculation of final energy

//given values
B=.4;//max magnetic field in Wb/m^2
c=3*10^8;
e=1.6*10^-19;
d=1.52;//diametre in m
r=d/2;

//calculation
E=B*e*r*c;//E=pc,p=mv=Ber
disp(E,'final energy of e(in J) is');
E1=(E/e)/10^6;
disp(E1,'final energy of e (in MeV) is');
```

Scilab code Exa 15.12 calculation of amount of fuel

```
clc;clear;
//Example 15.12
//calculation of amount of fuel

//given values
P=100*10^6;//power required by city
M=235;//atomic mass of Uranium in g
```

```
e=20/100;//conversion efficiency
NA=6.02*10^26;//avogadros number
E=200*10^6*1.6*10^-19;//energy released per fission
t=8.64*10^4;//day in seconds


//calculation
E1=P*t;//energy requirement
m=E1*M/(NA*e*E);//no of nuclei N=NA*m/M, energy
    released by m kg is N*E, energy requirement=e*N*E
disp(m,'amount of fuel(in kg) required is');
```

Scilab code Exa 15.13 calculation of power output

```
clc;clear;
//Example 15.13
//calculation of power output

//given values
M=235;//atomic mass of Uranium in kg
e=5/100;//reactor efficiency
m=25/1000;//amount of uranium consumed per day in kg
E=200*10^6*1.6*10^-19;//energy released per fission
t=8.64*10^4;//day in seconds
NA=6.02*10^26;//avogadros number

//calculation
n=NA*m/M;//no of nuclei in 25g
E1=n*E;//energy produced by n nuclei
E2=E1*e;//energy converted to power
P=E2/t;//power output in Watt
disp(P/10^6,'power output in MW is');
```

Scilab code Exa 15.14 calculation of power developed

```
clc;clear;
//Example 15.14
//calculation of power developed

//given values
M=235;//atomic mass of Uranium in kg
m=20.4;//amount of uranium consumed per day in kg
E=200*10^6*1.6*10^-19;//energy released per fission
t=3600*1000;//time of operation
NA=6.02*10^26;//avogadros number

//calculation
n=NA*m/M;//no of nuclei in 20.4kg
E1=n*E;//energy produced by n nuclei
P=E1/t;//in Watt
disp(P/10^6,'power developed in MW is');
```

Scilab code Exa 15.15 calculation of amount of dueterium consumed

```
clc;clear;
//Example 15.15
//calculation of amount of dueterium consumed

//given values
M1=2.01478;//atomic mass of Hydrogen in amu
M2=4.00388;//atomic mass of Helium in amu
amu=931;//amu in MeV
e=30/100;//efficiency
P=50*10^6;//output power
NA=6.026*10^26;//avogadro number
t=8.64*10^4;//seconds in a day

//calculation
```

```
Q=(2*M1-M2)*amu;//energy released in a D-D reaction
   in MeV
O=Q*e*10^6/2;//actual output per dueterium atom in
   eV
n=P/(O*1.6*10^-19);//no of D atoms required
m=n*M1/NA;//equivalent mass of D required per s
X=m*t;

disp(X,'Deuterium requirement per day in kg is');
```

Chapter 16

Structure of Solids

Scilab code Exa 16.1 calculation of density

```
clc;clear;
//Example 16.1
//calculation of density

//given values
a=3.36*10^-10;//lattice constant in m
M=209;//atomicmass of polonium in kg
N=6.02*10^26;//avogadro's number
z=1;//no of atom
//calculation
d=z*M/(N*a^3)

disp(d,'density (in kg/m^3) is');
```

Scilab code Exa 16.2 calculation of no of atoms

```
clc;clear;
//Example 16.2
```

```
//calculation of no of atoms

//given values
a=4.3*10^-10;//edge of unit cell in m
d=963;//density in kg/m^3
M=23;//atomicmass of sodium in kg
N=6.02*10^26;//avogadro's number

//calculation
z=d*N*a^3/M;

disp(z,'no of atoms is');
```

Scilab code Exa 16.3 calculation of distance

```
clc;clear;
//Example 16.3
//calculation of distance

//given values
z=4;//no of atoms in fcc
d=2180;//density in kg/m^3
M=23+35.3;//atomicmass of sodium chloride in kg
N=6.02*10^26;//avogadro's number

//calculation
a1=z*M/(N*d);
a=a1^(1/3);
l=a/2;//in m

disp(l*10^10,'distance between adjacent chlorine and
    sodium atoms in armstrong is');
```

Scilab code Exa 16.4 calculation of interatomic spacing

```
clc;clear;
//Example 16.4
//calculation of interatomic spacing

//given values
alpha=30*%pi/180;//Bragg angle in degree
h=1;
k=1;
l=1;
m=1;//order of reflection
x=1.75*10^-10;//wavelength in m

//calculation
d=m*x/(2*sin(alpha));
a=d*sqrt(h^2+k^2+l^2);//in m

disp(a*10^10,'interatomic spacing in armstrong is');
```

Chapter 17

The Band Theory of Solids

Scilab code Exa 17.1 calculation of velocity of fraction of free electrone

```
clc;clear;
//Example 17.1
//calculation of probability

//given values
E=.01;//energy difference in eV
kT=.026;//temperture equivalent at room temp in e

//calculation
P=1/(1+(%e^(E/kT)));

disp(P,'interatomic spacing  is');
```

Scilab code Exa 17.2 calculation of velocity of e

```
clc;clear;
//Example 17.2
//calculation of velocity of e
```

```
//given values
e=1.6*10^-19;//charge of e in C
E=2.1*e;//fermi level in J
m=9.1*10^-31;//mass of e in kg

//calculation
v=sqrt(2*E/m);

disp(v,'velocity of e(in m/s)');
```

Scilab code Exa 17.3 calculation of velocity of fraction of free electrones

```
clc;clear;
//Example 17.3
//calculation of velocity of fraction of free
    electrons

//given values
E=5.5;//fermi level in eV
kT=.026;//temperture equivalent at room temp in e

//calculation
f=2*kT/E;

disp(f,'fraction of free electrone\s upto width kT
    on either side of Ef is');
```

Chapter 18

Semiconductors

Scilab code Exa 18.2 calculation of probability

```
clc;clear;
//Example 18.2
//calculation of probability

//given values
T=300;//temp in K
kT=.026;//temperture equivalent at room temp in eV
Eg=5.6;//forbidden gap in eV

//calculation
f=1/(1+%e^(Eg/(2*kT)));

disp(f,'probability of an e being thermally promoted
    to conduction band is');
```

Scilab code Exa 18.3 calculation of fraction of e in CB

```
clc;clear;
```

```
//Example 18.3
//calculation of fraction of e in CB

//given values
T=300;//temp in K
kT=.026;//temperture equivalent at room temp in eV
Eg1=.72;//forbidden gap of germanium in eV
Eg2=1.1;//forbidden gap of silicon in eV
Eg3=5.6;//forbidden gap of diamond in eV

//calculation
f1=%e^(-Eg1/(2*kT));
disp(f1,'fraction of e in  conduction band of
    germanium is');
f2=%e^(-Eg2/(2*kT));
disp(f2,'fraction of e in  conduction band of
    silicon is');
f3=%e^(-Eg3/(2*kT));
disp(f3,'fraction of e in  conduction band of
    diamond  is');
```

Scilab code Exa 18.4 calculation of fractionional change in no of e

```
clc;clear;
//Example 18.3
//calculation of fractionional change in no of e

//given values
T1=300;//temp in K
T2=310;//temp in K
Eg=1.1;//forbidden gap of silicon in eV
k=8.6*10^-5;//boltzmann's constant in eV/K

//calculation
n1=(10^21.7)*(T1^(3/2))*10^(-2500*Eg/T1);//no of
```

```
conduction e at T1
n2=(10^21.7)*(T2^(3/2))*10^(-2500*Eg/T2);//no of conduction e at T2
x=n2/n1;
disp(x,'fractional change in no of e is');
```

Scilab code Exa 18.5 calculation of resistivity

```
clc;clear;
//Example 18.5
//calculation of resistivity

//given values
e=1.6*10^-19;
ni=2.5*10^19;//intrinsic density of carriers per m^3
ue=.39;//mobility of e
uh=.19;//mobility of hole


//calculation
c=e*ni*(ue+uh);//conductivity
r=1/c;//resistivity
disp(r,'resistivity in ohm m is');
```

Scilab code Exa 18.6 calculation of conductivity of intrinsic and doped semiconductors

```
clc;clear;
//Example 18.6
//calculation of conductivity of intrinsic and doped semiconductors

//given values
```

```
h=4.52*10^24;//no of holes per m^3
e=1.25*10^14;//no of electrons per m^3
ue=.38;//e mobility
uh=.18;//hole mobility
q=1.6*10^-19;//charge of e in C
//calculation
ni=sqrt(h*e);//intrinsic concentration
ci=q*ni*(ue+uh);
disp(ci,'conductivity of semiconductor(in S/m) is');
cp=q*h*uh;
disp(cp,'conductivity of doped semiconductor (in S/m
    ) is');
```

Scilab code Exa 18.7 calculation of hole concentration

```
clc;clear;
//Example 18.7
//calculation of hole concentration

//given values
ni=2.4*10^19;//carrier concentration per m^3
N=4*10^28;//concentration of ge atoms per m^3

//calculation
ND=N/10^6;//donor cocntrtn
n=ND;//no of electrones

p=ni^2/n;
disp(p,'concentartion of holes per m^3 is');
```

Scilab code Exa 18.8 calculation of Hall voltage

```
clc;clear;
```

```
//Example 18.8
//calculation of Hall voltage

//given values
ND=10^21;//donor density per m^3
B=.5;//magnetic field in T
J=500;//current density in A/m^2
w=3*10^-3;//width in m
e=1.6*10^-19;//charge in C

//calculation


V=B*J*w/(ND*e);//in volts
disp(V*10^3,'Hall voltage in mv is');
```

Chapter 19

PN Junction Diode

Scilab code Exa 19.1 calculation of potential barrier

```
clc;clear;
//Example 19.1
//calculation of potential barrier

//given values
e=1.6*10^-19;
n=4.4*10^28;//no of atoms per m^3
kT=.026*e;//temp eqvlnt at room temp
ni=2.4*10^19;//no of intrinsic carriers per m^3
NA=n/10^6;//no of acceptors
ND=n/10^6;//no of donors

//calculation
V=(kT/e)*log(NA*ND/ni^2);
disp(V,'potential barrier in volts is');
```

Scilab code Exa 19.2 calculation of current

```
clc;clear;
//Example 19.2
//calculation of current

//given values
e=1.6*10^-19;
kT=.026*e;//temp eqvlnt at room temp
Io=2*10^-7;//current flowing at room temp in A
V=.1;//forward bias voltage in volts

//calculation
I=Io*(%e^(e*V/kT)-1);//in Ampere
disp(I*10^6,'current flowing when forward bias
   applied(in microampere)is');
```

Chapter 21

Magnetic Materials

Scilab code Exa 21.1 calculation of magnetizing force and relative permeability

```
clc;clear;
//Example 21.1
//calculation of magnetizing force and relative
   permeability

//given values
M=2300;//magnetization in A/m
B=.00314;//flux density in Wb/m^2
u=12.57*10^-7;//permeability in H/m

//calculation
H=(B/u)-M;
disp(H,'magnetizing force(in A/m)is ');
Ur=B/(u*H);
disp(Ur,'relative permeability is')
```

Scilab code Exa 21.2 calculation of magnetization and magnetic flux density

```
clc;clear;
//Example 21.2
//calculation of magnetization and magnetic flux
   density

//given values
H=10^5;//external field  in A/m
X=5*10^-5;//susceptibility
u=12.57*10^-7;//permeability in H/m

//calculation
M=X*H;
disp(M,'magnetization (in A/m) is  ');
B=u*(M+H);
disp(B,'magnetic flux density (in wb/m^2) is')
```

Scilab code Exa 21.3 calculation of relative permeability

```
clc;clear;
//Example 21.3
//calculation of relative permeability

//given values

X=3.7*10^-3;//susceptibility at 300k
T=300;//temp in K
T1=200;//temp in K
T2=500;//temp in K

//calculation
C=X*T;//curie constant
XT1=C/T1;
disp(XT1,'relative permeability at T1 is  ');
XT2=C/T2;
disp(XT2,'relative permeability at T2 is')
```

Chapter 22

Superconductivity

Scilab code Exa 22.1 calculation of magnetic field

```
clc;clear;
//Example 22.1
//calculation of magnetic field

//given values

Tc=7.2;//transition temp in K
T=5;//temp in K
Hc=3.3*10^4;//magnetic field at T in A/m


//calculation
Hc0=Hc/(1-(T^2/Tc^2));
disp(Hc0,'max value of H at 0K (in A/m) is ');
```

Scilab code Exa 22.2 calculation of transition temperature

```
clc;clear;
```

```
//Example 22.2
//calculation of transition temperature

//given values

T=8;//temp in K
Hc=1*10^5;//critical magnetic field at T in A/m
Hc0=2*10^5;//magnetic field at 0 K in A/m

//calculation
Tc=T/(sqrt(1-Hc/Hc0));
disp(Tc,'transition temp in K is');
```

Scilab code Exa 22.3 calculation of temp at which there is max critical field

```
clc;clear;
//Example 22.3
//calculation of temp at which there is max
   critical field

//given values

Tc=7.26;//critical temp in K
Hc=8*10^5;//max critical magnetic field at T in A/m
H=4*10^4;// subjected magnetic field at in A/m

//calculation
T=Tc*(sqrt(1-H/Hc));
disp(T,'max temp for superconductivity in K is');
```

Chapter 23

Dielectrics

Scilab code Exa 23.1 calculation of relative permittivity

```
clc;clear;
//Example 23.1
//calculation of relative permittivity

//given values

E=1000;//electric field in V/m
P=4.3*10^-8;//polarization in C/m^2
e=8.85*10^-12;//permittivity in F/m


//calculation
er=1+(P/(e*E));
disp(er,'relative permittivity of NaCl is ');
```

Scilab code Exa 23.2 calculation of electronic polarizability

```
clc;clear;
```

```
//Example 23.2
//calculation of electronic polarizability

//given values

e=8.85*10^-12;//permittivity in F/m
er=1.0024;//relative permittivity at NTP
N=2.7*10^25;//atoms per m^3


//calculation
alpha=e*(er-1)/N;
disp(alpha,'electronic polarizability (in F/m^2)is '
   );
```

Scilab code Exa 23.3 calculation of electronic polarizability and relative permittivity

```
clc;clear;
//Example 23.3
//calculation of electronic polarizability and
   relative permittivity

//given values

e=8.85*10^-12;//permittivity in F/m
N=9.8*10^26;//atoms per m^3
r=.53*10^-10;//radius in m


//calculation
alpha=4*%pi*e*r^3;
disp(alpha,'electronic polarizability (in F/m^2)is '
   );
er=1+(4*%pi*N*r^3);
```

```
disp(er,'relative permittivity is')
```

Scilab code Exa 23.4 calculation of electronic polarizability and relative permittivity

```
clc;clear;
//Example 23.4
//calculation of electronic polarizability and
   relative permittivity

//given values
w=32;//atomic weight of sulphur
d=2.08*10^3;//density in kg/m^3
NA=6.02*10^26;//avogadros number
alpha=3.28*10^-40;//electronic polarizability in F.m
   ^2
e=8.854*10^-12;//permittiviy
//calculation

n=NA*d/w;
k=n*alpha/(3*e);
er=(1+2*k)/(1-k);
disp(er,'relative permittivity is')
```

Scilab code Exa 23.5 calculation of ionic polarizability

```
clc;clear;
//Example 23.5
//calculation of ionic polarizability

//given values
n=1.5;//refractive index
er=6.75;//relative permittivity
```

```

//calculation
Pi=(er-n^2)*100/(er-1);
disp(Pi,'percentage ionic polarizability (in %)) is'
   )
```

Scilab code Exa 23.6 calculation of frequency and phase difference

```
clc;clear;
//Example 23.6
//calculation of frequency and phase difference

//given values
t=18*10^-6;//relaxation  time in s

//calculation
f=1/(2*%pi*t);
disp(f,'frequency at which real and imaginary part
   of complx dielectric constant are equal is');
alpha=atan(1)*180/%pi;// phase difference between
   current and voltage( 1 because real and imaginry
   parts are equal of the dielectric constant)
disp(alpha,'phase diffeerence (in degree) is');
```

Scilab code Exa 23.7 calculation of frequency

```
clc;clear;
//Example 23.7
//calculation of frequency

//given values
t=5.5*10^-3;//thickness of plate in m
Y=8*10^10;//Young's modulus in N/m^2
```

```
d=2.65*10^3;//density in kg/m^3



//calculation
f=sqrt(Y/d)/(2*t);//in Hz
disp(f/10^3,'frequency of fundamental note(in KHz)
   is');
```

Chapter 24

Fibre optics

Scilab code Exa 24.1 Fiber optics numerical aperture calculation

```
clc;clear;
//Example 24.1
//Fiber optics

//given values
n=1.5;//refractive index
x=.0005;//fractional index difference

//calculation
u=n*(1-x);
disp(u,'cladding index is');
alpha=asin(u/n)*180/%pi;
disp(alpha,'critical internal reflection angle(in
    degree) is');
theta=asin(sqrt(n^2-u^2))*180/%pi;
disp(theta,'critical acceptance angle(in degree) is'
    );
N=n*sqrt(2*x);
disp(N,'numerical aperture is');
```

Scilab code Exa 24.2 calculation of acceptance angle

```
clc;clear;
//Example 24.2
//calculation of acceptance angle

//given values
n=1.59;//cladding refractive index
u=1.33;//refractive index of water
N=.20;//numerical aperture offibre
//calculation
x=sqrt(N^2+n^2);//index of fibre
N1=sqrt(x^2-n^2)/u;//numerical aperture when fibre is in water
alpha=asin(N1)*180/%pi;
disp(alpha,'acceptance angle in degree is');
```

Scilab code Exa 24.3 calculation of normailsed frequency

```
clc;clear;
//Example 24.3
//calculation of normalised frequency

//given values
n=1.45;//core refractive index
d=.6;//core diametre in m
N=.16;//numerical aperture of fibre
l=.9*10^-6;//wavelength of light

//calculation
u=sqrt(n^2+N^2);//index of glass fibre
V=%pi*d*sqrt(u^2-n^2)/l;
```

```
disp(V,'normalised frequency is');
```

Scilab code Exa 24.4 calculation of normailsed frequency and no of modes

```
clc;clear;
//Example 24.4
//calculation of normailsed frequency and no of
   modes

//given values
n=1.52;//core refractive index
d=29*10^-6;//core diametre in m
l=1.3*10^-6;//wavelength of light
x=.0007;//fractional refractive index

//calculation
u=n*(1-x);//index of glass fibre
V=%pi*d*sqrt(n^2-u^2)/l;
disp(V,'normalised frequency is');
N=V^2/2;
disp(N,'no of modes is');
```

Scilab code Exa 24.5 calculation of numerical aperture and maximum acceptance angle

```
clc;clear;
//Example 24.5
//calculation of numerical aperture and maximum
   acceptance angle

//given values
n=1.480;//core refractive index
u=1.47;//index of glass
```

```
l=850*10^-9;//wavelength of light
V=2.405;//V-number

//calculation
r=V*l/sqrt(n^2-u^2)/%pi/2;//in m
disp(r*10^6,'core radius in micrometre is');
N=sqrt(n^2-u^2);
disp(N,'numerical aperture is');
alpha=asin(N)*180/%pi;
disp(alpha,'max acceptance angle is');
```

Scilab code Exa 24.6 calculation of power level

```
clc;clear;
//Example 24.6
//calculation of power level

//given values
a=3.5;//attenuation in dB/km
Pi=.5*10^-3;//initial power level in W
l=4;//length of cable in km

//calculation
Po=Pi*10^6/(10^(a*l/10));
disp(Po,'power level after km(in microwatt) is');
```

Scilab code Exa 24.7 calculation of power loss

```
clc;clear;
//Example 24.7
//calculation of power loss

//given values
```

```
Pi=1*10^-3;//initial power level in W
l=.5;//length of cable in km
Po=.85*Pi

//calculation
a=(10/l)*log10(Pi/Po);
disp(a,'loss in dB/km is');
```

Chapter 25

Digital electronics

Scilab code Exa 25.1 sum of two binary numbers

```
clc;clear;
//Example 25.1
//calculation of sum of two binary numbers

//given values
X='0011';//first binary number
Y='0101';//second binary number

//calculation
x=bin2dec(X);//decimal equivalent
y=bin2dec(Y);//decimal equivalent
z=x+y;
Z=dec2bin(z);
disp(Z,'Sum of the given binary numbers is ')
```

check Appendix AP 1 for dependency:

`bin21dec.sci`

check Appendix AP 2 for dependency:

`dec21bin.sci`

Scilab code Exa 25.2 sum of two binary numbers

```
clc;
clear;
//example 25.2
//addition of binary numbers

a=1010.00;          //first number
b=0011.11;          //second number
A=bin21dec(a);    //converting a in to decimal number
B=bin21dec(b);    //converting b in to decimal number
S=A+B;            //adding the two decimal numbers
temp=dec21bin(S); //converting the decimal sum back
   to binary
format('v',10);    //changing the default precision
   to 8
disp(temp,'sum is'); //displaying the final output
```

check Appendix AP 1 for dependency:

`bin21dec.sci`

check Appendix AP 2 for dependency:

`dec21bin.sci`

Scilab code Exa 25.3 sum of two binary numbers

```
clc;
clear;
//example 25.3
//addition of two binary numbers

```

```
a=1011.01;          //first number
b=1101.11;          //second number
A=bin21dec(a);    //converting a in to decimal number
B=bin21dec(b);    //converting b in to decimal number
S=A+B;            //adding the two decimal numbers
temp=dec21bin(S); //converting the decimal sum back to binary
format('v',10);    //changing the default precision to 8
disp(temp,'sum is');         //displaying the final output
```

Scilab code Exa 25.4 difference of two binary numbers

```
clc;clear;
//Example 25.4
//calculation of difference of two binary numbers

//given values
X='1011';//first binary number
Y='0101';//second binary number

//calculation
x=bin2dec(X);//decimal equivalent
y=bin2dec(Y);//decimal equivalent
z=x-y;
Z=dec2bin(z);
disp(Z,'difference of the given binary numbers ');
```

Scilab code Exa 25.5 difference of two binary numbers

```
clc;clear;
//Example 25.5
```

```
//calculation of difference of two binary numbers

//given values
X='1000';//first binary number
Y='0011';//second binary number

//calculation
x=bin2dec(X);//decimal equivalent
y=bin2dec(Y);//decimal equivalent
z=x-y;
Z=dec2bin(z);
disp(Z,'difference of the given binary numbers ')
```

check Appendix AP 1 for dependency:

`bin21dec.sci`

check Appendix AP 2 for dependency:

`dec21bin.sci`

Scilab code Exa 25.6 difference of two binary numbers

```
clc;
clear;
//example 25.6
//binary substraction

format('v',8);//changing the default precision to 8
a=1001.01;//first number
b=0011.10;//second number
A=bin21dec(a);//converting a in to decimal number
B=bin21dec(b);//converting b in to decimal number
S=A-B;          //multiply the two decimal numbers
temp=dec21bin(S);//converting the decimal product
    back to binary

```

```
disp(temp,'difference is');//displaying the final
    output
```

Scilab code Exa 25.7 product of two binary numbers

```
clc;clear;
//Example 25.7
//calculation of product of two binary numbers

//given values
X='10101';//first binary number with last two digits
     in fractional part
Y='101';//second binary number with last two digits
    in fractional part

//calculation
x=bin2dec(X);//decimal equivalent
y=bin2dec(Y);//decimal equivalent
z=x*y;
Z=dec2bin(z);
disp(Z,'product of the given binary numbers is ')
```

check Appendix AP 1 for dependency:

`bin21dec.sci`

check Appendix AP 2 for dependency:

`dec21bin.sci`

Scilab code Exa 25.8 binary multiplication

```
clc;
clear;
```

```
//example 25.8
//binary multiplication

format('v',8);//changing the default precision to 8
a=10101.01;//first number
b=110.10;//second number
A=bin21dec(a);//converting a in to decimal number
B=bin21dec(b);//converting b in to decimal number
S=A*B;        //multiply the two decimal numbers
temp=dec21bin(S);//converting the decimal product
    back to binary

disp(temp,'product is');//displaying the final
    output
```

Scilab code Exa 25.9 binary division

```
clc;clear;
//Example 25.9
//calculation of quotient of two binary numbers

//given values
X='1101001';//divident
Y='101';//divisor

//calculation
x=bin2dec(X);//decimal equivalent
y=bin2dec(Y);//decimal equivalent
z=x/y;
Z=dec2bin(z);
disp(Z,'quotient of the given binary numbers with
    last two digits in fractional part is ')
```

check Appendix AP 1 for dependency:

`bin21dec.sci`

check Appendix AP 2 for dependency:

`dec21bin.sci`

Scilab code Exa 25.10 binary division

```
clc;
clear;
//example 25.10
//binary division

format('v',8);//changing the default precision to 8
a=11001;//first number
b=100;//second number
A=bin21dec(a);//converting a in to decimal number
B=bin21dec(b);//converting b in to decimal number
S=A/B;         //multiply the two decimal numbers
temp=dec21bin(S);//converting the decimal product
   back to binary

disp(temp,'quotient is');//displaying the final
   output
```

Scilab code Exa 25.11 octal addition

```
clc;clear;
//Example 25.11
//calculation of sum of two octal numbers

//given values
X='256';//divident
Y='437';//divisor

```

```
//calculation
x=oct2dec(X);//decimal equivalent
y=oct2dec(Y);//decimal equivalent
z=x+y;
Z=dec2oct(z);//binary equivalent
disp(Z,'sum of the given octal numbers is')
```

Scilab code Exa 25.12 octal multiplication

```
clc;clear;
//Example 25.12
//calculation of product of two octal numbers

//given values
X='15';//divident
Y='24';//divisor

//calculation
x=oct2dec(X);//decimal equivalent
y=oct2dec(Y);//decimal equivalent
z=x*y;
Z=dec2oct(z);//binary equivalent
disp(Z,'product of the given octal numbers is')
```

Scilab code Exa 25.13 hexadecimal addition

```
clc;clear;
//Example 25.13
//calculation of sum of hexadecimal numbers

//given values
X1='C';
X2='A';
```

```
X3='E';
Y1='3';
Y2='2';
Y3='D';

//calculation
x1=hex2dec(X1);//decimal equivalent
x2=hex2dec(X2);//decimal equivalent
x3=hex2dec(X3);//decimal equivalent
y1=hex2dec(Y1);//decimal equivalent
y2=hex2dec(Y2);//decimal equivalent
y3=hex2dec(Y3);//decimal equivalent
z1=x1+y1;
z2=x2+y2;
z3=x3+y3;
Z1=dec2hex(z1);//binary equivalent of sum
Z2=dec2hex(z2);//binary equivalent of sum
Z3=dec2hex(z3);//binary equivalent of sum
disp(Z1,'sum of the first set of hexadecimal numbers
    is');
disp(Z2,'sum of the second set of hexadecimal
   numbers is');
disp(Z3,'sum of the thirdm set of hexadecimal
   numbers is');
```

Scilab code Exa 25.14 binary to decimal conversion

```
clc;clear;
//Example 25.13
//conversion of binary to decimal

//given values
X=10.101;//binary number

//calculation
```

```
Z=(1*2^1)+(0*2^0)+(1*2^-1)+(0*2^-2)+(1*2^-3);
disp(Z,'decimal equivalent of the given binary
   number is')
```

Scilab code Exa 25.15 decimal to binary conversion

```
clc;clear;
//Example 25.15
//conversion of decimal to binary

//given values
X=43;//decimal number

//calculation
Z=dec2bin(X);
disp(Z,'binary equivalent of the given decimal
   number is');
```

Scilab code Exa 25.16 decimal to binary conversion

```
clc;//clears the command window
clear;//clears all the variables
//example 25.16
//decimal to binary conversion

format('v',18);//changing the default prcision to 20
    significant digits

i=1;x=1;//flag bits

dec=43.3125;//given decimal number which should be
   expressed in binary
```

```
temp2=floor(dec);//separating integer part from the given number
temp4=modulo(dec,1);//separating decimal part from the given number

while(temp2>0)//storing each integer digit in vector for convenience
    p(i)=(modulo(floor(temp2),2))
    temp2=floor(temp2/2);
    i=i+1;
end

temp2=0;//clearing temporary variable 'temp2'

for j=1:length(p)
//multipliying bits of integer part with their position values and adding
    temp2=temp2+(p(j)*10^(j-1));
end

while(temp4~=0) //storing each decimal digit in vector for convenience
    temp4=temp4*2;
    d(x)=floor(temp4);
    x=x+1;
    temp4=modulo(temp4,1);
end

temp5=0;//clearing temporary variable 'temp5'

for j=1:length(d)
//multipliying bits of decimal part with their position values and adding
    temp5=temp5+(10^(-1*j)*d(j))
end

temp3=temp2+temp5;
//finally adding both the integer and decimal parts
```

```
to get total output.
disp(temp3,'the equivalent binary number is');
```

Scilab code Exa 25.17 decimal to octal conversion

```
clc;//clears the command window
clear;//clears all the variables
//example 25.17
//decimal to octa conversion

format('v',8);//making the default precision to 8 significant digits
i=1;w=1;
dec=375.23;//given decimal number which should be expressed in base 8
temp=modulo(dec,1);//separating decimal part from the given number
temp2=floor(dec);//separating integer part from the given number


while(temp2>0)//storing each integer digit in vector for convenience
    p(i)=(modulo(floor(temp2),8))
    temp2=floor(temp2/8);
    i=i+1;
end

temp2=0;//clearing temporary variable 'temp2'

for j=1:length(p)
//multipliying bits of integer part with their position values and adding
    temp2=temp2+(p(j)*10^(j-1));
end
```

```

while(temp~=0) //storing each decimal digit in
   vector for convenience
    temp=temp*8;
    q(w)=floor(temp);
    w=w+1;
    temp=modulo(temp,1);
end

temp1=0; //flag bit
for k=1:length(q)
//multipliying bits of decimal part with their
   position values and adding
    temp1=temp1+(10^(-1*k)*q(k));
end
temp3=temp2+temp1;
disp(temp3,'octal number is');
```

Scilab code Exa 25.18 octal to binary conversion

```
clc;clear;
//Example 25.18
//ocatl to binary conversion

//given values
X='257';//octal number

//calculation
x=oct2dec(X);//decimal equivalent
Z=dec2bin(x);
disp(Z,'binary number is ')
```

Scilab code Exa 25.19 octal to binary conversion

```
clc;//clears the command window
clear;//clears all the variables
//example 25.19
//octal to binary conversion

format('v',8);//setting the default precision to 8

i=1;w=1;

bin=34.56; //Given octal number which we need to be convert into binary
temp1=floor(bin);//separating integer part from the given number
temp0=modulo(bin,1);//separating decimal part from the given number
temp2=temp0*10^2;//converting decimal value to interger for convenience
while(temp1>0)  //storing each integer digit in vector for convenience
    p(i)=modulo(temp1,10);
    temp1=round(temp1/10);
    i=i+1;
end

while(temp2>0)  //storing each decimal digit in vector for convenience
    q(w)=modulo(temp2,10);
    temp2=floor(temp2/10);
    w=w+1;

end
temp1=0;  //clearing temporary variable 'temp1

for i=1:2
//multipliying bits of decimal part with their position values and adding
    temp1=temp1+(p(i)*8^(i-1));
end
```

```
temp2=0;//clearing temporary variable 'temp2'
for z=1:2
//multipliying bits of decimal part with their
   position values and adding
    temp2=temp2+(q(z)*8^(-1*(3-z)));

end

temp=temp1+temp2;
//adding both integer and decimal parts to get total
    deciaml value.
dec=temp;

temp2=floor(dec); //separating integer part from the
    given number
temp3=modulo(dec,1);//separating decimal part from
   the given number
format('v',18);//setting the default precision to 8

i=1;x=1;//flag bits

while(temp2>0)//storing each integer digit in vector
    for convenience
    p(i)=(modulo(floor(temp2),2))
    temp2=floor(temp2/2);
    i=i+1;
end

temp2=0; //clears temporary variable 'temp2'

for j=1:length(p)
//multipliying bits of integer part with their
   position values and adding
    temp2=temp2+(p(j)*10^(j-1));
end

temp4=modulo(temp3,1);
```

```

while(temp4~=0)//storing each decimal digit in vector for convenience
    temp4=temp4*2;
    d(x)=floor(temp4);
    x=x+1;
    temp4=modulo(temp4,1);
end

temp5=0; //clears temporary variable 'temp2'

for j=1:length(d)
//multipliying bits of decimal part with their position values and adding
    temp5=temp5+(10^(-1*j)*d(j))
end

temp=temp2+temp5;
//finally adding both the integer and decimal parts to get total output.
disp(temp,'binary number is');
```

Scilab code Exa 25.20 binary to octal conversion

```
clc;//clears the command window
clear;//clears all the variables
i=1;w=1;
bin=1011.01101;//Given binary number which we need to be convert into octal

//conversion to decimal first
temp1=floor(bin);//separating integer part from the given number
temp2=modulo(bin,1);//separating decimal part from the given number
```

```
temp2=temp2*10^5;//converting decimal value to
    integer for convenience
while(temp1>0)//storing each integer digit in vector
     for convenience
    p(i)=modulo(temp1,10);
    temp1=floor(temp1/10);
    i=i+1;
end
while(temp2>0)//storing each decimal digit in vector
     for convenience
    q(w)=modulo(temp2,2);
    temp2=(temp2/10);
    temp2=floor(temp2);
    w=w+1;
end
temp1=0;//flag bit
for i=1:length(p)//checking whether it is a binary
    number or not
    if(p(i)>1) then
        disp('not a binary number');
        abort;
    end
end
for i=1:length(p)
//multipliying bits of integer part with their
    position values and adding
    temp1=temp1+(p(i)*2^(i-1));
end
temp2=0;//flag bit
for z=1:length(q)
//multipliying bits of decimal part with their
    position values and adding
    temp2=temp2+(q(z)*2^(-1*(6-z)));
end
dec=temp1+temp2;
//finally adding both the integer and decimal parts
    to get decimal equivalent

```

```
//conversion from decimal to octal

format('v',8);//making the default precision to 8 significant digits
i=1;w=1;

temp=modulo(dec,1);//separating decimal part from the given number
temp2=floor(dec);//separating integer part from the given number


while(temp2>0)//storing each integer digit in vector for convenience
    r(i)=(modulo(floor(temp2),8))
    temp2=floor(temp2/8);
    i=i+1;
end

temp2=0;//clearing temporary variable 'temp2'

for j=1:length(r)
//multipliying bits of integer part with their position values and adding
    temp2=temp2+(r(j)*10^(j-1));
end

while(temp~=0) //storing each decimal digit in vector for convenience
    temp=temp*8;
    s(w)=floor(temp);
    w=w+1;
    temp=modulo(temp,1);
end

temp1=0; //flag bit
for k=1:length(s)
//multipliying bits of decimal part with their
```

```
   position values and adding
   temp1=temp1+(10^(-1*k)*s(k));
end
temp3=temp2+temp1;
disp(temp3,'octal number is');
```

Scilab code Exa 25.21 hexa to decimal conversion

```
clc;clear;
//Example 25.21
//hexadecimal to decimal conversion

//given values
X='AC5';//hexadecimal number

//calculation
x=hex2dec(X);//decimal equivalent
disp(x,'decimal number is ')
```

Scilab code Exa 25.22 decimal to hexadecimal conversion

```
clc;//clears the command window
clear;//clears all the variables
//example 25.22
//decimal to hexadecimal conversion
format('v',4);//making the default precision to 8
   significant digits
dec=379.54;//given decimal
w=1;i=1;

temp1=floor(dec);//separating integer part from the
   given number
```

```
temp2=modulo(dec,1);//separating decimal part from
   the given number
x=dec2hex(temp1);//hexadecimal equivalent of integer
    part
s=0;

while(temp2~=0) //storing each decimal digit in
   vector for convenience
    temp2=temp2*16;
    q(w)=floor(temp2);
    s=s+1;//counter of a
    a(w)=dec2hex(q(w));
    w=w+1;
    temp2=modulo(temp2,1);
end
f=a(1);
for i=2:s
    f=f+a(i);
end
b='.';//for concatenating to get the decimal part of
    hexadecimal
hex=x+b+f;//concatenating integer and decimal part
disp(hex,'hexadecimal equivalent is');
```

Scilab code Exa 25.23 hexa to binary conversion

```
clc;clear;
//Example 25.23
//hexadecimal to binary conversion

//given values
X='7AB';//hexadecimal number

//calculation
x=hex2dec(X);//decimal equivalent
```

```
z=dec2bin(x);
disp(z,'binary number is ');
```

Scilab code Exa 25.24 binary to hexa conversion

```
clc;clear;
//Example 25.24
//binary to hexadecimal conversion

//given values
X='1011101';//binary number

//calculation
x=bin2dec(X);//decimal equivalent
z=dec2hex(x);
disp(z,'hexadecimal number is ');
```

Scilab code Exa 25.25 Substraction by ones complement method

```

clc;
clear;
//Example 25.25
//substraction by one's complement method
//aaa=input(" Enter the first no (in decimal) :");
//bb=input(" Enter the number from which first no
    has to be substracted:");
bb=14;
aaa=-7;// substraction is addition of negative
    number
if aaa<0 then
    aa=-1*aaa;
else aa=aaa;
```

```
end
a=0;
b=0;
q=0;
for i=1:5              //converting from decimal to binary
     x=modulo(aa,2);
     a= a + (10^q)*x;
     aa=aa/2;
     aa=floor(aa);
     q=q+1;
end
q=0;
for i=1:5   //converting from decimal to binary
     y=modulo(bb,2);
     b= b + (10^q)*y;
     bb=bb/2;
     bb=floor(bb);
     q=q+1;
end
for i=1:5
     a1(i)=modulo(a,10);
     a=a/10;
     a=round(a);

end
for i=1:5
    b1(i)=modulo(b,10);
     b=b/10;
     b=round(b);
end;
if aaa<0 then// making one's complement if number is less than zero
     for i=1:5
         a1(i)=bitcmp(a1(i),1);
     end

     car(1)=0;
```

```

for i=1:5
    c1(i)=a1(i)+b1(i)+car(i);
    if c1(i)== 2 then
        car(i+1)= 1;
        c1(i)=0;
    elseif c1(i)==3 then
         car(i+1)= 1;
        c1(i)=1;
    else
        car(i+1)=0;
    end;
end;
car2(1)=car(6);
re=0;
format('v',18);
    for i=1:5
        re=re+(c1(i)*(10^(i-1))) //result of one's
           complement addition
    end;



for i=1:5
   s(i)=modulo(re,10);
    re=re/10;
    re=round(re);
end;

for i=1:5
 re1(i)=s(i)+car2(i);//addition of carry after one's
     complement addition
    if re1(i)== 2 then
        car2(i+1)= 1;
        re1(i)=0;
    elseif re1(i)==3 then
         car2(i+1)= 1;
        re1(i)=1;
```

```
    else
        car2(i+1)=0;
    end;
end;

 re2=0;
format('v',18);
    for i=1:5
        re2=re2+(re1(i)*(10^(i-1)))
    end;

 disp(re,'difference is')
```

Scilab code Exa 25.26 Substraction by ones complement method

```

clc;
clear;
//example 25.26
//substraction by one's complement method
//a=input(" Enter the first no (binary) :");
//b=input(" Enter the number from which first no has
    to be substracted:");
a=10001;
b=10011;
q=0;

for i=1:5
    a1(i)=modulo(a,10);
    a=a/10;
    a=round(a);

end
for i=1:5
   b1(i)=modulo(b,10);
```

```
    b=b/10;
    b=round(b);
end;
 for i=1:5//making one's complement of number to be substracted
        a1(i)=bitcmp(a1(i),1);
end

car(1)=0;

for i=1:5
    c1(i)=a1(i)+b1(i)+car(i);
    if c1(i)== 2 then
        car(i+1)= 1;
        c1(i)=0;
    elseif c1(i)==3 then
         car(i+1)= 1;
        c1(i)=1;
    else
        car(i+1)=0;
    end;
end;
car2(1)=car(6);
re=0;
format('v',18);
for i=1:5
    re=re+(c1(i)*(10^(i-1))) //result of one's complement addition
end;


for i=1:5
   s(i)=modulo(re,10);
    re=re/10;
    re=round(re);
end;
if car2(1)==1 then// checking carry

```

```
for i=1:5
 re1(i)=s(i)+car2(i);//addition of carry after one's complement addition
    if re1(i)== 2 then
        car2(i+1)= 1;
        re1(i)=0;
    elseif re1(i)==3 then
         car2(i+1)= 1;
        re1(i)=1;
    else
        car2(i+1)=0;
    end;
end;

 re2=0;
format('v',18);
    for i=1:5
        re2=re2+(re1(i)*(10^(i-1)))
    end;
disp(re2,'difference is') ;

else
    for i=1:5
        re1(i)=bitcmp(s(i),1);
    end
    re2=0;
    for i=1:5
        re2=re2+(re1(i)*(10^(i-1)))
    end;
    re2=-1*re2;
    disp(re2,'difference is') ;
    end;
```

Scilab code Exa 25.27 Substraction by ones complement method

```

clc;
clear;
//example 25.27
//substraction by one's complement method
//a=input(" Enter the first no (binary) :");
//b=input(" Enter the number from which first no has
    to be substracted:");
a=10011;
b=10001;
q=0;

for i=1:5
    a1(i)=modulo(a,10);
    a=a/10;
    a=round(a);
end
for i=1:5
   b1(i)=modulo(b,10);
    b=b/10;
    b=round(b);
end;
for i=1:5//making one's complement of number to be
   substracted
     a1(i)=bitcmp(a1(i),1);
end

car(1)=0;

for i=1:5
    c1(i)=a1(i)+b1(i)+car(i);
    if c1(i)== 2 then
        car(i+1)= 1;
        c1(i)=0;
    elseif c1(i)==3 then
         car(i+1)= 1;
        c1(i)=1;
    else
```

```
        car(i+1)=0;
    end;
end;
car2(1)=car(6);
re=0;
format('v',18);
for i=1:5
        re=re+(c1(i)*(10^(i-1))) //result of one's complement addition
end;

for i=1:5
   s(i)=modulo(re,10);
    re=re/10;
    re=round(re);
end;
if car2(1)==1 then// checking carry

for i=1:5
 re1(i)=s(i)+car2(i);//addition of carry after one's complement addition
    if re1(i)== 2 then
        car2(i+1)= 1;
        re1(i)=0;
    elseif re1(i)==3 then
         car2(i+1)= 1;
        re1(i)=1;
    else
        car2(i+1)=0;
    end;
end;

 re2=0;
format('v',18);
    for i=1:5
        re2=re2+(re1(i)*(10^(i-1)))
    end;
   re2= -1*re2;
```

```
disp(re2,'difference is') ;

else
    for i=1:5
        re1(i)=bitcmp(s(i),1);
    end
    re2=0;
    for i=1:5
        re2=re2+(re1(i)*(10^(i-1)))
    end;
    re2=-1*re2;
    disp(re2,'difference is') ;

end;
```

Scilab code Exa 25.28 finding twos complement

```
clc;
clear;
//example25.28
//finiding two's complement
//a=input(" Enter the number (binary) :");
a=1010;
for i=1:4
    a1(i)=modulo(a,10);
    a=a/10;
    a=round(a);

end
for i=1:4//making one's complement of number
    a1(i)=bitcmp(a1(i),1);
end
for i=1:4
car(1)=1;
re(i)=a1(i)+car(i);//addition of one to one's
```

```
    complement to contain two's complement
    if re(i)== 2 then
        car(i+1)= 1;
        re(i)=0;
    elseif re(i)==3 then
         car(i+1)= 1;
        re(i)=1;
    else
        car(i+1)=0;
    end;
end;

 re2=0;
format('v',18);
    for i=1:4
        re2=re2+(re(i)*(10^(i-1)))
    end;
disp(re2,'two s complement is');
```

Scilab code Exa 25.29 Addition of negative number by twos complement method

```

clc;
clear;
//Example 25.29
//addition of negative number by by two's complement
    method
//bb=input(" Enter the first no (in decimal) :");
//aaa=input(" Enter the negative number that has to
   be added");
bb=14;
aaa=-7;
if aaa<0 then
    aa=-1*aaa;
```

```
else aa=aaa;
end
a=0;
b=0;
q=0;
for i=1:5              //converting from decimal to binary
    x=modulo(aa,2);
    a= a + (10^q)*x;
    aa=aa/2;
    aa=floor(aa);
    q=q+1;
end
q=0;
for i=1:5   //converting from decimal to binary
    y=modulo(bb,2);
    b= b + (10^q)*y;
    bb=bb/2;
    bb=floor(bb);
    q=q+1;
end
for i=1:5
    a1(i)=modulo(a,10);
    a=a/10;
    a=round(a);

end
for i=1:5
   b1(i)=modulo(b,10);
    b=b/10;
    b=round(b);
end;
if aaa<0 then// making one's complement of the negative number
    for i=1:5
        a1(i)=bitcmp(a1(i),1);
    end

```

```
    car(1)=0;

for i=1:5
    c1(i)=a1(i)+b1(i)+car(i);
    if c1(i)== 2 then
        car(i+1)= 1;
        c1(i)=0;
    elseif c1(i)==3 then
         car(i+1)= 1;
        c1(i)=1;
    else
        car(i+1)=0;
    end;
end;
re=0;
format('v',18);
    for i=1:5
        re=re+(c1(i)*(10^(i-1))) //result of one's complement addition
    end;
for i=1:5
   s(i)=modulo(re,10);
    re=re/10;
    re=round(re);
end;
if car(6)==1 then// checking carry
    car2(1)=1;

for i=1:5
 re1(i)=s(i)+car2(i);//addition of carry after one's complement addition
    if re1(i)== 2 then
        car2(i+1)= 1;
        re1(i)=0;
    elseif re1(i)==3 then
         car2(i+1)= 1;
        re1(i)=1;
    else
```

```
        car2(i+1)=0;
    end;
end;

 re2=0;
format('v',18);
    for i=1:5
        re2=re2+(re1(i)*(10^(i-1)))
    end;

 disp(re2,'difference is') ;

else
    for i=1:5
        re1(i)=bitcmp(s(i),1);
    end
    re2=0;
    for i=1:5
        re2=re2+(re1(i)*(10^(i-1)))
    end;
    re2=-1*re2;
    disp(re2,'difference is') ;
    end;
```

Scilab code Exa 25.30 Substraction by twos complement method

```

clc;
clear;
//example 25.27
//substarction by one's complement method
//a=input(" Enter the first no (binary) :");
//b=input(" Enter the number from which first no has to be substracted:");
a=10011;
```

```
b=10001;
q=0;

for i=1:5
    a1(i)=modulo(a,10);
    a=a/10;
    a=round(a);
end
for i=1:5
   b1(i)=modulo(b,10);
    b=b/10;
    b=round(b);
end;
for i=1:5//making one's complement of number to be
   substracted
     a1(i)=bitcmp(a1(i),1);
end

car(1)=0;

for i=1:5
    c1(i)=a1(i)+b1(i)+car(i);
    if c1(i)== 2 then
        car(i+1)= 1;
        c1(i)=0;
    elseif c1(i)==3 then
         car(i+1)= 1;
        c1(i)=1;
    else
        car(i+1)=0;
    end;
end;

re=0;
format('v',18);
for i=1:5
        re=re+(c1(i)*(10^(i-1))) //result of one's
           complement addition
```

```
end;

for i=1:5
   s(i)=modulo(re,10);
    re=re/10;
    re=round(re);
end;
if car(6)==1 then// checking carry

for i=1:5
 re1(i)=s(i)+car2(i);//addition of carry after one's complement addition
    if re1(i)== 2 then
        car2(i+1)= 1;
        re1(i)=0;
    elseif re1(i)==3 then
         car2(i+1)= 1;
        re1(i)=1;
    else
        car2(i+1)=0;
    end;
end;

 re2=0;
format('v',18);
    for i=1:5
        re2=re2+(re1(i)*(10^(i-1)))
    end;
   re2= -1*re2;
disp(re2,'difference is') ;

else
    for i=1:5
        re1(i)=bitcmp(s(i),1);
    end
    re2=0;
    for i=1:5
        re2=re2+(re1(i)*(10^(i-1)))
```

```
    end;
    re2=-1*re2;
    disp(re2,'difference is');

end;
```

Appendix

Scilab code AP 1 Binary to Decimal convertor

```
//bin21dec is a function whcih converts any binary number given to it will output its equivalent decimal number
//pass the binary number as an argument to the function
// For eg:bin21decimal(1010)
//Will give an output of 10

function [temp]=bin21dec(bin)
    i=1;w=1;

    temp1=floor(bin);                                          //separating integer part from the given number
    temp2=modulo(bin,1);                                       //separating decimal part from the given number
    temp2=temp2*10^3;                                          //converting decimal value to interger for convenience

    while(temp1>0)                                             //storing each integer digit in vector for convenience
        p(i)=modulo(temp1,10);
        temp1=floor(temp1/10);
```

```
        i=i+1;
    end

    while(temp2>0)
       //storing each integer digit in vector for
       convenience
        q(w)=modulo(temp2,2);
        temp2=(temp2/10);
        temp2=floor(temp2);
        w=w+1;
    end

    temp1=0;
       //clearing the temporary variable 'temp2'

    for i=1:length(p)
       //checking whether it is binary or not.
        if(p(i)>1) then
            disp('not a binary number');
            abort;
        end
    end

    for i=1:length(p)
       //multipliying the bits of integer part with
       their position values and adding
        temp1=temp1+(p(i)*2^(i-1));
    end

    temp2=0;
       //clearing the temporary variable 'temp2'

    for z=1:w-1
       //multipliying the bits of decimal part with
       their position values and adding
        temp2=temp2+(q(z)*2^(-1*(4-z)));
    end

```

```
    temp=temp1+temp2;      //finally adding both the integer and decimal parts to get total output.
endfunction
```

Scilab code AP 2 Decimal to Base 2 Converter

```
//dec21bin is a function whcih converts any decimal number given to it will output its equivalent binary number
//pass the decimal number as an argument to the function
// For eg:dec21bin(10)
//Will give an output of 1010

function [temp]=dec21bin(dec)
    temp2=floor(dec);                                   //separating integer part from the given number
    temp4=modulo(dec,1);                                //separating decimal part from the given number

    format('v',18);                                     //changing the default precision to 18

    i=1;p=0;x=1;                                        //flag bits

    while(temp2>0)       //storing each integer digit in vector for convenience
        p(i)=(modulo(floor(temp2),2))
        temp2=floor(temp2)/2;
        i=i+1;
    end
```

```
    temp2=0;                //clearing the temporary variable 'temp2'

    for j=1:length(p)       //multipliying the bits of integer part with their position values and adding
        temp2=temp2+(p(j)*10^(j-1));
    end

    while(temp4~=0)                                     //storing each integer digit in vector for convenience
        temp4=temp4*2;
        d(x)=floor(temp4);
        x=x+1;
        temp4=modulo(temp4,1);
    end

    temp5=0;                //clearing the temporary variable 'temp2'

    for j=1:x-1                                 //multipliying the bits of decimal part with their position values and adding
        temp5=temp5+(10^(-1*j)*d(j))
    end

    temp=temp2+temp5;                                   //finally adding both the integer and decimal parts to get total output.
endfunction
```