Scilab Textbook Companion for Engineering Physics by K. Rajagopal[1]

Created by
Surbhi Suryakant Patel
Engineering Physics
Electronics Engineering
G.H. Patel Engineering College
College Teacher
None
Cross-Checked by
Chaitanya Potti

July 31, 2019

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

Book Description

Title: Engineering Physics

Author: K. Rajagopal

Publisher: Phi Learning, New Delhi

Edition: 2

Year: 2011

ISBN: 978-81-203-4340-5

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

Elasticity

Scilab code Exa 1.1 example 1

```
clc;
clear all;
Y = 2e12 // Youngs modulus of steel in dynes per cm
    square
g = 981; // Gravity Constant in am per second square
l = 400; // Length of wire in cm
r = 0.1; // Radius of wire in cm
deltaL = 0.1; // Change in length of wire in cm
M = (Y * %pi * r^2 * deltaL )/(g*l*1000);
disp('kg',M,'The mass to be added is',);
//There is slight variation in answer than book's
    answer.. verified in calculator too
```

Scilab code Exa 1.2 example 2

```
clc;
clear all;
r = 0.15; // Radius of wire in cm
```

```
A = %pi* r^2; // Area of wirw in cm square
F = 200; // Force in dyne
Y = 12.5e11; // Young's modulus in dyne per cm
    square
t = ((F*9.8e5)/(A*Y))*100;
disp('%',t,'Percentage of increase is ');
```

Scilab code Exa 1.3 example 3

```
clc;
clear all;
lss = 5; // Length of steel wire in m
as = 4e-5; // Cross section area of steel wire in
    square meters
lc = 6; // Length of copper wire in m
ac = 5e-5; // Cross section area of copper wire in
    square meters
Ratio = (lss/as)*(ac/lc); // Ratio os youngs modulus
     of steel to copperAfter eliminating force and
    delta change
disp(Ratio,'The ratio of youngs modulus of steel to
    copper is ');
```

Scilab code Exa 1.4 example 4

```
clc;
clear all;
change = 0.01/100;
h = 1e5; // Height
rho = 1 // Density of water in gm per cm square
g = 980 // Gravity constant in am per square cm
deltap = h*g*rho;
k = deltap/change;
```

```
disp('dyne cm^-2',k,'Bulk modulus of sphere is ')
```

Scilab code Exa 1.5 example 5

```
clc;
clear all;
deltav = 0.5; // change in volume
v = 200; // initial volume in litres
deltap = 100*1.013e5 // change in pressure in Pa
k = (deltap/(deltav/v));
disp('Pa',k,'Bulk modulus of liquid is ')
```

Scilab code Exa 1.6 example 6

```
clc;
clear all;
l = 0.4 // Length in meter
A = 240e-4 // Area of slab in meter square
F = 1e5 // Shaering force in newton
n = 5.6e9 // Shear modulus in pa
deltal = (F*l)/(n*A);
disp('m',deltal,'The displacement is ')
```

Scilab code Exa 1.7 example 7

```
clc;
clear all;
l = 7; //  Length of rubber cube
n = 2e7; // Rigidity modulus in dyne per cm square
F = 200*1000*981; // Force in dyne
```

```
A = 49; // Area in cm square
theta = (F/(A*n));
disp('rad',theta,'Shearing stress is ') ;
deltal = l*theta;
disp('cm',deltal, 'Change is' );
```

Scilab code Exa 1.8 example 8

```
clc;
clear all;
A = 2e-4; // Area of steel wire in meter square
Y = 2e11 // Young's modulus in Newton per meter
    square
F = A*Y //l = L in this problem hence eliminating
    and rearranging equation of Y
disp('N',F,'The value of force is')
```

Scilab code Exa 1.9 example 9

```
clc;
clear all;
sigma = 0.2; // Poisson's ratio
changel = 2e-3; // longitudinal strain
changev = (changel-(2*sigma*changel))*100;
disp('%',changev,'Percentage change in volume is')
```

Scilab code Exa 1.10 example 1

```
clc;
clear all;
```

```
n = 2.8e10; // Rigidity modulus in Newton per meter
    suquare
theta = 90; // In degress
theta1 = theta*(%pi/180); // in radians
l = 2; //Length of wire in meter
r = 0.5e-3; //  Radius of wire in meter
 t = (%pi^2 * n *r^4)/(4*l);
 disp('Nm',t,'Torque is');
```

Scilab code Exa 1.11 example 11

```
clc;
clear all;
l = 50*1e-2; // length of wire in m
a = 2e-3; // radius of wire in m
theta = 45; // In degree
theta1 = theta*(%pi/180); // In radian
n = 8*1e8 //Rigidity modulus in Newton per meter
    square
t = (0.5*%pi*n*a^4*theta1^2)/(2*l);
disp('J',t,'Torque is')
```

Scilab code Exa 1.12 example 12

```
clc;
clear all;
l = 1; // Length of wire in m
a = 2e-3; // Radius of wire in m
theta = %pi/2; // in radians
theta1=theta*(180/%pi);//in degrees
n = 5e10; // Rigidity modulus of wire in newton per
    square meter
t = (%pi*n*a^4*theta)/(2*l);
```

```
disp('Nm',t,'Torsional couple is ');
y=a*theta1/(2*l);//angle of shear at surface
disp('degree',y,'angle of shear at surface');
z=y/2;//angle of shear at midway
disp('degree',z,'angle of shear at midway');
```

Scilab code Exa 1.13 example 13

```
clc;
//t=(pi*n*((2*a)^4)*theta)/(2*2*l)=(pi*n*((4*a)^4)*
    theta1)/(2*4*l)
//by solving this we get : theta/theta1 = 256/16
theta = 90; //theta
theta1= 256/16;//theta/theta'
theta2=theta/theta1;//theta'
disp(+'degree',theta2,'The twist on the longer
    cylinder =')
```

Scilab code Exa 1.14 example 14

```
clc;
clear all;
l = 0.5; // Length of wire in meter
a = 2e-3; // Radius pf wire in meter
theta = 30; // In degree
Ashear = (a*theta)/l;//Angle of shear
disp('degree',Ashear,'Angle of shear is');
```

Scilab code Exa 1.15 example 15

```
clc;
clear all;
e = 1e-2; // Restoring couple per unit twist in
    Newton meter
a = 6e-2; // Radius of cyinder in meter
a1 = 0.10 // Internel diameter of hollow cylinder in
     meters
a2 = sqrt(a^2 + a1^2); // Externel Diameter in meter
disp(a2);
c = (e * (a2^2 - a1^2))/(a^4);//Restoring couple per
     unit twist for hollow cylinder
disp('Nm',c,'Restoring couple per unit twist for
    hollow cylinder is ');
//There is slight variation in answer than book's
    answer.. verified in calculator too
```

Scilab code Exa 1.16 `example 16`

```
clc;
clear all;
l = 0.80; // Distance between the knife edges in
    meter
r = 0.75e-2; // Radius of rod in meter
m = 800e-3; // Mass of load in Kilogram
dp = 0.030e-2; //  depression on meter
g = 9.8; // Gravity constant
Y = (m*g*l^3)/(12*dp*%pi*r^4);
disp('N/m^2',Y,'Youngs modulus of the material is ')
    ;
```

Scilab code Exa 1.17 `example 17`

```
clc;
```

```
clear all;
l = 1; // Length of beam in meter
dp = 10e-3; // Depression in meter
x = 0.4 // Distance at which depression is to be
    found in meter
dpx = (dp*3*(x-x^2+x^3))/l^3;
disp('m',dpx,'Depression at x = 0.4m is ');
```

Scilab code Exa 1.18 example 18

```
clc;
clear all;
dp = 12e-3; // Depression for a cantilever os
    another cantilever of some material of length ,
    width of thickness three times the first case
//delta=4mgl^3/ybd^3 here replace l=3l b=3b and d=3d
     so..
dpd = dp/3;
disp('m',dpd,'The depression in second cantilever is
     ');
```

Chapter 2

Acoustics Of Buildings

Scilab code Exa 2.1 `example 1`

```
clc;
//delta_L=L2-L1
//I proportional to square of amplitude so when amplitude is doubled intensity will becomes 4 times
//L1=10*l0g10(I1/I0)
//L2=10*log10(I2/I0)
//delta_L=L2-L1
//delta_L=10*log(I1/I0)-10*log(I2/I0)=10*log(I2/I1)
I21=4;//I2/I1=4 because intensity=amp^2
delta_L=10*log10(I21);//increase in intensity level
disp(+'dB',delta_L,'increase in intensity level =')
```

Scilab code Exa 2.2 `example 2`

```
clc;
//L2-L1=10*log10(I2/I1)
//so , we can write that
```

```
L2=40  //i dB
L1=10 //in dB
//where L1 and L2 are intensity level of two waves of same frequency
L=L2-L1;
//let I2/I1=I
I=10^(L/10);
//let a2/a1=a
a=sqrt(I);//Ratio of their amplitudes
disp(a,'Ratio of their amplitudes = ')
```

Scilab code Exa 2.3 `example 3`

```
clc;
clear all;
I1=25.2 //in Wm^-2
I2=0.90 //in Wm^-2
B=10*log10(I1/I2) //Relative loudness of sound in dB
disp(+'dB',B,'Relative loudness of sound = ')
```

Scilab code Exa 2.4 `example 4`

```
clc;
clear all;
I=1e4 //in W/(m*m)
I0=1e-12 //in W/(m*m)
B=10*log10(I/I0);//intensity level
disp(+'dB',B,"intensity level = ")
```

Scilab code Exa 2.5 `example 5`

```
clc;
B=5 // in dB
//B=10*log(I2/I1)
//let I2/I1=x
//10*log(x)=5
x=10^(5/10);
disp('times more intense than the unamplified sound'
   ,x,'Amplified sound is')
```

Scilab code Exa 2.6 `example 6`

```
clc;
d=198; //in meter
t=1.2;//in second
//velocity=distance/time
v=2*d/t;//velocity
disp(+'m/s',v,'velocity =');
```

Scilab code Exa 2.7 `example 7`

```
clc;
//need to find absorption coefficient
V=5600 //in m^3
T=2 //in second
s=700 //in m^2
a=0.16*V/(s*T)
disp(a,"absorption coefficient =")
```

Scilab code Exa 2.8 `example 8`

```
clc;
absorp1=92.90; //in m^^2
absorp2=92.90;//in m^2
V=2265.6;//in m^3
T1=0.16*V/(absorp1);
T2=0.16*V/(absorp1+absorp2);
ans=T2/T1;//effect on Reverberation time
disp(+"of its original value",ans,"Reverberation
    time will reduced to ")
```

Scilab code Exa 2.9 example 9

```
clc;
clear all;
v=25.2*20.3*8.04 ;//in m^3
T=0.75; //in second
absorp1=500*0.3176 ;//in m^2
absorp2=(0.16*v)/T;
T1=(0.16*v)/(absorp1+absorp2);//reverbaration time
disp(+'second',T1,"reverbaration time =");
```

Scilab code Exa 2.10 example 10

```
clc;
clear all;
v=45*100*17.78;//in m^3
absorp1=(700*0.03)+(600*0.06)+(400*0.025)+(600*0.3);
absorp_p=600*4.3;
T1=(0.16*v)/(absorp1);//Reverbaration time (empty
    hall)
T2=(0.16*v)/(absorp_p+absorp1);//Reverbaration time
    with full capacity
```

```
disp(+'second',T1,'Reverbaration time (empty hall) =
   ');
disp(+'second',T2,'Reverbaration time with full
   capacity =');
//There is slight variation in answer than book's
   answer.. verified in calculator too.(mistake in
   textbook)
```

Chapter 3

Ultrasonics

Scilab code Exa 3.1 example 1

```
clc;
clear all;
t=1.6*1e-3 //thickness in meter
v=5760 //velocity in m/s
lemda=2*t//wavelength
f=v/lemda//fundamental frequency
disp(+'Hz',f,'fundamental frequency =')
```

Scilab code Exa 3.2 example 2

```
clc;
t=40*1e-2;
//pulse covers 2x distance in arriving back
//so, 30*1e-6=2*x/v
//and, 2nd pulse will cover a distance of 2*40 cm in
    80*1e-6 seconds
//therfore, 80*1e-6=(2*40*1e-2)/v
//compare both equation
```

```
e1=30;
e2=40*2
x=e1*t*2/(2*e2);
disp(+'m',x,'distanc of the flow from near end =')
```

Scilab code Exa 3.3 example 3

```
clc;
f_diff=50*1e3 //in Hz
v=5000 //in m/s
//f1=v/2*t
//f2=2v/2t
//f2-f1=v/2t
t=v/(2*f_diff)
disp(+'meter',t,'Thickness of steel plate =')
```

Scilab code Exa 3.4 example 4

```
clc;
f=1e6 //frequency in Hz
L=1 //inductance in henry
//f=(1/2*pi)*(sqrt(1/(L*C)))
c=1/(4*%pi^2*f^2*L);//capacitance
disp(+'F',c,'capacitance =')
```

Chapter 4

Crystal Physics

Scilab code Exa 4.1 example 1

```
clc;
clear all;
r=1.278*1e-8 ;//atomic radius in cm
M=63.5; //atomic weight
N=6.023*1e23; //avogadro number
n=4//for fcc n=4
a=4*r/(sqrt(2));
density=n*M/(N*a^3);//Density of copper
disp(+'g/cc',density,'Density of copper =')
```

Scilab code Exa 4.2 example 2

```
clc;
M=58.45;//atomic mass
N=6.02*1e23;//avogadro number
density=2.17*1e3 ; //in kg/m^3
n=4 //Nacl is FCC
a=(n*M/(N*density))^(1/3);//lattice constant
```

```
disp(+'m',a,'lattice constant = ');
//slight variation in ans than book.. checked in
    calculator also
```

Scilab code Exa 4.3 `example 3`

```
clc;
//let three intercepts are I1,I2,I3
I1=3;
I2=-2;
I3=3/2;
//let their reciprocals are I1_1,I2_1,I3_1
I1_1=1/I1;
I2_1=1/I2;
I3_1=1/I3;
//LCM of I1_1,I2_1,I3_1 are 6 .
//By multiply LCM with I1_!,I2_1,I3_1 we will get
    miller indices
LCM=6;
M_1=LCM*I1_1;
M_2=LCM*I2_1 ;
M_3=LCM*I3_1;
disp(M_1,'Miller indices of plane =');
disp(M_2);
disp(M_3);
```

Scilab code Exa 4.4 `example 4`

```
clc;
r=1.246 //in A
a=4*r/sqrt(2)
d_200=3.52/sqrt(4+0+0)
disp(+'m',d_200*1e-10,'d200 = ')
```

```
d_220=3.52/sqrt(4+4)
disp(+'m',d_220*1e-10,'d220 = ')
d_111=3.52/sqrt(1+1+1)
disp(+'m',d_111*1e-10,'d111 = ')
```

Scilab code Exa 4.5 example 5

```
clc;
h=1
k=1
l=1
h1=1
k1=1
l1=1
a=((h*h1)-(k*k1)+(l*l1))/(sqrt((h*h)+(k*k)+(l*l))*
   sqrt((h1*h1)+(k1*k1)+(l1*l1)));
//cosine angle=a so angle=cosine inverse of a
thita=acosd(a);//angle between two planes
disp(+'degree',thita,'angle between two planes =')
```

Scilab code Exa 4.6 example 6

```
clc;
a=2.9*1e-8; //in cm
M=55.85;//atomic mass
density=7.87 //in g/cc
N=6.023*1e23;
n=(a^3*N*density)/M;//Number of atoms per unit cell
disp(n,'Number of atoms per unit cell =');
//slight variation in ans than book.. checked in
   calculator also
```

Scilab code Exa 4.7 example 7

```
clc;
M=55.85;//atomic mass
d=7.86 //density of iron in g/cc
N=6.023*1e23
n=2//BCC structure
a=((n*M)/(N*d))^(1/3);
r=(sqrt(3)*a)/4;//radius of iron atom
disp(+'cm',r,'radius of iron atom =')
```

Scilab code Exa 4.8 example 8

```
clc;
M=207.21;//atomic mass
d=11.34*1e3 //in kg/m^3
N=6.023*1e26 //in kg/m^3
n=4;//for FCC
a=((n*M)/(N*d))^(1/3);//lattice constant
r=(sqrt(2)*a)/4;//Atomic radius
disp(+'m',a,'lattice constant =');
disp(+'m',r,'Atomic radius =');
```

Scilab code Exa 4.9 example 9

```
clc;
n=1;
thita=30;//angle in degree
lamda=1.75; //in A
```

```
h=1;
k=1;
l=1;
//d111=a/sqrt((h*h)+(k*k)+(l*l))
//2dsin(thita)=n*lamda
d=n*lamda/(2*sind(thita));
a=sqrt(3)*d;//lattice constant
disp(+'meters',a*1e-10,"lattice constant =")
```

Scilab code Exa 4.10 `example 10`

```
clc;
//let three intercepts are I1,I2,I3
I1=0.96;
I2=0.64;
I3=0.48;
//as they are ratios we will multiply by some some
    constants so that  it will become integers
I1=6;
I2=4;
I3=3 ;
//let their reciprocals are I1_1,I2_1,I3_1
I1_1=1/I1;
I2_1=1/I2;
I3_1=1/I3;
//LCM of I1_1,I2_1,I3_1 are 12.
//By multiply LCM with I1_!,I2_1,I3_1 we will get
    miller indices
LCM=12;
M_1=LCM*I1_1;
M_2=LCM*I2_1 ;
M_3=LCM*I3_1;
disp(M_1,'Miller indices of plane =');
disp(M_2);
disp(M_3);
```

Chapter 5

Wave Optics

Scilab code Exa 5.1 `example 1`

```
clc;
refractive_index=1.65 //refractive index
lamda=5893*1e-10;//wavelength
n=400;
t=n*lamda/(2*(refractive_index-1));//Thickness of film
disp(+'meter',t,'Thickness of film = ')
```

Scilab code Exa 5.2 `example 2`

```
clc;
clear all;
x=0.40*1e-3; //in meter
n=900;
lamda=2*x/n;//Wavelength of light in meters
lamda1=lamda/1e-10;//Wavelength of light in A
disp(+'Angstorm',lamda1,'Wavelength of light in A =')
```

Scilab code Exa 5.3 example 3

```
clc;
lamda=5893*1e-10;//wavelength of monocromatic light
n=4000;
x=n*lamda/2;//distance moved by mirror M1
disp(+'meter',x,'distance moved by mirror M1 =')
```

Scilab code Exa 5.4 example 4

```
clc;
clear all;
lamda=5461*1e-10;//wavelength of light
n=8;//no of frings
t=6*1e-6;//in meter
u=((n*lamda)/(2*t))+1;//refractive index of material
disp(u,'refractive index of material =');
```

Scilab code Exa 5.5 example 5

```
clc;
ue=1.553;//given ue
u0=1.544;//given uo
lamda=500*1e-9;//in meter
t=lamda/(4*(ue-u0));//The thickness of quarter wave
    plate
disp(+'meter',t,'The thickness of quarter wave plate
    =')
```

Scilab code Exa 5.6 `example 6`

```
clc;
lamda=5893*1e-10;//in meter
ue=1.55333;//given ue
u0=1.5442;//given u0
t=lamda/(2*(ue-u0));//Thicknesss of half wave plate
disp(+'meter',t,'Thicknesss of half wave plate =');
```

Scilab code Exa 5.7 `example 7`

```
clc;
u0=1.5442;//given u0
ue=1.5533;//given ue
lamda=5*1e-5;//wavelrngth in cm
t=lamda/(2*(ue-u0));//Thicknesss of half wave plate
disp(+'cm',t,'Thicknesss of half wave plate =')
//slight variation in ans than book.. checked in
    calculator also
```

Scilab code Exa 5.8 `example 8`

```
clc;
clear all;
u0=1.658;//given u0
ue=1.486;//given ue
lamda=5893*1e-8 //in cm
t=lamda/(4*(u0-ue));//Thicknesss of quarter wave
    plate
disp(+'cm',t,'Thicknesss of quarter wave plate =')
```

Chapter 6

Lasers

Scilab code Exa 6.1 example 1

```
clc;
clear all;
D=4*1e8;//distance between earth and moon in m
lemda=16000*1e-10;//wavelength in meters
d=1e-3;//aperture in meter
th=lemda/d;//angular speed
disp('rad',th,'angular speed is=');
aos=(D*th)^2;//area of spread
disp('m^2',aos,'area of spread is=');
//there is variation in the answer than book..
   checked in calculator too..
```

Scilab code Exa 6.2 example 2

```
clc;
clear all;
a1=2*1e-3;//distance from the laser
a2=3*1e-3;//distance from the laser
```

```
d1=2;//output beam spot diameter
d2=4;//output beam spot diameter
th=(a2-a1)/(2*(d2-d1));//angle of divergence
disp('rad',th,'angle of divergence');
```

Scilab code Exa 6.3 example 3

```
clc;
clear all;
D=0.1;//focal length of lens
lemda=14400*1e-10;//wavelength in meters
p=100*1e-3;//power of laser beam
d=10*1e-3;//aperture in meter
th=lemda/d;//angular speed
disp('rad',th,'angular speed is=');
aos=(D*th)^2;//area of spread
disp('m^2',aos,'area of spread is=');
I=p/aos;//'intensity
disp('W*m^-2',I,'intensity is=');
```

Chapter 7

Optical Fiber Communication

Scilab code Exa 7.1 example 1

```
clc;
clear all;
NA = 0.24;//Numerical Aperture
delta = 0.014;
n1 = (NA)/sqrt(2*delta);//Refractive index of first
    medium
disp('',n1,'Refractive index of first medium is ');
n2 = n1 - (delta*n1);//Refractive index of secong
    material
disp('',n2,'Refractive index of secong material is '
    );
```

Scilab code Exa 7.2 example 2

```
clc;
clear all;
n1 = 1.49; // Refractive index of first medium
n2 = 1.44; // Refractive index of second medium
```

```
delta = (n1-n2)/n1; // Index difference
NA = n1* sqrt(2*delta);
disp('',NA,'Numerical Aperture of fiber is');
thetaa = asind(NA);
disp('degree',thetaa,'Acceptance angle is ');
```

Scilab code Exa 7.3 example 3

```
clc;
clear all;
NA = 0.15 ; // Numerical Aperture of fiber
n2 = 1.55; // Refractive index of cladding
n0w = 1.33; // Refractive index of water
n0a = 1; // Refractive index of air
n1 = sqrt(NA^2 + n2^2);
NAW = (sqrt(n1^2 -n2^2))/n0w;
thetaa = asind(NAW);//Acceptance angle in water
disp('degree',thetaa,'Acceptance angle in water is '
   );
```

Scilab code Exa 7.4 example 4

```
clc;
clear all;
l = 16; // Length of optical fiber in Km
Pi = 240e-6; // Mean optical length launched in
   optical fiber in Watts
Po = 6e-6; // Mean optical power at the output in
   watts
alpha = 10*log10(Pi/Po);//Signal attenuation in
   fiber
disp('dB',alpha,'Signal attenuation in fiber')
```

```
alpha1 = alpha/l;//Signal attenuation per km of the
    fiber
disp('dB/km',alpha1,'Signal attenuation per km of
    the fiber');
```

Scilab code Exa 7.5 example 7

```
clc;
clear all;
Tf = 1400; // Fictive temperature of silicon in
    Kelvin
betai = 7e-11; // Isothermal compressibility square
    meter per newton
n = 1.46; // Refractive index of silicon
p = 0.286; // Photoelastic constant of silicon
lambda = 0.63e-6 // Wavelength in micrometer
kb = 1.38e-23 // Boltzmann constant in joule per
    kelvin
L = 1e3;
alphas = (8 * %pi^3 * n^8 * p^2 * kb * Tf * betai)
    /(3 * lambda^4);//Rayleigh scattering coefficient
alphars = exp(-alphas * L);//Loss factor
disp('meter^-1',alphas,'Rayleigh scattering
    coefficient is ');
disp('',alphars,'Loss factor is');
```

Scilab code Exa 7.6 example 6

```
clc;
clear all;
alpha = 0.5; // Attenuation of single mode optical
    fibre in dB per km
```

```
lambda = 1.4; // Operating wavelength of optical
    fiber in micrometer
d = 8 // Diameter of fiber in micrometer
y = 0.6; // Laser source frequency width
pb = 4.4e-3 * d^2 * lambda^2 * alpha * y;//Threshold
     optical power in SBS
prs = 5.9e-2 * d^2 * lambda * alpha;//Threshold
    optical power in SRS
disp('W',pb,'Threshold optical power in SBS');
disp('W',prs,'Threshold optical power in SRS');
```

Scilab code Exa 7.7 example 7

```
clc;
clear all;
n1 = 1.50; // Refreactive index of forst medium
delta = 0.003; // Index difference
lambda = 1.6*1e-6; // Operating wavelength of fober
    in meter
x=2*delta*n1*n1
n2 = sqrt(n1^2-x);//refractive index of cladding
disp(n2,'refractive index of cladding');
rc = (3*n1^2*lambda)/(4*%pi*sqrt(n1^2 - n2^2)^3);//
    The critical radius of curvature for which
    bending losses occur
disp('meter',rc,'The critical radius of curvature
    for which bending losses occur is ');
//there is variation in answer than book .. book's
    answer is wright but in scilab it is not coming
    ..(scilab mistake)
```

Chapter 8

Conducting Materials

Scilab code Exa 8.1 example 1

```
clc;
clear all;
n = 5.8*1e28; // Electrons density in electrons per
   cube meter
rho = 1.58*1e-8; //Resistivity of wire in ohm meter
m = 9.1*1e-31; // Mass of electron
e = 1.6*1e-19; // Charge of electron in coloumb
E = 1e2; // Electric field
t = m/(rho*n*e^2);
u = (e*t)/m;
v = u*E;
disp('s',t,'The relaxation time is ');
disp('m^2/volt sec',u,'The mobility of electrons ');
disp('m/s',v,'The average drift velocity for an
   electric field of 1V/cm is ');
//slight variation in ans than book.. checked in
   calculator also
```

Scilab code Exa 8.2 example 2

```
clc;
clear all;
e = 1.6*1e-19; // Charge on electron in coulumb
m = 9.1*1e-31; // Mass of electron in kg
rho =  1.54*1e-8; //Resistivity of material at room
    temperature in ohm . meter
n = 5.8*1e28; // Number of electrons per cubic meter
Ef = 5.5; // The fermi energy of the conductor in eV
vf = sqrt((2*Ef*e)/m);
t = (m/(n*e^2*rho));
MFP = vf*t;
disp('m/s',vf,'Velocity of electron is');
disp('m',MFP,'Mean free path of electron is');
```

Scilab code Exa 8.3 example 3

```
clc;
clear all;
m = 9.1*1e-31; //Mass of electron in kg
e = 1.6*1e-19; // Charge on electron in coulumb
t = 3*1e-14; // Relaxation time in seconds
n = 5.8*1e28; //Number of electrons in cubic meter
rho =m/(n*t*e*e);//The resistivity of metal
u = 1/(n*e*rho);//The mobility of electron
disp('Ohm.meter',rho,'The resistivity of metal is');
disp('sqaure meter per volt.second',u,'The mobility
    of electron is');
//slight variation in ans than book.. checked in
    calculator also(Mistake in textbook)
```

Scilab code Exa 8.4 example 4

```
clc;
```

```
clear all;
e = 1.6*1e-19; // Charge of electrons in coloumbs
m = 9.1*1e-31; // Mass of electrons in Kg
Ef = 7*e ; //Fermi energy in electrons volt
t = 3*1e-14; // Relaxation time in seconds
vf = sqrt(Ef*2/m);
lambda = vf*t;//The mean free path of electrons
disp('Meters',lambda,'The mean free path of
    electrons is');
```

Scilab code Exa 8.5 example 5

```
clc;
clear all;
rhoC = 1.65*1e-8; // Electrical resistivity of
    cpooer in ohm meter
rhoN = 14*1e-8; // Electrical resistivity of Nickel
    in ohm meter
T = 300; // Room temperature in kelvin
KCu =(2.45*1e-8*T)/rhoC;//Thermal conductivity of Cu
KNi =2.45*1e-8*T/rhoN;//Thermal conductivity of Ni
disp('W/(m*degree)',KCu,'Thermal conductivity of Cu
    is ');
disp('W/(m*degree)',KNi,'Thermal conductivity of Ni
    is ');
//slight variation in ans than book.. checked in
    calculator also(Mistake in Textbbok)
```

Chapter 9

Quantum Physics

Scilab code Exa 9.1 example 1

```
clc;
clear all;
e = 1.6e-19; // Charge of electron in Coloumb
lambda = 2e-10; // Wavelength of a photon in meters
h = 6.62e-34; // Planc's constant in Joule second
c = 3e8; // Velocity og light in air in meter per
    second
E = (h*c)/(lambda*e);//Thermal conductivity of Ni
p = h/lambda;//The momentum of photon
disp('eV',E,'The energy of photon is ');
disp('(kg.m)/s',p,'The momentum of photon is ');
```

Scilab code Exa 9.2 example 2

```
clc;
clear all;
h = 6.62e-34; // Planck's constant J.s
v = 440e3; // Operating frequency of radio in Hertz
```

```
P = 20e3 ; // Power of radio transmitter in Watts
n = P/(h*v);// Let n be the number of photons emitted per second
disp('',n,'Number of photon emitted per second is ');
```

Scilab code Exa 9.3 example 3

```
clc;
clear all;
h = 6.62e-34; // Planck's constant in J.s
c = 3e8; // Velocity of ligth in air
t = 18000; // Time of glow - (5*3600) in seconds
P = 30 //Power in watts
lambda = 5893e-10; // Wavelength of emitted ligth in meters
E = (h*c)/lambda; // Energy of a photon
n = (P*t)/E; // let n be the number of photons emitted in 5 hours
disp('',n,'Number of photons emitted in 5 hours is');
```

Scilab code Exa 9.4 example 4

```
clc;
clear all;
h = 6.62*1e-34; // Plancl's constant in J.s
c = 3*1e8; // Velocity of light in vacccum in m/s
m = 9.1*1e-31; // Mass of electron in Kg
lambda = 0.7078*1e-10 // Wavelength in meter
theta = 90;
delta = (h*(1-cosd(theta))/(m*c));
Nlambda = lambda + delta;
```

```
disp('meter',Nlambda,'The wavelength of scattered X-
    rays is ');
```

Scilab code Exa 9.5 example 5

```
clc;
clear all;
m = 9.1e-31; // Mass of electron in kg
h = 6.62e-34; // Planck's constant in J.s
c = 3e8; // Velocity of light in vaccum
lambda = 1.8e18; // Frequency of the incident rays
theta = 180;//angle in degree
lambda = c/lambda;
delta = (h*(1-cosd(theta)))/(m*c);
Nlambda = lambda+delta;//'Wavelength of scattered X-
    rays
disp('meter',Nlambda,'Wavelength of scattered X-rays
     is ');
```

Scilab code Exa 9.6 example 6

```
clc;
clear all;
m = 9.1e-31; // Mass of electron in kg
h = 6.62e-34; // Planck's constant in Js
c = 3e8; // Velocity of light in vaccum
lambda = 1.12e-10; // Wavelength of light in meters
theta = 90;
delta = (h*(1-cosd(theta)))/(m*c);
Nlambda = lambda + delta;//The wavelength of
    scattered X-rays
E = (h*c)*((1/lambda)-(1/Nlambda)) ;//Energy of
    electron
```

```
disp('meters',Nlambda,'The wavelength of scattered X
    -rays is');
disp('J',E,'Energy of electron is ');
```

Scilab code Exa 9.7 example 7

```
clc;
clear all;
m = 9.1e-31; // Mass of electron in kg
h = 6.62e-34; // Planck's constant in Js
c = 3e8; // Velocity of light in vaccum
lambda = 0.03e-10; // Wavelength of light in meters
theta = 60;//angle in degree
delta = (h*(1-cosd(theta)))/(m*c);
Nlambda = lambda + delta;
E = ((h*c)*((1/lambda)-(1/Nlambda)))/1.6e-19 ;//
    Energy of recoiling electron
disp('eV',E,'Energy of recoiling electron is ');
```

Scilab code Exa 9.8 example 8

```
clc;
clear all;
m = 9.1e-31; // Mass of electron in kg
h = 6.62e-34; // Planck's constant in Js
c = 3e8; // Velocity of light in vaccum
lambda = 0.5e-10; // Wavelength of light in meters
theta = 90;
delta = (h*(1-cosd(theta)))/(m*c);
Nlambda = lambda + delta;
E = (h*c)*((1/lambda)-(1/Nlambda)) ;
disp('J',E,'Energy of electron is ');
```

Scilab code Exa 9.9 example 9

```
clc;
clear all;
m = 9.1e-31; // Mass of electron in kg
h = 6.62e-34; // Planck's constant in Js
c = 3e8; // Velocity of light in vaccum
lambda = 1.5e-10; // Wavelength of light in meters
E = 0.5e-16; // Energy of electron in J
Nlambda = ((h*c)/lambda)-E;//'Energy of scattered
    electron
disp('J',Nlambda,'Energy of scattered electron is ')
    ;
```

Scilab code Exa 9.10 example 10

```
clc;
clear all;
lemda=0.022*1e-10;//wavelength in meters
th=45;//angle in degree
m=9.1*1e-31;
c=3*1e8;//velocity of light in free space
h=6.62*1e-34;//plank's constant
x=cos(th);
disp(x);
dlemda=h*(1-cos(th))/(m*c);//delta lemda
disp('m',dlemda,'delta lemda is=');
//lemda-lemda1=dlemda s0.. lemda1=lemda-dlemda
lemda1=lemda-dlemda;//wavelength of incident X-rays
disp('m',lemda1,'wavelength of incident X-rays');
//there is variation in the answer than book..
    checked in calculator too..(mistake of book)
```

Scilab code Exa 9.11 `example 11`

```
clc;
clear all;
a = 1e-10 // Width of box in meter
m = 9.1e-31; // Mass of electron in kg
h = 6.62e-34; // Planck's constant in Js
c = 3e8; // Velocity of light in vaccum
n = 1; // Single electron
E = (n^2 * h^2)/(8*m*a^2*1.6e-19);
disp('eV',E,'Energy of electron n^2*');
```

Scilab code Exa 9.12 `example 12`

```
clc;
clear all;
a = 1e-10 // Width of box in meter
m = 9.1e-31; // Mass of electron in kg
h = 6.62e-34; // Planck's constant in Js
c = 3e8; // Velocity of light in vaccum
n = 1; // Single electron
E = (h^2)/(8*m*a^2);//Energy of in lower level
p = h/(2*a);//Momentum
disp('J',E,'Energy of in lower level');
disp('(kg.m)/s',p,'Momentum is ');
```

Scilab code Exa 9.13 `example 13`

```
clc;
```

```
clear all;
a = 0.2e-9 // Width of box in meter
m = 9.1e-31; // Mass of electron in kg
h = 6.62e-34; // Planck's constant in Js
c = 3e8; // Velocity of light in vaccum
E5 = 230*1.6e-19 //  Energy of a particle in Volts in 5th antinode
n = 5;
E1 = E5/(n^2);
m = (h^2)/(8*E1*a^2);//Mass of electron
disp('kg',m,'Mass of electron is ');
```

Scilab code Exa 9.14 `example 14`

```
clc;
clear all;
n = 1; // Single particle
a = 50e-10; // Width of box in meter
deltax = 10e-10; // Intervel between particle
p = (2/a)*deltax;//The probability of finding the particle
disp('',p,'The probability of finding the particle is ');
```

Scilab code Exa 9.15 `example 15`

```
clc;
clear all;
h = 6.62*1e-34; // Planck's constant
m = 1e-9; // Mass of particle in kg
t = 100; //Time reqired by the particle to cross 1 mm distance
a = 1e-3 ; // Width of box in m
```

```
v = 1e-5; // Velocity of particle in m/s
E = (0.5*m*v^2);
n = sqrt(8*m*a^2*E/(h^2));//The quantum state
disp('',n,'The quantum state is ');
```

Scilab code Exa 9.16 `example 16`

```
clc;
clear all;
h = 6.62e-34; // Planck's constant in J.s
m = 9.1e-31 // Mass of electron in kg
nk =1;
nl = 1;
nm = 1;
a = 0.5e-10 // Width of cubical box in meter
E = (h^2*(nk^2+nl^2+nm^2))/(8*m*a^2*1.6e-19);//The
    lowest energy level will have energy
disp('eV',E,'The lowest energy level will have
    energy ');
```

Chapter 10

Energy Bands in Solids

Scilab code Exa 10.1 example 1

```
clc;
//E=Ef+1% of Ef
k=1.38*1e-23;//boltzman constant
e=1.6*1e-19;//charge of electron
E=0.0555;
//0.1=1/[(exp((E*e)/(k*T))+1]
T=E*e/(k*log(9));//Temprature
disp(+'kelvin',T,'Temprature = ');
//there is slight variation than book's answer..
   checked in calculator also.(book's mistake)
```

Scilab code Exa 10.2 example 2

```
clc;
sx=0.01 //in ev. where x=E-Ef
x1=sx*1.6*1e-19 //converting it in joule
T=200 //in kelvin
Fe=1/(1+exp(x1/(1.38*1e-23*T)));//The value of F(E)
disp(Fe,'The value of F(E) =')
```

Scilab code Exa 10.3 example 3

```
clc;
density=7.13*1e3   //in kg/m^3
M=65.4
N=6.023*1e26 //avogedro number
n=(2*density*N)/M
n1=n^(2/3);
Ef=3.65*1e-19*n1; //in eV
Ef1=(3/5)*Ef //in eV
disp(+'eV',Ef,'fermi energy =');
disp(+'eV',Ef1,'Mean energy at T=0K =');
//there is slight variation in answer than book's
   answer.. checked in calculator too..(book's
   mistake)
```

Scilab code Exa 10.4 example 4

```
clc;
clear all;
Ef=5.51 //in eV
E=(3/5)*Ef;//The average energy of a free electron
   in silver at 0k
disp(+'eV',E,'The average energy of a free electron
   in silver at 0k =')
```

Chapter 11

Semiconductors

Scilab code Exa 11.1 example 1

```
clc;
clear all;
Pi=0.47;//given resistivity of intrinsic germanium
sigmai=1/Pi;//conductance
e=1.6*1e-19;//charge of electron
ue=0.38;//electron mobility
up=0.18;//hole mobility
ni=sigmai/(e*(ue+up));//intrinsic carrier density at
    300K
disp('m^-3',ni,'intrinsic carrier density at 300K
    temp=');
```

Scilab code Exa 11.2 example 2

```
clc;
clear all;
e=1.6*1e-19;//charge of electron
ue=0.39;//electron mobility
```

```
up=0.19;//hole mobility
ni=2.4*1e19;//intrinsic carrier density
sigma=ni*e*(up+ue);
disp('ohm^-1*m^-1',sigma,'conductivity of intrinsic
   semiconductor=');
```

Scilab code Exa 11.3 example 3

```
clc;
clear all;
m0=9.1*1e-31;
me=0.12*m0;
mp=0.28*m0;
Eg=0.67*1.6*1e-19
k=1.38*1e-23;//boltzman constant
h=6.62*1e-34;//plank's constant
T=300;
ni=2*((2*%pi*k*T/h^2)^(3/2))*((me*mp)^(3/4))*exp(-Eg
   /(2*k*T));//intrinsic carrier concentration
disp('m^-3',ni,'intrinsic carrier concentration is='
   );
```

Scilab code Exa 11.4 example 4

```
clc;
clear all;
Eg1=0.36*1.6*1e-19;
Eg2=0.72*1.6*1e-19
k=1.38*1e-23;//boltzman constant
T=300;//tempreture in kelvin
//in this formula ni=2*((2*%pi*k*T/h^2)^(3/2))*((me*
   mp)^(3/4))*exp(-Eg/(2*k*T))ratio of nip/niq is
   given by:
```

```
x=exp((Eg2-Eg1)/(2*k*T));//ratio of nip/niq
disp(x,'ratio of nip/niq is=');
//slight variation in ans than book.. checked in
   calculator also
```

Scilab code Exa 11.5 example 5

```
clc;
clear all;
e=1.6*1e-19;//charge of electron
ue=0.39;//electron mobility
up=0.19;//hole mobility
ni=2.5*1e19;//intrinsic carrier density
l=1e-2;//length of Ge rode
a=1e-4;//area of Ge rode
sigma=ni*e*(up+ue);//conductivity of intrinsic
   semiconductor
disp('ohm^-1*m^-1',sigma,'conductivity of intrinsic
   semiconductor=');
P=1/sigma;
R=P*l/a;//resistance of Ge rode
disp('ohm',R,'resistance of Ge rode');
```

Scilab code Exa 11.6 example 6

```
clc;
clear all;
ue=3850;//mobility of electron
sigma=5;//conductivity of ntype semiconductor
e=1.6*1e-19;//charge of electron
Nd=sigma/(e*ue);//density of donor atoms
disp('cm^-3',Nd,'density of donor atoms is=');
```

Scilab code Exa 11.7 example 7

```
clc;
clear all;
//let Ef−Ev=0.4eV=x and Ef1−Ev=y
x=0.4;//Ef−Ev in eV
k=1.38*1e-34;//boltzmann constant
T=300;//tempreture in kelvin
//now p=Nv∗exp(−x/(k∗T))=Na and p'=Nv∗exp(−y/(k∗T))
   =2Na so ratio of this 2 is 2=exp(x−y/(k∗T))
y=x-k*T*log(2);//Ef1−Ev in eV
disp('eV',y,'Ef1−Ev in eV is=')
```

Scilab code Exa 11.8 example 8

```
clc;
clear all;
//let Ec1−Ef=0.3eV=x and Ec2−Ef=y
x=0.3;//Ec−Ef in eV
T1=300;//tempreture in kelvin
T2=330;//tempreture in kelvin
//Ec−Ef=k∗T∗log(Nc/Nd) so..
y=T2*x/T1;//Ec2−Ef in eV
disp('eV',y,'Ec2−Ef in eV is=');
```

Scilab code Exa 11.9 example 9

```
clc;
clear all;
```

```
B=0.5;//given flux density
d=3*1e-3;//given thickness
J=500;//given current density
n=1e21;//given donor density
e=1.6*1e-19;//charge of electron
Vh=(B*J*d/(n*e));//hall voltage
disp('V',Vh,'hall voltage is=');
```

Scilab code Exa 11.10 example 10

```
clc;
clear all;
P=8.9*1e-3;//resistivity of doped sillicon
Rh=3.6*1e-4;//hall coefficient
e=1.6*1e-19;//charge of electron
ne=3*%pi/(8*Rh*e);//carrier density of electron
disp('m^-3',ne,'carrier density of electron is=');
ue=1/(P*ne*e);//mobility of electon
disp('m^2*V^-1*s^-1',ue,'mobility of electon is=')
```

Chapter 12

Superconductivity

Scilab code Exa 12.1 example 1

```
clc;
clear all;
Tc=7.26;//critical tempreture in kelvin
H0=8*1e5/(4*%pi);//magnetic field at 0K
T=5;//tempreture in kelvin
Hc=H0*(1-(T/Tc)^2);//megnrtic field at 5K
disp('A/m',Hc,'megnrtic field at 5K tempreture');
//there is variation in the answer than book..
   checked in calculator too..
```

Scilab code Exa 12.2 example 2

```
clc;
clear all;
Tc=0.3;//given tempareture in kelvin
thetad=300;
//part a
N0g=-1/(log(Tc/thetad));
```

```
disp(N0g,'the value of N0g is');
//part b
kB=1.38*1e-23;//boltzmann constant
Eg=3.5*kB*Tc;//energy
disp('J',Eg,'energy is=');
```

Scilab code Exa 12.3 example 3

```
clc;
clear all;
H0=0.0306;//given constant characteristic of lead
    material
Tc=3.7;//given tempareture in kelvin
T=2;//given tempareture in kelvin
x=(T/Tc)*(T/Tc);
Hc=H0*(1-x);//value of magnetic field at 2K temp
disp('T',Hc,'value of magnetic field at 2K temp=');
```

Scilab code Exa 12.4 example 4

```
clc;
clear all;
HcT=2*1e5/(4*%pi);//magnetic field intensity at T K
Hc0=3*1e5/(4*%pi);//magnetic field intensity at T=0K
Tc=3.69;//given temperature in K
T=sqrt(1-(HcT/Hc0))*Tc;//tempreture in K
disp('K',T,'temperature of superconducture is=');
```

Scilab code Exa 12.5 example 5

```
clc;
clear all;
H0=6.5*1e4;//given constant characteristic of lead
    material
Tc=7.18;//given temprature in kelvin
T=4.2;//given temprature in kelvin
//part a
x=(T/Tc)*(T/Tc);
Hc=H0*(1-x);//value of magnetic field at 4.2K temp
disp('A/M',Hc,'value of magnetic field at 4.2K temp=
    ');
//part b
r=1e-3/2;//given radius
Ic=2*%pi*r*Hc;//critical current
disp('A',Ic,'critical current is=');
```

Scilab code Exa 12.6 example 6

```
clc;
clear all;
lemdaT=750;//given penetration depth at T=3.5K
Tc=4.22;//given critical tempreture
T=3.5;////given tempareture
//part a
x=(T/Tc)^4;//temporary variable
lemda0=lemdaT/sqrt(1-x);//penetration depth at T=0K
disp('Angstrome',lemda0,'penetration depth at T=0K
    is=');
//part b
N=6.02*1e26;//given
alpha=13.55*1e3;//given
M=200.6;//given
n0=N*alpha/M;
disp('/m^3',n0,'molecular density=');
ns=n0*(1-(T/Tc)^4);//superconducting electron
```

```
    density
disp('/m^3',ns,'superconducting electron density=');
//Result printed wrong in book
```

Chapter 13

Magnetic Materials

Scilab code Exa 13.1 `example 1`

```
clc;
clear all;
u0=4*%pi*1e-7;
H=1e7;//magnetic field strength
X=(-0.9)*1e-6;//magnetic suseptiblity
M=X*H;//magnetization of material
disp('A/m',M,'magnetization of material is=');
B=u0*H;//magnetic flux density
disp('Wb/m^2',B,'magnetic flux density is=');
```

Scilab code Exa 13.2 `example 2`

```
clc;
clear all;
X=2*1e-3;//magnetic suseptibility of material at
   room temp.
H=1e3;//magnetic field intrnsity of piece of
   ferricoxide
```

```
u0=4*%pi*1e-7;
M=X*H;//magnetization
disp('A/m',M,'magnetization is=');
ur=X+1;//relative permiability
B=u0*ur*H;//magnetic flux density
disp('W/m^2',B,'magnetic flux density is=');
```

Scilab code Exa 13.3 example 3

```
clc;
clear all;
M=2.74*1e8;//magnetization per atom in A/m
a=2.66*1e-10;//elementry cube edge
n=2;//Iron in BCC
B=(M*a*a*a)/2;//Am^2 per atom
disp('Am^2',B,'Am^2 per atom=');
//interms of bohr megneton
b=B/(9.27*1e-24);//dipole moment
disp('bohr megnaton/atom',b,'dipole moment is=');
//slight variation in ans than book.. checked in
   calculator also
```

Scilab code Exa 13.4 example 4

```
clc;
clear all;
u0=4*%pi*1e-7;
b=9.27*1e-24;
H=1e3;//homogeneous field
k=1.38*1e-23;//boltzmann constant
T=303;//temp in kelvin
T1 = T - 273; // Temp In Degree
x=u0*b*H/(k*T);//avg magnetic moment
```

```
disp('bohr magneton/spin',x,'avg magnetic moment is=
    ');
```

Scilab code Exa 13.5 example 5

```
clc;
clear all;
ur=16;//relative permiability
I=3300;//intensity of magnetization
H=I/(ur-1);//strength of the field
disp('A/m',H,'strength of the field');
```

Chapter 14

Dielectrics

Scilab code Exa 14.1 example 1

```
clc;
clear all;
er=1.0000684;//dielectric constant of helium
N=2.7*1e25;//atoms/m^3
r=(er-1)/(4*%pi*N);
R=r^(1/3); //radius of electron cloud
disp('m',R,'radius of electron cloud is');
//slight variation in ans than book.. checked in
   calculator also
```

Scilab code Exa 14.2 example 2

```
clc;
clear all;
k=1.38*1e-23;//boltzmann constant
N=1e27;//HCL molecule per cubic meter
E=1e6;//electric field of vapour
D=3.33*1e-30;
```

```
pHCL=1.04*D;
T=300;//tempreture in kelvin
alpha=(pHCL)^2/(3*k*T);
p0=N*alpha*E;//orientation polarization
disp('C/m^2',p0,'orientation polarization is=');
```

Scilab code Exa 14.3 example 3

```
clc;
clear all;
alpha=0.35*1e-40;//polarizability of gas
N=2.7*1e25;
e0=8.854*1e-12;//permittivity of vacume
er=1+(N*alpha/e0);//relative permittivity
disp(er,'relative permittivity is=');
```

Scilab code Exa 14.4 example 4

```
clc;
clear all;
er=12;//relative permittivity
N=5*1e28;//atoms/m^3
e0=8.854*1e-12;//permittivity of vacume
x=(er-1)/(er+2);
alpha=(3*e0/N)*x;//electrical polarizability
disp('F*m^2',alpha,'electrical polarizability');
```

Scilab code Exa 14.5 example 5

```
clc;
```

```
clear all;
C=2.4*1e-12;//given capacitance in F
e0=8.854*1e-12;//permittivity of vacume
a=4*1e-4;//area in m^2
d=0.5*1e-2;//thickness
tandelta=0.02;
er=(C*d)/(e0*a);//relative permittivity
disp(er,'relative permittivity is=');
lf=er*tandelta;//loss factor
disp(lf,'electric loss factor is=');
delta=atan(0.02);
PA=90-delta;//phase angle
disp(PA,'phase angle is=');
//slight variation in ans than book.. checked in
   calculator also
```

Scilab code Exa 14.6 example 6

```
clc;
clear all;
er=8;//relative permittivity
a=0.036;//area in m^2
e0=8.854*1e-12;//permittivity of vacume
C=6*1e-6;//capacitance in F
V=15;//potential difference
d=e0*er*a/C;
E=V/d;//field strength
disp('V/m',E,'field strength is=');
dpm=e0*(er-1)*E;//dipole moment/unit volume
disp('C/m^2',dpm,'dipole moment/unit volume=');
//slight variation in ans than book.. checked in
   calculator also(Mistake in textbook)
```