

Scilab Textbook Companion for
Engineering Physics
by U. Mukherji¹

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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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Chapter 1

Crystallography And Crystal Imperfection

Scilab code Exa 1.1 density of metal

```
1 //chapter -1,Example1.1 ,pg 40
2
3 n=4
4
5 M=65.34
6
7 N=6.023*10^23
8
9 d111=2.08*10^-8//interplannar spacing
10
11 a=d111*sqrt((1^2)+(1^2)+(1^2))
12
13 D=(n*M)/(N*(a^3))
14
15 printf("density of Cu-metal\n")
16
17 printf("D=%0.2 f g/cc",D)
```

Scilab code Exa 1.2 find intercepts along crystal axis

```
1 //chapter -1,Example1_2 ,pg 40
2
3 //miller plane 231
4
5 a=1.2*10^-10
6
7 b=1.8*10^-10
8
9 c=2*10^-10//primitives of crystal
10
11 //intercepts of ABC plane
12
13 a1=a/2
14
15 b1=b/3
16
17 c1=c/1
18
19 //intercept of ABC plane along X-axis =0.6*10^-10
20
21 //ABC is not the reqd. plane
22
23 //intercept of DEF plane parallel to ABC
24
25 a2=a
26
27 b2=(2*b)/3
28
29 c2=2*c
30
31 //miller indices for DEF
32
```

```
33 //1:(3/2):(1/2)
34
35 printf("intercept of DEF plane\n")
36
37 printf("along x-axis=%0.11f\n",a2)
38
39 printf("along y-axis=%0.11f\n",b2)
40
41 printf("\nalong z-axis=%0.11f",c2)
42
43 printf("\nDEF is the reqd. plane")
```

Chapter 2

Thermoelectricity

Scilab code Exa 2.1 find out inversion temperature

```
1 //chapter -2,Example2.1 , pg 54
2
3 Tn=285
4
5 Tc1=20
6
7 Ti1=(2*Tn)-Tc1
8
9 Tc2=-20
10
11 Ti2=(2*Tn)-Tc2
12
13 printf(" higher temperature\n")
14
15 printf(" Ti1=%f deg. C",Ti1)
16
17 printf("\ntemperature of inversion\n")
18
19 printf(" Ti2=%f deg. C",Ti2)
```

Scilab code Exa 2.2 thermo emf of thermocouple

```
1 //chapter -2,Example2_2 , pg 54
2
3 aFe=16.65
4
5 aAg=2.86
6
7 bFe=-0.095
8
9 bAg=0.017
10
11 aFe_Ag=aFe-aAg
12
13 bFe_Ag=bFe-bAg
14
15 a=aFe_Ag
16
17 b=bFe_Ag
18
19 Tn=-(a/b)
20
21 t=100
22
23 EFe_Ag=(a*t)+0.5*(b*(t^2))
24
25 printf("neutral temp. of Fe-Ag thermocouple\n")
26
27 printf("Tn=%.3f deg. C",Tn)
28
29 printf("\nthermo e.m.f of thermocouple\n")
30
31 printf("EFe_Ag=%.f volts",EFe_Ag)
```

Scilab code Exa 2.3 emf of thermocouple

```
1 //chapter -2,Example2_3 , pg 54
2
3 //P=(dE/ dt ) Fe=a+b*t =1734-4.87*t
4
5 //P=(dE/ dt ) Cu=a+b*t =136+0.95*t
6
7 aFe_Pb=1734*10^-6
8
9 aFe_Cu=(1734-136)*10^-6
10
11 aCu_Pb=136*10^-6
12
13 bFe_Pb=-4.87*10^-6
14
15 bFe_Cu=(-4.87-0.95)*10^-6
16
17 bCu_Pb=0.95*10^-6
18
19 a=aFe_Cu
20
21 b=bFe_Cu
22
23 t=100
24
25 EFe_Cu=(a*t)+0.5*(b*(t^2))
26
27 printf("e.m.f of termocouple\n")
28
29 printf("EFe_Cu=%.4f Volt",EFe_Cu)
```

Chapter 3

Thermionic Emission

Scilab code Exa 3.1 Richardson Dushman Equation

```
1 //chapter -3,Example3_1 , pg 67
2
3 S=2*10^-6
4
5 T=2000
6
7 A=60.2*10^4
8
9 b=52400 //Q/K
10
11 e=1.6*10^-19
12
13 I=A*S*(T^2)*(%e^(-(b/T)))
14
15 J=A*(T^2)*(%e^(-(b/T)))
16
17 no=J/e
18
19 printf("maximum obtainable electronic emission
        current\n")
20
```

```

21 disp(I)
22
23 printf("\n emission current density\n")
24
25 printf("J=%0.3 f A/m2",J)
26
27 printf("\nno. of electrons emitted per unit area per
      sec.\n")
28
29 disp(no)

```

Scilab code Exa 3.2 calculate plate voltage

```

1 //chapter -3,Example3-2 , pg 67
2
3 Ip1=20*10^-3
4
5 Ip2=30*10^-3
6
7 Vp1=80
8
9 //Ip=K*(Vp^(3/2))
10
11 Vp2=(((Vp1)^(3/2))*Ip2)/Ip1)^(2/3)
12
13 printf("plate voltage for 30mA current\n")
14
15 printf("Vp2=%0.2 f volts",Vp2)

```

Chapter 4

Ultrasonic

Scilab code Exa 4.1 find distance between two ships

```
1 //chapter4 , Example4_1 , pg 84
2
3 V1=343
4
5 //S=V1*t1
6
7 V2=1372
8
9 //S=V2*t2
10
11 dt=3//time difference
12
13 S=((V1*V2)*(dt))/(V2-V1)
14
15 printf("distance between two ships\n")
16
17 printf("S=%f m",S)
```

Scilab code Exa 4.2 calculate depth of sea


```

1 //chapter4 ,Example4_2 ,pg 84
2
3 V=1700
4
5 t=0.65
6
7 d=(V*t)/2
8
9 n=0.07*10^6
10
11 lam=V/n
12
13 printf("depth of sea\n")
14
15 printf("d=%0.1 f m" ,d)
16
17 printf("\nwavelength of pulse\n")
18
19 printf("lam=%0.4 f m" ,lam)

```

Scilab code Exa 4.3 calculate natural frequency

```

1 //chapter4 ,Example4_3 ,pg 84
2
3 P=1
4
5 l=40*10^-3
6
7 E=115*10^9
8
9 D=7.25*10^3
10
11 n=(P/(2*l))*sqrt(E/D)
12
13 printf("natural frequency\n")

```

```
14
15 printf("n=%0.2 f Hz",n)
16
17 printf("\nfrequency of rod is more than audible
    range, rod cannot be used in magnetostriction
    oscillator\n")
```

Chapter 5

Acoustics

Scilab code Exa 5.1 find absorption coefficient

```
1 //chapter5 ,Example5_1 ,pg 97
2
3 T1=1.5
4
5 T2=1
6
7 A=20
8
9 V=10*8*6
10
11 a=((0.161*V)/(2*A))*((1/T2)-(1/T1))
12
13 printf("absorption coefficient\n")
14
15 printf("a=%0.3f Sabines",a)
```

Scilab code Exa 5.2 find area of wall covered by curtain

```

1 //chapter5 ,Example5_2 ,pg 97
2
3 V=3000
4
5 T1=3.5//reverberation time
6
7 A=(0.161*V)/T1
8
9 l=20
10
11 b=15
12
13 h=10
14
15 S=2*((l*b)+(b*h)+(h*l))
16
17 sum_a=A/S
18
19 am=0.5
20
21 a=0.106
22
23 T2=2.5//reverberation time after cloth use
24
25 S1=(((0.161*V)/(am-a))*((1/T2)-(1/T1)))
26
27 printf("area of wall covered by curtain cloth\n")
28
29 printf("S1=%.3f sq.m",S1)

```

Scilab code Exa 5.3 find reverberation time

```

1 //chapter5 ,Example5_3 ,pg 98
2
3 V=1450

```

```

4
5 A1=112*0.03//absorption due to plastered wall
6
7 A2=130*0.06//absorption due to wooden floor
8
9 A3=170*0.04//absorption due to plasted. celing
10
11 A4=20*0.06//absorption due to wooden door
12
13 A5=100*1//absorption due to cushioned chairs
14
15 sum_as=A1+A2+A3+A4+A5
16
17 T1=(0.161*V)/sum_as//reverberation time case-1
18
19 T2=(0.161*V)/(sum_as+(60*4.7))//persons=60,A=4.7
    case-2
20
21 T3=(0.161*V)/(sum_as+(100*4.7))//seat cushioned=100
    rev. case-3
22
23 printf("rev. time for case-1\n")
24
25 printf("T1=%0.3 f sec",T1)
26
27 printf("\nrev. time for case-2\n")
28
29 printf("T2=%0.3 f sec",T2)
30
31 printf("\nrev. time for case-3\n")
32
33 printf("T3=%0.3 f sec",T3)

```

Chapter 6

Semiconductors

Scilab code Exa 6.1 final velocity of electron

```
1 //chapter6 ,Example6_1 ,pg 121
2
3 e=1.6*10^-19
4
5 V=1000
6
7 m=9.1*10^-31
8
9 v=sqrt((2*e*V)/m)
10
11 printf("final velocity of electron\n")
12
13 printf("v=%0.1f m/sec",v)
```

Scilab code Exa 6.2 find electric field

```
1 //chapter6 ,Example6_2 ,pg 121
2
```

```

3 Jc=1
4
5 sig=5.8*10^7
6
7 E=(Jc)/sig
8
9 printf("electric field established\n")
10
11 disp(E)

```

Scilab code Exa 6.3 electric field intensity for silver

```

1 //chapter6 ,Example6_3 ,pg 121
2
3 vd=1*10^-3
4
5 sig=6.17*10^7
6
7 ue=0.0056
8
9 rhoe=-(sig/ue)
10
11 Jc1=-rhoe*vd
12
13 E1=(Jc1)/sig
14
15 I=80
16
17 A=9*10^-6
18
19 Jc2=I/A
20
21 E2=Jc2/sig
22
23 V=0.5*10^-3

```

```

24
25 d=3*10^-3
26
27 E3=V/d
28
29 printf("E-field due to Jc1\n")
30
31 printf("E1=%.6 f V/m",E1)
32
33 printf("\nE-field due to Jc2\n")
34
35 printf("E2=%.6 f V/m",E2)
36
37 printf("\nE-field due to cube\n")
38
39 printf("E3=%.6 f V/m",E3)

```

Scilab code Exa 6.4 find current density current and power out

```

1 //chapter6 ,Example6_4 ,pg 122
2
3 sig=3.82*10^7
4
5 L=1000*12*2.54*10^-2//converting into m
6
7 r=0.4*2.54*10^-2
8
9 V=1.2
10
11 Jc=sig*(V/L)
12
13 A=3.14*(r^2)
14
15 Ic=Jc*A
16

```



```

17 P=Ic*V
18
19 printf(" current density\n")
20
21 printf(" Jc=%f A/m2",Jc)
22
23 printf("\ntotal current\n")
24
25 printf(" Ic=%f A",Ic)
26
27 printf("\npower dissipation\n")
28
29 printf("P=%f watt",P)

```

Scilab code Exa 6.5 conductivity due to holes and electrons

```

1 //chapter6 ,Example6_5 ,pg 122
2
3 ni=2.5*10^19
4
5 um=0.39
6
7 up=0.19
8
9 e=1.6*10^-19
10
11 L=6*10^-3
12
13 R=120
14
15 A=0.5*10^-6
16
17 sigp=L/(R*A)
18
19 p=sigp/(e*up)

```

```

20
21 Na=p
22
23 n=(ni^2)/Na
24
25 sigm=n*e*um
26
27 ratio=sigp/sigm
28
29 printf("p-type impurity concentration\n")
30
31 disp(p)
32
33 printf("\nproportion of conductivity due to hole and
        electron\n")
34
35 printf(" ratio=%f",ratio);printf(":1")

```

Scilab code Exa 6.6 calculate current due to Ge plate

```

1 //chapter6 , Example6_6 , pg 123
2
3 ni=2*10^19
4
5 e=1.6*10^-19
6
7 up=0.17
8
9 un=0.36
10
11 V=2
12
13 A=10^-4
14
15 d=0.3*10^-3

```

```
16
17 I=(ni*e*(up+un)*V*A)/d
18
19 printf("current produced in Ge-plate\n")
20
21 printf("I=%0.4f A",I)
```

Scilab code Exa 6.7 find intrinsic carrier density

```
1 //chapter6 ,Example6_7 ,pg 123
2
3 rho=6.3*10^4
4
5 e=1.6*10^-19
6
7 up=0.14
8
9 un=0.05
10
11 ni=1/(rho*e*(up+un))
12
13 printf("intrinsic carrier concentration\n")
14
15 disp(ni)
```

Scilab code Exa 6.8 Hall Effect

```
1 //chapter6 ,Example6_8 ,pg 123
2
3 L=10^-3
4
5 R=1.5
6
```

```

7 A=10^-6
8
9 Ey=0.6
10
11 w=10^-3
12
13 d=10^-3
14
15 I=120*10^-3
16
17 Bz=0.05
18
19 e=1.6*10^-19
20
21 sigp=L/(R*A)
22
23 Vhp=Ey*w
24
25 Rhp=(Vhp*d)/(I*Bz)
26
27 Uhp=sigp*Rhp
28
29 theta=atan(Uhp*Bz)
30
31 theta=theta*(180/%pi)
32
33 p=1/(Rhp*e)
34
35 printf("hall voltage :Vhp=%0.4 f Volt\n",Vhp)
36
37 printf("\nhall coeff. :Rhp=%0.5 f m3/e\n",Rhp)
38
39 printf("\nhall mobility :Uhp=%0.4 f m2/VS\n",Uhp)
40
41 printf("\nhall angle :theta=%0.2 f deg.\n",theta)
42
43 printf("\ndensity of charge carrier\n")
44

```

45 `disp(p)`

Scilab code Exa 6.9 concentration of holes in Si

```
1 //chapter6 , Example6_9 , pg 123
2
3 n=1.4*10^24
4
5 ni=1.4*10^19
6
7 Nd=n
8
9 p=(ni^2)/Nd
10
11 nbyp=n/p
12
13 printf("electron-hole concentration ratio\n")
14
15 disp(nbyp)
```

Scilab code Exa 6.10 Hall Effect

```
1 //chapter6 , Example6_10 , pg 124
2
3 Rhp=3.66*10^-4
4
5 rho=8.93*10^-3
6
7 e=1.6*10^-19
8
9 p=1/(Rhp*e)
10
11 Uhp=Rhp/rho
```

```

12
13 Bz=0.5
14
15 theta=atan(Uhp*Bz)
16
17 theta=theta*(180/%pi)
18
19 printf("density of charge carrier\n")
20
21 disp(p)
22
23 printf("\nhall angle\n")
24
25 printf("theta=%.2f deg.",theta)
26
27 printf("\nhall mobility\n")
28
29 printf("Uhp=%.4f m2/VS",Uhp)

```

Scilab code Exa 6.11 effect of external impurity

```

1 //chapter6 ,Example6_11 ,pg 124
2
3 ni=2.5*10^13
4
5 e=1.6*10^-19
6
7 un=3900
8
9 up=1900
10
11 sigin=ni*e*(un+up)//intrinsic conductivity
12
13 //1 donor atom/10^8 Ge atom dropped
14

```

```

15 rhoGe=4.42*10^22//no. of Ge atom/cc
16
17 Nd=rhoGe/10^8
18
19 sigex=Nd*e*un//extrinsic conductivity
20
21 printf("extrinsic conductivity\n")
22
23 printf("sigex=%0.4f ohm cm",sigex)

```

Scilab code Exa 6.12 probability of electron in CB

```

1 //chapter6 ,Example6_12 ,pg 124
2
3 //permeability of electron to be in C.B=F(Ec)
4
5 e=1.6*10^-19
6
7 Eg=5.6
8
9 Ef=Eg/2
10
11 Ec=Eg
12
13 K=1.38*10^-23
14
15 T=27+273//converting in Kelvin
16
17 KT=K*T
18
19 KT=KT/e
20
21 //e^(Ec-Ef/KT)>>1
22
23 Fermi_F=e^((Ef-Ec)/KT)//fermi factor

```

```
24
25 printf("probability of electron on CB\n")
26
27 disp(Fermi_F)
28
29 printf("\nit is infinite in negative direction for
    an insulator like diamond, so diamond cannot take
    part in conduction")
```

Scilab code Exa 6.13 Hall Effect

```
1 //chapter6 ,Example6_13 ,pg 125
2
3 e=1.6*10^-19
4
5 n=7*10^21
6
7 ue=0.39
8
9 V=10^-3
10
11 A=10^-6
12
13 L=10*10^-3
14
15 I=(n*e*ue*V*A)/L
16
17 Rhe=-(1/(n*e))
18
19 Bz=0.2
20
21 d=10^-3
22
23 Vhe=(Rhe*I*Bz)/d
24
```



```
25 printf("current through bar I=%0.7f A\n",I)
26
27 printf("\nhall coeff. Rhe=%0.6f m3/c\n",Rhe)
28
29 printf("\nhall voltage Vhe=%0.8f volt\n",Vhe)
```

Scilab code Exa 6.14 find forward bias current flow

```
1 //chapter6 ,Example6_14 ,pg 136
2
3 J2=0.2*10^-6
4
5 e=1.6*10^-19
6
7 V=0.1
8
9 K=1.38*10^-23
10
11 T=300
12
13 J=J2*(e^((e*V)/(K*T)))//as e^((e*v)/KT)>>1
14
15 printf("forward bias current flow\n")
16
17 disp(J)
```

Scilab code Exa 6.15 find static and dynamic resistance

```
1 //chapter6 ,Example6_15 ,pg 148
2
3 V1=1.4
4
5 I1=60*10^-3
```

```

6
7 V2=1.5
8
9 I2=85*10^-3
10
11 Rs1=V1/I1
12
13 Rs2=V2/I2
14
15 dV=V2-V1
16
17 dI=I2-I1
18
19 Rd=dV/dI
20
21 printf("static resistance\n")
22
23 printf("Rs1=%0.2f ohm\n",Rs1)
24
25 printf("Rs2=%0.2f ohm\n",Rs2)
26
27 printf("dynamic resistance\n")
28
29 printf("Rd=%0.2f ohm",Rd)

```

Scilab code Exa 6.16 find alpha and beta

```

1 //chapter6 ,Example6_16 ,pg 148
2
3 Ie=1*10^-3
4
5 Ib=0.02*10^-3
6
7 Ic=Ie-Ib
8

```

```
9 B=Ic/Ib
10
11 alpha=Ic/Ie
12
13 printf("alpha=%0.2 f \n",alpha)
14
15 printf("B=%0.2 f \n",B)
```

Scilab code Exa 6.17 find leakage current I_{ce0}

```
1 //chapter6 ,Example6_17 ,pg 148
2
3 alpha=0.99
4
5 Icbo=0.5*10^-6
6
7 B=alpha/(1-alpha)
8
9 Iceo=(1/(1-alpha))*Icbo
10
11 printf("B=%0. f \n",B)
12
13 printf("Iceo=%0.8 f A",Iceo)
```

Scilab code Exa 6.18 find alpha and beta

```
1 //chapter6 ,Example6_18 ,pg 148
2
3 delIc=2.5*10^-3
4
5 delIb=40*10^-6
6
7 B=delIc/delIb
```

```
8
9 alpha=B/(1+B)
10
11 printf(" alpha=%0.5 f\n", alpha)
12
13 printf("B=%0.2 f", B)
```

Scilab code Exa 6.19 find current gain

```
1 //chapter6 , Example6_19 , pg 148
2
3 Ie=1*10^-3
4
5 Ib=0.04*10^-3
6
7 Ic=Ie-Ib
8
9 alpha=Ic/Ie
10
11 printf(" current gain\n")
12
13 printf(" alpha=%0.2 f", alpha)
```

Scilab code Exa 6.20 find base current

```
1 //chapter6 , Example6_20 , pg 149
2
3 V=1.5
4
5 R=10^3
6
7 Ic=V/R
8
```

```
9 alpha=0.96
10
11 Ie=Ic/alpha
12
13 Ib=Ie-Ic
14
15 printf("base current\n")
16
17 printf("Ib=%.6f A",Ib)
```

Chapter 8

Interference Diffraction And Polarisation

Scilab code Exa 8.1 distance of fringe from wedge

```
1 //chapter8 ,Example8_1 ,pg 180
2
3 alpha=0.01
4
5 n=10
6
7 lam=6000*10^-8
8
9 u=1.5
10
11 //for dark fringe  $2*u*t*cos(alpha)=n*lam$ 
12
13 //t=xtan(alpha)
14
15 // $2*u*x*sin(alpha)=2*u*x*alpha=n*lam \rightarrow alpha$  is
    small ,  $sin(alpha)=alpha$ 
16
17  $x=(n*lam)/(2*u*alpha)$ 
18
```

```
19 printf("distance of 10th fringe from edge of wedge\n
    ")
20
21 printf("x=%0.2 f cm" ,x)
```

Scilab code Exa 8.2 light reflected in visible spectrum

```
1 //chapter8 ,Example8_2 ,pg 181
2
3 //for constructive interference of reflected light
4
5 //2*u*t*cos(r)=(2*n+1)(lam/2) , where n=0,1,2,3
6
7 //for normal incidence
8
9 //r=0, cos(r)=1
10
11 t=5*10^-5
12
13 u=1.33
14
15 //for n=0 lam=lam1
16
17 lam1=4*u*t
18
19 //for n=1 lam=lam2
20
21 lam2=4*u*t*(1/3)
22
23 //for n=2 lam=lam3
24
25 lam3=4*u*t*(1/5)
26
27 //for n=3 lam=lam4
28
```

```
29 lam4=4*u*t*(1/7)
30
31 printf("wavelength that is strongly reflected in
    visible spectrum\n")
32
33 disp(lam3)
```

Scilab code Exa 8.3 radius of 50th dark ring

```
1 //chapter8 ,Example8_3 ,pg 181
2
3 n=10
4
5 D10=0.5
6
7 lam=5000*10^-8
8
9 R=(D10^2)/(4*n*lam)
10
11 D50=sqrt(4*50*R*lam)
12
13 r50=D50/2
14
15 printf("radius of 50th dark ring\n")
16
17 printf("r50=%0.2f cm",r50)
```

Scilab code Exa 8.4 thickness of film

```
1 //chapter8 ,Example8_4 ,pg 182
2
3 i=45*(%pi/180)
4
```



```

5 u=1.33
6
7 r=asin(sin(i)/u)
8
9 r=r*(180/%pi)
10
11 //for bright fringe  $2*u*t*cos(r)=(2*n+1)(lam/2)$ 
12
13 //for minimum thickness  $n=0$ 
14
15 lam=5000*10^-8
16
17 t=lam/(4*u*t*cos(r))
18
19 printf("min. thickness of film\n")
20
21 disp(t)

```

Scilab code Exa 8.5 find RI of oil

```

1 //chapter8 ,Example8_5 ,pg 182
2
3 //since both reflections occur at surface of denser
  medium
4
5 //condition for brightness for min thickness , n=1
6
7 //for normal incidence  $r=0$ ,  $cos(r)=1$ 
8
9 lam=5500*10^-8
10
11 V=0.2
12
13 A=100*100 //converting into cm2
14

```

```

15 t=V/A
16
17 u=lam/(2*t)
18
19 printf("RI of oil\n")
20
21 printf("u=%0.2 f",u)

```

Scilab code Exa 8.6 change in film thickness

```

1 //chapter8 , Example8_6 , pg 183
2
3 lam=6300*10^-10
4
5 u=1.5
6
7 //condition for dark 2*u*t=n*lam
8
9 //condition for bright 2*u*t=(2*n-1)(lam/2)
10
11 //when t=0 n=0 order dark band will come and at edge
    10th bright band will come
12
13 n=10
14
15 t=(((2*n)-1)*(lam))/(4*u)
16
17 printf("thickness of air film\n")
18
19 printf("t=%0.12 f cm",t)

```

Scilab code Exa 8.7 thickness of layer

```

1 //chapter8 ,Example8_7 ,pg 183
2
3 ug=1.5
4
5 uo=1.3
6
7 //here reflection occurs both time at surface of
  denser medium
8
9 //condition for distructive interference in
  reflected side
10
11 //2*u*t*cos(r)=(2*n-1)(lam1/2) , for nth min.
12
13 r=0
14
15 //for nth min.
16
17 //2*u*t=(2*n+1)(lam1/2) , n=0,1,2,3
18
19 //for (n+1)th min.
20
21 ///2*u*t=(2*(n+1)+1)(lam2/2) , n=0,1,2,3
22
23 lam1=7000*10^-10
24
25 lam2=5000*10^-10
26
27 //from eq. of nth and (n+1)th min.
28
29 t=(2/(4*uo))*((lam1*lam2)/(lam1-lam2))
30
31 printf("thickness of layer\n")
32
33 printf("t=%0.12f m" ,t)

```

Scilab code Exa 8.8 calculate RI of liquid

```
1 //chapter8 ,Example8_8 ,pg 184
2
3 Dn=1.40
4
5 D=1.27
6
7 //when u=1
8
9 //  $(Dn^2)=4*n*lam*R=(1.40^2)$ 
10
11 //when u=u1
12
13 //  $(D^2)=(4*n*lam*R)/u1=(1.27^2)$ 
14
15 //from above eqn's
16
17 u1=((Dn^2)/(D^2))
18
19 printf("RI of liquid\n")
20
21 printf("u=%0.2f",u1)
```

Scilab code Exa 8.9 calculate wavelength of light

```
1 //chapter8 ,Example8_9 ,pg 184
2
3 alpha=((%pi*10)/(60*60*180))//converting into radian
4
5 B=0.5//fringe width
6
```

```

7 u=1.4
8
9 lam=2*B*alpha*u
10
11 printf("wavelength of light used\n")
12
13 printf("lam=%0.12 f m", lam)

```

Scilab code Exa 8.10 calculate change in thickness

```

1 //chapter8 ,Example8_10 ,pg 185
2
3 //condition for dark fringe is 2*t=n*lam
4
5 //refer to fig.(e) pg 185
6
7 //but B=(lam/(2*alpha*u))
8
9 //delt=alpha*x
10
11 lam=6000*10^-8
12
13 u=1.5
14
15 delt=(10*lam)/(2*u) //alpha=lam/(2*B*u) , B=x/10
16
17 printf("difference t2-t1 from fig.\n")
18
19 printf("delt=%0.4 f cm", delt)

```

Scilab code Exa 8.11 calculate min thickness of glass plate

```

1 //chapter8 ,Example8_11 ,pg 185

```

```

2
3 //condition for dark is  $2*u*t*cos(r)=n*lam$ 
4
5 lam=5890*10^-8
6
7 u=1.5
8
9 r=60*(%pi/180)
10
11 //for n=1
12
13 t=(lam)/(2*u*cos(r))
14
15 printf("smallest thickness of glass plate\n")
16
17 printf("t=%0.8f cm",t)

```

Scilab code Exa 8.12 position of brightest and darkest spot

```

1 //chapter8 ,Example8_12 ,pg 193
2
3 //for brightest spot  $R1=sqrt(b*lam)$ 
4
5 R1=0.05
6
7 lam=5*10^-5
8
9 bb=(R1^2)/lam//brightest spot
10
11 //for darkest spot
12
13 bd=(R1^2)/(2*lam)//darkest spot
14
15 printf("position of brightest spot\n")
16

```

```

17 printf("b=%0.2 f cm" ,bb)
18
19 printf("\nposition of darkest spot\n")
20
21 printf("b=%0.2 f cm" ,bd)

```

Scilab code Exa 8.13 zone plate for point source

```

1 //chapter8 ,Example8_13 ,pg 193
2
3 lam=6000*10^-10
4
5 b1=30 //for m=1
6
7 b2=6 //for m=2
8
9 //(1/b) - (1/a) = (n*lam) / (R1^2) , b=b1 , b2
10
11 //from b1 , b2 equations
12
13 a = ((5*b2) - (3*b1)) / 2
14
15 R1 = sqrt(lam / ((1/b1) - (1/a)))
16
17 F1 = (R1^2) / lam
18
19 printf("distance of source from zone plate\n")
20
21 printf("a=%0.2 f cm" , a)
22
23 printf("\nradius of 1st zone plate\n")
24
25 printf("R1=%0.4 f cm" , R1)
26
27 printf("\nprincipal focal length\n")

```

28

```
29 printf("F1=%0.2 f cm" ,F1)
```

Scilab code Exa 8.14 wavelength of spectral line

```
1 //chapter8 ,Example8_14 ,pg 209
2
3 grat=1/1250//transmission grating
4
5 n=2
6
7 theta=30*(%pi/180)//deviation angle
8
9 //(a+b) sin(theta)=n*lam
10
11 //grat=(a+b)
12
13 lam=(grat*sin(theta))/n//wavelength of spectral line
14
15 printf("wavelength of spectral line\n")
16
17 printf("lam=%0.6 f cm" ,lam)
```

Scilab code Exa 8.15 max orders visible

```
1 //chapter8 ,Example8_15 ,pg 209
2
3 lam=5893*10^-8
4
5 grat=2.54/2540//converting into cm
6
7 //(a+b)=grat
8
```



```

9 // (a+b) sin(theta) = n * lam
10
11 // n = nmax, if sin(theta) = 1
12
13 nmax = (grat / lam)
14
15 printf("maximum order\n")
16
17 printf("nmax = %.2f ", nmax)
18
19 printf("so maximum order = 16\n")

```

Scilab code Exa 8.16 linear separation of Na lines

```

1 // chapter8 , Example8_16 , pg 209
2
3 n = 2
4
5 grat = 1/5000 // transmission grating
6
7 lam = 5893 * 10^-8
8
9 dtheta = (2.5 * 3.14) / (180 * 60) // change in angular
    displacement (in radian)
10
11 // (a+b) = grat
12
13 // dlam = ((a+b) cos(theta) / n) dtheta
14
15 cos(theta) = sqrt(1 - ((n * lam) / grat)^2)
16
17 dlam = (dtheta * grat * cos(theta)) / n // difference in
    wavelength
18
19 f = 30 // focal length

```

```

20
21 dl=f*dtheta//linear separation
22
23 printf("difference between two yellow lines (in cm)\n")
24
25 disp(dlam)
26
27 printf("\nlinear separation\n")
28
29 printf("dl=%0.4f cm",dl)

```

Scilab code Exa 8.17 linear separation of spectra lines

```

1 //chapter8 ,Example8_17 ,pg 210
2
3 grat=1/6000
4
5 f=30
6
7 n=2
8
9 lam1=5770*10^-8
10
11 lam2=5460*10^-8
12
13 dlam=lam1-lam2
14
15 lam=lam2
16
17 cos(theta)=sqrt(1-(((n*lam)/grat)^2))
18
19 dl=((n*f)/(grat*cos(theta)))*dlam
20
21 printf("linear separation of two spectral lines\n")

```

22

```
23 printf("dl=%0.4f cm",d1)
```

Scilab code Exa 8.18 calculate lines per cm in grating

```
1 //chapter8 ,Example8_18 ,pg 210
2
3 //nth order of lam1 is superimposed on (n+1)th order
  of lam2 for theta=30
4
5 //(a+b) sin (30)=n*5400*10-8=(n+1)*4050*10-8
6
7 lam1=5400*10-8
8
9 lam2=4050*10-8
10
11 n=(lam2/(lam1-lam2))
12
13 theta=30*(%pi/180)
14
15 N=sin(theta)/(n*lam1)
16
17 printf("lines/cm in grating\n")
18
19 printf("N=%0.2f lines/cm",N)
```

Chapter 9

X Rays

Scilab code Exa 9.1 highest order of reflection

```
1 //chapter9 ,Example9_1 ,pg 237
2
3 d=4.255*10^-10
4
5 lam=1.549*10^-10//wavelength of K-copper line
6
7 n=1//theta is smallest when n=1
8
9 theta=asin(lam/(2*d))//glancing angle
10
11 theta=theta*(180/%pi)
12
13 //max value of sin(theta)=1
14
15 //for highest order
16
17 nmax=((2*d)/lam)//highest bragg's order
18
19 printf("smallest glancing angle\n")
20
21 printf("theta=%0.2f deg.",theta)
```

```
22
23 printf("\nmaximum order of reflection\n")
24
25 printf("nmax=%0.2 f", nmax)
26
27 printf("\nsince fraction is meaningless for order
    nmax=5")
```

Scilab code Exa 9.2 find plancks constant

```
1 //chapter9 ,Example9_2 ,pg 237
2
3 V=60*10^3
4
5 c=3*10^8
6
7 e=1.6*10^-19
8
9 lam=0.194*10^-10//min. wavelength of x-rays
10
11 h=(lam*e*V)/c
12
13 printf("plancks constant\n")
14
15 disp(h)
```

Scilab code Exa 9.3 find wavelength and maximum order of reflection

```
1 //chapter9 ,Example9_3 ,pg 238
2
3 //for 110 plane
4
5 a=3*10^-10//lattice parameter
```

```

6
7 d=(a/sqrt(2))//d110=(a/sqrt((1^2)+(1^2)+0))
8
9 theta=12.5*(%pi/180)//glancing angle
10
11 n=1
12
13 lam=2*d*sin(theta)//wavelength of x-ray
14
15 nmax=((2*d)/lam)//highest order
16
17 printf("wavelength of x-ray beam\n")
18
19 disp(lam)
20
21 printf("\nhighest braggs order\n")
22
23 printf("nmax=%0.2f",nmax)
24
25 printf("\nfraction is meaningless so nmax=4")

```

Scilab code Exa 9.4 find plancks constant

```

1 //chapter9 ,Example9_4 ,pg 238
2
3 d=2.81*10^-10
4
5 theta=14*(%pi/180)//glancing angle
6
7 lam=2*d*sin(theta)//min. wavelength
8
9 e=1.6*10^-19
10
11 V=9100
12

```

```
13 c=3*10^8
14
15 h=(lam*e*V)/c
16
17 printf("plancks constant\n")
18
19 disp(h)
```

Scilab code Exa 9.5 find wavelength of line A

```
1 //chapter9 ,Example9_5 ,pg 238
2
3 //for line A-> 2*d*sin(thetaA)=lamA(n=1)
4
5 thetaA=30*(%pi/180)//glancing angle for line A
6
7 //for line B-> 2*d*sin(thetaB)=3*lamB(n=3)
8
9 thetaB=60*(%pi/180)
10
11 lamB=0.97*10^-10
12
13 d=(3*lamB)/(2*sin(thetaB))
14
15 lamA=2*d*sin(thetaA)//wavelength of line A
16
17 printf("wavelength of line A\n")
18
19 disp(lamA)
```

Scilab code Exa 9.6 find wavelength of x rays

```
1 //chapter9 ,Example9_6 ,pg 239
```

```

2
3 a=3.615*10^-10
4
5 d111=a/sqrt(1+1+1)//for 111 plane
6
7 theta=21.7*(%pi/180)//converting into radian
8
9 lam=2*d111*sin(theta)
10
11 printf("wavelength of X-rays\n")
12
13 disp(lam)

```

Scilab code Exa 9.7 find min wavelength and glancing angle

```

1 //chapter9 ,Example9_7 ,pg 239
2
3 V=50*10^3
4
5 lam=(12400/V)*10^-10
6
7 n=4//FCC crystal
8
9 m=74.6
10
11 N=6.022*10^26
12
13 rho=1.99*10^3
14
15 a((((n*m)/(N*rho))^(1/3)))
16
17 //for kcl ionic crystal
18
19 d=a/2
20

```



```

21 theta=asin(lam/(2*d))
22
23 theta=theta*(180/%pi)
24
25 printf("min. wavelength of spectrum from tube\n")
26
27 disp(lam)
28
29 printf("glancing angle for that wavelength\n")
30
31 printf("theta=%0.2f deg.",theta)

```

Scilab code Exa 9.8 identify type of crystal

```

1 //chapter9 ,Example9_8 ,pg 239
2
3 //from bragg 's law
4
5 //2*d*sin(theta)=n*lam
6
7 n=1
8
9 theta1=5.4*(%pi/180)
10
11 theta2=7.6*(%pi/180)
12
13 theta3=9.4*(%pi/180)
14
15 d100=lam/2*sin(theta1)
16
17 d110=lam/2*sin(theta2)
18
19 d111=lam/2*sin(theta3)
20
21 printf("ratio of interplannar spacing \n(1/d100):(1/

```

```

    d110):(1/d111)=")
22
23 printf("%.2f:",sin(theta1));printf("%.2f:",sin(
    theta2));printf("%.2f",sin(theta3));
24
25 printf("\nas ratio (1/d100):(1/d110):(1/d111)=1:sqrt
    (2):sqrt(3) this relation is valid for simple
    cubic crystal therefore, this is a SCC crystal")

```

Scilab code Exa 9.9 find interplannar spacing

```

1 //chapter9 ,Example9_9 ,pg 240
2
3 lam=0.58*10^-10
4
5 theta1=6.5*(%pi/180)
6
7 theta2=9.15*(%pi/180)
8
9 theta3=13*(%pi/180)
10
11 //from bragg 's law
12
13 d1=lam/(2*sin(theta1))*10^10
14
15 d2=lam/(2*sin(theta2))*10^10
16
17 d3=lam/(2*sin(theta3))*10^10
18
19 printf("interplannar spacing of crystal\n")
20
21 printf("%.2f:",d1);printf("%.2f:",d2);printf("%.2f",
    d3);

```

Chapter 10

Motion Of Charged Particle In Electric And Magnetic Field

Scilab code Exa 10.1 find KE of particle

```
1 //chapter10 ,Example10_1 ,pg 270
2
3 L=1.33*10^-22
4
5 B=0.025
6
7 m=6.68*10^-27
8
9 q=3.2*10^-19
10
11 w=(B*q)/m
12
13 E=0.5*L*w//E=0.5I(w^2),Iw=L
14
15 E=E/(1.6*10^-19)//converting into ev
16
17 printf("KE of particle\n")
18
19 printf("E=%0.2f ev",E)
```

Scilab code Exa 10.2 frequency of oscillation and maximum energy of particle

```
1 //chapter10 , Example10_2 , pg 271
2
3 R=0.35
4
5 n=1.38*10^7
6
7 m=1.67*10^-27
8
9 q=1.6*10^-19
10
11 B=(2*%pi*n*m)/q
12
13 E=((B^2)*(q^2)*(R^2))/(2*m)
14
15 E=E/q
16
17 printf("magnetic field induction\n")
18
19 printf("B=%0.2f wb/m2",B)
20
21 printf("\nmaximum energy of proton\n")
22
23 printf("E=%0.2f ev",E)
```

Scilab code Exa 10.3 radius of electron trajectory and angular momentum

```
1 //chapter10 , Example10_3 , pg 271
```

```

2
3 m=9.1*10^-31
4
5 e=1.6*10^-19
6
7 //due to potential difference V, electron is
  accelerated
8
9 //eV=0.5*m*(v^2)
10
11 //due to transverse magnetic field B electron moves
  in circular path of radius R
12
13 //(m*(v^2))/R=BeV
14
15 B=1.19*10^-3
16
17 V=1000
18
19 v=sqrt((2*e*V)/m)
20
21 R=(m*v)/(B*e)
22
23 L=m*v*R
24
25 printf("radius of electron trajectory\n")
26
27 printf("R=%0.2 f m",R)
28
29 printf("\nangular momentum of electron\n")
30
31 disp(L)

```

Scilab code Exa 10.4 vertical displacement and magnetic field of electron

```

1 //chapter10 , Example10_4 , pg 272
2
3 vx=1.7*10^7
4
5 Ey=3.4*10^4
6
7 x=3*10^-2
8
9 t=x/vx
10
11 //y=0.5*ay*(t^2)
12
13 ay=(e*Ey)/m
14
15 y=0.5*ay*(t^2)
16
17 Bz=Ey/vx
18
19 printf("verical displacement of electron \n")
20
21 printf("y=%0.2 f m" ,y)
22
23 printf("\nmagnitude of magnetic field\n")
24
25 printf("B=%0.4 f wb/m2" ,B)
26
27 printf("\ndirection of field is upward as Ey is
    downward")

```

Scilab code Exa 10.5 resonance frequency and maximum energy of proton

```

1 //chapter10 , Example10_5 , pg 272
2
3 m=1.67*10^-27
4

```

```

5 q=1.6*10^-19
6
7 B=0.5
8
9 n=((B*q)/(2*%pi*m))
10
11 R=1
12
13 E=((B^2)*(q^2)*(R^2))/(2*m)
14
15 E=E/(1.6*10^-19)
16
17 printf("frequency of oscillation voltage\n")
18
19 printf("n=%0.2 f Hz" ,n)
20
21 printf("\nmaximum energy of proton\n")
22
23 printf("E=%0.2 f ev" ,E)

```

Scilab code Exa 10.6 calculate force periodic time and resonance frequency

```

1 //chapter10 ,Example10_6 ,pg 273
2
3 q=3.2*10^-19
4
5 m=6.68*10^-27
6
7 B=1.5
8
9 v=7.263*10^6
10
11 F=B*q*v
12
13 printf("force on particle\n")

```

```

14
15 disp(F)
16
17 T=(2*%pi*m)/(B*q)
18
19 n=1/T
20
21 printf("\nperiodic time\n")
22
23 disp(T)
24
25 printf("\nresonance frequency\n")
26
27 printf("n=%0.2 f Hz" ,n)

```

Scilab code Exa 10.7 calculate flux density and radius of cyclotron for proton and alpha particle

```

1 //chapter10 , Example10-7 , pg 273
2
3 n=1.2*10^7
4
5 mp=1.67*10^-27
6
7 qp=1.6*10^-19
8
9 Bp=(2*%pi*mp*n)/qp
10
11 R=0.5
12
13 Ep=((Bp^2)*(qp^2)*(R^2))/(2*mp)
14
15 Ep=Ep/qp
16
17 malp=6.68*10^-27

```



```

18
19 qalp=2*1.6*10^-19
20
21 Balp=(2*pi*malp*n)/qalp
22
23 Ealp=((Balp^2)*(qalp^2)*(R^2))/(2*malp)
24
25 Ealp=Ealp/qp
26
27 printf("flux density for proton\n")
28
29 printf("Bp=%.2 f Wb/m2" ,Bp)
30
31 printf("\nflux density for alpha particle\n")
32
33 printf("Balp=%.2 f Wb/m2" ,Balp)
34
35 printf("\nenergy of proton\n")
36
37 printf("Ep=%.2 f ev" ,Ep)
38
39 printf("\nenergy of alpha particle\n")
40
41 printf("Ealp=%.2 f ev" ,Ealp)

```

Scilab code Exa 10.8 linear separation of electron beam

```

1 //chapter10 , Example10_8 , pg 274
2
3 e=1.6*10^-19
4
5 me=9.1*10^-31 //mass of electron
6
7 q=3.2*10^-19
8

```

```

 9 malp=6.68*10^-27//mass of alpha particle
10
11 B=0.05
12
13 V=20*10^3
14
15 //v=sqrt((2*q*V)/m)
16
17 //R=(1/B)*sqrt((2*m*V)/q)
18
19 Re=(1/B)*sqrt((2*me*V)/e)
20
21 Ralp=(1/B)*sqrt((2*malp*V)/q)
22
23 S=2*Ralp-2*Re//linear separation between two
    particles on common boundary wall
24
25 printf("linear separation between two particles on
    common boundary wall\n")
26
27 printf("S=%0.2 f m",S)

```

Scilab code Exa 10.9 find potential difference

```

1 //chapter10 ,Example10_9 ,pg 274
2
3 V1=200
4
5 //electrostatic focusing condition
6
7 //(sini/sinr)=(v2/v1)=sqrt(V2/V1)
8
9 //0.5mv2=eV
10
11 i=60*(%pi/180)//converting into radian

```

```

12
13 r=45*(%pi/180)//converting into radian
14
15 V2=200*((sin(i)/sin(r))^2)
16
17 pd=V2-V1//potential difference
18
19 printf("potential difference between two region\n")
20
21 printf("\n pd=%0.2 f Volts",pd)

```

Scilab code Exa 10.10 charge on drop

```

1 //chapter10 , Example10-10 , pg 275
2
3 //F=mg=qE
4
5 E=250
6
7 R=10^-8
8
9 rho=10^3//density
10
11 m=(4/3)*%pi*(R^3)*rho//m=volume*density
12
13 W=m*9.8//weight of drop(mg)
14
15 q=W/E
16
17 printf("charge on water drop\n")
18
19 disp(q)

```

Scilab code Exa 10.11 bainbridge mass spectograph

```
1 //chapter10 , Example10.11 , pg 275
2
3 e=1.6*10^-19
4
5 v=5*10^5
6
7 B=0.3
8
9 N=6.025*10^26
10
11 M72=72/N
12
13 R72=(M72*v)/(B*e)
14
15 M74=74
16
17 R74=(R72/72)*M74
18
19 S=2*(R74-R72)//linear separation of two line
20
21 printf("linear separation of two line\n")
22
23 printf("S=%0.2 f m" ,S)
```

Scilab code Exa 10.12 calculate flux density

```
1 //chapter10 , Example10.12 , pg 276
2
3 l=5*10^-2
4
5 d=0.3//distance of screen from end of mag. field
6
7 D=d+(1/2)
```

```

8
9 y=0.01
10
11 m=9.1*10^-31
12
13 e=1.6*10^-19
14
15 Va=1000
16
17 B=(y/(D*1))*sqrt((2*m*Va)/e)
18
19 printf("flux density\n")
20
21 printf("B=%.8 f Wb/m2" ,B)

```

Scilab code Exa 10.13 electron in transverse electric field

```

1 //chapter10 , Example10_13 , pg 276
2
3 e=1.6*10^-19
4
5 Va=150
6
7 m=9.1*10^-31
8
9 vx=sqrt((2*e*Va)/m)
10
11 V=20
12
13 d=10^-2
14
15 ay=(e/m)*(V/d)
16
17 l=10*10^-2
18

```

```

19 vy=ay*(l/vx)
20
21 theta=atan(vy/vx)
22
23 theta=theta*(180/%pi)//converting into degree
24
25 theta=theta*(%pi/180)//converting into radian
26
27 Y=D*tan(theta)
28
29 S=(Y/V)
30
31 printf("velocity of electron reaching field vx=%0.2f
    m/sec\n",vx)
32
33 printf("\nacceleration due to electric field ay=%0.2f
    m/sec2\n",ay)
34
35 printf("\nfinal velocity attained by deflecting
    field vy=%0.2f m/sec\n",vy)
36
37 printf("\nangle of deflection theta=%0.2f deg.\n",
    theta)
38
39 printf("\ndeflection on screen Y=%0.2f m\n",Y)
40
41 printf("\ndeflection sensitivity S=%0.2f m/volt\n",S)

```

Chapter 11

Quantum Physics And Schrodinger Wave Equation

Scilab code Exa 11.1 uncertainty in velocity

```
1 //chapter11 ,Example11_1 ,pg 298
2
3 me=9.1*10^-31//masss of electron
4
5 h=6.62*10^-34//planck 's const.
6
7 delx=10^-8//uncertainty in position
8
9 delp=(h/(2*%pi*delx))//uncertainty principle
10
11 delv=(delp/me)//uncertainty in velocity
12
13 printf("uncertainty in velocity\n")
14
15 printf("delv=%0.2 f m/sec",delv)
```

Scilab code Exa 11.2 find KE and velocity of proton

```
1 //chapter11 ,Example11_2 ,pg 298
2
3 lam=0.2865*10^-10//wavelength
4
5 mp=1.67*10^-27//mass of proton
6
7 h=6.625*10^-34
8
9 v=(h/(mp*lam))//debroglie 's equation
10
11 KE=0.5*mp*(v^2)//kinetic energy of proton(J)
12
13 KE=KE/(1.6*10^-19)//converting into ev
14
15 printf("kinetic energy of proton\n")
16
17 printf("KE=%0.2 f ev" ,KE)
```

Scilab code Exa 11.3 momentum and energy of electron and photon

```
1 //chapter11 ,Example11_3 ,pg 299
2
3 KEnu=0.025*1.6*10^-19//kinetic energy of neutron
4
5 mn=1.676*10^-27//mass of neutron
6
7 v=sqrt((2*KEnu)/mn)
8
9 h=6.626*10^-34
10
11 lamn=h/(mn*v)//debroglie wavelength of neutron
12
13 printf("wavelength of beam of neutron\n")
```



```

14
15 printf("lamn=%0.12 f m" ,lamn)
16
17 p=(h/lamn)
18
19 printf("\nmomentum of electron and photon\n")
20
21 printf("p=%0.26 f kgm/sec" ,p)
22
23 me=9.1*10^-31//mass of electron
24
25 ve=(p/me)//velocity of electron
26
27 Ee=0.5*p*ve//energy of electron
28
29 Ee=Ee/(1.6*10^-19)//convering into ev
30
31 printf("\nenergy of electron\n")
32
33 printf("Ee=%0.2 f ev" ,Ee)
34
35 Ep=(h*3*10^8)/lamn//energy of photon
36
37 Ep=Ep/(1.6*10^-19)
38
39 printf("\nenergy of photon\n")
40
41 printf("Ep=%0.2 f ev" ,Ep)

```

Scilab code Exa 11.4 find mass of particle

```

1 //chapter11 ,Example11.4 ,pg 300
2
3 e=1.6*10^-19
4

```

```

5 V=200
6
7 lam=0.0202*10^-10//debroglie wavelength
8
9 h=6.625*10^-34
10
11 //eV=0.5*m*(v^2)
12
13 //mv=sqrt(2*m*eV)
14
15 m=((h^2)/(2*(lam^2)*e*V))//mass of particle
16
17 printf("mass of particle\n")
18
19 disp(m)

```

Scilab code Exa 11.5 calculate debroglie wavelength of neutron

```

1 //chapter11 , Example11_5 , pg 300
2
3 mn=1.676*10^-27//mass of neutron
4
5 h=6.625*10^-34
6
7 En=1.6*10^-19//energy of neutron
8
9 v=sqrt((2*En)/mn)
10
11 lam=(h/(mn*v))//de-broglie wavelength
12
13 printf("de-broglie wavelength\n")
14
15 disp(lam)

```

Scilab code Exa 11.6 existence of electron within nucleus

```
1 //chapter11 ,Example11.6 ,pg 300
2
3 //acc. to uncertainty principle
4
5 //delx*delp >= (h/2*%pi)
6
7 rad=10^-14
8
9 delx=2*rad
10
11 h=6.625*10^-34
12
13 delp=(h/(2*%pi*delx))
14
15 //from einstein 's relavistic relation
16
17 //E=mc2=KE+rest mass energy=0.5mv2+moc2
18
19 //when velocity of particle is very high
20
21 //m=(mo/sqrt(1-((v/c)^2)))
22
23 //m-mass of particle with velocity v
24
25 //mo-rest mass of particle
26
27 //c-velocity of particle
28
29 p=delp//assume
30
31 c=3*10^8
32
```

```

33 mo=9.1*10^-31
34
35 E=sqrt(((p*c)^2)+((mo*(c^2))^2))
36
37 E=E/(1.6*10^-19)
38
39 printf("E=%.2 f ev",E)
40
41 printf("\nthis value is much higher than
        experimentally obtained values of energy of
        electron\n")
42
43 printf("of a radioactive nuclei i.e 4 Mev this
        proves that electron cannot reside within nucleus
        ")

```

Scilab code Exa 11.7 calculate debroglie wavelength

```

1 //chapter11 , Example11_7 , pg 302
2
3 m1=60*10^-9
4
5 v1=80
6
7 p1=m1*v1
8
9 h=6.625*10^-34
10
11 lam1=h/p1//de-broglie wavelength case-1
12
13 m2=8*10^-27
14
15 v2=1.3
16
17 p2=m2*v2

```

```

18
19 lam2=h/p2//de-broglie wavelength case-2
20
21 printf("de-broglie wavelength for case-1\n")
22
23 disp(lam1)
24
25 printf("\nde-broglie wavelength for case-2\n")
26
27 disp(lam2)
28
29 printf("\nfrom case-1 it is clear that for normal
    particles de-broglie wavelength is not visible it
    is very small")

```

Scilab code Exa 11.8 calculate KE of electron

```

1 //chapter11 ,Example11-8 ,pg 302
2
3 h=6.634*10^-34
4
5 c=3*10^8
6
7 e=1.6*10^-19
8
9 m=9.1*10^-31
10
11 Ep=100*10^3*e//energy of photon
12
13 lamp=((h*c)/Ep)//wavelength of photon
14
15 lame=lamp//wavelength of electron
16
17 v=h/(m*lame)
18

```

```
19 KEe=0.5*m*(v^2)//kinetic energy of electron
20
21 KEe=KEe/(1.6*10^-19)
22
23 printf("kinetic energy of electron\n")
24
25 printf("KEe=%0.2f ev",KEe)
```

Chapter 12

Laser Holography And Fibre Optics

Scilab code Exa 12.1 normalised frequency and guided modes

```
1 //chapter12 ,Example12_1 ,pg 357
2
3 n1=1.53//refractive index
4
5 n2=1.5
6
7 lam=1*10^-6//wavelength
8
9 a=50*10^-6
10
11 NA=sqrt((n1^2)-(n2^2))
12
13 V=((2*pi*a)*NA)/lam
14
15 printf("normalised frequency\n")
16
17 printf("V=%0.2 f ",V)
18
19 M=(V^2)/2
```

```
20
21 printf("\ntotal no. of guided mode\n")
22
23 printf("M=%0.2 f" ,M)
```

Scilab code Exa 12.2 find core radius

```
1 //chapter12 , Example12_2 , pg 357
2
3 lam=1*10^-6 // wavelength
4
5 n1=1.53
6
7 n2=1.5
8
9 NA=sqrt((n1^2)-(n2^2))
10
11 a=(2.405*lam)/(2*pi*NA)
12
13 printf("core radius\n")
14
15 printf("a=%0.8 f m" ,a)
```

Scilab code Exa 12.3 calculate relative change in core cladding RI

```
1 //chapter12 , Example12_3 , pg 357
2
3 NA=0.5
4
5 n1=1.54
6
7 n2=sqrt((n1^2)-(NA^2))
8
```



```

9 printf("refractive index of cladding\n")
10
11 printf("n2=%0.2 f ",n2)
12
13 n=(n1-n2)/n1//relative change in refractive index of
    core
14
15 printf("\nrelative change refractive index of core\n
    ")
16
17 printf("n=%0.2 f ",n)

```

Scilab code Exa 12.4 find cladding RI and acceptance angle

```

1 //chapter12 ,Example12_4 ,pg 358
2
3 NA=0.5
4
5 n1=1.48
6
7 n2=sqrt((n1^2)-(NA^2))
8
9 printf("refractive index of cladding\n")
10
11 printf("n2=%0.2 f ",n2)
12
13 alpha=asin(NA)
14
15 alpha=alpha*(180/%pi)
16
17 printf("\nacceptance angle\n")
18
19 printf("alpha=%0.2 f deg",alpha)

```

Chapter 13

Radioactivity And Nuclear Reactions

Scilab code Exa 13.1 energy of incident particle

```
1 //chapter13 ,Example13_1 ,pg 391
2
3 //xMy -> x-mass no. , M-element , y-atomic no.
4
5 M7Li3=7.018232//mass of 7li3 (amu)
6
7 Malpha=4.003874//mass of alpha particle (amu)
8
9 Mpr=1.008145//mass of proton (amu)
10
11 //reaction:- 7li3 + 1H1-> 4He2 + 4He2
12
13 delM=M7Li3+Mpr-2*Malpha//mass defect
14
15 Q=delM*931//1 amu= 931 Mev
16
17 Ey=9.15//K.E energy of product nucleus
18
19 Ex=2*Ey-Q//K.E of incident particle
```

```
20
21 printf("kinetic energy of incident proton\n")
22
23 printf("Ex=%0.2 f Mev" ,Ex)
```

Scilab code Exa 13.2 power of explosion

```
1 //chapter13 , Example13_2 , pg 391
2
3 M235U=235 //at.mass of 235U
4
5 m=10^-3
6
7 N=6.023*10^23
8
9 Eperfi=200*10^6 //energy per fission
10
11 E=Eperfi*1.6*10^-19 //energy per fission (in joules)
12
13 T=10^-6
14
15 A=M235U
16
17 P=((m*N)/A)*(E/T) //power output
18
19 printf("power of explosion\n")
20
21 printf("P=%0.2 f watt" ,P)
```

Scilab code Exa 13.4 mass of uranium consumed

```
1 //chapter13 , Example13_4 , pg 392
2
```

```

3 n=0.4//efficiency
4
5 N=6.023*10^23
6
7 Eperfi=200*10^6//energy per fission
8
9 E=Eperfi*1.6*10^-19
10
11 P=100*10^6
12
13 A=235
14
15 T=24*60*60
16
17 m=(P*A*T)/(n*N*E)
18
19 printf("mass of 235U consumed/day\n")
20
21 printf("m=%0.2 f gm",m)

```

Scilab code Exa 13.5 energy liberated per reaction

```

1 //chapter13 ,Example13_5 ,pg 392
2
3 M2H1=2.01474
4
5 M3H1=3.01700
6
7 M1n0=1.008986
8
9 M4He2=4.003880
10
11 //thermonuclear reaction in hydrogen bomb explosion
12
13 //2H1 + 3H1 -> 4He2 + 1n0

```

```

14
15 Mreac=M2H1+M3H1//mass of reactants
16
17 Mprod=M4He2+M1n0//mass of products
18
19 Q=Mreac-Mprod
20
21 Q=Q*931//converting in Mev
22
23 printf("energy/reaction\n")
24
25 printf("Q=%0.2 f Mev" ,Q)

```

Scilab code Exa 13.6 calculate binding energy

```

1 //chapter13 ,Example13_6 ,pg 393
2
3 M7Li3=7.01818
4
5 M1H1=1.0081
6
7 M1n0=1.009
8
9 BEpernu=(1/7)*((3*M1H1)+(4*M1n0)-M7Li3)//binding
   energy per nucleon
10
11 BEpernu=BEpernu*931//converting in Mev
12
13 printf("binding energy per nucleon\n")
14
15 printf("BE=%0.2 f Mev" ,BEpernu)

```

Scilab code Exa 13.7 calculate power output

```
1 //chapter13 ,Example13_7 ,pg 394
2
3 m=10*10^3
4
5 N=6.023*10^23
6
7 Eperfi=200*10^6//energy per fission
8
9 E=Eperfi*1.6*10^-19//energy in joules
10
11 A=235
12
13 T=24*60*60
14
15 P=((m*N)/A)*(E/T)
16
17 printf("power output\n")
18
19 printf("P=%.2f watt",P)
```
