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

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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

Elasticity

Scilab code Exa 1.1 example 1

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

Scilab code Exa 1.2 example 2

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

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

Scilab code Exa 1.3 example 3

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

Scilab code Exa 1.4 example 4

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

9

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

Scilab code Exa 1.5 example 5

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

Scilab code Exa 1.6 example 6

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

Scilab code Exa 1.7 example 7

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

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

Scilab code Exa 1.8 example 8

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

Scilab code Exa 1.9 example 9

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

Scilab code Exa 1.10 example 1

```
1 clc;
2 clear all;
```

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

Scilab code Exa 1.11 example 11

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

Scilab code Exa 1.12 example 12

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

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

Scilab code Exa 1.13 example 13

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

Scilab code Exa 1.14 example 14

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

Scilab code Exa 1.15 example 15

13

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

Scilab code Exa 1.16 example 16

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

Scilab code Exa 1.17 example 17

```
1 clc ;
```

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

Scilab code Exa 1.18 example 18

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

Chapter 2

Acoustics Of Buildings

Scilab code Exa 2.1 example 1

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

Scilab code Exa 2.2 example 2

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

16

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

Scilab code Exa 2.3 example 3

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

Scilab code Exa 2.4 example 4

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

Scilab code Exa 2.5 example 5

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

Scilab code Exa 2.6 example 6

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

Scilab code Exa 2.7 example 7

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

Scilab code Exa 2.8 example 8

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

Scilab code Exa 2.9 example 9

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

Scilab code Exa 2.10 example 10

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

```scilab
 8  disp (+ ' second ' ,T1 , ' Reverbaration  time  ( empty  hall ) =
        ' ) ;
 9  disp (+ ' second ' ,T2 , ' Reverbaration  time  with  full
        capacity =' ) ;
10  // 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

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

Scilab code Exa 3.2 example 2

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

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

Scilab code Exa 3.3 example 3

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

Scilab code Exa 3.4 example 4

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

Chapter 4

Crystal Physics

Scilab code Exa 4.1 example 1

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

Scilab code Exa 4.2 example 2

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

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

Scilab code Exa 4.3 example 3

```
1 clc;
2 //let three intercepts are I1,I2,I3
3 I1=3;
4 I2=-2;
5 I3=3/2;
6 //let their reciprocals are I1_1,I2_1,I3_1
7 I1_1=1/I1;
8 I2_1=1/I2;
9 I3_1=1/I3;
10 //LCM of I1_1,I2_1,I3_1 are 6 .
11 //By multiply LCM with I1_!,I2_1,I3_1 we will get
      miller indices
12 LCM=6;
13 M_1=LCM*I1_1;
14 M_2=LCM*I2_1 ;
15 M_3=LCM*I3_1;
16 disp(M_1,'Miller indices of plane =');
17 disp(M_2);
18 disp(M_3);
```

Scilab code Exa 4.4 example 4

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

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

Scilab code Exa 4.5 example 5

```
1  clc ;
2  h =1
3  k =1
4  l =1
5  h1 =1
6  k1 =1
7  l1 =1
8  a =(( h * h1 ) -( k * k1 )+( l * l1 ))/( sqrt (( h * h )+( k * k )+( l * l ))*
      sqrt (( h1 * h1 )+( k1 * k1 )+( l1 * l1 )));
9  // cosine  angle =a  so  angle = cosine  inverse  of  a
10 thita = acosd ( a );// angle  between  two  planes
11 disp (+ 'degree ', thita , 'angle  between  two  planes =')
```

Scilab code Exa 4.6 example 6

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

Scilab code Exa 4.7 example 7

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

Scilab code Exa 4.8 example 8

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

Scilab code Exa 4.9 example 9

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

```
 5  h =1;
 6  k =1;
 7  l =1;
 8  // d111=a/ sqrt ((h*h)+(k*k)+(l*l))
 9  //2 dsin ( thita )=n* lamda
10  d=n* lamda /(2* sind ( thita ));
11  a=sqrt (3)*d;// lattice  constant
12  disp (+ 'meters ',a*1e-10 ," lattice  constant =")
```

Scilab code Exa 4.10 example 10

```
 1  clc ;
 2  // let  three  intercepts  are  I1 ,I2 ,I3
 3  I1 =0.96;
 4  I2 =0.64;
 5  I3 =0.48;
 6  // as  they  are  ratios  we  will  multiply  by  some  some
        constants  so  that   it  will  become  integers
 7  I1 =6;
 8  I2 =4;
 9  I3 =3  ;
10  // let  their  reciprocals  are  I1_1 ,I2_1 ,I3_1
11  I1_1 =1/ I1 ;
12  I2_1 =1/ I2 ;
13  I3_1 =1/ I3 ;
14  // LCM of  I1_1 ,I2_1 ,I3_1  are  12.
15  // By  multiply  LCM with  I1_! ,I2_1 ,I3_1  we  will  get
        miller  indices
16  LCM =12;
17  M_1 = LCM * I1_1 ;
18  M_2 = LCM * I2_1  ;
19  M_3 = LCM * I3_1 ;
20  disp (M_1 ,' Miller  indices  of  plane =');
21  disp (M_2 );
22  disp (M_3 );
```

Chapter 5

Wave Optics

Scilab code Exa 5.1 example 1

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

Scilab code Exa 5.2 example 2

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

Scilab code Exa 5.3 example 3

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

Scilab code Exa 5.4 example 4

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

Scilab code Exa 5.5 example 5

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

Scilab code Exa 5.6 example 6

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

Scilab code Exa 5.7 example 7

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

Scilab code Exa 5.8 example 8

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

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Chapter 6

Lasers

Scilab code Exa 6.1 example 1

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

Scilab code Exa 6.2 example 2

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

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

Scilab code Exa 6.3 example 3

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

Chapter 7

Optical Fiber Communication

Scilab code Exa 7.1 example 1

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

Scilab code Exa 7.2 example 2

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

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

Scilab code Exa 7.3 example 3

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

Scilab code Exa 7.4 example 4

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

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

Scilab code Exa 7.5 example 7

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

Scilab code Exa 7.6 example 6

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

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

Scilab code Exa 7.7 example 7

```
1  clc;
2  clear all;
3  n1 = 1.50; // Refreactive index of forst medium
4  delta = 0.003; // Index difference
5  lambda = 1.6*1e-6; // Operating wavelength of fober
       in meter
6  x=2*delta*n1*n1
7  n2 = sqrt(n1^2-x);//refractive index of cladding
8  disp(n2,'refractive index of cladding');
9  rc = (3*n1^2*lambda)/(4*%pi*sqrt(n1^2 - n2^2)^3);//
       The critical radius of curvature for which
       bending losses occur
10 disp('meter',rc,'The critical radius of curvature
       for which bending losses occur is ');
11 //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

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

Scilab code Exa 8.2 example 2

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

Scilab code Exa 8.3 example 3

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

Scilab code Exa 8.4 example 4

```
1  clc ;
```

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

Scilab code Exa 8.5 example 5

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

Chapter 9

Quantum Physics

Scilab code Exa 9.1 example 1

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

Scilab code Exa 9.2 example 2

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

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

Scilab code Exa 9.3 example 3

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

Scilab code Exa 9.4 example 4

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

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

Scilab code Exa 9.5 example 5

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

Scilab code Exa 9.6 example 6

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

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

Scilab code Exa 9.7 example 7

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

Scilab code Exa 9.8 example 8

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

Scilab code Exa 9.9 example 9

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

Scilab code Exa 9.10 example 10

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

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Scilab code Exa 9.11 example 11

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

Scilab code Exa 9.12 example 12

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

Scilab code Exa 9.13 example 13

```
1 clc;
```

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

Scilab code Exa 9.14 example 14

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

Scilab code Exa 9.15 example 15

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

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

Scilab code Exa 9.16 example 16

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

Chapter 10

Energy Bands in Solids

Scilab code Exa 10.1 example 1

```
1 clc;
2 //E=Ef+1% of Ef
3 k=1.38*1e-23; //boltzman constant
4 e=1.6*1e-19; //charge of electron
5 E=0.0555;
6 //0.1=1/[(exp((E*e)/(k*T)))+1]
7 T=E*e/(k*log(9)); //Temprature
8 disp(+'kelvin',T,'Temprature = ');
9 //there is slight variation than book's answer..
      checked in calculator also.(book's mistake)
```

Scilab code Exa 10.2 example 2

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

Scilab code Exa 10.3 example 3

```scilab
1  clc ;
2  density =7.13*1 e3    // in  kg/mˆ3
3  M=65.4
4  N=6.023*1 e26 // avogedro  number
5  n=(2*density*N)/M
6  n1=nˆ(2/3);
7  Ef =3.65*1 e-19*n1 ; // in  eV
8  Ef1 =(3/5)*Ef  // in  eV
9  disp (+'eV ',Ef ,'fermi  energy  =');
10 disp (+'eV ',Ef1 ,'Mean  energy  at  T=0K =');
11 // there  is  slight  variation  in  answer  than  book's
       answer ..  checked  in  calculator  too ..( book's
       mistake )
```

Scilab code Exa 10.4 example 4

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

Chapter 11

Semiconductors

Scilab code Exa 11.1 example 1

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

Scilab code Exa 11.2 example 2

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

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

Scilab code Exa 11.3 example 3

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

Scilab code Exa 11.4 example 4

```
1  clc;
2  clear all;
3  Eg1 =0.36*1.6*1e-19;
4  Eg2 =0.72*1.6*1e-19
5  k =1.38*1e-23; //boltzman constant
6  T =300; //tempreture in kelvin
7  //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:
```

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

Scilab code Exa 11.5 example 5

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

Scilab code Exa 11.6 example 6

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

Scilab code Exa 11.7 example 7

```
1 clc;
2 clear all;
3 //let Ef-Ev=0.4eV=x and Ef1-Ev=y
4 x=0.4;//Ef-Ev in eV
5 k=1.38*1e-34;//boltzmann constant
6 T=300;//tempreture in kelvin
7 //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))
8 y=x-k*T*log(2);//Ef1-Ev in eV
9 disp('eV',y,'Ef1-Ev in eV is=')
```

Scilab code Exa 11.8 example 8

```
1 clc;
2 clear all;
3 //let Ec1-Ef=0.3eV=x and Ec2-Ef=y
4 x=0.3;//Ec-Ef in eV
5 T1=300;//tempreture in kelvin
6 T2=330;//tempreture in kelvin
7 //Ec-Ef=k*T*log(Nc/Nd) so..
8 y=T2*x/T1;//Ec2-Ef in eV
9 disp('eV',y,'Ec2-Ef in eV is=');
```

Scilab code Exa 11.9 example 9

```
1 clc;
2 clear all;
```

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

Scilab code Exa 11.10 example 10

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

Chapter 12

Superconductivity

Scilab code Exa 12.1 example 1

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

Scilab code Exa 12.2 example 2

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

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

Scilab code Exa 12.3 example 3

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

Scilab code Exa 12.4 example 4

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

Scilab code Exa 12.5 example 5

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

Scilab code Exa 12.6 example 6

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

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

Chapter 13

Magnetic Materials

Scilab code Exa 13.1 example 1

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

Scilab code Exa 13.2 example 2

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

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

Scilab code Exa 13.3 example 3

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

Scilab code Exa 13.4 example 4

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

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

Scilab code Exa 13.5 example 5

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

Chapter 14

Dielectrics

Scilab code Exa 14.1 example 1

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

Scilab code Exa 14.2 example 2

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

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

Scilab code Exa 14.3 example 3

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

Scilab code Exa 14.4 example 4

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

Scilab code Exa 14.5 example 5

```
1 clc;
```

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

Scilab code Exa 14.6 example 6

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