Scilab Textbook Companion for Engineering Physics by G. P. Reddy, K.J. Pratap, P. M. Rao, and S.Asadullah[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 1

Wave Optics

Scilab code Exa 1.1 1

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
lamda=5890*10**-8     //wavelength
myu=1.6               //refractive index
m=12                  //order of the fringe

//Calculations
t=(lamda*m)/(myu-1)/10**-6

//Result
mprintf("Thickness of sheet= %d*10**-8 cm",t)
```

Scilab code Exa 1.2 2

```
//Chapter 1 : Wave Optics
```

```
clear;

//Variable declaration
lamda=5893*10**-8     //wavelength
myu=1.55              //refractive index
n=10                  //order of the fringe

//Calculations
t=(lamda*n)/(myu-1)/(10**-3)*10**3

//Result
mprintf("Thickness of sheet= %.2f*10**-8 cm",t)
```

Scilab code Exa 1.3 3

```

//Chapter 1 : Wave Optics

clear;

//Variable declaration
lamda=5640*10**-8     //wavelength
d=0.01                //distance between slits
n=0                   //first minimum

//Calculations
theta=(n+(1/2))*(lamda/d)
theta=theta*180/%pi

//Result
mprintf("Angular position of first minima is= %0.2f"
   ,theta)
```

Scilab code Exa 1.4 4

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
lamda=5890*10**-8     //wavelength
myu=1.5               //refractive index of glass
n=1                   //first minimum
r=60                  //angle in degrees

//Calculations
t=(n*lamda)/(2*myu*0.5)/10**-5

//Result
mprintf("Minimum thickness of the film t= %.5f
   *10**-5 cm",t)
//The answer provided in the textbook is incorrect
```

Scilab code Exa 1.5 5

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
i=35                  //incident angle in degrees
myu=1.33              //refractive index
n=1                   //first minimum
t=4*10**-5            //thickness

```

```
//Calculations
cos_r=0.90
lamda1=2*myu*t*cos_r/10**-5          //for first order n=1
lamda2=(2*myu*t*cos_r)/2/10**-5      //for second order n=2
lamda3=(2*myu*t*cos_r)/3/10**-5      //for third order n=3

//Result
mprintf("(i)For the first order wavelength= %.2f*10**-5 cm" ,lamda1)
//The answer provided in the textbook is incorrect
mprintf("\n(ii)For the second order wavelength= %.2f*10**-5 cm",lamda2)
mprintf("\n(iii)For the third order wavelength= %.2f*10**-5 cm",lamda3)
```

Scilab code Exa 1.6 6

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
lamda=5890*10**-10    //wavelength
myu=1.5               //refractive index of glass
n=1                   //first minimum
r=60                  //angle in degrees

//Calculations
t=(n*lamda)/(2*myu*0.5)/10**-7

//Result
mprintf("Thickness of the film t= %.3f*10**-4 mm",t)
```

Scilab code Exa 1.7 7

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
lamda=5890*10**-10    //wavelength
myu=1.33              //refractive index of glass
n=1                   //first minimum
r=45                  //angle in degrees
cos_r=0.707

//Calculations
t=(n*lamda)/(2*myu*cos_r)/10**-7

//Result
mprintf("Thickness of the film t= %.3f*10**-4 mm",t)
```

Scilab code Exa 1.8 8

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
lamda=5.1*10**-7      //wavelength
myu=4/3               //refractive index of glass
r=45                  //angle in degrees
sin_i=4/5
n=50
```

```

//Calculations
sin_r=sin_i/myu
cos_r=(1-sin_r**2)**0.5
t=(n*lamda)/(2*myu*cos_r)/10**-5

//Result
mprintf("Thickness of the film t= %.1f*10**-5 m",t)
```

Scilab code Exa 1.9 9

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
n2=20                       //order of dark ring
lamda=5890*10**-8           //wavelenght

//Calculations
n1=n2*4

//Result
mprintf("Order of the dark ring n1= %d" ,n1)
```

Scilab code Exa 1.10 10

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
Dm=0.590                    //diameter of ring 15
```

```
Dn=0.336                    //diameter of ring 5
lamda=5890*10**-8
m=15
n=5

//Calculation
R=(Dm**2-Dn**2)/(4*lamda*(m-n))

//Result
mprintf("Radius of curvature= %0.1f cm",R)
```

Scilab code Exa 1.11 11

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
lamda1=6000*10**-8
lamda2=4500*10**-8
R=90                        //Radius of curvature
n=3

//Calculation
dn=sqrt(4*n*lamda1*R)

//Result
mprintf("Diameter of the nth ring= %0.4f cm" ,dn)
```

Scilab code Exa 1.12 12

```
//Chapter 1 : Wave Optics

```

```
clear;

//Variable declaration
Dm=0.50                    //diameter of ring 1
lamda=5900*10**-8          //wavelenght
m=10

//Calculation
R=(Dm**2)/(4*lamda*m)/10**2*10**2

//Result
mprintf("Radius of curvature= %.2f cms",R)
```

Scilab code Exa 1.13 13

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
dn=0.3                     //diameter of ring 5
lamda=5.895*10**-5         //wavelenght
R=100
n=5

//Calculation
myu=(4*R*n*lamda)/dn**2

//Result
mprintf("Refractive index of liquid= %.2f ",myu)
```

Scilab code Exa 1.14 14

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
D2=1.40
D1=1.20

//Calculation
myu=(D2/D1)**2

//Result
mprintf("Refractive index of liquid= %0.3f ",myu)
```

Scilab code Exa 1.15 15

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
myu=4/3
Dn=0.5                        //diameter of 10th ring
lamda=6*10**-5
n=10

//Calculation
R=(myu*Dn**2)/(4*n*lamda)

//Result
mprintf("Radius of curvature= %.0f cm",R)
```

Scilab code Exa 1.16 16

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
myu=4/3
Dn=0.5                       //diameter of 10th ring
lamda=5895*10**-8
n=6
R=100
r=0.15

//Calculation
myu=(((2*n)-1)*lamda*R)/(2*r**2)

//Result
mprintf("Refractive index of liquid= %.3f ",myu)
```

Scilab code Exa 1.17 17

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
D15=5.90*10**-3              //diameter of 15th ring
D5=3.36*10**-3               //diameter of 5th ring
m=10
R=100

//Calculation
lamda=(D15**2-D5**2)/(4*m*R)/10**-9*10**3

//Result
mprintf("Wavelength of liquid used= %d Armstrong",
```

```
lamda)
```

Scilab code Exa 1.18 18

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
D1=1.50
D2=1.30

//Calculation
myu=(D1/D2)**2

//Result
mprintf("Refractive index of liquid= %.3f",myu)
```

Scilab code Exa 1.19 19

```
//Chapter 1 : Wave Optics

clear;

//Variable declaration
lamda=5.9*10**-7
r=5.2*10**-3            //radius of ring
n=10

//Calculation
R=(r**2)/(n*lamda)
t=(n*lamda)/2/10**-6

```

```
//Result
mprintf("(i)Radius of curvature R= %f m",R)
mprintf("\n(ii)Thickness of air film t= %.2f*10**-6
   m",t)
```

Chapter 2

Diffraction

Scilab code Exa 2.1 1

```
//Chapter 2 : Diffraction

clear;

//Variable declaration
m=1                          //first minimum
lamda=6000*10**-10           //wavelength
theta=(35*%pi/180)      //angle in radians

//Calculations
a=(m*lamda)/sin(theta)/10**-6

//Result
mprintf("Width of the slit a= %.2f micro-m",a)
```

Scilab code Exa 2.2 2

```
//Chapter 2 : Diffraction

clear;

//Variable declaration
m=1                          //first minimum
lamda=6500*10**-10           //wavelength
a=2*10**-6                   //slit width

//Calculations
theta=((asin((m*lamda)/a))*180/%pi)

//Result
mprintf("Angle of first minimum theta= %.2f degrees"
   ,theta)
```

Scilab code Exa 2.3 3

```
//Chapter 2 : Diffraction

clear;

//Variable declaration
m=1                          //first minimum
a=90*10**-16                 //slit width
y=6*10**-3                   //distance from central
   maximum
D=0.98                       //Screen distance

//Calculations
lamda=(y*a)/D/10**-17*10**3

//Result
mprintf("Wavelength of incident light lamda= %d
```

```
Armstrong",lamda)
```

Scilab code Exa 2.4 4

```

//Chapter 2 : Diffraction

clear;

//Variable declaration
a=2*10**-4                    //slit width
lamda=6*10**-7                //wavelength

//Calculations
theta=asin(lamda/a)
TLW=4*theta/10**-2
theta1=asin(lamda/a)/10**-3

//Result
mprintf("Total linear width= %.1f cm",TLW)
mprintf("\nAngular position of the minima= %d*10**-3
    radian",theta1)
```

Scilab code Exa 2.5 5

```

//Chapter 2 : Diffraction

clear;

//Variable declaration
n1=1
n2=2
```

```
lamda=6000*10**-8             //wavelength
N=6000                        //number of lines for
    diffraction grating

//Calculations
theta1=((asin(n1*lamda*N))*180/%pi)
theta2=((asin(n2*lamda*N))*180/%pi)

//Result
mprintf("Angle between 1st and 2nd order line is %.2
    f degrees",(theta2-theta1))
```

Scilab code Exa 2.6 6

```
//Chapter 2 : Diffraction

clear;

//Variable declaration
lamda1=5890*10**-8            //waveleght
lamda2=5896*10**-8            //waveleght
N=6000                        //number of lines for
    diffraction grating

//Calculations
theta1=((asin(2*lamda1*N))*180/%pi)
theta2=((asin(2*lamda2*N))*180/%pi)

//Result
mprintf("Angular separation= %.2f degrees",(theta2-
    theta1))
```

Scilab code Exa 2.7 7

```

//Chapter 2 : Diffraction

clear;

//Variable declaration
lamda=5000*10**-8            //wavelength
N=4000                       //number of lines for diffraction grating
n=3                          //third order

//Calculations
theta=((asin(n*lamda*N))*180/%pi)

//Result
mprintf("Dispersive power in third order spectum= %.2f degrees",theta)
```

Scilab code Exa 2.8 8

```
//Chapter 2 : Diffraction

clear;

//Variable declaration
N=5000                       //number of lines for diffraction grating
n=2                          //second order
theta2=(30*%pi/180)     //angle in radians

//Calculations
lamda=sin(theta2)/(n*N)/10**-5*10**3

//Result
mprintf("Wavelength lamda= %.0f Armstrong",lamda)
```

Scilab code Exa 2.9 9

```

//Chapter 2 : Diffraction

clear;

//Variable declaration
lamda=5893*10**-8           //wavelength
dlamda=6*10**-8
n=3                         //third order

//Calculations
N=lamda/(n*dlamda)

//Result
mprintf("Number of grating lines= %.1f",N)
```

Scilab code Exa 2.10 10

```

//Chapter 2 : Diffraction

clear;

//Variable declaration
lamda=6.5*10**-7            //wavelength
n=1                         //first order
theta=(15*%pi/180)    //angle in radians

//Calculations
```

```
d=(n*lamda)/sin(theta)/10**-6

//Result
mprintf("Grating element= %.3f*10**-6 m",d)
```

Scilab code Exa 2.11 11

```
//Chapter 2 : Diffraction

clear;

//Variable declaration
lamda2=4992                 //wavelenght

//Calculations
lamda=(4*lamda2)/3

//Result
mprintf("Lamda= %d Armstrong",lamda)
```

Scilab code Exa 2.12 12

```

//Chapter 2 : Diffraction

clear;

//Variable declaration
theta=(30*%pi/180)   //angle in radians
lamda1=5400*10**-10
n=3                        //third order

//Calculations
```

```
d=(n*lamda1)/sin(theta)*10**2/10**-4
N1=1/d/10**-1*10**3

//Result
mprintf("Grating element= %.2f*10**-4 cm",d)
mprintf("\nNumber of lines in 1 cm length of grating
   = %d",N1)
```

Chapter 3

Polarization

Scilab code Exa 3.1 1

```
//Chapter 3 : Polarization

clear;

//Variable declaration
theta=(60*%pi/180)                          //angle in radians

//Calculations
Intensityred=100-(1-cos(theta)**2)*100

//Result
mprintf("Percentage of light that passes through =
    %d percent",Intensityred)
```

Scilab code Exa 3.2 2

```

//Chapter 3 : Polarization
```

```
clear;

//Variable declaration
lamda=6000                  //wavelength in Armstrong

//Calculations
Ie=3/4
Io=1/4
Ratio=Ie/Io

//Result
mprintf("Ratio of the two intensities Ie:Io is %d or
    = 3:1",Ratio)
```

Scilab code Exa 3.3 3

```
//Chapter 3 : Polarization

clear;

//Variable declaration
myu=1.55                    //refractive index of glass

//Calculations
theta_p=(atan(myu))*180/%pi
theta_r=(asin(sin((theta_p*%pi/180))/1.55))*180/%pi
Total=theta_p+theta_r

//Result
mprintf("Angle of polarization= %f degrees",theta_p)
mprintf("\nAngle between reflected and refracted ray
   = %d degrees",Total)
```

Scilab code Exa 3.4 4

```
//Chapter 3 : Polarization

clear;

//Variable declaration
lamda=6000*10**-8          //wavelength
no=1.544                   //refractive index of O-ray
ne=1.553                   //refractive index of E-ray

//Calculations
t=lamda/(4*(ne-no))/10**-3

//Result
mprintf("Thickness of a quarterwave plate= %.2f
   *10**-5 m",t)
```

Scilab code Exa 3.5 5

```
//Chapter 3 : Polarization

clear;

//Variable declaration
lamda=6000*10**-8          //wavelength
no=1.54                   //refractive index of O-ray
ne=1.55                   //refractive index of E-ray

//Calculations
t=lamda/(6*(ne-no))

```

```
//Result
mprintf("Thickness of a quarterwave plate= %f",t)
```

Scilab code Exa 3.6 6

```
//Chapter 3 : Polarization

clear;

//Variable declaration
lamda=6000*10**-8           //wavelength
no=1.54                     //refractive index of O-ray
ne=1.55                     //refractive index of E-ray

//Calculations
t=lamda/(2*(ne-no))

//Result
mprintf("Thickness of a quarterwave plate= %f cm",t)
```

Scilab code Exa 3.7 7

```
//Chapter 3 : Polarization

clear;

//Variable declaration
l=2                         //length of the tube
s=60                        //specific rotation
theta=12                    //angle of rotation of plane
    vibration

//Calculations
```

```
C=theta/(l*s)*100

//Result
mprintf("The solution is of %d percent",C)
```

Chapter 4

Laser and Holography

Scilab code Exa 4.1 1

```
//Chapter 4 : Laser and Holography

clear;

//Variable declaration
delE=3*1.6*10**-19         //Energy of laser
h=6.63*10**-34             //planck's constant
c=3*10**8                  //speed of light

//Calculations
lamda=(h*c)/delE/10**-9

//Result
mprintf("Wavelength of radiation= %d nm",lamda)
```

Scilab code Exa 4.2 2

```
//Chapter 4 : Laser and Holography
```

```

clear;

//Variable declaration
lamda=6328*10**-10        //wavelength
h=6.63*10**-34            //planck's constant
c=3*10**8                 //speed of light

//Calculations
E=((h*c)/lamda)/1.6*10**19
Momentum=h/lamda/10**-27

//Result
mprintf("Energy of radiation= %f eV",E)
mprintf("\nMomentum of electron= %f*10**-27 kgm/s",
   Momentum)
```

Scilab code Exa 4.3 3

```
//Chapter 4 : Laser and Holography

clear;

//Variable declaration
lamda=6730*10**-18        //wavelength
h=6.63*10**-34            //planck's constant
c=3*10**8                 //speed of light
P=10**-3                  //Power of laser

//Calculations
n=(P*lamda)/(h*c)/10**5

//Result
mprintf("Wavelength of radiation= %d*10**15 photons/
   sec",n)
```

Chapter 5

Fibre Optics

Scilab code Exa 5.1 1

```
//Chapter 5 : Fibre Optics

clear;

//Variable declaration
n1=1.5                        //core refractive index
n2=1.47                       //clad refractive index

//Calculations
thetac=asin(n2/n1)
NA=(n1**2-n2**2)**0.5
im=asin(NA)
im=im*180/%pi
thetac=thetac*180/%pi

//Result
mprintf("Critical angle= %f degrees",thetac)
mprintf("\nNumerical aperture= %f",NA)
mprintf("\nAcceptance angle= %f degrees",im)
```

Scilab code Exa 5.2 2

```
//Chapter 5 : Fibre Optics

clear;

//Variable declaration
n1=1.6                    //core refractive index
NA=0.2                    //Numerical aperture

//Calculations
NA=(n1**2-NA**2)**0.5

//Result
mprintf("Refractive index of cladding= %f",NA)
```

Scilab code Exa 5.3 3

```
//Chapter 5 : Fibre Optics

clear;

//Variable declaration
n1=1.6                     //core refractive index
n2=1.58                    //clad refractive index

//Calculations
NA=(n1**2-n2**2)**0.5
im=asin(NA)
im=im*180/%pi

//Result
```

```
mprintf("Numerical aperture= %f",NA)
mprintf("\nAcceptance angle= %2.2f degrees",im)
//The answer provided in the textbook is incorrect
```

Scilab code Exa 5.4 4

```
//Chapter 5 : Fibre Optics

clear;

//Variable declaration
delr=12*10**-3           //fractional refractive index change
NA=0.22                  //Numerical aperture

//Calculations
n1=NA/sqrt(2*delr)
n2=n1-(n1*delr)

//Result
mprintf("Refractive index of core material= %f",n1)
mprintf("\nRefractive index of cladding material= %f",n2)
```

Scilab code Exa 5.5 5

```
//Chapter 5 : Fibre Optics

clear;

//Variable declaration
NA=0.2                   //Numerical aperture
n0=1.33                  //refractive index
```

```
n2=1.59                    //clad refractive index

//Calculations
n1=sqrt(NA**2+n2**2)
NA1=sqrt(n1**2-n2**2)/n0
thetac=asin(NA1)
thetac=thetac*180/%pi

//Result
mprintf("Acceptance angle= %f degrees",thetac)
```

Chapter 9

Electromagnetic Theory

Scilab code Exa 9.1 1

```
//Chapter 9 : Electromagnetic Theory

clear;

//Variable declaration
P=60                    //Power
r=2                     //distance from source
epsilon0=8.85*10**-12
C=3*10**2

//Calculations
E0=sqrt((P*2)/(4*%pi*r**2*C*epsilon0))/1000

//Result
mprintf("Amplitude of field E= %.0f V/m",E0)
```

Scilab code Exa 9.2 2

```
//Chapter 9 : Electromagnetic Theory

clear;

//Variable declaration
P=8*10**-4                    //Power
A=2*10**-6                    //cross-sectional Area
epsilon0=8.85*10**-12
C=3*10**2

//Calculations
I=P/A/100
E0=sqrt((2*I)/(C*epsilon0))/100
B0=E0/C

//Result
mprintf("Intensity of Beam= %d*10**2 W",I)
mprintf("\nE0= %.0f V/m",E0)
mprintf("\nB0= %f myu-T",B0)
```

Scilab code Exa 9.3 3

```
//Chapter 9 : Electromagnetic Theory

clear;

//Variable declaration
E0=9*10**-12
myu0=4*%pi*10**-7
r=10**4                       //radius of Hemisphere
epsilon0=8.85*10**-12
C=3*10**2
P=10**5

//Calculations
```

```
S=P/(2*%pi*r**2)/10**-4
E0=sqrt((2*S)/(C*epsilon0))/10**5
B0=E0/C/10**-4

//Result
mprintf("Poynting vector S= %.2f*10**-4 W/m**2",S)
mprintf("\nE0= %.3f V/m",E0)
mprintf("\nB0= %.2f *10**-10 T",B0)
```

Scilab code Exa 9.4 4

```
//Chapter 9 : Electromagnetic Theory

clear;

//Variable declaration
myu0=4*%pi*10**-7
r=2                          //radius of Hemisphere
epsilon0=8.85*10**-12
P0=1000                      //Power

//Calculations
E=((P0*sqrt(myu0/epsilon0))/(16*%pi))**(1/2)
H=P0/(16*%pi*E)

//Result
mprintf("Intensity of Electric field E= %.2f V/m" ,E
  )
mprintf("\nIntensity of Magnetic field H= %.2f amp.
  turn/m" ,H)
```

Scilab code Exa 9.5 5

```
//Chapter 9 : Electromagnetic Theory

clear;

//Variable declaration
E=81
c=3*10**8                //speed of ligth

//Calculations
n=sqrt(E)
V=c/n/10**7

//Result
mprintf("Refractive index n= %d",n)
mprintf("\nVelocity of light= %.2f*10**7 m/sec",V)
```

Chapter 10

Crystallography and Crystal Imperfections

Scilab code Exa 10.1 1

```
//Chapter 10 : Crystallography and Crystal Imperfections

clear;

//Variable declaration
rho=10.6                    //density of material
n=4                         //No. of atoms/cell
A=108                       //Atomic weigth
No=6.023*10**23             //Avagadro's No.

//Calculations
a=((n*A)/(No*rho))**(1/3)/10**-8

//Result
mprintf("Lattice parameter a= %.5f*10**-8 cm",a)
```

Scilab code Exa 10.2 2

```
//Chapter 10 : Crystallography and Crystal
    Imperfections

clear;

//Variable declaration
rho=7.86*10**3          //density of material
n=2                     //No. of atoms/cell
A=55.85                 //Atomic weigth
No=6.023*10**26         //Avagadro's No.

//Calculations
a=((n*A)/(No*rho))**(1/3)/10**-10

//Result
mprintf("Lattice parameter a= %.5f*10**-10 m",a)
```

Scilab code Exa 10.3 3

```
//Chapter 10 : Crystallography and Crystal
    Imperfections

clear;

//Variable declaration
M=58.5                  //formula weigth
rho=2180                //density of material
n=4                     //No. of atoms/cell
No=6.02*10**26          //Avagadro's No.

//Calculations
a=((n*M)/(No*rho))**(1/3)/10**-10/2

```

```
//Result
mprintf("Distance between like atoms a= %.5f*10**-10 m",2*a)
mprintf("\nDistance between adjacent atoms a/2= %.2f*10**-10 m",a)
```

Scilab code Exa 10.4 4

```
//Chapter 10 : Crystallography and Crystal Imperfections

clear;

//Variable declaration
M=58.45                    //formula weigth
rho=2.17*10**3             //density of material
n=4                        //No. of atoms/cell
No=6*10**26                //Avagadro's No.

//Calculations
a=((n*M)/(No*rho))**(1/3)/10**-10

//Result
mprintf("Lattice constant a= %.3f*10**-10 m",a)
```

Scilab code Exa 10.5 5

```
//Chapter 10 : Crystallography and Crystal Imperfections

clear;

//Variable declaration
```

```
r=1.278                     //atomic weigth
No=6.02*10**26              //Avagadro's No.

//Calculations
a=2*sqrt(2)*r

//Result
mprintf("Lattice constant a= %.3f Armstrong",a)
```

Scilab code Exa 10.6 6

```
//Chapter 10 : Crystallography and Crystal
    Imperfections

clear;

//Variable declaration
r=1.278                     //atomic weigth
N0=6.02*10**23              //Avagadro's No.
no=4                        //No. of atoms/cell
A=63.54                     //Atomic weigth

//Calculations
a=2*sqrt(2)*r
rho=(no*A)/(N0*a**3)/10**-24

//Result
mprintf("Density of the material= %.2f gm/cc",rho)
```

Scilab code Exa 10.7 7

```
//Chapter 10 : Crystallography and Crystal
    Imperfections
```

```
clear;

//Variable declaration
x=2                    //x intercept
y=3                    //y intercept
z=3                    //z intercept

//Calculations
rx=(1/x)*6             //reciprocal of x intercept
ry=(1/y)*6             //reciprocal of y intercept
rz=(1/z)*6             //reciprocal of z intercept

//Result
mprintf("Miller indices are (%d , %d , %d)",rx,ry,rz
   )
```

Scilab code Exa 10.8 8

```
//Chapter 10 : Crystallography and Crystal
   Imperfections

clear;

//Variable declaration
h=1
k=1
l=2
a=2.5
b=a
c=2.6

//Calculations
d=((h**2/a**2)+(k**2/b**2)+(l**2/c**2))**(-0.5)

```

```
//Result
mprintf("Inter-planar spacing d= %.3f Armstrong",d)
```

Chapter 11

Free Electron Theory Of Metals

Scilab code Exa 11.1 1

```
//Chapter 11 : Free Electron Theory Of Metals

clear;

//Variable declaration
k=1.376*10**-23                //Boltzmann's constant in
    J/K
T=300                          //Temperature
m=9.11*10**-31                 //Mass of electron

//Calculations
v=sqrt((3*k*T)/m)/10**5

//Result
mprintf("Root Mean Square Velocity v= %1.2f*10**5 m/
    s",v)
```

Scilab code Exa 11.2 2

```
//Chapter 11 : Free Electron Theory Of Metals

clear;

//Variable declaration
sigma=6.8*10**7          //conductivity
n=8.5*10**28             //number of electrons
m=9.1*10**-31            //Mass of electron
e=1.6*10**-19            //charge on electron
k=1.38*10**-23           //Boltzmann's constant in J/K
T=300                    //temperature in K

//Calculations
lamda=(2*sigma*sqrt(3*m*k*T))/(n*e**2)/10**-9

//Result
mprintf("Mean free path for electron= %1.1f*10**-9 m
   ",lamda)
```

Scilab code Exa 11.3 3

```
//Chapter 11 : Free Electron Theory Of Metals

clear;

//Variable declaration
rho=1.54*10**-8           //resistivity
n=5.8*10**28              //electron density
e=1.602*10**-19           //charge on electron
m=9.1*10**-31             //Mass of electron

//Calculations
tau=m/(n*(e**2)*rho)/10**-14

//Result
```

```
mprintf("Relaxation time= %1.2f*10**-14 seconds",tau
    )
```

Scilab code Exa 11.4 4

```
//Chapter 11 : Free Electron Theory Of Metals

clear;

//Variable declaration
EF=1.1214*10**-18          //fermi energy in J
m=9.11*10**-31             //Mass of electron
h=6.63*10**-34             //planck's constant

//Calculations
n=((8*m*EF)/(h**2))**(3/2)*(%pi/3)/10**28

//Result
mprintf("No. of free electrons per unit volume= %1.3
    f*10**28 electrons per meter**3",n)
```

Scilab code Exa 11.5 5

```
//Chapter 11 : Free Electron Theory Of Metals

clear;

//Variable declaration
fE=0.01                    //probability
delE=8*10**-20             //ev to J

//Calculations
T=5797/log(99)
```

```

//Result
disp('K',T,"Temperature=")
```

Chapter 12

Semiconductor Physics

Scilab code Exa 12.1 1

```
//Chapter 12 : Semiconductor Physics

clear;

//Variable declaration
ni=2.5*10**19          //intrinsic concentration
myun=0.40              //mobility of electrons
myup=0.25              //mobility of holes
e=1.6*10**-19

//Calculations
sigmai=ni*e*(myun+myup) //conductivity of intrinsic
   semiconductor
rhoi=1/sigmai

//Result
mprintf("Resistivity = %f ohm-m",rhoi)
```

Scilab code Exa 12.2 2

```
//Chapter 12 : Semiconductor Physics

clear;

//Variable declaration
myun=0.36                   //mobility of electrons
myup=0.14                   //mobility of holes
e=1.6*10**-19
rhoi=2.2                    //resistivity

//Calculations
ni=1/(rhoi*e*(myun+myup))/10**18

//Result
mprintf("Intrinsic concentration= %.3f*10**18 m**-3"
    ,ni)
```

Scilab code Exa 12.3 3

```
//Chapter 12 : Semiconductor Physics

clear;

//Variable declaration
myun=0.39                   //mobility of electrons
myup=0.21                   //mobility of holes
ni=2.5*10**19               //intrinsic concentration
e=1.6*10**-19

//Calculations
sigmai=ni*e*(myun+myup) //conductivity of intrinsic
    semiconductor
rhoi=1/sigmai

//Result
```

```
mprintf("Conductivity = %.1f ohm**-1-m**-1",sigmai)
mprintf("\nResistivity= %.2f ohm-m",rhoi)
//The answer provided in the textbook is wrong
```

Scilab code Exa 12.4 4

```
//Chapter 12 : Semiconductor Physics

clear;

//Variable declaration
Eg=0.8                    //Energy gap width
T=300
m=9.1*10**-31             //mass of electron
k=1.38*10**-23
h=6.63*10**-34

//Calculations
ni=2*((2*22*m*k*T)/(7*h**2))**(3/2)*exp((-Eg
    *1.6*10**-19)/(2*k*T))/10**18

//Result
mprintf("Concentration of intrinsic charge= %.2f
    *10**18 /m**3",ni)
 //The answer provided in the textbook is wrong
```

Scilab code Exa 12.5 5

```
//Chapter 12 : Semiconductor Physics

clear;

//Variable declaration
```

```
RH=3.22*10**-4          //Hall coefficient
rho=9.0*10**-3
e=1.6*10**-19

//Calculations
p=1/(RH*e)/10**21
myup=RH/rho

//Result
mprintf("Hole concentration= %.2f*10**21 m**-3",p)
mprintf("\nMobility of holes= %.5f m**2 V**-1 s**-1"
   ,myup)
```

Scilab code Exa 12.6 6

```
//Chapter 12 : Semiconductor Physics

clear;

//Variable declaration
RH=3.66*10**-4          //Hall coefficient
t=10**-3                //thickness
I=1                     //current
B=0.5                   //magnetic induction

//Calculations
VH=(RH*I*B)/t

//Result
mprintf("Hall voltage VH= %.3f V",VH)
```

Scilab code Exa 12.7 7

```
//Chapter 12 : Semiconductor Physics

clear;

//Variable declaration
RH=7.5*10**-5          //Hall coefficient
sigma=200               //conductivity
e=1.6*10**-19           //electron charge

//Calculations
n=1/(e*RH)/10**22
myu=sigma*RH

//Result
mprintf("Charge density= %.2f*10**22 /m**3",n)
mprintf("\nMobility= %.3f m**2 V**-1 s**-1",myu)
```

Chapter 13

Thin Film Preparation Techniques and their Applications

Scilab code Exa 13.1 1

```
//Chapter 13 : Thin Film Preparation Techniques and
    their Applications

clear;

//Variable declaration
delV1=2*10**-3            //milivolts to volts
delI1=4*10**-6            //microAmpere to Ampere

//Calculations
Rs=delV1/delI1

//Result
mprintf("Series Resistance = %d V/m",Rs)
```

Scilab code Exa 13.2 2

```
//Chapter 13 : Thin Film Preparation Techniques and their Applications

clear;

//Variable declaration
I=2*10**-3
V=1

//Calculations
rho=(V/I)*2
delR=rho-800   //change in resitance
A=1/delR       //change in conductance
A=A*10**3

//Result
mprintf("Change in conductivity = %d *10**-3 Ohm**-1-cm**-1",A)
```

Scilab code Exa 13.3 3

```
//Chapter 13 : Thin Film Preparation Techniques and their Applications

clear;

//Variable declaration
Pmax=21*10**-3         //maximum power output
Isc=100*10**-3         //short circuit voltage
Voc=500*10**-3         //open circuit voltage
Pin=35*10**-3          //Power input
A=4                    //area of solar cell

```

```
//Calculations
Fill_Factor=Pmax/(Isc*Voc)
n=(Pmax/(Pin*A))*100

//Result
mprintf("Fill factor = %.2f",Fill_Factor)
mprintf("\nPercentage of efficieny = %d percent",n)

//The answer provided in the textbook is wrong
```

Scilab code Exa 13.4 4

```
//Chapter 13 : Thin Film Preparation Techniques and
   their Applications

clear;

//Variable declaration
Pmax=18*10**-3          //maximum power output
F=0.6                 //fill factor
Voc=300*10**-3          //open circuit voltage
Pin=21*10**-3           //Power input
A=5                     //area of solar cell

//Calculations
Isc=Pmax/(F*Voc)
n=(Pmax/(Pin*A))*100

//Result
mprintf("Isc = %d mA",Isc*1000)
mprintf("\nPercentage of efficieny = %f percent",n)
```

Chapter 15

Dielectric Material

Scilab code Exa 15.1 1

```
//Chapter 15 : Dielectric Material

clear;

//Variable declaration
V=15                     //potential difference
C=6*10**-6               //Capacitance
epsilon0=8.854*10**-12   //absloute permittivity
epsilonr=8               //relative permittivity
A=360*10**-4             //surface Area

//Calculations
E=(V*C)/(epsilon0*epsilonr*A)/10**7
T=epsilon0*(epsilonr-1)*V*A/10**-12

//Result
mprintf("Electric field strength = %f*10**7 V/m",E)
mprintf("\nTotal dipole moment = %.1f*10**-12 C-m",T
    )
```

Chapter 16

Magnetic Materials

Scilab code Exa 16.1 1

```
//Chapter 16 : MAGNETIC MATERIALS

clear;

//Variable declaration
H=10**6                    //Magnetic Field Strength in ampere/m
x=0.5*10**-5               //Magnetic susceptibility
mu_0=4*%pi*10**-7

//Calculatiions
M=x*H
B=mu_0*(M+H)

//Result
mprintf("Intensity of Magnetization=%d ampere/m",M)
mprintf("\nFlux density in the material=%f weber/m^2",B)
```