

Scilab Textbook Companion for  
Engineering Physics  
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# Book Description

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Scilab numbering policy used in this document and the relation to the above book.

**Exa** Example (Solved example)

**Eqn** Equation (Particular equation of the above book)

**AP** Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

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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=%0.2f 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.f 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=%0.2 f ohm\n",Rs1)
24
25 printf("Rs2=%0.2 f ohm\n",Rs2)
26
27 printf("dynamic resistance\n")
28
29 printf("Rd=%0.2 f 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  $I_{ceo}$

```
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*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=%0.2 f ",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 theta=acos(sqrt(1-(((n*lam)/grat)^2)))
16 dlam=(dtheta*grat*cos(theta))/n//difference in
    wavelength
17
18 f=30//focal length
19

```

```

20 dl=f*dtheta//linear separation
21
22 printf(" difference between two yellow lines (in cm)\
    n")
23
24 disp(dlam)
25
26 printf("\nlinear separation\n")
27
28 printf(" dl=%.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 theta=acos(sqrt(1-(((n*lam)/grat)^2)))
18 dl=((n*f)/(grat*cos(theta)))*dlam
19
20 printf(" linear separation of two spectral lines\n")
21
22 printf(" dl=%.4f cm",dl)

```

---

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 lam = 2
16
17 d100=lam/2*sin(theta1)
18
19 d110=lam/2*sin(theta2)
20
21 d111=lam/2*sin(theta3)

```

```

22
23 printf("ratio of interplannar spacing \n(1/d100):(1/
    d110):(1/d111)=")
24
25 printf("%.2 f:", sin(theta1)); printf("%.2 f:", sin(
    theta2)); printf("%.2 f", sin(theta3));
26
27 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("%.2 f:", d1); printf("%.2 f:", d2); printf("%.2 f",
    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=%0.2 f wb/m2" ,B)
20
21 printf("\nmaximum energy of proton\n")
22
23 printf("E=%0.2 f 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=%.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 e = 1.6*10^-19;

```

```

3 m=9.1*10^-31;
4 vx=1.7*10^7
5
6 Ey=3.4*10^4
7
8 x=3*10^-2
9
10 t=x/vx
11
12 //y=0.5*ay*(t^2)
13
14 ay=(e*Ey)/m
15
16 y=0.5*ay*(t^2)
17
18 Bz=Ey/vx
19
20 printf("verical displacement of electron \n")
21
22 printf("y=%0.2 f m",y)
23
24 printf("\nmagnitude of magnetic field\n")
25
26 printf("B=%0.4 f wb/m2",Bz)
27
28 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

```

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("\npd=%0.2f 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*l))*sqrt((2*m*Va)/e)
18
19 printf("flux density\n")
20
21 printf("B=%0.8f 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=%.2f 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)
```

---