Scilab Textbook Companion for Applied Physics-ii by H. J. Sawant[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.

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List of Scilab Codes

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Chapter 1

Interference of Light

Scilab code Exa 1.2.1 find the wavelength of light in the visible spectrum

```
1  //Chapter-1,Example1_2_1 ,pg 1-11
2
3  i=45                                    //angle of
       incidence
4
5  u=1.2                                         //
       refractive index of soap film
6
7  t=4*10^-5                                      //
       thickness of soap film
8
9  r=asind(sind(i)/u)                            //by
        Snell's law
10
11  //for dark band    '2*u*t*cos(r) = n*lam'
12
13  wavelength_1=(2*u*t*cosd(r)/1)*10^8
                              //for n=1
14
15  wavelength_2=(2*u*t*cosd(r)/2)*10^8
                              //for n=2
```

```
16
17  wavelength_3=(2*u*t*cosd(r)/3)*10^8
                                  //for n=3
18
19  //visible range of wavelengths is 4000 A.   to   7000
        A.
20
21  printf('\n for n=1  wavelength = %.1f A.\n',
        wavelength_1)
22
23  printf('\n for n=2  wavelength = %.1f A.\n',
        wavelength_2)
24
25  printf('\n for n=3  wavelength = %.2f A.\n',
        wavelength_3)
26
27  printf('\n hence, none of the wavelengths from the
        visible region are absent in reflected light ')
```

Scilab code Exa 1.2.2 find the wavelength of light in the visible spectrum

```
1  //Chapter-1,Example1_2_2 ,pg 1-12
2
3  u=1.33                                    //
        refractive index of soap film
4
5  t=5*10^-5                                 //thickness
        of soap film
6
7  //for normal incidence
8
9  r=0                                       //angle of
        refraction
10
11 //for constructive interference        '2*u*t*cos(r)
```

```
        = (2*n-1)*wavelength/2'
12
13  wavelength_1=(2*u*t*cos(r)*2/(2*1-1))*10^8
                    //for    n=1
14
15  wavelength_2=(2*u*t*cos(r)*2/(2*2-1))*10^8
                    //for    n=2
16
17  wavelength_3=(2*u*t*cos(r)*2/(2*3-1))*10^8
                    //for    n=3
18
19  wavelength_4=(2*u*t*cos(r)*2/(2*4-1))*10^8
                    //for    n=4
20
21  //visible range of wavelengths is 4000 A.  to   7000
        A.
22
23  printf('\n for n=1   wavelength = %.1f A.\n',
        wavelength_1)
24
25  printf('\n for n=2   wavelength = %.1f A.\n',
        wavelength_2)
26
27  printf('\n for n=3   wavelength = %.1f A.\n',
        wavelength_3)
28
29  printf('\n for n=4   wavelength = %.1f A.\n',
        wavelength_4)
30
31  printf('\n The wavelength will be reflected is
        wavelength = %.1f A.\n',wavelength_3)
```

Scilab code Exa 1.2.3 find the order of interference band

```
1  //Chapter-1,Example1_2_3 , pg  1-12
```

```
 2
 3  u =4/3                                     //
       refractive  index  of  soap  film
 4
 5  t =1.5*10^ -4                              //
       thickness  of  soap  film
 6
 7  wavelength =5*10^ -5                             //
       wavelength  of  light
 8
 9  i =45                                //angle  of
       incidece
10
11  r= asind ( sind (i )/u )                      //by
       Snell 's  law
12
13  n=2* u*t* cosd (r )/ wavelength
       // for  nth  dark  band
14
15  printf ("\n  the  order  of  an  interference  band  is  n =
       %.0 f",n)
```

Scilab code Exa 1.2.4 find the thickness of soap film

```
 1  // Chapter −1, Example1_2_4 , pg  1−13
 2
 3  // for  constructive  interference    2 u  t  cos (r )  =  (2
       n  −1)  wavelength /2
 4
 5  u =1.33
 6
 7  i =45
 8
 9  r= asind ( sind (i )/u )                        //by
       Snell 's  law
```

```
10
11  n =1                                        // for
        minimum  thickness
12
13  wavelength =5896*10^ -8
14
15  t =(2* n -1) * wavelength /(4* u * cosd ( r ))
16
17  printf (" \n  the  minimum  thickness  of  soap  film  is  t  =
        %.7 f  cm" ,t )
```

Scilab code Exa 1.2.5 find the thickness of oil layer

```
1  // Chapter −1 , Example1_2_5 , pg  1 −14
2
3  u =1 .3                                       //
        refractive  index  of  liquid
4
5  r =0                                          // angle
        of  refraction  for  normal  incidence
6
7  wavelength_1 =7000                            //
        wavelength  of  light
8
9  wavelength_2 =5000                            //
        wavelength  of  light
10
11  // for  destructive  interference     '2* u * t * cos ( r )  =
        (2* n −1)* wavelength /2 '
12
13  // 'n'  order  for  'wavelength_1 '  and  'n+1'  order  for  '
        wavelength_2 '
14
15  // as  LHS   is  same  for  both  the  wavelengths ,
        therefore
```

```
16
17  //(2*n-1)*7000/2  =(2*(n+1)-1)*5000/2
18
19  n=3                                        //number
        of  orders
20
21  t=((2*n)-1)*wavelength_1/(4*u*cosd(r))
22
23  printf('\nThe  thickness  of  oil  layer  is  t = %.2f A.'
        ,t)
```

Scilab code Exa 1.2.6 find the thickness of film

```
1  //Chapter-1,Example1_2_6 ,pg  1-15
2
3  n=8
4
5  wavelength=5890*10^-8                       //
        wavelength  of  light
6
7  u=1.46                                      //refractive
        index  of  oil
8
9  i=30                           //angle  of  incidence
10
11  r=asind(sind(i)/u)                     //by  Snell 's
        law
12
13  t=n*wavelength/(2*u*cosd(r))
14
15  printf("\n  the  thickness  of  an  oil  film  is  t =%.7f
        cm",t)
```

Scilab code Exa 1.2.7 `find the minimum thickness of film`

```
1  //Chapter-1,Example1_2_7 ,pg 1-15
2
3  u=1.5                                    //refractive
       index of thin film
4
5  r1=60                              //angle of refraction
6
7  wavelength=5890*10^-8                          //
       wavelength of light
8
9  n=1                                     //for minimum
       thickness
10
11 t1=n*wavelength/(2*u*cosd(r1))
12
13 printf("\n the thickness of an oil film is t =%.7f
       cm",t1)
14
15 r2=0                                   //for normal
       incidence
16
17 t2=n*wavelength/(2*u*cosd(r2))
18
19 printf("\n the thickness of an oil film is t =%.7f
       cm",t2)
```

Scilab code Exa 1.2.8 `find the refractive index of oil`

```
1  //Chapter-1,Example1_2_8 ,pg 1-16
2
3  V=0.2                                 //volume of oil
4
5  A=10^4                                //area
```

14

```
6
7  t=V/A                                          //Thickness of
       oil film
8
9  r=0                                            //for normal
       incidence
10
11 n=1                                            //for 1st dark
       band
12
13 wavelength=5.5*10^-5                               //
       wavelength of light
14
15 u=n*wavelength/(2*t*cosd(r))
16
17 printf('\nrefractive index of oil is  u = %.3f',u)
```

Scilab code Exa 1.2.9 find the wavelength of light in the visible region

```
1  //Chapter−1,Example1_2_9 ,pg 1−17
2
3  u=1.2                                          //refractive
       index of oil film
4
5  t=2*10^-7                                      //thickness
       of oil film
6
7  r=60                              //angle of refraction
8
9  //for destructive interference    '2*u*t*cos(r) =
       (2*n−1)*wavelength/2'
10
11 wavelength_1=(2*u*t*cosd(r)*2/(2*1-1))*10^10
                   //for    n=1
12
```

```
13  wavelength_2 = (2*u*t*cosd(r)*2/(2*2-1))*10^10
                          //for    n=2
14
15  wavelength_3 = (2*u*t*cosd(r)*2/(2*3-1))*10^10
                          //for    n=3
16
17  //visible  range  of  wavelengths  is  4000*10^-10 m   to
        7000*10^-10 m
18
19  printf('\n for  n=1   wavelength = %.f A.\n',
        wavelength_1)
20
21  printf('\n for  n=2   wavelength = %.f A.\n',
        wavelength_2)
22
23  printf('\n for  n=3   wavelength = %.f A.\n',
        wavelength_3)
24
25  printf('\n The  wavelength  will  be  reflected  is
        wavelength = %.f A.\n',wavelength_1)
```

Scilab code Exa 1.3.1 find wavelength of monochromatic light

```
1  //Chapter-1,Example1_3_1 ,pg  1-21
2
3  N=10
       //no  of  dark  fringes
4
5  d=1.2
       //distance  between  consecutive  fringes
6
7  B_air=d/N
                                                    //
       fringe  width  in  air
8
```

16

```
9  a =(40/3600) *(% pi /180)
      // angle made by film in radians
10
11  wavelength =2* a * B_air
                                            // as
      fringe width in air is      'B_air = wavelength
      /(2*a) '
12
13  printf(" \nThe wavelength of monochromatic light is =
      %.8 f cm \n" ,wavelength)
```

Scilab code Exa 1.3.2 calculate the angle of wedge

```
1  // Chapter −1, Example1_3_2 , pg 1−22
2
3  wavelength =5893*10^-8

      // wavelength of light
4
5  B=0.1

      // fringe width
6
7  u=1.52

      // refractive index of glass wedge
8
9  a =( wavelength /(2* u * B )) *3600 *(180/% pi )
                                            // as fringe
      spacing is      'B = wavelength /(2*a*u) '
10
11  printf(" \nThe angle of wedge is   a =%.2 f seconds \n"
      ,a)
```

Scilab code Exa 1.3.3 `calculate the wavelength of light`

```
1  //Chapter-1,Example1_3_3,pg 1-22
2
3  B=0.25
       //fringe width
4
5  u=1.4
       //refractive index of film
6
7  a=(20/3600)*(%pi/180)
                                     //
       angle made by film in radians
8
9  wavelength=2*a*B*u
       //as fringe width is    'B = wavelength/(2*a*u)'
10
11 printf("\nThe wavelength of monochromatic light is =
       %.8f cm\n",wavelength)
```

Scilab code Exa 1.3.4 `find the number of fringes`

```
1  //Chapter-1,Example1_3_4,pg 1-23
2
3  wavelength=5.82*10^-5
       //wavelength of a monochromatic light
4
```

```
5  u=1.5

      //refractive  index  of  glass
6
7  a=(20/3600)*(%pi/180)
                                                              //
      angle  made  by  glass  film  in  radians
8
9  B=wavelength/(2*u*a)

      //The  fringe  width
10
11  N=1/B

      //the  number  of  fringes  per  cm
12
13  printf("\nThe  number  of  fringes  per  cm  =  %.f  \n",N)
```

Scilab code Exa 1.3.5 find the diameter of wire

```
1  //Chapter−1,Example1_3_5 ,pg  1−24
2
3  wavelength=6*10^-5

      //wavelength  of  light
4
5  B=0.1

      //fringe  width(as  there  are  10  fringes)
6
7  u=1

      //refractive  index  of  air  wedge
8
9  a=wavelength/(2*u*B)
```

```
    //as  fringe  spacing  is     'B = wavelength/(2*a*u)
    '
10
11 dist =10

    //distance  of  plane  of  rectangular  pieces  from
    wire
12
13 d=a*dist

    //as  for  small  angle  'tan(a) = a = d/dist '
14
15 printf("\nThe  diameter  of  wire  is   d = %.3f cm\n",d)
```

Scilab code Exa 1.3.6 find the separation between consecutive bright fringes

```
1 //Chapter −1,Example1_3_6 ,pg  1−24
2
3 a=10^-4

    //as  for  small  angle  'tan(a) = a'
4
5 wavelength=5900*10^-10
                                                //
    wavelength  of  light  in  air
6
7 u=1

    //refractive  index  of  air
8
9 B=wavelength/(2*u*a)
                                                //The
    fringe  width
10
```

```
11  printf(”\nThe fringe width is  B = %.5f m\n”,B)
```

Scilab code Exa 1.4.1 find the ring number

```
1  // Chapter −1, Example1_4_1 , pg  1−32
2
3  // let  the  diameter  of  nth  dark  ring  be  double  the
        diameter  of  that  of  40th  ring
4
5  // as    Dn^2  =  4*R*n*wavelength
6
7  n_1=40

      //40 th  dark  ring
8
9  n=4*n_1

      // as  diameter  is  double
10
11  printf(’\nThe  ring  number  is    n= %.f ’,n)
```

Scilab code Exa 1.4.2 find radius of curvature and thickness of film

```
1  // Chapter −1, Example1_4_2 , pg  1−32
2
3  // For  dark  rings  Dn=sqrt(4*R*n*wavelength)
4
5  n=10                        //10th  ring
6
7  Dn=0.5                      // diameter  of  10th  ring
8
9  wavelength=5*10^-5                  // wavelength  of  light
10
```

```
11  R=Dn^2/(4*n*wavelength)          //radius  of  curvature

12

13  t=Dn^2/(8*R)              //thickness  of  film

14

15  printf('\nThe  radius  of  curvature  is   R = %.2f  cm\n'
        ,R)

16

17  printf('\nThe  thickness  of  film  is   t = %.5f  cm\n',t
        )

18

19  //mistake  in  textbook
```

Scilab code Exa 1.4.3 find the radius of curvature

```
 1  //Chapter −1,Example1_4_3 ,pg  1−33

 2

 3  n_1=5                                    //5th
        ring

 4

 5  n_2=15                                   //15th
        ring

 6

 7  p=n_2-n_1                                //
        difference  between  rings

 8

 9  Dn_1=0.336                               //diameter  of
        5th  ring

10

11  Dn_2=0.59                                //diameter  of
        15th  ring

12

13  wavelength=5890*10^-8                    //
        wavelength  of  light

14

15  R=(Dn_2^2-Dn_1^2)/(4*p*wavelength)
```

22

```
                //radius of curvature
16
17  printf('\nThe radius of curvature is  R = %.2f cm\n'
        ,R)
```

Scilab code Exa 1.4.4 find the wavelength of light

```
1  //Chapter-1,Example1_4_4 ,pg 1-33
2
3  //as   n1 = nth ring       n2 = (n+8)th ring
4
5  p=8                                          //
        difference between rings
6
7  Dn_1=0.42                              //diameter of 5
        th ring
8
9  Dn_2=0.7                               //diameter of
        15th ring
10
11 R=200                                          //
        radius of curvature
12
13 wavelength=(Dn_2^2-Dn_1^2)/(4*p*R)
        //wavelength of light
14
15 printf('\nThe wavelength of light  is  wavelength =
        %.6f cm\n',wavelength)
```

Scilab code Exa 1.4.5 find the refractive index of liquid

```
1  //chapter-1,Example1_4_5 ,pg 1-34
2
```

```
3  Dn_1 =0.218                          // Diameter  of
       nth  ring
4
5  Dn_2 =0.451                          // Diameter  of  (
       n+10) th  ring
6
7  wavelength =5893*10^-8                      //
       wavelength  of  light
8
9  R=90                             // Radius  of
       curvature
10
11 p=10
12
13 u=(4*p*wavelength*R)/(Dn_2^2-Dn_1^2)           //
       Refractive  index  of  liquid
14
15 printf('\nRefractive  index  of  liquid  is   u = %.3f',u
       )
```

Scilab code Exa 1.4.6 find the diameter of dark ring

```
1  // chapter −1, Example1_4_6 , pg  1−34
2
3  // For  nth  dark  ring         Dn^2  =4*R*n*wavelength
4
5  D_5 =0.42                    // Diameter  of  5th  dark
       ring
6
7  D_10 =sqrt(2*D_5^2)                 // as  number  of  ring
        double ,  the  diameter  is  sqrt(2)  times  the
       diameter  of  original  ring
8
9  printf('\nThe  diameter  of  10th  dark  ring  is   D10 = %
       .3f  cm',D_10)
```

Scilab code Exa 1.4.7 find the diameter of dark ring

```
1  //Chapter-1,Example1_4_7 ,pg 1-35
2
3  R=200
       //radius of curvature
4
5  wavelength_1=6000*10^-8
                                      //wavelength
       of light for nth dark ring
6
7  wavelength_2=5000*10^-8
                                      //wavelength
       of light for (n+1)th dark ring
8
9  //as nth ring due to wavelength_1= 6000*10^-8 cm
       is coincide with (n+1)th ring  due to
       wavelength_2=5000*10^-8 cm
10
11 //therefore  6*n = 5*(n+1)
12
13 n=5
14
15 Dn=sqrt(4*R*n*wavelength_1)
16
17 printf('\nDiameter of nth dark ring due to
       wavelength 6000 A. is   Dn = %.4f cm\n',Dn)
18
19 //wrong ans in textbook
```

Scilab code Exa 1.4.8 find the refractive index of liquid

```
1  // Chapter −1, Example1_4_8 , pg  1−35
2
3  D_air=2.3                                    //
       Diameter  of  bright  ring  in  air
4
5  D_liquid=2                                         //
       Diameter  of  bright  ring  in  liquid
6
7  u=D_air^2/D_liquid^2
                                     // Refractive
       index  of  liquid
8
9  printf('\n  The  refractive  index  of  liquid  is  u = %
       .4f  \n',u)
```

Scilab code Exa 1.4.11 find the diameter of ring

```
1  // Chapter −1, Example1_4_11 , pg  1−37
2
3  D_4=0.4                                    // diameter
       of  4th  dark  ring
4
5  D_12=0.7                                        // diameter
       of  12th  dark  ring
6
7  const=D_4^2/(4*4)                                //
       assume  (R∗wavelength = const )  for  4th  dark  ring
8
9  D_20=sqrt(4*20*const)                            //
       For  20th  dark  ring
10
11 printf('\nDiameter  of  20th  dark  ring  is  D20 = %.3f
        cm\n',D_20)
```

Scilab code Exa 1.4.12 `calculate the wavelength of light`

```
1  //Chapter-1,Example1_4_12,pg 1-38
2
3  n_1=5                                    //5th
       ring
4
5  n_2=15                                   //15th
       ring
6
7  p=n_2-n_1                                //
       difference between rings
8
9  Dn_1=0.336                              //diameter of
       5th ring
10
11 Dn_2=0.59                               //diameter of
       15th ring
12
13 R=100                                    //
       Radius of curvature
14
15 wavelength=(Dn_2^2-Dn_1^2)/(4*p*R)*10^8
                       //wavelength of light
16
17 printf('\nwavelength of light is = %.f A.',
       wavelength)
```

Scilab code Exa 1.7.1 `find the thickness of coating`

```
1  //Chapter-1,Example1_7_1,pg 1-42
2
```

```
3  wavelength =560

      // wavelength of light in air
4
5  u =2.0

      // refractive index of silicon monoxide material
6
7  //The wavelength of 'wavelength_1' in a medium of
       refractive index 'u' is
8
9  wavelength_1 = wavelength/u
10
11 t= wavelength_1/4

      // thickness of the film
12
13 printf ("\nThe thickness of the film is = %. f nm\n",t
      )
```

Scilab code Exa 1.7.2 find the thickness of coating

```
1  // Chapter −1, Example 1_7_2 , pg 1−42
2
3  wavelength =6000

      // wavelength of light in air
4
5  u =1.2

      // refractive index of transparant material
6
7  wavelength_1 = wavelength/u

      //The wavelength of wavelength_1 in a medium of
```

```
          refractive index 'u'
 8
 9  t=wavelength_1/4

          // thickness of coating
10
11  printf("\nThe thickness of coating to eliminate
          reflection is   t = %.f A.\n",t)
```

Chapter 2

Diffraction of Light

Scilab code Exa 2.2.1 calculate the width of slit

```
1  //Chapter-2,Example2_2_1 ,pg 2-10
2
3  angle=30                                    //angle of
       incidance
4
5  n=1                                         //first
       minimum
6
7  wavelength=6500*10^-8                             //
       wavelength of light
8
9  a=(n*wavelength)/sind(angle)
       //For minimum intensity in single slit
10
11 printf('\nvalue of a =%.5f cm\n',a)
```

Scilab code Exa 2.2.2 calculate the angular separation between first order minima

```
1  //Chapter −2,Example2_2_2 , pg  2−10
2
3  a =6*10^ -6                                     // width  of
       slit
4
5  n =1                                            // for  first
       minimum
6
7  wavelength =6000*10^ -10                           //
       wavelength  of  light
8
9  angle =2* asind ( n * wavelength / a )             // angular
       seperation
10
11 printf ( '\nThe  angular  seperation  between  first  order
        minima  is  angle  =  %.4 f  degree \n ' , angle )
```

Scilab code Exa 2.2.3 `calculate wavelength of light`

```
1  //Chapter −2,Example2_2_3 , pg  2−11
2
3  n2 =2                                            // for
       second  order  minima
4
5  n3 =3                                            // for
       third  order  minima
6
7  wavelength_3 =4000                                 //
       wavelength  of  light  for  third  order  minima
8
9  //as  second  order  minima  is  coincide  with  third
       order  minima ,   n2* wavelength2=  n3* wavelength_3
10
11 wavelength_2 = n3 * wavelength_3 / n2
12
```

```
13  printf("\nwavelength  of  light  for  second  order
        minima  is  =  %.f  A.",wavelength_2)
```

Scilab code Exa 2.2.4 find half angular width of a principal maximum

```
1  //Chapter-2,Example2_2_4 ,pg  2-11
2
3  a=0.16*10^-3                              //width  of
        slit
4
5  n=1                                       //for  first
        minimum
6
7  wavelength=5600*10^-10                          //
        wavelength  of  light
8
9  angle=asind(n*wavelength/a)              //angular
        seperation
10
11 printf('\nThe  half  angular  width  of  a  principal
        maximum  is  angle  =  %.4f  degrees\n',angle)
```

Scilab code Exa 2.2.5 find half angular width of central maximum

```
1  //Chapter-2,Example2_2_5 ,pg  2-11
2
3  a=12*10^-7                                //width  of
        slit
4
5  n=1                                       //for
        first  minimum
6
```

```
 7  wavelength=6000*10^-10                              //
        wavelength  of  light
 8
 9  angle=asind(n*wavelength/a)                    //
        angular  seperation
10
11  printf('\nThe  half  angular  width  of  the  central
        maximum  is  angle  =  %.1f  degrees\n',angle)
```

Scilab code Exa 2.2.6 calculate the angle

```
 1  //Chapter-2,Example2_2_6 , pg  2-12
 2
 3  a=2*10^-6                                       //width  of
        slit
 4
 5  n=1                                             //for
        first  minimum
 6
 7  wavelength=6500*10^-10                          //
        wavelength  of  light
 8
 9  angle=asind(n*wavelength/a)                    //angular
        seperation
10
11  printf('\nThe  half  angular  width  of  a  principal
        maximum  is    angle =%.2f  degrees\n',angle)
```

Scilab code Exa 2.3.1 calculate the missing orders

```
 1  //Chapter-2,Example2_3_1 , pg  2-16
 2
 3  a=0.16                                          //width  of  slit
```

```
4
5  b=0.8                                    // width  of  slit
6
7  n=[1 2 3]                                // no  of  minima
8
9  m=((a+b)/a).*n
10
11  printf('\nthe  missing  orders  are  m = ')
12
13  disp(m)
```

Scilab code Exa 2.4.1 find the orders

```
1  // Chapter −2, Example2_4_1 , pg  2−24
2
3  wavelength_1=5000
       // wavelength  of  light
4
5  wavelength_2=7000
       // wavelength  of  light
6
7  N=4000
       // number  of  lines  per  cm
8
9  m_1=1/((wavelength_1*10^-8)*N)
                                 // for  wavelength=
       5000  A.
10
11  m_2=1/((wavelength_2*10^-8)*N)
                                 // for  wavelength=
       7000  A.
12
13  printf('\nnumber  of  orders  visible  for  7000*10^−10
       meter  are   %.2 f\n',m_2)
14
```

```
15 printf('\nnumber of orders visible for 5000*10^-10
       meter are %.1f\n',m_1)
```

Scilab code Exa 2.4.2 find the number of lines per meter

```
1 //Chapter-2,Example2_4_2 ,pg 2-24
2
3 //as a mth order of wavelength  5400 A. is
       superimposed on (m+1)th order of wavelength  4050
       A.
4
5 angle=30                                        //angle
       of diffraction
6
7 wavelength_1=5400                                      //
       for mth order
8
9 wavelength_2=4050                                      //
       for (m+1)th order
10
11 m=wavelength_2/(wavelength_1-wavelength_2)
12
13 N=(sind(angle)/(m*wavelength_1))*10^8
                                      //Number of lines
       per cm
14
15 printf('\nNumber of lines per cm  N = %.2f',N)
```

Scilab code Exa 2.4.3 calculate the wavelength of spectral line

```
1 //Chapter-2,Example2_4_3 ,pg 2-25
2
```

```
3  //as 3rd order line of wavelength lam is coincide
        with 4th order wavelength 4992 A.
4
5  m_1 =3
            //3rd order
6
7  m_2 =4
            //for 4th order
8
9  wavelength_2 =4992
                                        //for 4th
        order
10
11 wavelength_1 = m_2 * wavelength_2 / m_1
12
13 printf ('\nwavelength of light is  = %.0f A.',
        wavelength_1 )
```

Scilab code Exa 2.4.4 find the angle of diffraction

```
1  // Chapter −2, Example2_4_4 , pg  2−25
2
3  wavelength =6328*10^-10                                //
        wavelength of light
4
5  m1 =1                                           //for
        first order
6
7  m2 =2                                           //for
        second order
8
9  N= 6000*10^2                                   //Number
        of lines per unit length
```

```
10
11  angle_1=asind(N*m1*wavelength)
12
13  angle_2=asind(N*m2*wavelength)
14
15  printf('\nangle of diaffraction for 1st order minima
        is   ang1 = %.2f degrees ',angle_1)
16
17  printf('\nangle of diaffraction for 2nd order minima
        is   ang2 = %.2f degrees ',angle_2)
```

Scilab code Exa 2.4.5 calculate the number of lines per meter

```
1  //Chapter −2,Example2_4_5 ,pg  2−26
2
3  m=2                                        //ofr second
      order principal maximum
4
5  wavelength=5*10^-5                              //
      wavelength of light
6
7  angle=30                                    //ang of
      diaffraction
8
9  N=sind(angle)/(m*wavelength)
10
11 printf('\nNumber of lines per cm is   N = %.f ',N)
```

Scilab code Exa 2.4.6 find the longest wavelength

```
1  //Chapter −2,Example2_4_6 ,pg  2−26
2
```

```
3  m=3                                           //third
      order
4
5  angle=90                                      //for  normal
      incidence
6
7  N=7000                                        //Number  of
      lines  per  meter
8
9  wavelength=(sind(angle)/(m*N))*10^8
10
11 printf('\nThe  longest  wavelength  is  lam  =  %.0 f A.  ',
      wavelength)
```

Scilab code Exa 2.4.7 calculate the total number of lines

```
1  //Chapter −2,Example2_4_7 ,pg  2−27
2
3  m=1                                           //first
      ordr  spectrum
4
5  wavelength=6560*10^-8                         //
      wavelength  of  light
6
7  angle=16.2                                    //angle
      of  diffraction
8
9  N=2*sind(angle)/(m*wavelength)
10
11 printf('\nNumber  of  lines  per  2 cm   is   N = %.0 f ',N)
```

Scilab code Exa 2.4.8 calculate total number of lines

```
1  // Chapter −2, Example2_4_8 , pg  2−27
2
3
4  m=1

      // first  ordr  spectrum
5
6  wavelength =6.56*10^-5

                                    // wavelength  of
      light
7
8  angle =18.23333333

                                    // angle  of
      diffraction
9
10 N=2* sind ( angle ) /( m* wavelength )
11
12 printf ( '\nNumber  of  lines  per  2 cm   is   N = %.2 f ',N)
```

Scilab code Exa 2.4.9 calculate the highest order spectrum

```
1  // Chapter −2, Example2_4_9 , pg  2−27
2
3  N=5000                                        // Number  of
      lines  per  meter
4
5  wavelength =6*10^-5                                      //
      wavelength  of  light
6
7  m_max =1/( N* wavelength )
8
9  printf ( '\nThe  highest  order  spectrum  is   m = %.0 f  ',
      m_max )
```

Scilab code Exa 2.4.10 `find the order of absent spectra`

```
1  //Chapter -2,Example2_4_10 , pg 2-28
2
3  N=5000*10^2                                    //
       Number of lines per meter
4
5  wavelength =6000*10^-10
                                      //wavelength of
       light
6
7  m_max =1/(N*wavelength)
8
9  //for absent spectra
10
11 n=[1 2 3]
12
13 m=3*n                                         //as b
       = 2a          and m = ((a+b)/a)*n
14
15 printf('\n The order of absent spectra is m = %.0f '
       ,m_max)
```

Scilab code Exa 2.4.11 `calculate total number of lines`

```
1  //Chapter -2,Example2_4_11 , pg 2-28
2
3  m=1

       //first ordr spectrum
4
```

```
5  wavelength =5790*10^ -10
                                            //
       wavelength  of  light
6
7  angle =19.994                                  //
       angle  of  diffraction
8
9  N=2.54* sind ( angle )/(m* wavelength *100)
10
11 printf ('\nNumber  of  lines  per  2.54  cm   is   N = %.0 f
       lines ',N)
```

Scilab code Exa 2.6.1 find angular separation and number of lines per meter

```
1  //Chapter −2,Example2_6_1 ,pg  2−31
2
3  wavelength_1 =5893*10^ -10
                                            //wavelength  of
       light
4
5  wavelength_2 =5896*10^ -10
                                            //wavelength  of
       light
6
7  m=2
       //for  second  order
8
9  N1 =3000*10^2/0.5
       //Number  of  lines  per  meter
10
11 angle_1 = asind (m* wavelength_1 *N1)
                          //for  wavelength_1
12
13 angle_2 = asind (m* wavelength_2 *N1)
                          //for  wavelength_2
```

```
14
15 angle_sep=angle_2-angle_1
16
17 printf('\nangular seperation is  %.4f degrees \n',
      angle_sep)
18
19 d_wavelength=3*10^-10
20
21 N=wavelength_1/(m*d_wavelength)
22
23 printf('\n The number of lines per meter is  N = %.0
      f\n ',N)
```

Scilab code Exa 2.6.2 find the smallest wavelength interval

```
1  //Chapter−2,Example2_6_2 , pg  2−32
2
3  wavelength=481                              //
      wavelength of light
4
5  m=3                                        //for
      third order
6
7  N=620*5.05                                 //
      number of lines per meter
8
9  d_wavelength=wavelength/(m*N)
10
11 printf('\n The smallest wavelength interval is
      d_wavelength = %.4f nm\n',d_wavelength)
```

Scilab code Exa 2.6.3 find the width of grating

```
1  //Chapter −2,Example2_6_3 , pg  2−33
2
3  wavelength =5890*10^ -10
                                                 //wavelength
     of  light
4
5  d_wavelength =6*10^ -10
6
7  m=2
     //for  second  order
8
9  N=wavelength/(d_wavelength *m)
10
11 W=N/500                                       //
     as  there  are  500  lines/cm
12
13 printf('\n The  width  of  grating  is  W =  %.3 f  cm',W)
```

Scilab code Exa 2.6.4 find the resolving power of diffraction

```
1  //Chapter −2,Example2_6_4 , pg  2−33
2
3  N=3*5000                                      //
     number  of  lines
4
5  n_l=5000*10^2                                 //
     number  of  lines  per  meter
6
7  wavelength =5890*10^ -10
                                            //wavelength  of
     light
8
9  m_max =1/( n_l*wavelength )
10
11 R_P_max =( m_max )*N
```

```
12
13 printf('\n The maximum R.P. = %.0f ',R_P_max)
```

Scilab code Exa 2.6.5 calculate number of lines and the grating element

```
1 //Chapter-2,Example2_6_5 ,pg 2-34
2
3 wavelength =5890*10^-10
                                              //wavelength
      of light
4
5 d_wavelength =6*10^-10
6
7 m=2
      //for second order
8
9 N=wavelength/(d_wavelength*m)
10
11 W=3                                                    //
      width of grating
12
13 width=W/N
14
15 printf('\nNumber of lines is  N = %.0f \n',N)
16
17 printf('\n The grating element(width of line) is   a+
      b =%.7f cm',width)
```

Scilab code Exa 2.6.6 find the resolving power

```
1 //Chapter-2,Example2_6_6 ,pg 2-34
2
```

```
3  m=2                                    //for  second
      order

4
5  N=40000                                //Number  of
      lines

6
7  RP=m*N

8
9  printf('\n The  resolving  power  is    R.P.  = %.0f ',RP)
```

Chapter 3

Fibre Optics

Scilab code Exa 3.3.1 find refractive index of cladding

```
1  //Chapter-3,Example3_3_1 ,pg 3-6
2
3  NA=0.5
       //Numerical aperture
4
5  n1=1.54
                                                    //
       refractive index of core
6
7  n2=sqrt(n1^2-NA^2)
                                   //Numerical
       aperture is 'NA^2 = n1^2 - n2^2'
8
9  printf("\nThe refractive index of cladding is  n2 =
       %.3f\n",n2)
```

Scilab code Exa 3.3.2 find refractive index of core and acceptance angle

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```
1  //Chapter−3,Example3_3_2 ,pg 3−6
2
3  NA=0.2
       //Numerical aperture
4
5  n2=1.59
                                                    //
       refractive index of cladding
6
7  n1=sqrt(n2^2-NA^2)
                                           //Numerical
       aperture is 'NAˆ2 = n1ˆ2 − n2ˆ2'
8
9  printf("\nThe refractive index of core is n1 = %.1f\
       n",n1)
10
11 n0=1.33
                                                    //
       refractive index of medium
12
13 angle_0=asind(NA/n0)
       //For medium numerical aperture is 'NA=n0*sin(
       angle_0)'
14
15 printf("\nThe acceptance angle is angle_0 = %.2f
       Degree\n",angle_0)
```

Scilab code Exa 3.3.3 find the numerical aperture and acceptance angle

```
1  //Chapter−3,Example3_3_3 ,pg 3−6
2
3  n1=1.49
       //refractive index f core
```

```
4
5  n2 =1.44

      // refractive  index  of  cladding
6
7  NA=sqrt(n1^2 - n2^2)
                                        // Numerical
      aperture  is  'NA^2 = n1^2 − n2^2'
8
9  printf(" \nThe  Numerical  aperture  is  N.A.  = %.5f\n",
      NA)
10
11 angle_0=asind(NA)
      // for  air  numerical  aperture  is  'NA=sin(angle_0)'
12
13 printf(" \nThe  acceptance  angle  is  angle_0 = %.1f
      Degree\n",angle_0)
```

Scilab code Exa 3.3.4 find the critical angle and angle of acceptance cone

```
1  // Chapter −3, Example3_3_4 , pg  3−7
2
3  n1 =1.6

      // refractive  index  f  core
4
5  n2 =1.3

      // refractive  index  of  cladding
6
7  angle_c=asind(n2/n1)
      // Critical  angle
8
9  printf(" \nThe  critical  angle  is  angle_c = %.2f
      Degree\n",angle_c)
```

```
10
11  angle_0=asind(sqrt(n1^2-n2^2))
                                //for  air  numerical
       aperture  is  'NA=sin(angle_0)'
12
13  angle_cone=2*angle_0
14
15  printf("\nThe  acceptance  angle  cone  =  %.3f  Degree\n"
       ,angle_cone)
16
17  //mistake  in  textbook
```

Scilab code Exa 3.3.5 the refractive index of cladding

```
1  //Chapter-3,Example3_3_5,pg 3-7
2
3  angle_0=30
                                                      //
       acceptance  angle
4
5  n1=1.4
                                                      //
       refractive  index  of  core
6
7  n2=sqrt(n1^2-sind(angle_0)^2)
                             //Numerical  aperture  is  '
       NA^2 = n1^2 - n2^2'  also  numerical  aperture  is  '
       NA=sin(angle_0)'
8
9  printf("\nThe  refractive  index  of  cladding  is   n2 =
       %.4f\n",n2)
```

Scilab code Exa 3.3.6 calculate the fractional index change

```
1  // Chapter −3, Example3_3_6 , pg  3−8
2
3  n1 =1.563

      // refractive  index  f  core
4
5  n2 =1.498

      // refractive  index  of  cladding
6
7  delta =( n1 - n2 )/ n1
                                                      //
      fractional  index  change
8
9  printf (" \nThe  fractional  index  change  is   Delta  = %
      .4 f  \n", delta )
```

Scilab code Exa 3.3.7 calculate the maximum refractive index of cladding

```
1  // Chapter −3, Example3_3_7 , pg  3−8
2
3  // as  total  internal  reflection  takes  place  for  light
        travlling  within  5  degree  of  the  fibre  axis
4
5  angle_c =90 -5

      // critical  angle
6
7  n1 =1.50

      // refractive  index  of  core
8
9  n2 = n1 * sind ( angle_c )
10
11 printf (" \nThe  maximum  refractive  index  of  cladding
```

```
is   n2 = %.4 f \n",n2)
```

Scilab code Exa 3.3.8 calculate the acceptance angle

```
1  //Chapter -3,Example3_3_8 ,pg 3-8
2
3  //In air
4
5  angle_0_air=30
       //acceptance angle of an optical fibre
6
7  NA=sind(angle_0_air)
                                    //Numerical
       aperture is 'NA^2 = n1^2 - n2^2'   also numerical
        aperture is 'NA=sin(angle)'
8
9  n0=1.33
       //refractive index of medium
10
11 angle_0=asind(NA/n0)
                                        //For
       medium numerical aperture is 'NA=n0*sin(angle_0)'
12
13 printf("\nThe acceptance angle in medium is angle_0
       = %.2f Degree\n",angle_0)
```

Scilab code Exa 3.4.1 calculate normalized frequency and number of modes

```
1  //Chapter -3,Example3_4_1 ,pg 3-10
2
```

```
3  d=29*10^-6
        //diameter  of  core  of  step  index  fibre
4
5  wavelength=1.3*10^-6
        //wavelength  of  light
6
7  n1=1.52
        //refractive  index  of  core
8
9  n2=1.5189
        //refractive  index  of  cladding
10
11 V=%pi*d*sqrt(n1^2-n2^2)/wavelength
                                    //Normalized
        frequency  of  the  fibre
12
13 printf("\nThe  normalised  frequency  of  fibre  is   V =
        %.3f\n",V)
14
15 N=V^2/2
        //The  number  of  modes
16
17 printf("\nThe  number  of  modes  =  %.f\n",N)
```

Scilab code Exa 3.4.2 calculate the maximum radius for fibre

```
1  //Chapter-3,Example3_4_2 , pg  3-10
2
3  //For  single  mode  fibre ,   V < 2.405
4
```

```
5  V =2.405

       // normalized  frequency  of  fibre
6
7  n1 =1.47

       // refractive  index  of  core
8
9  n2 =1.46

       // refractive  index  of  cladding
10
11  wavelength =1.3

       // wavelength
12
13  d=V* wavelength /(%pi* sqrt (n1^2-n2^2))
                                        // diameter  of
       core
14
15  r =(d/2)
16
17  printf("\nThe  maximum  radius  for  fibre  =  %.3 f  um\n",
       r)
```

Scilab code Exa 3.4.3 find various parameters of fibre

```
1  // Chapter −3, Example3_4_3 , pg  3−11
2
3  wavelength =1*10^-6

       // wavelength  of  light
4
5  r =50*10^-6
```

```
        // radius  of  core
6
7  delta =0.055

        // relative  refractive  index  of  fibre
8
9  n1 =1.48

        // refractive  index  of  core
10
11 n2=n1 *(1 - delta )

        // as      'delta= (n1−n2)/n1'
12
13 printf ("\nThe  refractive  index  of  cladding  n2 = %.4
      f \n",n2)
14
15 NA=sqrt ( n1 ^2 - n2 ^2)
                                                      //
      numerical  aperture
16
17 printf ("\nThe  numerical  aperture N.A. = %.3 f \n", NA )
18
19 angle_0 = asind ( NA )
                                                      // as
          N.A.= sin ( angle_0 )
20
21 printf ("\nThe  acceptance  angle  is  angle_0 = %.2 f
      Degree \n", angle_0 )
22
23 d=2* r
24
25 V=%pi *d* NA / wavelength
                                                      //
      Normalized  frequency  of  the  fibre
26
27 printf ("\nThe  normalised  frequency  of  fibre  is  V =
      %.2 f \n",V)
```

```
28
29  N=V^2/2

        //The number of modes
30
31  printf("\nThe number of modes  = %.f \n",N)
```

Scilab code Exa 3.4.4 calculate various parameters of fibre

```
1  //Chapter -3, Example3_4_4, pg 3-12
2
3  wavelength =1*10^-6

        //wavelength of light
4
5  d=6*10^-6

        //diameter of core
6
7  n1 =1.45

        //refractive index of core
8
9  n2 =1.448

        //refractive index of cladding
10
11  angle_c = asind (n2/n1)
                                                    //
        critical angle is    'sin(angle_c) = n2/n1'
12
13  printf("\nThe critical angle is   angle_c = %.f
        Degree\n",angle_c)
14
15  NA=sqrt(n1^2-n2^2)
```

55

```
16
17  angle_0=asind(NA)
                                                    //
        acceptance  angle  is      'sin(angle_0) = NA = sqrt(
        n1^2-n2^2)'
18
19  printf("\nThe  acceptance  angle  is    angle_0 =   %.3f
        Degree\n",angle_0)
20
21  N=%pi^2*d^2*NA^2/(2*wavelength^2)
                                                    //the
        number  of  modes  propogating  through  fibre
22
23  printf("\nthe  number  of  modes  propogating  through
        fibre  is    N = %.f\n",N)
```

Scilab code Exa 3.4.5 `calculate the number of modes`

```
1  //Chapter-3,Example3_4_5 ,pg  3-12
2
3  wavelength=1*10^-6

        //wavelength  of  light
4
5  r=50*10^-6

        //radius  of  core
6
7  n1=1.50

        //refractive  index  of  core
8
9  n2=1.48

        //refractive  index  of  cladding
```

```
10
11  NA=sqrt(n1^2-n2^2)
                                                        //
        numerical  aperture
12
13  d=2*r

        //diameter  of  core
14
15  N=%pi^2*d^2*NA^2/(2*wavelength^2)
                                                    //the
        number  of  modes  propogating  through  fibre
16
17  printf("\nthe  number  of  modes  propogating  through
        fibre  is    N = %.f\n",N)
```

Scilab code Exa 3.4.6 calculate various parameters of fibre

```
1  //Chapter−3,Example3_4_6 ,pg  3−13
2
3  wavelength=1.4*10^-6

        //wavelength  of  light
4
5  d=40*10^-6

        //diameter  of  core
6
7  n1=1.55

        //refractive  index  of  core
8
9  n2=1.50

        //refractive  index  of  cladding
```

```
10
11  NA=sqrt(n1^2-n2^2)

        //numerical aperture
12
13  printf("\nThe numerical aperture N.A. = %.4f \n",NA)
14
15  delta=(n1-n2)/n1

        //Fractional index change
16
17  printf("\nThe fractional index change Delta = %.5f\n
        ",delta)
18
19  V=%pi*d*NA/wavelength

        //Normalized frequency of the fibre
20
21  printf("\nthe V-number is   V = %.2f   \n",V)
```

Scilab code Exa 3.6.1 calculate the fibre attenuation

```
1  //Chapter-3,Example3_6_1 ,pg 3-17
2
3  Pin=1

        //Input power in mW
4
5  Pout=0.3

        //output power in mW
6
7  Pl=(-10)*log10(Pout/Pin)
                                        //Power loss
        or attenuation
```

```
8
9  L=0.1
       //Length of cable in km
10
11 a=Pl/L
       //fibre attenuation
12
13 printf("\nThe fibre attenuation is a = %.2f dB/km\n"
       ,a)
```

Scilab code Exa 3.6.2 calculate the output power

```
1  //Chapter−3,Example3_6_2,pg 3−18
2
3  L=3
       //length of fibre in km
4
5  a=1.5
       //Loss specification in dB/km
6
7  Pin=9.0
       //input power in uW
8
9  Pl=a*L
       //Power loss
10
11 Pout=Pin*10^(-Pl/10)
                                            //as
       Power loss or attenuation is    Pl=(−10)*log10(
```

```
      Pout/Pin )
12
13  printf (" \nThe output power Pout = %.3 f uW\n" ,Pout )
```

Scilab code Exa 3.6.3 calculate the fractional initial intensity

```
1  //Chapter −3,Example3_6_3 ,pg 3−18
2
3  a =2.2
4
5  //ratio= Pout/Pin
6
7  //For a length of L=2 km
8
9  Pl1=a*2
10
11  ratio_1 =10^( -Pl1/10)
                                                //
       as Power loss or attenuation is    Pl=(−10)∗log10 (
       Pout/Pin )
12
13  printf (" \nThe fractional initial intensity after 2
       km is %.3 f \n" ,ratio_1 )
14
15  //For a length of L=6 km
16
17  Pl2=a*6
18
19  ratio_2 =10^( -Pl2/10)
                                                //
       as Power loss or attenuation is    Pl=(−10)∗log10 (
       Pout/Pin )
20
21  printf (" \nThe fractional initial intensity after 6
       km is %.3 f \n" ,ratio_2 )
```

Scilab code Exa 3.6.4 find the loss specification in cable

```
1  //Chapter-3,Example3_6_4 ,pg 3-19
2
3  Pin =8.6

       //Input power in mW
4
5  Pout =7.5

       //output power in mW
6
7  Pl=(-10)*log10(Pout/Pin)
                                           //Power loss
       or attenuation
8
9  L=0.5

       //Length of cable in km
10
11 a=Pl/L

       //Loss secification
12
13 printf("\nThe loss specification in cable is  a = %
       .3 f dB/km\n",a)
```

Chapter 4

Lasers

Scilab code Exa 4.6.1 find the number of emitted photons

```
1  //Chapter-4,Example4_6_1 ,pg 4-7
2
3  P=3.147*10^-3                          //output
       power
4
5  t=60                                   //time
6
7  wavelength=632.8*10^-9                       //
       wavelength of He-Ne laser
8
9  h=6.63*10^-34                          //Plancks
        constant
10
11 c=3*10^8                              //
       velocity of light in air
12
13 N=P*t*wavelength/(h*c)                       //
       No. of photons emitted
14
15 printf("\nNo. of photons emitted each minute\n")
16
```

```
17  disp(N)
```

Scilab code Exa 4.6.2 find the ratio of population of two energy levels

```
1  //Chapter −4, Example4_6_2 , pg  4−7
2
3  wavelength =694.3*10^-9                             //
       wavelength  of  He−Ne  laser
4
5  h =6.63*10^-34                                 //Plancks
        constant
6
7  c =3*10^8                                      //
       velocity  of  light  in  air
8
9  k =1.38*10^-23                                 //
       Boltzmann  constant
10
11  T =300                                        //ambient
        temperature  in  kelvin
12
13  ratio =%e^-(h*c/(wavelength*k*T))                    //
       ratio  of  population  of  two  energy  level  in  laser
14
15  printf(”\nRatio  of  population  of  two  energy  level  in
        laser  N2/N1  is \n”)
16
17  disp(ratio)
```

Scilab code Exa 4.6.3 calculate the wavelength of photons

```
1  //Chapter −4, Example4_6_3 , pg  4−8
2
```

```
3  P=100*10^3                                          //
      avrage  power  per  pulse
4
5  t=20*10^-9                                          //
      time  duration
6
7  h=6.63*10^-34                                       //
      Plancks  constant
8
9  c=3*10^8                                            //
      velocity  of  light  in  air
10
11  N=6.981*10^15                                      //
      No.  of  photons  per  pulse
12
13  wavelength=N*h*c/(P*t)*10^10
14
15  printf("\nWavelength  of  photons  = %.f  A.\n",
      wavelength)
```

Chapter 5

Quantum Mechanics

Scilab code Exa 5.3.1 calculate de Broglie wavelength and velocity and time

```
1  // Chapter −5,Example5_3_1 ,pg 5−5
2
3  h=6.63*10^-34                                    //
       Plancks  constant
4
5  m=10^-2                                          //
       mass  of  an  moving  object
6
7  v1=1                                             //
       velocity  of  that  object
8
9  wavelength_1=h/(m*v1)
10
11 printf("\nThe  de  Broglie  Wavelength  is\n")
12
13 disp(wavelength_1)
14
15 printf("meter\n")
16
17 wavelength_2=10^-10
                                    //new  de
```

```
         Broglie  wavelength
18
19  v2=h/(m*wavelength_2)
                                          //new  velocity
        of  an  object
20
21  printf(")\nThe  new  velocity  of  an  object  is\n")
22
23  disp(v2)
24
25  printf(")meter/sec\n")
26
27  d=10^-3                                              //
        Distance  travelled  with  speed  v2
28
29  t=(d/v2)/(365*24*60*60)
                                                 //time
        required  to  travel  distance
30
31  printf(")\nTime  required  to  travel  distance  is\n")
32
33  disp(t)
34
35  printf(")years\n")
36
37  //mistake  in  textbook
```

Scilab code Exa 5.3.2 calculate the velocity

```
1  //Chapter-5,Example5_3_2 , pg  5-6
2
3  h=6.63*10^-34                                        //
        Plancks  constant
4
5  m=9.1*10^-31                                        //mass
```

```
        of  an  electron
 6
 7  wavelength =10^ -10
        //de  Broglie  wavelength  of  an  electron
 8
 9  v=h/( m* wavelength )
        // velocity  of  an  electron
10
11  printf("\nThe  velocity  of  an  electron  is   v = %.1 f  m
        /s\n",v)
```

Scilab code Exa 5.3.3 calculate kinetic energy of an electron

```
 1  //Chapter −5, Example5_3_3 , pg  5−6
 2
 3  h=6.63*10^ -34                                           //
        Plancks  constant
 4
 5  m=9.1*10^ -31                                           //mass
        of  an  electron
 6
 7  wavelength =5000*10^ -10
        //de  Broglie  wavelength  of  an  electron
 8
 9  e=1.6*10^ -19                                           //
        charge  on  electron
10
11  E=h^2/(2* m* wavelength ^2* e )
        //Kinetic  energy  of  an  electron
12
13  printf("\nKinetic  energy  of  an  electron  is   E = %.9 f
        eV\n",E)
```

Scilab code Exa 5.3.4 find the wavelength of a beam of neutron

```
1  //Chapter-5,Example5_3_4,pg 5-7
2
3  E=0.025                            //
      energy of neutron
4
5  h=6.63*10^-34                      //
      Plancks constant
6
7  m=1.676*10^-27                     //mass
      of a neutron
8
9  e=1.6*10^-19                       //
      charge on electron
10
11  wavelength=h/sqrt(2*m*E*e)
      //The Wavelength of a beam of neutron
12
13  printf("\nThe Wavelength of a beam of neutron is\n")
14
15  disp(wavelength)
16
17  printf("meter\n")
```

Scilab code Exa 5.3.5 find the de Broglie wavelength of an electron

```
1  //Chapter-5,Example5_3_5,pg 5-7
2
3  E=120                             //
      kinetic energy of an electron
4
5  h=6.63*10^-34                     //
      Plancks constant
6
```

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```
7  m=9.1*10^-31                                   //mass
       of  an  electron
8
9  e=1.6*10^-19                                    //
       charge  on  electron
10
11 wavelength=h/sqrt(2*m*E*e)
       //The  de  Broglie  Wavelength  of  an  electron
12
13 printf(")\nThe  de  Broglie  Wavelength  of  an  electron
       is \n")
14
15 disp(wavelength)
16
17 printf("meter\n")
```
───

Scilab code Exa 5.3.6 calculate the velocity and kinetic energy of neutron

```
1  //Chapter −5, Example5_3_6 , pg  5−7
2
3  h=6.63*10^-34                                   //
       Plancks  constant
4
5  m=1.67*10^-27                                   //mass
       of  a  neutron
6
7  e=1.6*10^-19                                    //
       charge  on  electron
8
9  wavelength=10^-10
       //The  de  Broglie  Wavelength  of  a  neutron
10
11 v=h/(m*wavelength)
       //velocity  of  a  neutron
12
```

```
13 printf("\nThe velocity of a neutron is   v= %.f m/s\n
      ",v)

14
15 E=h^2/(2*m*wavelength^2*e)
      //Kinetic energy of a neutron

16
17 printf("\nKinetic energy of a neutron is   E= %.5f eV
      \n",E)
```

Scilab code Exa 5.3.7 find the de Broglie wavelength

```
1 //Chapter −5,Example5_3_7 ,pg 5−8
2
3 //(1)
4 V=182                                            //
      Potential difference
5
6 wavelength_1=12.27*10^-10/sqrt(V)
                        //The de Broglie wavelength of
      an electron accelerated through a potential diff
      . of 'V'
7
8
9 printf("\nThe de Broglie wavelength of an electron
      accelerated through a potential diff. of V is \n")
10
11 disp(wavelength_1)
12
13 printf("meter\n")
14
15 //(2)
16 h=6.63*10^-34                                    //
      Plancks constant
17
18 m=1
```

```
19
20  v =1
21
22  wavelength_2=h/(m*v)
23
24  printf("\nThe de Broglie wavelength of an object is\
        n")
25
26  disp(wavelength_2)
27
28  printf("meter\n")
```

Scilab code Exa 5.3.8 find the momentum and energy of an electron

```
1   //Chapter-5, Example5_3_8, pg 5-9
2
3   h=6.63*10^-34                                    //
        Plancks constant
4
5   m=9.1*10^-31                                     //mass
        of an electron
6
7   e=1.6*10^-19                                     //
        charge on electron
8
9   wavelength=10^-14
        //The de Broglie wavelength of an electron
10
11  p=h/wavelength
        //as the de Broglie wavelength of an electron is
        (lam=h/p)
12
13  printf("\nThe momentum of an electron is\n")
14
15  disp(p)
```

```
16
17  printf ( " kg−meter / sec \ n " )
18
19  E=p^2 / ( 2∗m∗e ) ∗10^ −6
        // energy   corresponds  to  momentum
20
21  printf ( " \ nenergy  of  an  electron  is     E = %.2 f  MeV\n "
        , E )
```

Scilab code Exa 5.3.9 find the parameters for an electron wave

```
1  // Chapter −5, Example5_3_9 , pg  5−10
2
3  V=3000                                            //
        Potential  difference
4
5  wavelength =12.27/ sqrt (V)                       //
        The  de  Broglie  wavelength  of  an  electron
        accelerated  through  a  potential  diff . of  'V'
6
7  printf ( " \ nThe  de  Broglie  wavelength  of  an  electron
        accelerated  through  a  potential  diff . of  V  is   %
        .3 f  A. \ n " , wavelength )
8
9  h=6.63∗10^ −34                                    //
        Plancks  constant
10
11  p=h / ( wavelength ∗10^ −10)
                                          // as  the  de
        Broglie  wavelength  of  an  electron  is  ( wavelength=
        h/p )
12
13  printf ( " \ nThe  momentum  of  an  electron  is \ n " )
14
15  disp (p)
```

```
16
17  printf("kg−meter/sec\n")
18
19  wave_no=1/(wavelength*10^-10)
                                      //wave
        number
20
21  printf("\nThe  wave  number  = %.f/m\n",wave_no)
22
23  d=2.04                                           //
        distance  between  planes
24
25  n=1                                              //
        For  first  ordet  reflection
26
27  angle=asind(n*wavelength/(2*d))                  //
        By  Bragg's  law  '2 dsin(angle)=n*wavelength'
28
29  printf("\nThe  Bragg  angle  = %.3f  Degree\n",angle)
```

Scilab code Exa 5.3.10 calculate the de Broglie wavelength and momentum of an elec

```
1  //Chapter−5,Example5_3_10 ,pg  5−11
2
3  V=10*10^3                                          //
        Potential  difference
4
5  wavelength=12.27/sqrt(V)                          // de
        Broglie  wavelength  of  an  eThelectron  accelerated
        through  a  potential  difference  of  'V'
6
7  printf("\nThe de  Broglie  wavelength  of  an  electron
        accelerated  through  a  potential  difference  of V
        is  = %.4f  A.\n",wavelength)
8
```

```
9  h =6.63*10^-34                                    //
       Plancks  constant
10
11  p=h/( wavelength *10^-10)
                                                     //The
       momentum  of  an  electron
12
13  printf("\nThe  momentum  of  an  electron\n")
14
15  disp(p)
16
17  printf("kg-meter/sec\n")
```

Scilab code Exa 5.3.11 calculate the ratio of de Broglie wavelengths

```
1  //Chapter-5,Example5_3_11 , pg  5-11
2
3  //a  proton  and  alpha  particle  are  accelerated  by  the
        same  potential  difference
4
5  m_p =1.67*10^-27
                                                     //mass  of
        proton
6
7  m_a =4*m_p
                                                     //
       mass  of  alpha  particle  (assume  mass  of  alpha
       particle  to  be  4  times  the  mass  of  proton)
8
9  e =1.6*10^-19
                                                     //
       charge  of  proton
10
11  e_a =2*e
```

```
       // charge  of  an  alpha  particle
12
13  h =6.63*10^-34
                                                       //
      plancks  constant
14
15  wavelength_p=h/sqrt(2*m_p*e)
                                             // wavelength
      of  proton
16
17  wavelength_a=h/sqrt(2*m_a*e_a)
                                           // wavelength  of
       an  alpha  particle
18
19  ratio=wavelength_p/wavelength_a
                                             // ratio  of
      the  de  Broglie  wavelengths  associated  with
      proton  and  alpha  particle
20
21  printf("\nthe  ratio  of  wavelengths  associated  with
      proton  and  alpha  particle  = %.3 f\n",ratio)
```

Scilab code Exa 5.3.12 calculate the velocity and de Broglie wavelength of an alph

```
1  // Chapter −5, Example5_3_12 , pg  5−12
2
3  h =6.63*10^-34

      // Plancks  constant
4
5  m =6.68*10^-27

      // mass  of  alpha  particle
6
7  E =1.6*10^-16
```

```
        //energy asociated with alpha particle
8
9   wavelength=h/sqrt(2*m*E)
10
11  printf("\nThe de Broglie wavelength of an alpha
        particle\n")
12
13  disp(wavelength)
14
15  printf("meter\n")
16
17  v=h/(m*wavelength)

        //velocity of an alpha particle
18
19  printf("\nThe velocity of an alpha particle   v = %.2
        f m/s\n",v)
```

Scilab code Exa 5.3.13 find the de Broglie wavelengths of photon and electron

```
1   //Chapter−5,Example5_3_13 , pg 5−12
2
3   h=6.63*10^-34

        //Plancks constant
4
5   c=3*10^8

        //velocity of light in air
6
7   E=1.6*10^-19

        //energy of photon
8
```

```
 9  wavelength_ph =h * c/E

        //The energy of photon is E=h*c/lamph
10
11  printf("\nThe de Broglie wavelength of a photon\n")
12
13  disp(wavelength_ph)
14
15  printf("meter\n")
16
17  m=9.1*10^-31

        //mass of an electron
18
19  wavelength_e=h/sqrt(2*m*E)
20
21
22  printf("\nThe de Broglie wavelength of an electron\n
        ")
23
24  disp(wavelength_e)
25
26  printf("meter\n")
```

Scilab code Exa 5.3.14 find the de Broglie wavelength of an electron

```
1  //Chapter-5,Example5_3_14,pg 5-13
2
3  h=6.63*10^-34

        //Plancks constant
4
5  m_0=9.1*10^-31

        //rest mass of electron
```

```
6
7  c =3*10^8

      // velocity  of  light  in  air
8
9  E= m_0 * c ^2

      // kinetic  energy  associated  with
10
11  wavelength=h/ sqrt (2* m_0 *E)
                                                  // The
      de  broglie  wavelength  of  an  electron
12
13 printf (" \nThe  de  Broglie  wavelength  of  an  electron \n
      ")
14
15 disp ( wavelength )
16
17 printf (" meter \n")
```

Scilab code Exa 5.7.1 find the accuracy in position of an electron

```
1  // Chapter −5, Example5_7_1 , pg  5−26
2
3  unc =1*10^ -4
                                                  // as
      uncertainty  is  0.01%
4
5  m =9 .1*10^ -31
                                                  // mass  of
      an  electron
6
7  h =6.63*10^ -34
                                                  // Plancks
      constant
```

```
8
9  v=400
                                                                    //
       speed  of  an  electron
10
11 delta_v=unc*v
                                                           //
       error  in  measurement  of  speed
12
13 delta_x=h/(4*%pi*m*delta_v)
                                                  //By
       Heisenberg's  uncertainty  priciple
14
15 printf("\nThe  accuracy  in  position  of  an  electron
       Delta_x = %.5 f  m\n",delta_x)
```

Scilab code Exa 5.7.2 calculate the percentage of uncertainty

```
1  //Chapter−5,Example5_7_2 ,pg  5−27
2
3  delta_x=10*10^-9
                                                           //
       position  is  located  within  this  distance
4
5  h=6.63*10^-34
                                                           //
       plancks  constant
6
7  delta_px=h/(4*%pi*delta_x)
                                                  //By
       Heisenberg's  uncertainty  priciple
8
9  E=1.6*10^-16
                                                        //
       Energy  associated  with  an  electron
```

```
10
11  m=9.1*10^-31
                                                    //mass
        of an electron
12
13  p=sqrt(2*m*E)
                                                    //
        momentum of an electron
14
15  percentage=delta_px*100/p
                                                    //
        percentage uncertainty in momentum
16
17  printf("\npercentage uncertainty in momentum of an
        electron = %.4f \n",percentage)
```

Scilab code Exa 5.7.3 find the accuracy in position of an electron

```
1  //Chapter-5,Example5_7_3,pg 5-27
2
3
4  uncertainty=1*10^-4
                                                    //as
        uncertainty is 0.01%
5
6  m=9.1*10^-31
                                                    //mass of
        an electron
7
8  h=6.63*10^-34
                                                    //Plancks
        constant
9
10 v=4*10^5
                                                    //
```

```
      speed  of  an  electron
11
12  delta_v=uncertainty*v
                                                            //
      error  in  measurement  of  speed
13
14  delta_x=h/(4*%pi*m*delta_v)
                                                    //By
      Heisenberg's  uncertainty  priciple
15
16  printf("\nThe  accuracy  in  position  of  an  electron
      Delta_x  =  %.8 f  m\n", delta_x)
```

Scilab code Exa 5.7.4 find the accuracy in position of an electron

```
1  //Chapter −5, Example5_7_4 , pg  5−27
2
3  uncertainty=1*10^-2
                                                    //as
      uncertainty  is  1%
4
5  m=9.1*10^-31
                                                    //mass  of
       an  electron
6
7  h=6.63*10^-34
                                                    //Plancks
      constant
8
9  v=1.88*10^6
                                                    //speed
      of  an  electron
10
11  delta_v=uncertainty*v
                                                            //
```

```
        error  in  measurement  of  speed
12
13  delta_x=h/(4*%pi*m*delta_v)
                                            //By
        Heisenberg 's  uncertainty  priciple
14
15  printf("\nThe  accuracy  in  position  of  an  electron
        Delta_x  =\n")
16
17  disp(delta_x)
18
19  printf("meter\n")
```

Scilab code Exa 5.7.5 `calculate the minimum time spent by the electrons`

```
1  //Chapter −5, Example5_7_5 , pg  5−28
2
3  //By  Heisenberg 's  uncertainty  principle
4
5  //( delta_E * delta_t )>=h/(4*%pi)
6
7  //therefore        (h*c*delta_wavelength*delta_t/
        wavelength ^2)  >=  h/(4*%pi)
8
9  wavelength=4*10^-7

        //wavelength  of  spectral  line
10
11  c=3*10^8

        //velocity  of  light  in  air
12
13  delta_wavelength=8*10^-15

        //width  of  spectral  line
```

```
14
15  delta_t=wavelength^2/(4*%pi*c*delta_wavelength)
16
17  printf("\nThe minimum time required by the electrons
        in upper energy state   Delta_t = \n")
18
19  disp(delta_t)
20
21  printf("sec\n")
```

Scilab code Exa 5.7.6 calculate the uncertainty in energy

```
1  //Chapter-5,Example5_7_6 ,pg 5-29
2
3  h=6.63*10^-34

      //Plancks constant
4
5  e=1.6*10^-19

      //charge of an electron
6
7  delta_t=1.4*10^-10

      //time spent in excited state
8
9  delta_E=h/(4*%pi*delta_t*e)

      //By Heisenberg's uncertainty principle (delta_E*
      delta_t)>= h/(4*%pi)
10
11  printf("\nThe uncertainty in energy of Iradium in
        the excited state   Delta_E = %.8f eV\n",delta_E)
```

Scilab code Exa 5.7.7 find the time spent by an atom in excited state

```
1  //Chapter -5, Example5_7_7 , pg 5-29
2
3  //By Heisenberg's uncertainty principle
4
5  //( delta_E * delta_t )>=h/(4*%pi)
6
7  //therefore       (h*c*delta_wavelength*delta_t/
       wavelength^2) >= h/(4*%pi)
8
9  wavelength=546*10^-9
       //wavelength of spectral line
10
11 c=3*10^8
       //velocity of light in air
12
13 delta_wavelength=10^-14
       //width of spectral line
14
15 delta_t=wavelength^2/(4*%pi*c*delta_wavelength)
16
17 printf("\nThe time spent by an atom in the excited
       state \n")
18
19 disp(delta_t)
20
21 printf("sec\n")
```

Scilab code Exa 5.15.1 find the energy of an electron for different states

```
1  //Chapter-5,Example5_15_1,pg 5-41
2
3  //En=(n^2*h^2)/(8*m*e*L^2)                    n=1,2,3,....
4
5  e=1.6*10^-19

        //charge of an electron
6
7  h=6.63*10^-34
                                                                //
        Plancks constant
8
9  m=9.1*10^-31

        //mass of an electron
10
11 L=2*10^-10

        //width
12
13 E1=h^2/(8*m*e*L^2)
                                                        //For
        ground state n=1
14
15 printf("\nThe energy of an electron in ground state
        E1 = %.2f eV\n",E1)
16
17 E2=4*E1

        //For first excited state n=2
18
19 printf("\nThe energy of an electron in ground state
        E2 = %.2f eV\n",E2)
20
21 E3=9*E1
```

```
         // For  second  excited  state  n=3
22
23  printf (" \nThe  energy  of  an  electron  in  ground  state
         E3  =  %.2 f  eV\n" , E3 )
```

Scilab code Exa 5.15.2 find the ground state energy of an electron

```
1  // Chapter −5, Example5_15_2 , pg  5−42
2
3  // En=(n^2∗h^2) /(8∗m∗e∗L^2)                 n=1 ,2 ,3 ,....
4
5  // as  width  'L'  gets  double  , the  ground  state  energy
        becomes  one−fourth
6
7  E=5.6∗10^−3

        // Ground  state  energy  of  an  electron
8
9  E_new=E/4

        // width  is  doubled
10
11  printf (" \nThe  new  energy  of  an  electron  in  ground
        state   E  =  %.4 f \n" , E_new )
```

Scilab code Exa 5.15.3 calculate the probability of finding the particle

```
1  // Chapter −5, Example5_15_3 , pg  5_42
2
3  // for  box  of  width  a  ,  the  normalised  eigen
        functions  are
4
5  //     'sci  =  sqrt (2/ a )∗sin (n∗%pi∗x/a ) '
```

```
6
7  //    ' sci_c = sqrt (2/a) * sin ( n*%pi*x/a ) '       complex
        conjugate
8
9  // for  first  excitation
10
11  n =2
12
13  // probability  of  finding  the  particle  is       P =
        integral  a/4  to  3a/4  of   sci  *  sci_c
14
15  // as  'a'  is  constant  width
16  // assume
17  a =1
18
19  function  y=f(x),y= (2/a)*(sin(n*%pi*x/a))^2,
                        // y = sci  *  sci_c
20  endfunction
21
22  P=intg(a/4,3*a/4,f)
23
24  printf('\nThe  probability  of  finding  the  particle  is
          P = %.1 f ',P)
```

Scilab code Exa 5.15.4 find the probability of finding the particle

```
1  // Chapter −5, Example5_15_4 , pg  5_43
2
3  // probability  of  finding  the  particle  is        P =
        integral  x1  to  x2  of   sci  *  sci_c
4
5  // interval  is  (0,1/2)
6
7  x1 =0
8
```

```
 9  x2 =1/2
10
11  // sci= x*sqrt(3)
12
13  //complex conjugate is    sci_c = x*sqtr(3)
14
15  function y=f(x),y=(x*sqrt(3))^2,
        // y = sci * sci_c
16  endfunction
17
18  P=intg(x1,x2,f)
19
20  printf('\nThe probability of finding the particle is
          P = %.3 f ',P)
```

Scilab code Exa 5.15.5 find the lowest energy states

```
 1  //Chapter-5,Example5_15_5 ,pg 5-44
 2
 3  //for an electron
 4
 5  e=1.6*10^-19                                    //
        electron charge
 6
 7  m_e=9.1*10^-31                                  //mass
        of an electron
 8
 9  L=10^-9                                         //width
        of well
10
11  h=6.63*10^-34                                   //Plank
        's constant
12
13  //the energy level are given by    En = n^2 *h^2/(8*m
        *L^2)
```

```
14
15  Ee1 =(1^2)*(h^2)/(8*m_e*e*(L^2))
                                      // for    n = 1
16
17  Ee2 =(2^2)*(h^2)/(8*m_e*e*(L^2))
                                      // for    n = 2
18
19  Ee3 =(3^2)*(h^2)/(8*m_e*e*(L^2))
                                      // for    n = 3
20
21  printf('\n   FOR AN ELECTRON')
22  printf('\n   the  lowest  three  energy  states  are
         obtained  ')
23  printf('\n   for  n = 1    Ee1 = %.4 f  eV',Ee1)
24  printf('\n   for  n = 2    Ee2 = %.4 f  eV',Ee2)
25  printf('\n   for  n = 3    Ee3 = %.4 f  eV',Ee3)
26
27
28  // for  the  grain  of  dust
29
30  m=10^-9                                        // mass  of
         grain  of  dust
31
32  l=10^-4                                        // width  of
         well
33
34  E1 =(1^2)*(h^2)/(8*m*e*(l^2))
                                      // for    n = 1
35
36  E2 =(2^2)*(h^2)/(8*m*e*(l^2))
                                      // for    n = 2
37
38  E3 =(3^2)*(h^2)/(8*m*e*(l^2))
                                      // for    n = 3
39
40  printf('\n\n   FOR THE GRAIN OF DUST  ')
41  printf('\n   the  lowest  three  energy  states  are
         obtained  ')
```

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```
42  printf('\n   for  n = 1     E1 = ')
43  disp(E1)
44  printf('   eV')
45  printf('\n   for  n = 2     E2 = ')
46  disp(E2)
47  printf('   eV')
48  printf('\n   for  n = 3     E3 = ')
49  disp(E3)
50  printf('   eV')
```

Scilab code Exa 5.15.6 calculate the width of the well

```
1  //Chapter−5,Example5_15_6 ,pg  1−45
2
3  E=38

       //potential  energy
4
5  e=1.6*10^-19

       //charge  of  an  electron
6
7  h=6.63*10^-34

       //Plancks  constant
8
9  m=9.1*10^-31

       //mass  of  an  electron
10
11  //the  lowest  energy  of  an  electron  for  n=1  is      E=h
       ^2/(8*m*e*L^2)
12
13  L=sqrt(h^2/(8*m*e*E))
                                                              //
```

```
        width  of  the  well
14
15  printf("\nThe  width  of  the  well  is   L =\n")
16
17  disp(L)
18
19  printf("meter\n")
```

Scilab code Exa 5.15.7 calculate the energy and wavelength of the emitted photon

```
1  //Chapter−5,Example5_15_7,pg 1−45
2
3  e=1.6*10^-19
        //charge  of  an  electron
4
5  h=6.63*10^-34
        //Plancks  constant
6
7  m=9.1*10^-31
        //mass  of  an  electron
8
9  c=3*10^8
        //speed  of  light  in  air
10
11  //The  energy  eigen  values  are  given  by    E=(h^2*n
        ^2)/(8*m*e*L^2)
12
13  L=5*10^-10
        //width  of  potential  well
14
```

```
15  //as electron makes a transittion from its n=2 to n
       =1 energy level
16
17  E1=(1*h^2)/(8*m*e*L^2)
                                                            //
        for n=1
18
19  E2=(4*h^2)/(8*m*e*L^2)
                                                            //
        for n=2
20
21  E=E2-E1

        //The energy of emitted photon
22
23  printf("\nThe energy of emitted photon is  E2-E1 = %
        .2f eV\n",E)
24
25  //The energy of photon in terms of wavelength is (h*
        c)/lam
26
27  wavelength=(h*c)/(E*e)
28
29  printf("\nThe wavelength of emitted photon is = %.9f
        m\n",wavelength)
```

Chapter 6

Motion of Charged Particle in Electric and Magnetic Fields

```
1  //Chapter −6,Example6_1_1 ,pg 6−6
2
3  m=9.1*10^-31                              //
       mass of an electron in kg
4
5  v=2.5*10^6                                //
       velocity of an electron
6
7  B=0.94*10^-4                              //
       strength of uniform magnetic field
8
9  e=1.6*10^-19                              //
       charge of an electron
10
11 angle=30
       //angle between velocity vector and field
       direction
12
13 r=m*v*sind(angle)/(B*e)*10^3             //radius
```

```
          of revolution
14
15 printf("\nradius of revolution  r = %.2 f mm \n",r)
16
17 l=5*v*cosd(angle)*2*%pi*m/(B*e)              //
       distance coverd in five revolutions
18
19 printf("distance coverd in five revolutions  5l =%.3
       f m",l)
```

Scilab code Exa 6.1.2 calculate radius and pitch

```
1 //Chapter−6,Example6_1_2 ,pg 6−7
2
3 m=9.1*10^-31                                  //
       mass of an electron in kg
4
5 v=3*10^7                                      //
       velocity of an electron
6
7 B=0.23                                        //
       strength of uniform magnetic field
8
9 e=1.6*10^-19                                  //
       charge of an electron
10
11 angle=45                                     //
       angle between velocity vector and field direction
12
13 r=m*v*sind(angle)/(B*e)*10^3          //radius
       of revolution
14
15 printf("\nradius of revolution  r = %.3 f mm\n",r)
16
17 l=v*cosd(angle)*2*%pi*m/(B*e)*10^3         //pitch
```

```
         f  h e l i c a l   path
18
19  printf ( ” p i t c h   of   h e l i c a l   path    l  = %.1 f  mm\n” , l )
```

Scilab code Exa 6.1.3 `find the input voltage`

```
1  // Chapter −6, Example6_1_3 , pg  6−7
2
3  y=1.5                                    // d e f l e c t i o n
      in  the  beam
4
5  d=0.42                                   // d i s t a n c e
      between  two  p l a t e s
6
7  D=28                                     // d i s t a n c e   of
       screen  from  center  of  p l a t e s
8
9  l=1.8                                    // l e n g t h   of
      p l a t e s
10
11  Va=1.6*10^3                             // anode
      v o l t a g e
12
13  V=2*y*d*Va/(D*l)
14
15  Vin=V/6                                         // as
      a m p l i f i e r   gain  is   60
16
17  printf ( ”\napplied  v o l t a g e  is    Vin = %.2 f  V\n” , Vin )
```

Scilab code Exa 6.5.1 `calculate phase change`

```
1  // Chapter −6, Example6_5_1  , pg  6−16
```

```
 2
 3  dA =0.8                                        // minor
       axis
 4
 5  dB =2                                          // major
       axis
 6
 7  phase_shift = asind ( dA / dB )                // phase
       calculation
 8
 9  printf ("\n  phase  shift  = %.2 f  Degrees \n" , phase_shift
       )
```

Chapter 7

Superconductivity

Scilab code Exa 7.3.1 calculate critical temperature of element

```
1  //Chapter-7,Example7_3_1 ,pg 7-6
2
3  Ho=2*10^5                                      //
       critical field at absolute zero
4
5  Hc=1*10^5                                      //
       critical field at given temperature
6
7  T=8                                            //
       temperature
8
9  Tc=T/sqrt(1-(Hc/Ho))
10
11 printf("\ncritical temperature of the element Tc = %
       .2f Kelvin" ,Tc)
```

Scilab code Exa 7.3.2 find the critical field

```
1  // Chapter −7, Example7_3_2 , pg 7−7
2
3  Bo =3.06*10^-2                              //
       critical  field  at  absolute  zero
4
5  Tc =3.7                                     //
       critical  temperature
6
7  T=2                                         //
       temperature
8
9  Bc = Bo *(1 -( T / Tc ) ^2)
10
11 printf ("\ ncritical  field  of  wire   Bc = %.5 f  T" , Bc )
```

Scilab code Exa 7.3.3 calculate the critical current

```
1  // Chapter −7, Example7_3_3 , pg 7−7
2
3  Ho =6.5*10^4                               //
       critical  field  at  absolute  zero
4
5  Tc =7.18                                    //
       critical  temperature
6
7  T=4.2                                       //
       temperature
8
9  r=0.5*10^-3                                 //
       radius  of  lead  wire
10
11 Hc = Ho *(1 -( T / Tc ) ^2)
12
13 Ic =2*% pi * r * Hc
14
```

```
15  printf("\ncritical current for wire  Ic = %.2 f
        Amperes\n",Ic)
```

Scilab code Exa 7.3.4 calculate the isotopic mass

```
1  //Chapter−7,Example7_3_4 ,pg 7−8
2
3  Tc1=4.185                              //critical
        temperature 1
4
5  Tc2=4.133                              //critical
        temperature 2
6
7  M1=199.5                               //isotopic mass
        of a metal at temperature T1
8
9  a=0.5
10
11 M2=(Tc1*sqrt(M1)/Tc2)^2
12
13 printf("\nisotopic mass is M2 = %.2 f",M2)
```