Scilab Textbook Companion for Principle Of Physics by V. K. Mehta , R. Mehta[1]

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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.

Contents

List of Scilab Codes

Chapter 1

electric charge

Scilab code Exa 1.1 This value of charge

```
clear
//Given
q=4.5*10**-19                                    //C
e=1.6*10**-19                                    //C

//Calculation
n=q/e

//Result
printf("\n n=  %0.1f   This value of charge is not
   possible",n)
```

Scilab code Exa 1.6 Force

```
clear
//Given
q1=20                               //micro C
q2=-5                               //micro C
```

```
a=9*10**9
r=0.1

//Calculation
q=q1+q2
q3=q/2.0
F=(a*q3*q3)/r**2

//Result
printf("\n Force is  %0.3f  N",F*10**-13)
```

Scilab code Exa 1.10 Force on each charge

```
clear
//Given
m=9*10**9
q=5*10**-6
r=0.1

//Calculation
//
F=(m*q*q)/r**2
C=2*F*cos(30)*(180/3.14)

//Result
printf("\n Force on each charge is  %0.1f *10**-1 N"
    ,C)
```

Scilab code Exa 1.14 Acceleration of proton

```
clear
//Given
e=1.6*10**-19
```

```
m=9*10**9
G=6.67*10**-11
me=9.11*10**-31
mp=1.67*10**-27
r=10**-10

//Calculation
F0=(m*e**2)/(G*me*mp)
F1=(m*e**2)/(G*mp*mp)
F2=m*e**2/r**2
A1=F2/me
A2=F2/mp

//Result
printf("\n (a)(i)strength of an electrons and protons %0.1f *10**39 ",F0*10**-39)
printf("\n    (ii)Strength of two protons  %0.1f *10**36 ",F1*10**-36)
printf("\n (b)     Acceleration of electron is  %0.1f *10**22 m/s**2",A1*10**-22)
printf("\n         Acceleration of proton is  %0.1f *10**19 m/s*2",A2*10**-19)
```

Scilab code Exa 1.16 Resultant charge

```
clear
//Given
m=9*10**9                              //C
q1=10*10**-6
q2=5*10**-6
r=0.05

//Calculation
//
F1=m*q1*q2/r**2
```

```
F2=m*q1*q2/r**2
F3=sqrt(F1**2+F2**2+(2*F1*F2*cos(120)*180/3.14))

//Result
printf("\n Resultant charge is %0.0f N",F3*10**-1)
```

Scilab code Exa 1.18 Force experienced by 1 C Charge

```
clear
//Given
m=9*10**9
q1=1
q2=100
r=10
q3=75                    //C
r1=5

//Calculation
//
F=m*q1*q2/r**2                          //along BA
F1=m*q1*q2/r**2                          //along AC
F2=m*q3/(sqrt(r**2-r1**2)**2)
F3=sqrt(F1**2+F2**2)
X=F1/F2

//Result
printf("\n Force experienced by 1 C Charge is %0.2f
    N",F3*10**-9)
```

Chapter 2

electric field

Scilab code Exa 2.4 Tension in the thread of the pendulum

```
clear
//Given
q=2*10**-8
E=2*10**4
m=80*10**-6
g=9.8

//Calculation
//
a=q*E/(m*g)
b=atan(a)*180/3.14
T=(q*E/(sin(b*3.14/180.0)))*10**-4

//Result
printf("\n The angle is  %0.0f  degree",b)
printf("\n Tension in the thread of the pendulum is
    %0.2f  *10**-4 N",T*10**8)
```

Scilab code Exa 2.5 Electric field at the centre of the sphere

```
clear
//Given
m=9*10**9
r=0.707
q=5*10**-6

//Calculation
//
E=m*q/r**2                    //along AO
E2=m*q/r**2                   //along BO
E3=m*q/r**2                   //along OD
E11=E+E2
E12=E2+E3
I=(2*E11*r)*10**-4

//Result
printf("\n Electric field at the centre of the
   sphere is %0.2f *10**4 N/C",I)
```

Scilab code Exa 2.6 Intensity of the electric field

```
clear
//Given
q=5*10**-9
x=0.15                   //m
r=0.1                      //m
a=9*10**9

//Calculation
E=(a*q*x)/((r**2+x**2))**1.5

//Result
printf("\n Intensity of the electric field is %0.0f
     N/C",E)
```

Scilab code Exa 2.7 The distance

```
clear
//Given
m=10**-3
F=1
v0=20
v=0

//Calculation
a=-F/m
s=v**2-v0**2/(2.0*a)

//Result
printf("\n The distance is  %0.3f  m", s)
```

Scilab code Exa 2.9 Charge

```

clear
//Given
m=9*10**9
q1=1/3.0*10**-7
r=5*10**-2
F=58.8*10**-3

//Calculation
q2=F*r**2/(q1*m)

//Result
printf("\n Charge is  %e  C", q2)
```

Scilab code Exa 2.11 Potential energy of dipole in the stable equilibrium position

```
clear
//Given
q=16*10**-19
a=3.9*10**-12
E=10**5

//Calculation
p=q*a
U=-p*E

//Result
printf("\n (i) The electric dipole moment %e Cm", p)
printf("\n (ii) Potential energy of dipole in the stable equilibrium position %e J",U)
```

Scilab code Exa 2.12 Electric field intensity

```
clear
//Given
q=20*10**-6
a=10**-2
m=9*10**9
r=0.1

//Calculation
p=q*a
E=m*2*p/r**3

```

```
//Result
printf("\n Electric field intensity is %0.3f
    *10**5 N/C", E*10**-5)
```

Scilab code Exa 2.13 Maximum torque on the dipole

```
clear
//Given
E=4*10**5
q=1*10**-6
a=3*10**-2

//Calculation
t=q*a*E

//Result
printf("\n Maximum torque on the dipole is %0.3f
    *10**-2 Nm", t*10**2)
```

Scilab code Exa 2.14 Work done in the rotation

```

clear
//Given
q=1*10**-6// charges C
a=2*10**-2// seperation distance m
E=10**5 // electric field N

//Calculation
p=q*a // finding potential
W=2*p*E// total work done

//Result
```

```
printf("\n Work done in the rotation is  %0.3f
    *10**-3 J", W*10**3)
```

Scilab code Exa 2.15 Electric field intensity

```

clear
//Given
q=2*10**-6// charge C
a=0.1// dipole length m
m=9*10**9// constant
r=0.5// distance m

//Calculation
p=q*a // finding potential
E=m*p/r**3// electric field intensity

//Result
printf("\n Electric field intensity is  %0.3f
    *10**4 N/C",E*10**-4)
```

Scilab code Exa 2.16 Total charge

```
clear
//Given
qa=2.5*10**-7
qb=-2.5*10**-7
a=15
b=15

//Calculation
q=qa+qb
C=(a+b)*10**-2
```

```
E=qa*C

//Result
printf("\n Total charge is  %0.3f \nElectric dipole
   moment of the system is  %0.3f Cm",q,E)
```

Scilab code Exa 2.17 Magnitude of electric intensity

```

clear
//Given
p=2*10**-8// dipole moment coulomb-meter
m=9*10**9// constant
r=1.0// distance m

//Calculation
//
b=3*cos(60*3.14/180.0)**2+1
a=p*sqrt(b)
E=(m*a)/r**3// electric field intensity

//Result
printf("\n Magnitude of electric intensity is %0.1f
    N/C",E)
```

Scilab code Exa 2.18 Electric field along BA

```
clear
//Given
p=5*10**-8
m=9*10**9
r=0.15

```

```
//Calculation
E=m*2*p/r**3
E1=m*p/r**3

printf("\n (i) Electric field along AB is  %0.2f
    *10**5 N/C",E*10**-5)
printf("\n (ii) Electric field along BA is  %0.2f
    *10**5 N/C",E1*10**-5)
```

Chapter 3

electrostatic potential and flux

Scilab code Exa 3.1 Work done

```
clear
//Given
q=300*10**-6                              //c
V=6

//Calculation
W=q*V

//Result
printf("\n Work done is   %0.3f   *10**-3  J", W*10**3)
```

Scilab code Exa 3.2 The value of V

```
clear
//given
Va=-10                    //V
W=300                      //J
q=3.0                        //C
```

```

//Calculation
V=(W/q)+Va

//Result
printf("\n The value of V is %0.3f Volts", V)
```

Scilab code Exa 3.3 Workdone

```
clear
//Given
m=9*10**9
q=16*10**-10                //C
r=0.1
r1=0.06
q1=12*10**-10

//Calculation
Vb=m*q/r
Vb1=m*q/r1
V=Vb1-Vb
W=q1*V

//Result
printf("\n Workdone is %0.3f *10**-8 J", W*10**8)
```

Scilab code Exa 3.4 Electric potential at the surface of silver nucleus

```
clear
//Given
r=3.4*10**-14                  //m
n=47
q=1.6*10**-19               //C
```

```
m=9*10**9

//Calculation
V=m*n*q/r

//Result
printf("\n Electric potential at the surface of
   silver nucleus is  %0.2f  *10**6 V",V*10**-6)
```

Scilab code Exa 3.5 Electric potential

```
clear
//Given
m=9*10**9
q=4*10**-6

//Calculation
V=2*q*m

//Result
printf("\n Electric potential is  %0.3f  *10**3 V",
   V*10**-3)
```

Scilab code Exa 3.9 Electric potential at the centre

```
clear
//Given
m=9*10**9
q=250*10**-6
r=0.1

//Calculation
V=m*q/r
```

```
//Result
printf("\n Electric potential at the centre is %0.3
   f *10**7 V", V*10**-7)
```

Scilab code Exa 3.10 Voltage needed to balance an oil drop

```
clear
//Given
m=3*10**-16
g=9.8
d=5*10**-3
q=16.0*10**-18

//Calculation
V=(m*g*d/q)*10

//Result
printf("\n Voltage needed to balance an oil drop is
    %0.2f V",V)
```

Scilab code Exa 3.12 The mass of the particle

```
clear
//Given
q=1.6*10**-19                    //C
V=3000                           //V
r=5*10**-2                       //m
g=9.8

//Calculation
E=V/r
m=q*E/g
```

```
//Result
printf("\n The mass of the particle is  %0.1f
   *10**-16 Kg",m*10**16)
```

Scilab code Exa 3.13 Workdone

```

clear
//Given
m=9*10**-9// constant
q1=3*10**-9// charge q1
q2=3*10**-9// charge q2
q3=10**9// charge q3
r=0.2// side length of triangle

//Calculation
W=m*((q1*q3/r)+(q2*q3/r))// work done

//Result
printf("\n Workdone is  %e  J", W)
```

Scilab code Exa 3.14 Kinetic energy

```

clear
//Given
m=9*10**9// constant
q=1.6*10**-19// charge C
r=10**-10// distance m

//Calculation
U=m*q**2/r// potential energy
```

```
K=U/2.0// Kinetic energy

//Result
printf("\n Kinetic energy is  %e  J",K)
```

Scilab code Exa 3.15 Distance of the closest approach

```

clear
//Given
m=9*10**-31// mass of e kg
V=10**6// velocity of e m/s
q=1.6*10**-19// charge of e C
a=9*10**9// constant

//Calculation
K=m*V**2// kinetic energy
r=a*q**2/K // Distance of the closest approach

//Result
printf("\n Distance of the closest approach is  %e
   m", r)
```

Scilab code Exa 3.17 Potential energyof the system

```

clear
//Given
r=0.53*10**-10                              //m
q1=1.6*10**-19                              //C
q2=-1.6*10**-19                             //C
a=9*10**9 //constant
r1=1.06*10**-10 // seperation of electron
```

```
//Calculation
U=a*q1*q2/r
Ue=U/q1 //Potential energy of the system eV
K=-Ue/2.0 //eV
E=Ue+K //eV
U1=(a*q1*q2/r1)/q1// eV

//Result
printf("\n (i) Potential energy of the system is %0.1f eV",Ue)
printf("\n (ii) Minimum amount of work required to free the elctrons ia %0.1f ev",E)
printf("\n (iii) Potential energyof the system is %0.1f ev and work requiredto free the electrons is %0.1f eV",E,-E)
```

Scilab code Exa 3.18 Electrostatic energy

```
clear
//Given
a=9*10**9
q1=7*10**-6                          //C
q2=-2*10**-6
r=0.18
r1=0.09
A=9*10**5

//Calculation
U=a*q1*q2/r
W=0-U
U1=(q1*A/r1)+(q2*A/r1)+U

//Result
printf("\n (a) Electrostatic potential energy is %0
```

```
    .1f  J",U)
printf("\n (b) Work required to seperate two charges
     is  %0.1f  J",W)
printf("\n (c) Electrostatic energy is  %0.3f  J",
    U1)
```

Scilab code Exa 3.20 Heat released by substance

```
clear
//Given
p=6*10**-6
E=10**6
a=1

//Calculation ,
U1=-p*E*a
U2=(p*E*(cos(60)*180/3.14))*10**-2
U3=U2-U1

//Result
printf("\n Heat released by substance is  %0.0f  J",
    U3)
```

Scilab code Exa 3.21 Electric flux through the surface of the cube

```
clear
//Given
q=10**-7
e=8.854*10**-12

//Calculation
a=q/e

```

```
//Result
printf("\n Electric flux through the surface of the
   cube is  %0.2f  Nm**2C-1",a*10**-4)
```

Scilab code Exa 3.22 Electric flux through each face

```
clear
//Given
q=8.85*10**-6
e=8.85*10**-12

//Calculation
a=q/e
b=a/6.0

//Result
printf("\n Electric flux through each face is  %0.2f
     Nm**2C-1",b*10**-5)
```

Scilab code Exa 3.23 Electric flux of the field

```
clear
//Given
E0=2*10**3                    //N/C
S=0.2

//Calculation
a=(3/5.0)*E0*S

//Result
printf("\n Electric flux of the field is  %0.3f  Nm
   **2C-1", a)
```

Scilab code Exa 3.24 Charge contained in a sphere

```
clear
//Given
r=0.2
m=9*10**9
b=50

//
E=250*r
a=E*4*%pi*r**2
q=b*r**2/m

//Result
printf("\n Charge contained in a sphere is  %0.2f
    *10**-10 C",q*10**10)
```

Scilab code Exa 3.25 The charge within the cube

```
clear
//Given
a=0.1                    //m
A=800
e=8.854*10**-12

//Calculation
b=A*a**2.5*(sqrt(2)-1)
q=e*b

//Result
printf("\n (a) The flux through the cube is  %0.2f
    Nm**2C-1",b)
```

```
printf("\n The charge within the cube is %0.2f *10**-12 C",q*10**12)
```

Scilab code Exa 3.26 d The net charge in the cylinder

```
clear
//Given
E=200
a=0.05
e=8.854*10**-12
d=3.14

//Calculation
//
b=E*%pi*a**2
c=2*b
q=e*d

//Result
printf("\n (a) Net outward flux through each flat face is %0.2f Nm**2C-1",b)
printf("\n (b) Flux through the side of cylinder is zero ")
printf("\n (c) Net outward flux through the cylinder is %0.2f Nm**2C-1",c)
printf("\n (d) The net charge in the cylinder is %0.2f *10**-11 C",q*10**11)
```

Scilab code Exa 3.28 Electric field

```
clear
//Given
q=5.8*10**-6                  //C
```

```
r=8*10**-2                          //m
e=8.854*10**-12
l=3.0

//Calculation
//
E=q/(2*%pi*e*r*l)

//Result
printf("\n Electric field is  %0.1f  *10**5 N/C",E
   *10**-5)
```

Scilab code Exa 3.29 Linear charge density

```
clear
//Given
E=9*10**4                           //N/C
r=2*10**-2                          //m
m=9*10**9

//Calculation
a=r*E/(2.0*m)
printf("\n Linear charge density is  %0.3f  Cm-1", a
   )
```

Scilab code Exa 3.31 The magnitude of the electric field at a distance 2R from the

```
clear
//Given
Z=79
e=1.6*10**-19
e0=8.854*10**-12
R=6.2*10**-15
```

```
//Calculation
//
q=Z*e
E=q/(4.0*%pi*e0*R**2)
b=E/4.0

//Result
printf("\n (i) The magnitude of the electric field
   at the surface of nucleus is  %0.0f *10**21 N/C",
   E*10**-21)
printf("\n (ii) The magnitude of the electric field
   at a distance 2R from the centre of the nucleus
   is  %0.2f  *10**21 N/C",b*10**-21)
```

Scilab code Exa 3.32 Total charge on the sheet

```
clear
//Given
e=8.854*10**-12
A=0.5
F=1.8*10**-12                         //N
E=1.6*10**-19

//Calculation
q=(2*e*A**2*F)/E

//Result
printf("\n Total charge on the sheet is  %0.0f
   micro C",q*10**6)
```

Scilab code Exa 3.33 Electric flux through a circular area

```
clear
//Given
a=5*10**-6
e=8.854*10**-12
r=0.1

//Calculation
//
b=-(a*%pi*r**2*(cos(60)*180/3.14))/(2*e)

//Result
printf("\n Electric flux through a circular area is
    %0.2f  *10**3 Nm**2C-1",b*10**-5)
```

Chapter 4

capacitance

Scilab code Exa 4.1 The capacitance of the earth

```
clear
//Given
m=9*10**9
r=6.4*10**6                    //m

//Calculation
C=r/m

//Result
printf("\n The capacitance of the earth is  %0.0f
   micro F",C*10**6)
```

Scilab code Exa 4.2 Charge of a

```
clear
//Given
m=9*10**9
c=50*10**-12
```

```
V=10**4

//Calculation
r=(m*c)*10**2
q=(c*V)

//Result
printf("\n (i) Radius of a isolated sphere is  %0.3f
     cm",r)
printf("\n (ii) Charge of a isolated sphere is  %0.3
   f  micro C", q*10**6)
```

Scilab code Exa 4.3 Capacitance of the bigger drop

```
clear
//Given
r=3*10**-3                          //m
m=9*10**9
q1=27*10**-12                       //C

//Calculation
R=3*r
C=R/m
V=q1/C

//Result
printf("\n Capacitance of the bigger drop is  %0.3f
   pico F \npotential of the bigger drop is  %0.3f
   Volts",C*10**12,V)
```

Scilab code Exa 4.4 Capacitance of the capacitor

```
clear
```

```
//Given
m=9*10**9
ra=0.09
rb=0.1

//Calculation
C=ra*rb/(m*(rb-ra))

//Result
printf("\n Capacitance of the capacitor is %0.3f pico F", C*10**12)
```

Scilab code Exa 4.6 Area

```
clear
//Given
d=10**-3                          //m
c=1                               //F
e=8.854*10**-12

//Calculation
A=c*d/e

//Result
printf("\n Area is %0.1f *10**8 m**2",A*10**-8)
```

Scilab code Exa 4.7 Distance

```
clear
//Given
A=0.02                          //m**2
r=0.5                             //m

```

```
//Calculation
//
d=A/(4.0*%pi*r)

//Result
printf("\n Distance is  %0.2f  mm",d*10**3)
```

Scilab code Exa 4.8 Capacitance of a parallel plate

```
clear
//Given
e=8.854*10**-12
K=6
A=30
d=2.0*10**-3
E=500

//Calculation
C=e*K*A/d
V=E*d*10**3
q=C*V

//Result
printf("\n Capacitance of a parallel plate  %0.3f
   micro C",q*10**3)
```

Scilab code Exa 4.9 Potential gradient

```
clear
//Given
C=300*10**-12
V=10*10**3
A=0.01
```

```
d=1*10**-3

//Calculation
q=C*V
a=q/A
E=V/d

//Result
printf("\n (i) Charge on each plate is %0.3f C", q
   )
printf("\n (ii) Electric flux density is %0.3f
   10**-4 C/m**2", a*10**4)
printf("\n (iii) Potential gradient is %0.3f V/m",
    E)
```

Scilab code Exa 4.10 Distance between the plates of second capacitor

```
clear
//Given
A2=500                       //cm**2
A1=100                        //cm**2
d1=0.05                        //cm

//Calculation
d2=A2*d1/A1

//Result
printf("\n Distance between the plates of second
   capacitor is %0.3f cm", d2)
```

Scilab code Exa 4.11 The ratio ofmaximum capacitance to minimum capacitance

```
clear
```

```
//Given
c1=0.5                    //micro F
c2=0.3                    //micro F
c3=0.2                    //micro F

//Calculation
Cp=c1+c2+c3
Cs=(1/c1)+(1/c2)+(1/c3)

//Result
printf("\n  The ratio ofmaximum capacitance to
   minimum capacitance is  %0.1f  ",Cs)
```

Scilab code Exa 4.13 `The capacitance of capacitor C2`

```
clear
//Given
Ca=18                              //micro F
Cb=4                              //micro F

//Calculation
//
C=Ca*Cb
C12=sqrt(Ca**2-4*C)
C2=2*C12

//Result
printf("\n The capacitance of capacitor C1 is %0.3f
    micro F", C12)
printf("\n The capacitance of capacitor C2 is %0.3f
    micro F",C2)
```

Scilab code Exa 4.14 `The value of capacitance`

```
clear
//Given
q=750*10**-6
C1=15*10**-6
V2=20.0                                    //V
C3=8*10**-6

//Calculation
V1=q/C1
V=V1+V2
q3=C3*V2
q2=q-q3
C2=q2/V2

//Result
printf("\n The value of V1 is  %0.3f  V", V1)
printf("\n The value of V is  %0.3f  V",V)
printf("\n The value of capacitance is %0.3f  micro
   F",C2*10**6)
```

Scilab code Exa 4.15 Equivalent capacitance between point A and B

```
clear
//Given
C2=9.0                //micro F
C3=9.0
C4=9.0
C1=3
V=10                     //V

//Calculation
C=1/((1/C2)+(1/C3)+(1/C4))
Cab=C1+C
q=Cab*V

```

```
//Result
printf("\n Equivalent capacitance between point A
   and B is  %0.3f  micro F", Cab)
```

Scilab code Exa 4.17 The charge on 12 micro F capacitor

```
clear
//Given
Cab=10                         //micro F
C1=8.0                           //micro F
C2=8.0
C3=8
C4=8
C5=12
V=400

//Calculation
Cbc=((C1*C2)/(C1+C2))+C3+C4
Cac=Cab*Cbc/(Cab+Cbc)
Ccd=C1+C5
Cad=Cac*Ccd/(Cac+Ccd)
q=Cad*V
Vcd=q/Ccd
q1=C5*Vcd

//Result
printf("\n (i) The equivalent capacitance between A
   and D is  %0.3f  micro f", Cad)
printf("\n (ii) The charge on 12 micro F capacitor
   is  %0.3f  mC",q1*10**-3)
```

Scilab code Exa 4.20 Charge supplied by battery

```
clear
//Given
C1=5                    //micro F
C2=6                    //micro F
V=10                    //V

//Calculation
Cp=C1+C2
q=Cp*V

//Result
printf("\n Charge supplied by battery is  %0.3f
   micro F", q)
```

Scilab code Exa 4.21 The capacitance of the Capacitors

```
clear
//Given
C1=2                 //micro F
C2=2                 //micro F
C3=2
C4=2

//Calculation
Cs=C1*C2/(C1+C2)
Cab=C3*C4/(C3+C4)

//Result
printf("\n The capacitance of the Capacitors %0.3f
   micro F", Cab)
```

Scilab code Exa 4.22 The charge on 12 micro F Capacitor

```
clear
//Given
C1=10.0                    //micro F
C2=10.0
C3=10.0
C4=10*10**-3
V=500                    //V

//Calculation
Cs=1/((1/C1)+(1/C2)+(1/C3))
Cab=Cs+(C4*10**3)
Q=(C1*(500/3.0))*10**-3
Q1=C4*V

//Result
printf("\n (a) The equivalent capacitance of the
   network is %0.1f  micro F",Cab)
printf("\n (b) The charge on 12 micro F Capacitor is
    %0.3f  *10**-3 C",Q1)
```

Scilab code Exa 4.23 The value of capacitance C

```
clear
//Given
C4=6                        //micro F
C5=12
C1=8.0
C7=1

//Calculation
Cs=C4*C5/(C4+C5)
C11=(C1*Cs)/(C1+Cs)
Cs1=C1*C7/(C1+C7)
Cp=C11+Cs1
C=1/(1-(1/Cp))
```

```

//Result
printf("\n The value of capacitance C is  %0.2f
   micro F",C)
```

Scilab code Exa 4.24 The potential of the inner cylinder

```

clear
//Given
K=5
l=0.2
c=10**-9                    //F
b=15.4
a=15
pd=5000                        //V

//Calculation
//
C=(K*l*c)/(41.1*log10(b/a))

//Result
printf("\n (i) The capacitance of cylindrical
   capacitor is  %0.1f *10**-9 F",C*10**9)
printf("\n (ii) The potential of the inner cylinder
   is equal to p.d. between two cylinders i.e
   potential of inner cylinder is %0.3f  V",pd)
```

Scilab code Exa 4.25 P D across the capacitor

```
clear
//Given
C=5*10**-6
```

```
V=100
C1=3*10**-6

//Calculation
q=C*V
Cp=C+C1
pd=q/Cp

//Result
printf("\n P.D across the capacitor is %0.3f V",pd)
```

Scilab code Exa 4.26 `Charge on 6 micro F capacitor`

```
clear
//Given
V=250                    //V
C1=6                      //micro F
C2=4
Cp=10*10**-6

//Calculation
pd=V*C1/(C1+C2)
q=pd*C2*10**-6
q1=2*q
pd1=q1/Cp
q2=C2*pd1
q3=C1*pd1

//Result
printf("\n New potentila difference is %0.3f V",pd1)
printf("\n Charge on 4 micro F capacitor is %0.3f micro C",q2)
printf("\n Charge on 6 micro F capacitor is %0.3f
```

```
    micro C",q3)
```

Scilab code Exa 4.28 The electrostatic energies before and after the capacitors

```
clear
//Given
C1=16*10**-6                                    // F
C2=4                                  //micro F
V1=100                               //V
Cp=20*10**-6                          //f

//Calculation
q=C1*V1
U1=0.5*C1*V1**2
V=q/Cp
U2=0.5*Cp*V**2

//Result
printf("\n (i) Potential difference across the
    capacitor is %0.3f Volts", V)
printf("\n (ii) The electrostatic energies before
    and after the capacitors are connected %0.3f J"
    ,U2)
```

Scilab code Exa 4.29 The heat generated

```
clear
//Given
m=9*10**9
V=3.0*10**6
r=2

//Calculation
```

```
q=(V*r)/m
E=0.5*q*V

//Result
printf("\n The heat generated is %0.3f J", E)
```

Scilab code Exa 4.30 Extra Charge supplied by battery

```
clear
//Given
V=12                    //V
C=1.35*10**-10            //C

//Calculation
q=C

//Result
printf("\n Extra Charge supplied by battery is %0.3
    f C", q)
```

Scilab code Exa 4.31 Charge in the new stored energy

```
clear
//Given
C=100*10**-6              //F
V=500                     //V

//Calculation
q=V/2.0
E=0.5*(0.5*C*V**2)

//Result
```

```
printf("\n Charge in the new stored energy is  %0.3f
    J", E)
```

Scilab code Exa 4.32 The capacitance of the capacitor

```
clear
//Given
A=2*10**-3                              //m**2
d=0.01                                  //m
t=6*10**-3                              //m
K=3
a=8.854*10**-12

//Calculation
C=a*A/(d-t*(1-(1/3.0)))

//Result
printf("\n The capacitance of the capacitor is  %0.2
   f *10**-12 F",C*10**12)
```

Scilab code Exa 4.33 The capacitance of the capacitor

```
clear
//Given
e=8.854*10**-12
A=2
t1=0.5*10**-3
t2=1.5*10**-3
t3=0.3*10**-3
K1=2.0
K2=4.0
K3=6.0

```

```
//Calculation
C=(e*A)/((t1/K1)+(t2/K2)+(t3/K3))

//Result
printf("\n The capacitance of the capacitor is  %0.3
   f *10**-6 F",C*10**6)
```

Scilab code Exa 4.34 The relative permittivity of the additional dielectric

```
clear
//Given
a=3                   //mm
b=4.0                   //mm
K1=5

//Calaculation
K2=1/((a**2/b)-a/b)*K1

//Result
printf("\n The relative permittivity of the
   additional dielectric is  %0.2f  ",K2)
```

Scilab code Exa 4.35 New seperaion between the plates

```

clear
//Given
d=5
t=2
K=3.0

//Calculation
D=d+(t-t/K)
```

```

//Result
printf("\n New separation between the plates are  %0
    .2f  mm",D)
```

Scilab code Exa 4.36 Energy loss

```
clear
//Given
d=4
t=2
K=4.0
C1=50*10**-12                              //f
V0=200                                     //V

//Calculation
C=(d-t+(t/K))/d
q=C1*V0
V=V0*C
U=0.5*q*V
E=0.5*q*(V0-V)

//Result
printf("\n (i) Final charge on ach plate is  %0.3f
   C", q)
printf("\n (ii) P.D batween the plates is  %0.3f
    volts", V)
printf("\n (iii)Final energy in the capacitor is  %0
    .3f  J", U)
printf("\n (iv) Energy loss is  %0.3f  J", E)
```

Scilab code Exa 4.39 Minimum radius of the spherical shell

```
clear
//Given
V=25*10**5
E=5.0*10**7

//Calculation
r=V/E

//Result
printf("\n Minimum radius of the spherical shell is
    %0.3f  cm", r*100)
```

Chapter 5

electric current and resistance

Scilab code Exa 5.1 The magnitude of current in the wire

```
clear
//Given
n=10**17
e=1.6*10**-19                          //C
t=1.0                                  //S

//Calculation
I=n*e/t

//Result
printf("\n The magnitude of current in the wire is
   %0.3f  10**-2 A and direction is from left to
   right",I*10**2)
```

Scilab code Exa 5.2 The number of electrons

```
clear
//given
```

```
I=0.5
T=1
e=1.6*10**-19
t=60                    //minute

//Calculation
n=I*T/e
q=I*t**2
n1=q/e

//Result
printf("\n (i) The number of electrons passing a
    cross section of the bulb is %0.1f *10**18
    electrons/S",n*10**-18)
printf("\n (ii) The number of electrons is %0.1f
    *10**22 electrons/hour",n1*10**-22)
```

Scilab code Exa 5.3 The equivalent current

```
clear
//Given
e=1.6*10**-19                   //C
f=6.8*10**15                    //rev/sec
r=0.51*10**-10                  //m

//Calculation
I=e*f

//Result
printf("\n The equivalent current is %0.3f *10**-3
    A", I*10**3)
```

Scilab code Exa 5.5 Drift velocity of the conduction electrons

```
clear
//Given
I=10                  //A
A=1                   //m*m**2
e=1.6*10**-19             //C
n=10**28                  //m**-3

//Calculation
Vd=I/(n*A*e)

//Result
printf("\n Drift velocity of the conduction
   electrons are %0.3f m/s", Vd)
```

Scilab code Exa 5.6 `Time required by an electron`

```
clear
//Given
I=10                    //A
A=4*10**-6                      //m**2
e=1.6*10**-19                     //C
n=8*10**28                          //m**-3
l=4

//Calculation
Vd=I/(n*A*e)
t=l/Vd

//Result
printf("\n Time required by an electron is %0.3f
   *10**4 S", t*10**-4)
```

Scilab code Exa 5.7 `Speed of propagation of electric fild`

```
clear
//Given
a=6.023*10**23
m=63.5*10**-3
d=9*10**3
A=10**-7                           //m**2
e=1.6*10**-19                           //C
I=1.5                                   //a
K=1.38*10**-23                        //J/K
T=300                                   //K
Vd=1.1*10**-3
C=3*10**8

//Calculation
//
n=a*d/m
Vd=I/(n*A*e)
V=sqrt((3*K*T*a)/m)
V1=Vd/V
E=Vd/C

//Result
printf("\n (i) Thermal speeds of copper atoms at ordinary temperatures are  %0.2f  *10**-6 m/s",V1*10**6)
printf("\n (ii) Speed of propagation of electric fild is  %0.1f *10**-12 ",E*10**12)
```

Scilab code Exa 5.8 `The electron mobility`

```
clear
//Given
V=5
l=0.1
Vd=2.5*10**-4
```

```
//Calculation
E=V/l
u=Vd/E

//Result
printf("\n The electron mobility is %0.3f m**2/V/C
    ", u)
```

Scilab code Exa 5.9 Average relaxation time

```
clear
//Given
I=2.4
A=0.30*10**-6
m=9.1*10**-31
n=8.4*10**28
e=1.6*10**-19
E=7.5

//Calculation
J=I/A
t=m*J/(n*e**2*E)

//Result
printf("\n Average relaxation time is %0.2f
    *10**-16 S",t*10**16)
```

Scilab code Exa 5.10 Drift velocity of electrons in the copper wire

```
clear
//Given
r=0.12*10**-2                    //m
```

```
I=10
r1=0.08*10**-2                    //m
I=10                                  //A
e=1.6*10**-19                                  //C
n=8.4*10**28

//Calculation
//
A=%pi*(r**2)
J=I/A
A1=%pi*r1**2
Vd=I/(e*n*A1)

//Result
printf("\n (i) Current density in the alluminium
    wire is  %0.1f  *10**6 A/m**2",J*10**-6)
printf("\n (ii) Drift velocity of electrons in the
    copper wire is  %0.1f  *10**-4 m/S",Vd*10**4)
```

Scilab code Exa 5.11 Conductivity of a material

```
clear
//Given
D=0.13*10**-2
R=3.4                         //ohms
l=10.0

//Calculation
//
A=(%pi/4.0)*D**2
a=R*A/l
b=1/a

//Result
printf("\n Conductivity of a material is  %0.1f
```

```
*10**6 S/m",b*10**-6)
```

Scilab code Exa 5.12 The value of resistance

```
clear
//Given
A1=25.0                                  //mm**2
l2=1                                   //m
R2=1/58.0
A2=1
l1=1000

//Calculation
R=(l1/l2)*(A2/A1)
R1=R*R2

//Result
printf("\n The value of resistance is  %0.2f  ohm",
  R1)
```

Scilab code Exa 5.13 The resistance of another wire

```
clear
//Given
R1=4.5
A1=1
A2=2.0
l2=3
l1=1.0

//Calculation
R=(l2/l1)*(A1/A2)
R2=R*R1
```

```
//Result
printf("\n The resistance of another wire is  %0.3f
    ohm", R2)
```

Scilab code Exa 5.14 New resistance of the wire

```
clear
//Given
r=1
r1=0.5
R1=0.15                          //ohm

//Calculation
//
A1=(%pi/4.0)*r**2
A2=(%pi/4.0)*r1**2
l=A1/A2
R=l*l
R2=R*R1

//Result
printf("\n New resistance of the wire is  %0.3f  ohm
   ", R2)
```

Scilab code Exa 5.16 Effective resistance of the tube

```
clear
//Given
ne=2.8*10**18
np=1.2*10**18
e=1.6*10**-19
t=1                                 //S
```

```
V=220

//Calculation
q=(ne+np)*e
I=q/t
R=V/I

//Result
printf("\n Effective resistance of the tube is %0.0
    f ohm",R)
```

Scilab code Exa 5.17 Resistance between the opposite faces

```
clear
//Given
m=84                          //g
d=10.5                        //g/cm**3
a=1.6*10**-6

//Calculation
V=m/d
s=V**(1/3.0)
R=a/2.0

//Result
printf("\n Resistance between the opposite faces is
     %0.3f ohm", R)
```

Scilab code Exa 5.18 Percentage change in its resistance

```
clear
//Given
l=1.001
```

```
A=1.001

//Calculation
R=l*A
R1=R-1
A=R1*100

//Result
printf("\n Percentage change in its resistance is
   %0.1f  percentage",A)
```

Scilab code Exa 5.19 The value of radius

```
clear
//Given
m=0.45                              //Kg
R=0.0014                             //ohm
a=1.78*10**-8                        //ohm
d=8.93*10**3                            //Kg/m**3

//Calculation
//
l=sqrt(R*m/(a*d))
r=sqrt(m/(%pi*d*1.99))

//Result
printf("\n The value of length is %0.2f  m",l)
printf("\n The value of radius is  %0.2f  mm",r
   *10**3)
```

Scilab code Exa 5.20 The value of resistance at 50 degree C

```
clear
```

```
//Given
R15=80                    //ohm
a=0.004

//Calculation
R0=R15/(1+15*a)
R50=R0*(1+a*50)

//Result
printf("\n The value of resistance at 50 degree C is
    %0.2f  ohm",R50)
```

Scilab code Exa 5.21 Normal working temperature of the lamp

```
clear
//Given
R20=20                         //ohm
P=60                            //W
V=120.0                           //Volts
a=5*10**-3

//Calculation
I=P/V
Rt=V/I
t=(((Rt/R20)-1)/a)+R20

//Result
printf("\n Normal working temperature of the lamp is
    %0.3f  degree C", t)
```

Scilab code Exa 5.22 The temperature of the bath

```
clear
```

```
//Given
R0=5                        //ohm
R100=5.23                      //ohm
Rt=5.795                       //ohm

//Calculation
t=((Rt-R0)/(R100-R0))*100

//Result
printf("\n The temperature of the bath is  %0.2f
   degree C",t)
```

Scilab code Exa 5.23 The value of resistance

```
clear
//Given
A=15*10**-4                               //m**2
a=7.6*10**-8                                      // ohm m
l=2000                                    //m
b=0.005                                //degree/C

//Calculation
R0=a*l/A
R50=R0*(1+(b*50))

//Result
printf("\n The value of resistance is  %0.3f  ohm",
   R50)
```

Scilab code Exa 5.24 The resistance of a copper filament

```
clear
//Given
```

```
a=0.004
ac=0.0007
R0=100

//Calculation
R=ac*R0/a

//Result
printf("\n The resistance of a copper filament is
    %0.3f  ohm", R)
```

Scilab code Exa 5.28 The equivalent resisatance

```
clear
//Given
R1=4.0                      //ohm
R2=4.0                      //ohm

//Calculation
Rab=1/((1/R1)+(1/R2))

//Result
printf("\n The equivalent resisatance is  %0.3f  ohm
    ", Rab)
```

Scilab code Exa 5.29 The equivqlent resistance between A and B

```
clear
//Given
R1=15                     //ohm
R2=30                    //ohm

//Calculation
```

```
R=R1*R2/(R1+R2)

//Result
printf("\n The equivqlent resistance between A and B
    is %0.3f ohm", R)
```

Scilab code Exa 5.31 The value of current in the branch AF

```
clear
//Given
R1=5                    //ohm
R2=9                     //ohm
R3=14                     //ohm
R4=11
R5=7
R6=18
R7=13
R8=22
V=22

//Calculation
Rec=(R1+R2)*R3/(R1+R2+R3)
Rbe=(R4+R5)*R6/(R4+R5+R6)
Rae=(R7+R2)*R8/(R7+R2+R8)
I=V/Rae

//Result
printf("\n The value of current in the branch AF is
    %0.3f A", I)
```

Scilab code Exa 5.32 The equivalent resistance

```
clear
```

```
//Given
R1=12                          //ohm
R2=6                           //ohm

//Calculation
Rdg=R1*R2/(R1+R2)
Rch=R1*R2/(R1+R2)
Rab=Rdg+Rch

//Result
printf("\n The equivalent resistance is  %0.3f  ohm"
   , Rab)
```

Scilab code Exa 5.33 Resistance at BC

```
clear
//Given
Rab=500.0                           //ohm
Rl=500                             //ohm
Rbc=1500                           //ohm
E=50                               //Volts
Rac=2000.0                           //ohm
V=40

//Calculation
R=Rbc*Rl/(Rbc+Rl)
I=E/(Rab+R)
Pd=I*Rab
Rl1=E-Pd
I1=E/Rac
R12=V/I1

//Result
printf("\n (i) Potential difference across the road
   is  %0.2f  V",Rl1)
```

```
printf("\n (ii) Resistance at BC is %0.3f ohm",
    R12)
```

Scilab code Exa 5.35 There

```
clear
//Given
R1=5                                  //ohm
R2=5.0                                 //ohm
R=6

//Calculation
n=(1/(R-R1)*R2)

//Result
printf("\n There are %0.3f resistance are in
    parallel", n)
```

Scilab code Exa 5.36 The value of resistance

```
clear
//Given
R1=20.0                                //ohm
R2=10.0                                 //ohm
R4=10

//Calculation
Rbd=(R1*R2)/(R1+R2)
Rae=R2+Rbd+R4

//Result
printf("\n The value of resistance is %0.2f ohm",
    Rae)
```

Scilab code Exa 5.37 The steady state current

```
clear
//Given
R1=2.0                          //ohm
R2=3                              //ohm
R3=2.8
E=6                                     //V

//Calculation
Rab=R1*R2/(R1+R2)
Rt=Rab+R3
I=E/Rt
Vab=I*Rab
I1=Vab/2.0

//Result
printf("\n The steady state current is %0.3f A",
   I1)
```

Scilab code Exa 5.38 the effective resistance between the point A and B

```
clear
//Given
R1=3                      //ohm
R2=3
R3=6

//Calculation
Rad=(R1+R2)*R3/(R1+R2+R3)
Rae=(Rad+R1)*R3/(Rad+R1+R3)
```

```
Raf=(Rae+R1)*R3/(Rae+R1+R3)
Rab=(Raf+R1)*R2/(Rae+R1+R2)

//Result
printf("\n the effective resistance between the
   point A and B is %0.3f  Ohm", Rab)
```

Scilab code Exa 5.39 `Current in R4`

```
clear
//Given
R2=50.0                                   //ohm
R3=50.0                                     //ohm
R4=75.0                                     //ohm
E=4.75
R1=100

//Calculation
Rbc=1/((1/R2)+(1/R3)+(1/R4))
R=R1+Rbc
I=E/R
R11=I*R1
Vbc=E-(I*R1)
I2=Vbc/R2
I3=Vbc/R3
I4=Vbc/R4

//Result
printf("\n Equivalent resistance of the circuit is
   %0.3f  ohm", R)
printf("\n Current in R2 is %0.3f  A",I2)
printf("\n Current in R3 is %0.3f  A",I3)
printf("\n Current in R4 is %0.3f  A",I4)
```

Scilab code Exa 5.40 E M F

```
clear
//Given
V=19
I1=0.5
I2=2                               //A
r=2

//Calculation
E=V+I1*r

//Result
printf("\n E.M.F is  %0.3f  V", E)
```

Scilab code Exa 5.41 P D across the terminals of each cell

```
clear
//Given
V=1.5
a=1.5
r1=0.5                             //ohm
r2=0.25
R=2.25                              //ohm

//Calculation
E=V+a
r=r1+r2
Rt=r+R
I=E/Rt
pd=V-(I*r1)
pd1=V-(I*r2)
```

```

//Result
printf("\n (i) The circuit current is %0.3f A",I)
printf("\n (ii) P.D across the terminals of each
    cell is %0.3f V and %0.3f V",pd,pd1)
```

Scilab code Exa 5.42 Reduction in current

```
clear
//Given
n=10
E=1.5
R=4                    //ohm
r=0.1
a=8

//Calculation
Emf=n*E
Rt=R+(n*r)
I=Emf/Rt
Emf1=(a*E)-(2*E)
I1=Emf1/Rt
I11=I-I1

//Result
printf("\n Reduction in current is %0.3f A", I11)
```

Scilab code Exa 5.43 The reading of the ammeter

```
clear
//Given
Emf=2
Emf1=1.9
```

```
Emf2=1.8
R1=0.05
R2=0.06
R3=0.07
R0=5                    //ohm

//Calculation
Emft=Emf+Emf1+Emf2
R=R1+R2+R3
Rt=R+R0
I=Emft/Rt

//Result
printf("\n The reading of the ammeter is %0.1f A",
   I)
```

Scilab code Exa 5.44 The terminal potential difference of the battery

```
clear
//Given
R1=6.0                  //ohm
R2=3
I=0.8                   //A
a=24

//Calculation
I1=I*(R1+R2)/R1
I11=I1-I
Rp=R1*R2/(R1+R2)
Rt=Rp+8
r=(a/I1)-10
V=I1*Rt

//Result
printf("\n (i) Current in 6 ohm resistance is %0.3f
```

```
    A", I11)
printf("\n (ii) Internal resistance of the battery
    is %0.3f ohm", r)
printf("\n (iii) The terminal potential difference
    of the battery is %0.3f V", V)
```

Scilab code Exa 5.45 Internal resistance

```
clear
//Given
R1=2               //ohm
R2=4
R3=6
E=8
r=1

//Calculation
Rac=(R1+R2)*R3/(R1+R2+R3)
I=E/(Rac+r)
I1=I/2.0

//Result
printf("\n Internal resistance is %0.3f A", I1)
```

Scilab code Exa 5.46 The internal resisatnce of aech cell

```
clear
//Given
E=1
R=2

//Calculation
r=(E*R)-E
```

```
printf("\n The internal resisatnce of aech cell is
    %0.3f  ohm",r)
```

Scilab code Exa 5.47 Internal resisatnce of each cell

```
clear
//Given
R1=15.0                              // ohm
R2=15.0
E=2
V=1.6

//Calculation
R=R1*R2/(R1+R2)
r=((E/V)-1)*R*4

//Result
printf("\n Internal resisatnce of each cell is  %0.3
    f  ohm", r)
```

Scilab code Exa 5.48 Internal resisatnce of each battery

```
clear
//Given
I1=1                      //A
E=1.5
I2=0.6
R2=2.33                        //ohm

//Calculation
R=2*E/I1
R1=2*E/I2
r=R1-2*R2
```

```
//Result
printf("\n Internal resisatnce of each battery is
   %0.3f  ohm", r)
```

Scilab code Exa 5.49 `Voltage drop Vab`

```
clear
//Given
R1=4                    //ohm
R2=4                             //ohm
R3=12
R4=6.0
E=16
r=1                          //ohm

//calculation
Rab=R1*R2/(R1+R2)
Rcd=R3*R4/(R3+R4)
R=Rab+Rcd+1
I=E/(R+r)
I1=I/2.0
I3=I*R4/(R3+R4)
I4=I*R3/(R3+R4)
Vab=4*I1
Vbc=I*1
Vcd=12*I3

//Result
printf("\n (i) equivalent resistance of the network
   is  %0.3f  ohm", R)
printf("\n (ii) Circuit current is %0.3f A , Current
    in R1 is %0.3f A , Current in R3 is %0.2f A ,
   Current in R4 is  %0.2f ",I,I1,I3,I4)
printf("\n Voltage drop Vab is %0.3f V \nVbc is %0.3
```

```
f V \nVcd is %0.3f V",Vab,Vbc,Vcd)
```

Chapter 6

electrical measurements

Scilab code Exa 6.1 Terminal voltage

```
clear
//Given
a=4
b=2.0
c=8
d=5
e=3.0

//Calculation
I1=((a*c)+(b*e))/((b*c)+(d*e))
I2=(a-(2*I1))/e
V=(I1-I2)*5

//Result
printf("\n (i) Current through each battery is %0.2f
    A and %0.2f A",I1,I2)
printf("\n (ii) Terminal voltage is %0.2f  V",V)
```

Scilab code Exa 6.4 Potential difference across 10 ohm wire

```
clear
//Given
a=10
b=5.0
c=9.0
d=19.0

//Calculation
I2=(a-c)/((b*a)-(d*c))
I1=(1-(5*I2))/c
I=I1+I2
pd=I*10

//Result
printf("\n Current through each cell is %0.2f  A",I)
printf("\n Potential difference across 10 ohm wire
    is %0.3f  V",pd)
```

Scilab code Exa 6.6 `Current through each cell`

```
clear
//Given
a=-3
b=4.0
c=3

//Calculation
I1=a/(b+(c**2))
I2=-1-c*I1
I3=-(I1+I2)

//Result
printf("\n Current through each cell is %0.2f A  %0
    .2f A and %0.2f A",I1,I2,I3)
```

Scilab code Exa 6.7 The value of resistance

```
clear
//Given
a=15
b=4
c=12.0
d=10

//Calculation
R=(a*b)/c
X=(d*R)/(d-R)

//Result
printf("\n The value of resistance is %0.3f  ohm", X
   )
```

Scilab code Exa 6.8 The current drawn by the circuit

```
clear
//Given
R1=4                    //ohm
R2=3                   //ohm
R3=2.0
R11=2.4                 //ohm
E=6

//Calculation
X=(R1*R2)/R3
R4=R2+X
R5=R1+R3
Rt=((R4*R5)/(R4+R5))+R11
```

```
I=E/Rt

//Result
printf("\n the value of unknown resistance is %0.3f
    ohm", X)
printf("\n The current drawn by the circuit is %0.3f
     A",I)
```

Scilab code Exa 6.9 Current I1

```
clear
//Given
a=10
b=7.0
c=5
d=4
e=8.0

//Calculation
I1=(a+a)/(b+1)
I3=(c+(4*I1))/e
I2=(-a+(6*I3)+I1)/2.0

//Result
printf("\n Current I1= %0.3f A \nI2= %0.3f A \nI3=
   %0.3f A",I1,I2,I3)
```

Scilab code Exa 6.11 Total resistance from one end of vacant edge to other end

```
clear
//Given
a=28
b=5.0
```

```
c=2

//Calculation
Rak=a/(b*c)

//Result
printf("\n Total resistance from one end of vacant
   edge to other end is %0.3f  ohm", Rak)
```

Scilab code Exa 6.12 Value of X

```
clear
//Given
R=10
l2=68.5
l1=58.3

//Calculation
X=R*(l2/l1)

//Result
printf("\n Value of X is %0.1f  ohm",X)
```

Scilab code Exa 6.13 Length for zero galvanometer deflection

```
clear
//Given
R=2                    //ohm
R1=2.4                 //ohm
V=4                    //V
E=1.5

//Calculation
```

```
R11=R+R1
I=V/R11
Vab=I*R
K=Vab
l=E/K

//Result
printf("\n Length for zero galvanometer deflection
    is %0.3f m", l)
```

Scilab code Exa 6.15 `Value of R`

```
clear
//Given
l1=33.7
l2=51.9

//Calculation
S1=l1/(100-l1)
s11=l2/(100-l2)
s=((s11*12)/S1)-12
R=s*S1

//Result
printf("\n Value of R is %0.2f ohm \nValue of S is
    %0.1f ohm",R,s)
```

Scilab code Exa 6.16 `P D between point A and B`

```
clear
//Given
a=0.4
b=0.6
```

```
lab=10

//Calculation
K=a/b
Vab=K*lab

//Result
printf("\n (i) Potentila gradient along AB is %0.2f
    V/m",K)
printf("\n (ii) P.D between point A and B is %0.2f
   V",Vab)
```

Scilab code Exa 6.17 e m f generated by the thermocouple

```
clear
//Given
R1=990                              //ohm
R=10.0                              //ohm
E=2
l=1000                                  //mm
l1=400                                  //mm

//Calculation
Rt=R1+R
I=E/Rt
pd=I*R
K=pd/l
pd1=K*l1

//Result
printf("\n e.m.f. generated by the thermocouple is
   %0.3f  V", pd1)
```

Scilab code Exa 6.18 Resistance of the voltmeter

```
clear
//Given
AB=600                  //cm
AC=500.0                   //cm
l=40*10**-3              //A
E=2
r=10

//Calculation
R=2*AB/(AC*l)
K=2/AC
AC1=AC-r
pd=K*AC1
Iv=(E-pd)/r
R1=pd/Iv

//Result
printf("\n (i) The resistance of the whole wire is
   %0.3f  ohm", R)
printf("\n (ii) Reading of voltmeter is %0.3f  V",
   pd)
printf("\n (iii) Resistance of the voltmeter is %0.3
   f  ohm",R1)
```

Scilab code Exa 6.20 Resistance R1

```
clear
//Given
a=6
b=2

//Calculation
R1=a/((b*b)-1)
```

```
R2=b*R1

//Result
printf("\n Resistance R1 is %0.3f ohm \nR2 is %0.3f
   Ohm",R1,R2)
```

Scilab code Exa 6.21 The value of resistance

```
clear
//Given
R=20                            //ohm
L=10                            //m
pd=10**-3                       //V/m
V=10**-2                        //Volts

//Calculation
I=V/R
R11=(2/I)-R

//Result
printf("\n The value of resistance is %0.3f  ohm",
   R11)
```

Chapter 7

heating effect of electric curent

Scilab code Exa 7.2 Heat and light energy

```
clear
//Given
V=230                     //v
P=100
t=20*60
V1=115                         //V

//Calculation
R=V**2/P
E=(V1**2*t)/R

//Result
printf("\n Heat and light energy is %0.3f  J", E)
```

Scilab code Exa 7.3 Current in a circuit

```
clear
//Given
```

```
P=500                //W
V=200.0                 //V
V1=240

//Calculation
I=P/V
R=V1-V
R1=R/I

//Result
printf("\n The value of R= %0.3f  ohm",R1)
printf("\n Current in a circuit is %0.3f  A",I)
```

Scilab code Exa 7.4 The value of unknown resistance

```
clear
//Given
P1=100.0                          //W
P=1100.0                           //W
V=250

//Calculation
P2=P-P1
R=V**2/P2

//Result
printf("\n The value of unknown resistance is %0.3f
    ohm", R)
```

Scilab code Exa 7.7 Efficiency of the kettle

```
clear
//Given
```

```
m=1
c=1
a=100                    //W
b=15
t=7.5                     //second
P=1                       //KW
C=860                       //Kcal

//Calculation
A=m*c*(a-b)
B=P*t/60.0
D=B*C
n=A*a/D

//Result
printf("\n Efficiency of the kettle is %0.1f
   percentage",n)
```

Scilab code Exa 7.9 Heat generated in 4 ohm resistor

```
clear
//Given
H1=10
a=5.0
b=4.2

//Calculation
I1=(H1*b)/(a*4)
A=I1*4/b

//Result
printf("\n Heat generated in 4 ohm resistor is %0.3f
     cal/sec", A)
```

Scilab code Exa 7.10 Power output of the source

```
clear
//Given
E=12                          //V
I=1                            //A
r=0.5                          //ohm

//Calculation
P1=E*I
P2=I**2*r
P=P1-P2

//Result
printf("\n (i) Rate of consumption of chemical
   energy is %0.3f  W", P1)
printf("\n (ii) Rate Of energy dissipated inside the
    battery is %0.3f  W",P2)
printf("\n (iv) Rate of energy dissipated in the
   resistor is %0.3f  W", P)
printf("\n (v) Power output of the source is %0.3f
   W",P)
```

Scilab code Exa 7.11 Electricity bill for the month of september

```
clear
//Given
P=110                              //W
P1=100                             //W
n=5
V=220                              //V
t=2                           //hours
```

```
n1=4
P2=1120                    //W
m=1.5                          //per KWh

//Calculation
W=n*P1
W1=V*t
W2=n1*P
W3=W+W1+W2+P2
E=(W3*t)*10**-3
E2=E*30
B=m*E2

//Result
printf("\n Electricity bill for the month of
   september is %0.3f  Rs", B)
```

Scilab code Exa 7.12 `Maximum voltage`

```
clear
//Given
V=220                          //V
P=60.0                             //W
P1=85                             //w

//Calculation
//
R=V**2/P
V1=sqrt(P1*R)

//Result
printf("\n Maximum voltage is %0.1f  V",V1)
```

Scilab code Exa 7.13 Heat percentage

```
clear
//Given
V=200                  //V
P=500.0                    //W
V1=160                 //v

//Calculation
R=V**2/P
H=V1**2/R
P1=P-H
H1=P1*100/P

//Result
printf("\n Heat percentage is %0.3f  percentage", H1
   )
```

Scilab code Exa 7.15 Strength of the current

```
clear
//Given
m=900
w=100.0
c=1
a=80
b=4.2
V=210                     //V
x=12
y=60

//Calculation
Hout=(m+w)*c*a
Hin=(V*x*y)/b
Hin1=90/w*Hin
```

```
I=Hout/Hin1

//Result
printf("\n Strength of the current is %0.3f  A",I)
```

Scilab code Exa 7.16 Decreased percentage

```
clear
//Given
a=0.8

//Calculation
H=a**2
H1=(1-H)*100

//Result
printf("\n Decreased percentage is %0.3f  percentage
   ", H1)
```

Scilab code Exa 7.17 Time in parallel

```
clear
//Given
a=14
b=60
c=24
d=7.0

//Calculation
t=a*b/60.0
t1=(c/d)

//Result
```

```
printf("\n (i) Time in series is %0.3f  minute", t)
printf("\n (ii) Time in parallel is %0.2f  minute",
   t1)
```

Scilab code Exa 7.19 The rise of temperature

```
clear
//Given
I=0.5
R=100
t=30
a=4.2
m=200                       //g
w=10                       //g

//Calculation
H=I**2*R*t*60/a
A=H/(m+w)

//Result
printf("\n The rise of temperature is %0.2f  degree
   C",A)
```

Scilab code Exa 7.20 The value of current

```
clear
//Given
c=4.2                                //KJ/Kg/C
m=0.2                                //Kg
a=90
b=20
t=30
V=230
```

```

//calculation
d=a-b
H=c*m*d
P=H/t
I=P/V

//Result
printf("\n The value of current is %0.2f  A",I
   *10**3)
```

Chapter 8

magnetic field due to electric current

Scilab code Exa 8.1 Force on the proton

```
clear
//Given
q=1.6*10**-19                        //c
B=0.1                                //T
v=5.0*10**6                            //m/s
a=90                                 //degree

//Calculation
//
Fm=q*v*B*sin(a)

//Result
printf("\n Force on the proton is %0.1f *10**-14 N",
   Fm*10**14)
```

Scilab code Exa 8.2 Force acting on each electron

```
clear
//Given
n=1.0*10**29                                        //m**-3
e=1.6*10**-19                                         //C
A=2*10**-6                                                    //m
   **2
I=5                                                     //A
B=0.15                                                 //T
a=90                                                   //degree

//Calculation
//
Vd=I/(n*e*A)
Fm=e*Vd*B*sin(a)

//Result
printf("\n Force acting on each electron is %0.2f
   *10**-24 N",Fm*10**24)
```

Scilab code Exa 8.3 Acceleration of alpha particle

```
clear
//Given
q=2*1.6*10**-19                          //C
v=6*10**5                                //m/s
B=0.2                                     //T
a=90                                      //degree
m=6.65*10**-27

//Calculation
//
Fm=q*v*B*sin(a)
a=Fm/m

//Result
```

```
printf("\n Force on alpha particle is %0.2f *10**-14 N",Fm*10**14)
printf("\n Acceleration of alpha particle is %0.2f *10**12 m/s**2",a*10**-12)
```

Scilab code Exa 8.4 Magnetic fieldat the centroid of the triangle

```
clear
//Given
a=60                              //degree
u=4*3.14*10**-7                       //T/A m
Bc=2

//Calculation
//
a=(Bc/2.0)/(tan(60)*180/3.14)
B1=(10**-7*tan(60)*(sin(60*180/3.14)+sin(60*180/3.14)))*10
B=3*B1

//Result
printf("\n Magnetic fieldat the centroid of the triangle is %0.0f  *10**-7 T",B*10**7)
```

Scilab code Exa 8.5 Magnitude of the magnetic field

```
clear
//Given
n=20
I=1                     //A
r=0.08                     //m
u=4*3.14*10**-7                 //T/A m

```

```
//Calculation
B=u*n*I/(2*r)

//Result
printf("\n Magnitude of the magnetic field is %0.3f
    *10*4 T", B*10**4)
```

Scilab code Exa 8.6 Magnetic field on Y axis

```
clear
//Given
u=10**-7
I=10*10**-2                                    //A
r=0.5

//Calculation
B=u*I/r**2

//Result
printf("\n Magnetic field on Y axis is %0.3f  K^ T",
    B)
```

Scilab code Exa 8.7 Magnetic field

```
clear
//Given
I=5                //A
l=0.01               //m
a=45               //degree
r=2                //m
u=10**-7

//Calculation
```

```
//
B=(u*I*l*sin(a)*180/3.14)/r**2

//Result
printf("\n Magnetic field is %0.1f *10**-10 T",B
   *10**8)
```

Scilab code Exa 8.8 Magnetic field at the centre of coil

```
clear
//Given
u=4*3.14*10**-7                             //T/A m
n=20
I=12                                          //A
r=0.1                                         //m

//Calculation
B=u*n*I/(2*r)

//Result
printf("\n Magnetic field at the centre of coil is
   %0.1f  *10**-3 T",B*10**3)
```

Scilab code Exa 8.12 The magnitude of magnetic field

```
clear
//Given
r=0.02                 //m
u=4*3.14*10**-7                             //T/A m
I=12                                          //A

//Calculation
B=u*I/(4*r)
```

```
//Result
printf("\n The magnitude of magnetic field is %0.2f
    *10**-4 T",B*10**4)
```

Scilab code Exa 8.13 Magnetic field produced by the electrons

```
clear
//Given
v=4*10**6
r=0.5*10**-10
e=1.6*10**-19
t=1
u=4*3.14*10**-7                                //T/A m

//Calculation
//
f=v/(2.0*%pi*r)
I=f*e/t
B=u*I/(2*r)

//Result
printf("\n Magnetic field produced by the electrons
    is %0.1f  T",B)
```

Scilab code Exa 8.15 The magnetic field at the point on the axis of the coil

```
clear
//Given
n=100
I=5                             //A
r=0.1                           //m
x=0.05
```

```
u=4*3.14*10**-7                    //T/A m

//Calculation
B=u*n*I/(2*r)
B1=(u*n*I*r**2)/(2.0*(r**2+x**2)**1.5)

//Result
printf("\n (i) Magnetic field at the centre of the
    coil is %0.3f *10**-3 T",B*10**3)
printf("\n (ii) The magnetic field at the point on
    the axis of the coil is %0.2f *10**-3 T",B1
    *10**3)
```

Scilab code Exa 8.18 Force on electron when velocity

```
clear
//Given
a=5*10**-2
I=50
e=1.6*10**-19
B1=10**7
u=4*3.14*10**-7                    //T/A m

//Calculation
//
B=u*I/(2*%pi*a)
F=e*B1*B

//Result
printf("\n (i) Force on electron when velocity is
    towards the wire %0.1f *10**-16 N",F*10**16)
printf("\n (ii) Force on electron when velocity is
    parallel to the wire %0.1f *10**-16 N",F*10**16)
printf("\n (iii) Force on electron when velocity is
    perpendicular to the wire is zero")
```

Scilab code Exa 8.20 The effective dipole moment

```
clear
//Given
e=1.6*10**-19
f=6.8*10**15
r=0.51*10**-10
u=4*3.14*10**-7                          //T/A m

//Calculation
//
I=e*f
B=(u*I)/(2*r)
M=1*I*%pi*r**2

//Result
printf("\n The effective dipole moment is %0.0f
   *10**-24 Am**2",M*10**24)
```

Scilab code Exa 8.22 Magnitude of magnetic field

```
clear
//Given
n=5*850/1.23
I=5.57                    //A

//calculation
u=4*%pi*10**-7
B=u*n*I

//Result
```

```
printf("\n Magnitude of magnetic field is %0.1f
   *10**-3 T",B*10**3)
```

Scilab code Exa 8.23 magnetic field outside the toroid

```
clear
//Given
r1=20
r2=25
I=2                          //a

//Calculation
//
r=(r1+r2)/2.0
l=(2*%pi*r)*10**-2
n=1500/l
u=4*%pi*10**-7
B=u*n*I

//Result
printf("\n (i) Magnetic field inside the toroid is
   %0.3f  T",B)
printf("\n (ii) magnetic field outside the toroid is
    zero")
```

Chapter 9

motion of charged particles in electric and magnetic motion

Scilab code Exa 9.1 Transverse deflection produced by electric field

```
clear
//Given
V=90                                //V
d=2.0*10**-2
e=1.8*10**11
x=5*10**-2
v=10**7

//Calculation
E=V/d
a=e*E
t=x/v
y=0.5*a*t**2

//Result
printf("\n Transverse deflection produced by
   electric field is %0.1f cm",y*10**2)
```

Scilab code Exa 9.2 Angle

```
clear
//Given
V=500
d=2*10**-2                              //m
v=3*10**7
x=6*10**-2
e=1.8*10**11

//Calculation
//
E=V/d
a=E*e
t=x/v
v1=a*t
T=v1/v
A=atan(T)*180.0/3.14

//Result
printf("\n Angle is %0.1f  degree",A)
```

Scilab code Exa 9.3 Specific charge of the electron

```
clear
//Given
x=10*10**-2
v=3*10**7
S=1.76*10**-3
a=1800

//Calculation
```

```
t=x/v
e=S*2/(a*t**2)

//Result
printf("\n Specific charge of the electron is %0.3f
    C/Kg", e)
```

Scilab code Exa 9.4 Energy

```
clear
//Given
m=9*10**-31
v=3*10**7
q=1.6*10**-19                              //C
B=6*10**-4

//Calculation
//
r=m*v/(q*B)
f=q*B/(2.0*%pi*m)
E=(0.5*m*v**2)/1.6*10**-16

//Result
printf("\n Energy is %0.2f  Kev",E*10**32)
```

Scilab code Exa 9.5 Radius of the path

```
clear
//Given
m=9*10**-31
e=1.6*10**-19
V=100
B=0.004
```

```

//Calculation
//
r=sqrt(2*m*e*V)/(e*B)

//Result
printf("\n Radius of the path is %0.1f  mm",r*10**3)
```

Scilab code Exa 9.6 Pitch of helix

```
clear
//Given
m=1.67*10**-27
v=4*10**5
a=60
q=1.6*10**-19
B=0.3

//Calculation
//
r=(m*v*sin(a*3.14/180.0))/q*B
P=v*cos(a*3.14/180.0)*((2*%pi*m)/(q*B))

//Result
printf("\n (i) Radius of the helical path is %0.1f
    cm",r*10**3)
printf("\n (ii) Pitch of helix is %0.2f  cm",P
    *10**2)
```

Scilab code Exa 9.7 Magnitude of the force

```
clear
//Given
```

```
M=5*10**6                    //ev
e=1.6*10**-19
m=1.6*10**-27
B=1.5
q=1.6*10**-19

//Calculation
//
v=sqrt((2*M*e)/m)
F=q*v*B*sin(90*3.14/180.0)

//Result
printf("\n Magnitude of the force is %0.2f *10**-12
   N",F*10**12)
```

Scilab code Exa 9.8 Radius of helical path

```
clear
//Given
m=1.67*10**-27                            //Kg
v=4*10**5
B=0.3                             //T
q=1.6*10**-19                        //C

//Calculation
//
r=m*v*sin(60*3.14/180.0)/(q*B)
P=2*%pi*r*1/(tan(60*3.14/180.0))

//Result
printf("\n Pitch of the helix is %0.2f  cm",P*10**2)
printf("\n Radius of helical path is %0.3f  cm",r
   *10**2)
```

Scilab code Exa 9.9 Required potentila difference

```
clear
//Given
q=3.2*10**-19
B=1.2
r=0.45
m=6.8*10**-27

//Calculation
//
v=(q*B*r)/m
f=v/(2.0*%pi*r)
K=(0.5*m*v**2)/(1.6*10**-19)
V=K/2.0

//Result
printf("\n Required potentila difference is %0.0f
    *10**6 V",V*10**-6)
```

Scilab code Exa 9.10 Force

```
clear
//Given
I=4
u=10**-7
a=0.2                                    //m
v=4*10**6
q=1.6*10**-19

//Calculation
B=(u*2*I)/a
```

```
F=q*v*B

//Result
printf("\n Force is %0.3f  N", F)
```

Scilab code Exa 9.13 Radius of the circular path

```
clear
//Given
E=3.4*10**4                              //V/m
B=2*10**-3                               //Wb/m**2
m=9.1*10**-31
e=1.6*10**-19

//Calculation
v=E/B
r=(m*v)/(e*B)

//Result
printf("\n Radius of the circular path is %0.1f
   *10**-2 m",r*10**2)
```

Scilab code Exa 9.14 Magnitude of magnetic field

```
clear
//Given
V=600                                  //V
d=3*10**-3                                        //m
v=2*10**6                                       //m/s

//Calculation
B=V/(d*v)

```

```
//Result
printf("\n Magnitude of magnetic field is %0.3f  T",
    B)
```

Scilab code Exa 9.15 Radius of the cyclotron

```
clear
//Given
q=1.6*10**-19                                    //c
B=2                                              //T
m=1.66*10**-27                                   //Kg
K=5*10**6

//Calculation
//
f=(q*B)/(2.0*%pi*m)
v=sqrt((2*K*q)/m)
r=(m*v)/(q*B)

//Result
printf("\n (i) The frequency needed for applied
   alternating voltage is %0.0f  *10**7 HZ",f
   *10**-7)
printf("\n (ii) Radius of the cyclotron is %0.2f  m"
   ,r)
```

Scilab code Exa 9.16 Kinetic energy of proton

```
clear
//Given
B=1.7                    //T
q=1.6*10**-19            //c
r=0.5
```

```
m=1.66*10**-27

//Calculation
K=((B**2*q**2*r**2)/(2.0*m))/q

//Result
printf("\n Kinetic energy of proton is %0.0f  Mev",K
   *10**-6)
```

Scilab code Exa 9.17 Frequency of alternating voltage

```
clear
//Given
B=0.8
q=3.2*10**-19                       //C
d=1.2
m=4*1.66*10**-27                    //Kg
a=1.60*10**-19

//Calculation
//
r=d/2.0
K=(B**2*q**2*r**2)/(2.0*m*a)
v=(q*B*r)/m
f=(q*B)/(2.0*%pi*m)

//Result
printf("\n Frequency of alternating voltage is %0.2f
    *10**7 HZ",f*10**-7)
```

Scilab code Exa 9.18 Kinetic energy of the protons

```
clear
```

```
//Given
q=1.6*10**-19                    //C
r=0.6                             //m
m=1.67*10**-27                    //Kg
f=10**7

//Calculation
//
B=(2*%pi*m*f)/q
K=((B**2*q**2*r**2)/(2.0*m))/1.6*10**-13

//Result
printf("\n Kinetic energy of the protons is %0.1f
   Mev",K*10**26)
```

Scilab code Exa 9.19 Force

```
clear
//Given
I=5                          //A
l=0.06                        //m
B=0.02                        //T
a=90

//Calculation
//
F=I*B*l*sin(a*3.14/180.0)

//Result
printf("\n Force is %0.3f  N",F)
```

Scilab code Exa 9.20 Magnitude of the magnetic field

```
clear
//Given
m=0.2                                    //Kg
I=2                                      //A
l=1.5                                    //m
g=9.8

//Calculation
B=(m*g)/(I*l)

//Result
printf("\n Magnitude of the magnetic field is %0.2f
    T",B)
```

Scilab code Exa 9.21 `Current in each wire`

```
clear
//given
r=0.002                             //m
m=0.05
g=9.8

//Calculation
u=4*%pi*10**-7
f=u/(2*%pi*r)
f1=m*g
I=sqrt(f1*f**-1)

//Result
printf("\n Current in each wire is %0.3f  A", I)
```

Scilab code Exa 9.22 `Net force on the loop`

```
clear
//Given
r=0.04                    //m
I1=20
I2=16
l=0.15
r1=0.1

//Calculation
//
u=4*%pi*10**-7
F1=(u*I1*I2*l)/(2.0*%pi*r)
F2=(u*I1*I2*l)/(2.0*%pi*r1)
F=F1-F2

//Result
printf("\n Net force on the loop is %0.3f  *10**-4 N
   ", F*10**4)
```

Scilab code Exa 9.23 value of current

```
clear
//Given
m=0.3                 //Kg
a=30                   //degree
B=0.15                 //T
g=9.8                  //m/s**2

//Calculation
//
I=(m*g*tan(a*3.14/180.0))/B

//Result
printf("\n value of current is %0.2f  A",I)
```

Scilab code Exa 9.24 The direction of the force

```
clear
//Given
B=3*10**-5                          //T
I=1                                 //A

//Calculation
F=I*B*sin(90)

//Result
printf("\n The direction of the force is downward i.
   e %0.0f  *10**-5 N/m",F*10**5)
```

Scilab code Exa 9.25 Potentila difference

```

clear
//Given
m=1.2*10**-3
B=0.6                                 //T
g=9.8                                  //m/s**2
r=0.05
b=3.8

//Calculation
I=(m*g)/B
R=r*b
V=I*R

//Result
```

```
printf("\n Potentila difference is %0.1f  *10**-3 V"
    ,V*10**3)
```

Scilab code Exa 9.26 `Force on small conductor`

```
clear
//Given
I2=10                             //A
r=0.1                              //m
l=2                                //m
I1=2
I2=10
r=0.1

//Calculation
u=4*%pi*10**-7
F=u*I1*I2*I1/(2.0*%pi*r)

//Result
printf("\n Force on small conductor %0.3f  N", F)
```

Scilab code Exa 9.27 `Torque when magnetic field`

```
clear
//Given
A=10**-3                           //m**
n=10
I=2                              //A
B=0.1                           //T

//Calculation
//
t=n*I*A*B*cos(0)
```

```
t1=n*I*A*B*cos(60*3.14/180.0)

//Result
printf("\n (i) Torque when magnetic field is
    parallel to the field %0.0f *10**-3 Nm",t*10**3)
printf("\n (ii) Torque when magnetic field is
    perpendicular to the field is zero")
printf("\n (iii) Torque when magnetic field is 60
    degree to the field is %0.1f *10**-3 Nm",t1
    *10**3)
```

Scilab code Exa 9.28 Magnitude of maximum torque

```
clear
//Given
r=7
I=10
B=100*10**-4

//Calculation
//
A=%pi*r**2
t=I*A*B

//Result
printf("\n Magnitude of maximum torque is %0.2f
    *10**-3 Nm",t*10**-1)
```

Scilab code Exa 9.29 Torgue

```
clear
//Given
N=10
```

```
I=0.06
r=0.05
n=1000
I2=25

//Calculation
//
A=%pi*r**2
M=N*I*A
u=4*%pi*10**-7
B=u*n*I2
t=M*B*sin(45*3.14/180.0)

//Result
printf("\n Torgue is %0.2f  *10**-4 Nm",t*10**4)
```

Scilab code Exa 9.30 d Angular speed acquired by the coil

```
clear
//Given
n=100
l=3.2
r=0.1

//Calculation
//
u=4*%pi*10**-7
B=(u*n*l)/(2.0*r)
M=n*l*%pi*r**2
t=M*B*sin(0)
t1=(M*B*sin(90*3.14/180.0))*10**3
w=sqrt((2*M*B*10**3)/r)

//Result
printf("\n (a) Field at the centre of the coil is %0
```

```
.0f   *10**-3  T",B*10**3)
printf("\n (b) Magnetic moment of the coil is %0.0f
    Am**2",M)
printf("\n  Magnitude of the torque on the coil in
    the final position is %0.0f  Nm",t1)
printf("\n (d) Angular speed acquired by the coil is
    %0.0f  rad/s",w)
```

Scilab code Exa 9.31 Angular deflection of the coil

```
clear
//Given
n=125
I=20*10**-3                                 //A
B=0.5                                       //T
A=400*10**-6                                  //m**2
K=40*10**-6

//Calculation
T=n*I*B*A
a=T/K

//Result
printf("\n (i) Torque exerted is %0.3f  *10**-4 Nm",
    T*10**4)
printf("\n (ii) Angular deflection of the coil is %0
    .3f  degree", a)
```

Scilab code Exa 9.32 Maximum current

```
clear
//Given
K=3*10**-9                                      //Nm/deg
```

```
a=36
n=60
B=9*10**-3                                          //T
A=5*10**-5                                              //m**2

//Calculation
I=(K*a)/(n*B*A)

//Result
printf("\n Maximum current is %0.3f mA", I*10**3)
```

Scilab code Exa 9.33 Current sensitivity of the galvanometer

```
clear
//Given
n=30
B=0.25                          //T
A=1.5*10**-3
K=10**-3

//Calculation
S=(n*B*A)/K

//Result
printf("\n Current sensitivity of the galvanometer
   is %0.3f degree/A", S)
```

Scilab code Exa 9.35 Resistance of ammeter of range 0 15 A

```
clear
//Given
Ig=0.015                    //A
G=5
```

```
I=1
V=15

//Calculation
S=(Ig*G)/(I-Ig)
R=G*S/(G+S)
R1=(V/Ig)-G
R2=R1+G

//Result
printf("\n (i) Resistance of ammeter of range 0−1 A
    is %0.3f ohm", R)
printf("\n (ii) Resistance of ammeter of range 0−15
    A is %0.3f ohm", R2)
```

Scilab code Exa 9.36 Resistance for an ammeter of range 0 750 A

```
clear
//Given
V=75                    //mV
Ig=0.025                  //A
I=25                          //mA
I1=100
V1=750

//Calculation
G=V/I
S=(Ig*G)/(I1-Ig)
R=(V1/Ig)-G

//Result
printf("\n (i) Resistance for an ammeter of range
    0−100 A is %0.5f ohm",S)
printf("\n (ii) Resistance for an ammeter of range
    0−750 A is %0.5f ohm",R)
```

Scilab code Exa 9.37 The value of current

```
clear
//Given
Rg=60
R1=3.0
rs=0.02

//Calculation
Rt=Rg+R1
I=R1/Rt
Rm=(Rg*rs)/(Rg+rs)
R2=Rm+R1
I1=R1/R2
I2=R1/R1

//Result
printf("\n (i) The value of current is %0.3f  A",I)
printf("\n (ii) The value of current is %0.2f  A",I1
  )
printf("\n (iii) The value of current is %0.3f  A",
  I2)
```

Scilab code Exa 9.38 Resistance of the voltmeter

```
clear
//Given
V=100
v=1
a=1980

```

```
//Calculation
Rm=a/(V-v)

//Result
printf("\n Resistance of the voltmeter is %0.3f  ohm
    ", Rm)
```

Scilab code Exa 9.39 value of unknown resistance

```
clear
//Given
R1=1200.0                          //ohm
R2=600                           //ohm
Vab=5                            //V
V=35

//Calculation
Rp=(R1*R2)/(R1+R2)
I=Vab/Rp
pd=V-Vab
R=pd/I

//Result
printf("\n value of unknown resistance is %0.3f  ohm
    ", R)
```

Scilab code Exa 9.40 Hence the voltmeter will read

```
clear
//Given
R1=400                         //ohm
R2=800.0
R3=10
```

```
V=6
R11=10000.0
R22=400

//Calculation
Rt=R1+R2+R3
I=V/Rt
Rp=(R11*R22)/(R11+R22)
R=Rp+800
I1=V/R
Vab=I1*Rp

//Result
printf("\n Hence the voltmeter will read %0.2f  V",
   Vab)
```

Scilab code Exa 9.41 Reading of ammeter

```
clear
//Given
V=2                               //V
R=2000.0                           //ohm

//Calculation
I=V/R
pd=I*R

//Result
printf("\n Reading of ammeter is %0.3f mA \nReading
   of voltmeter is %0.3f V",I*10**3,pd)
```

Scilab code Exa 9.42 Figure of merit of the galvanometer

```
clear
//Given
E=3
G=100
R=200.0
n=30

//Calculation
Ig=E/(G+R)
K=(Ig/n)*10**6

//Result
printf("\n Figure of merit of the galvanometer is %0
    .1f  micro A/division",K)
```

Scilab code Exa 9.43 `Voltmeter will read`

```
clear
//Given
V1=60                    //ohm
V2=30
R=300.0
R1=1200
R2=400                        //ohm

//Calculation
V=V1-V2
I=V/R
R11=(R1*R)/(R1+R)
I=V1/(R11+R2)
V11=I*R11

//Result
printf("\n Voltmeter will read %0.3f  V", V11)
```

Scilab code Exa 9.44 Voltmeter resistance

```
clear
//Given
R=20.0                          //K ohm
R2=1                            //K ohm

//Calculation
Vr=(R*R2)/(R+R2)

//Result
printf("\n (i) Voltmeter resistance is %0.3f  K ohm"
   , R)
printf("\n (ii) Voltmeter resistance is %0.3f  K ohm
   ",R2)
printf("\n (iii) Voltmeter resistance is %0.2f  K
   ohm",Vr)
```

Scilab code Exa 9.45 Resistance of ammeter

```
clear
//Given
s=20*10**-6
n=30
I=1                           //A
G=25                           //ohm

//Calculation
Ig=s*n
S=Ig*G/(1-Ig)
Ra=G*S/(G+S)

```

```
//Result
printf("\n Resistance of ammeter is %0.3f  ohm",Ra)
```

Chapter 10

magnets and earths magnetism

Scilab code Exa 10.1 Strength of pole M2

```
clear
//Given
F=0.8*10**-3*9.8                              //N
d=0.1                                          //m
u=10**-7

//Calculation
//
m=sqrt(F*d**2/(u*5))
m1=5*m

//Result
printf("\n Strength of pole M1 is %0.2f  Am",m)
printf("\n Strength of pole M2 is %0.1f  Am",m1)
```

Scilab code Exa 10.2 Distance

```
clear
```

```
//Given
F=14.4*10**-4                           //N
d=0.05                                  //m
F1=1.6*10**-4

//Calculation
//
u=4*%pi*10**-7
m=sqrt((F*4*%pi*d**2)/u)
d1=1/(sqrt((F1*4*%pi)/(u*m**2)))

//Result
printf("\n Distance is %0.3f  m",d1)
```

Scilab code Exa 10.5 Magnetic induction at equatorial point

```
clear
//given
M=8
d=0.2
u=4*%pi*10**-7

//Calculation
B=u*2*M/(4*%pi*d**3)
Beqa=B/2.0

//Result
printf("\n (i) Magnetic induction at axial point %0
   .3f  *10**-4 T", B*10**4)
printf("\n (ii) Magnetic induction at equatorial
   point is %0.3f  *10**-4 T",Beqa*10**4)
```

Scilab code Exa 10.6 earths dipole moment

```
clear
//Given
d=6.4*10**6                    //m
B=0.4*10**-4                  //T
u=4*%pi*10**-7
//Calculation
//
M=(B*4*%pi*d**3)/u

//Result
printf("\n earths dipole moment is %0.2f *10**23 Am
   **2",M*10**-23)
```

Scilab code Exa 10.7 `Magnitude of equatorial field`

```
clear
//Given
M=0.40
d=0.5
u=4*%pi*10**-7

//Calculation
Beqa=u*M/(4*%pi*d**3)
Baxial=2*Beqa

//Result
printf("\n Magnitude of axial field is %0.3f  T",
   Baxial)
printf("\n Magnitude of equatorial field is %0.3f  T
   ",Beqa)
```

Scilab code Exa 10.8 `Equivalent magnetic moment`

```
clear
//Given
e=1.6*10**-19
f=6.8*10**15
n=1
r=0.53*10**-10

//Calculation
//
I=e*f
M=n*I*%pi*r**2

//Result
printf("\n Equivalent magnetic moment is %0.1f
    *10**-24 Am**2",M*10**24)
```

Scilab code Exa 10.9 Magnetic moment

```
clear
//Given
n=50
r=0.2                              //m
I=12                               //A
u=4*%pi*10**-7
//Calculation
B=(u*n*I)/(2.0*r)
M=n*I*%pi*r**2

//Result
printf("\n (i) Magnetic field at the centre of the
    coil is %0.3f *10**-3 T",B*10**3)
printf("\n (ii) Magnetic moment is %0.1f Am**2",M)
```

Scilab code Exa 10.10 Magnitude of the magnetic moment

```
clear
//Given
A=7.5*10**-4                                                    //m**2
I=12                                                              //A

//Calculation
M=A*I

//Result
printf("\n Magnitude of the magnetic moment is %0.3f
     *10**-3  Am**2", M*10**3)
```

Scilab code Exa 10.11 Workdone

```
clear
//Given
n=100
I=0.1                             //A
r=0.05
B=1.5                              //T

//Calculation
//
M=n*I*%pi*r**2
W=2*M*B

//Result
printf("\n Magnitude of the coil is %0.4f  Am**2",M)
printf("\n Workdone is %0.4f  J",W)
```

Scilab code Exa 10.12 Work done

```
clear
//Given
n=10
I=3
A=7.85*10**-3
B=10**-2                                    //T

//Calculation
//
M=n*I*A
U1=-M*B*cos(0)
Uf=-M*B*cos(90)
w=-U1
t=M*B*sin(90*3.14/180.0)

//Result
printf("\n Work done is %0.1f  *10**-3 Nm",t*10**3)
```

Scilab code Exa 10.13 Torque acting on the needle

```
clear
//Given
M=4.8*10**-2                                        //J/T
a=30                                                //degree
B=3*10**-2                                          //t

//Calculation
//
t=M*B*sin(a*3.14/180.0)

//Result
printf("\n Torque acting on the needle is %0.1f *10**-4 Nm",t*10**4)
```

Scilab code Exa 10.14 Orientation of the magnet

```
clear
//Given
B=0.2                        //T
a=30                             //degree
t=0.06                               //Nm

//Calculation
//
M=t/(B*sin(a*3.14/180.0))
U=M*B*cos(1*3.14/180.0)

//Result
printf("\n (i) Magnetic moment of the magnet is %0.1f Am**2",M)
printf("\n (ii) Orientation of the magnet is %0.0f",U)
```

Scilab code Exa 10.15 Current flowing through the solenoid

```
clear
//given
a=30                                    //degree
B=800*10**-4                            //T
t=0.016                                 //Nm
A=2*10**-4                              //m**2
n=1000                                  //turns

//Calculation
M=t/(B*sin(a*3.14/180.0))
W=2*M*B
```

```
I=M/(n*A)

//Result
printf("\n (a) Magnetic moment of the magnet is %0.2
    f  Am**2",M)
printf("\n (b) Work done is %0.3f  J",W)
printf("\n (c) Current flowing through the solenoid
    is %0.0f  A",I)
```

Scilab code Exa 10.16 Magnitude of the magnetic field

```
clear
//Given
t=6.70
n=10.0
I=7.5*10**-6                              //Kgm**2
M=6.7*10**-2                                    //Am**2

//Calculation
T=t/n
B=(4*%pi**2*I)/(M*T**2)

//Result
printf("\n Magnitude of the magnetic field is %0.2f
     T",B)
```

Scilab code Exa 10.18 Angle of the declination

```
clear
//Given
t=1.2*10**-3                              //nm
M=60
H=40*10**-6
```

```
//Calculation
//
A=t/(M*H)
a=asin(A)*180/3.14

//Result
printf("\n Angle of the declination is %0.0f  degree
   ",a)
```

Scilab code Exa 10.19 `Angle of dip`

```
clear
//Given
V=sqrt(3)

//calculation
//
a=atan(V)*180/3.14

//Result
printf("\n Angle of dip is %0.0f  Degree",a)
```

Scilab code Exa 10.20 `earths total magnetic field`

```
clear
//Given
H=0.28                              //G
V=0.40                              //G

//Calculation
//
A=V/H
```

```
a=atan(A)*180/3.14
R=sqrt(H**2+V**2)

//Result
printf("\n (i) Angle of dip is %0.0f  Degree",a)
printf("\n (ii) earths total magnetic field is %0.2f
    G",R)
```

Scilab code Exa 10.22 Magnitude of earths magnetic field

```
clear
//Given
H=0.40
a=18                    //degree

//Calculation
//
R=H/(cos(a*3.14/180.0))

//Result
printf("\n Magnitude of earths magnetic field is %0
   .2f  G",R)
```

Scilab code Exa 10.24 Apparant dip

```
clear
//Given
a=45                                    //Degree
b=60                                    //Degree

//Calculation
//
A=tan(a*3.14/180.0)/(cos(b*3.14/180.0))
```

```
a=atan(A)*180/3.14

//Result
printf("\n Apparant dip is %0.1f  Degree",a)
```

Scilab code Exa 10.25 Horizontal component of the earths magnetic field

```
clear
//Given
M=1.6                              //Am**2
d=0.20                                //m
u=10**-7                                 //N/A**2

//Calculation
H=u*2*M/(d**3)

//Result
printf("\n Horizontal component of the earths
   magnetic field is %0.3f  T", H)
```

Scilab code Exa 10.26 Magnetic moment of the magnet

```
clear
//Given
l=0.05                               //m
d=0.12                               //m
H=0.34*10**-4                               //T

//Calculation
//
u=4*%pi*10**-7
M=(4*%pi*H*(d**2+l**2)**1.5)/u

```

```
//Result
printf("\n Magnetic moment of the magnet is %0.3f  J
   /T",M)
```

Scilab code Exa 10.27 Value of current

```
clear
//Given
r=7*10**-2                              //m
H=2*10**-5                              //T
n=50
u=4*%pi*10**-7
//calculation
//
l=(2*r*H*tan(45*180/3.14))/u*n

//Result
printf("\n Value of current is %0.3f  A",l*10**-3)
```

Scilab code Exa 10.28 Horizontal component of earths magnetic field

```
clear
//Given
K=0.095                                 //A
n=50
r=10*10**-2                             //m
u=4*%pi*10**-7
//Calculation
H=K*u*n/(2.0*r)

//Result
printf("\n Horizontal component of earths magnetic
   field is %0.3f  *10**-4 T",H*10**4)
```

Scilab code Exa 10.30 Ratio of number of turns of the tangent galvanometers

```
clear
//Given
a=30                                          //degree
b=45                                           //degree
u=4*%pi*10**-7
//Calculation
//
m=(2*tan(a*3.14/180.0))/(tan(b*3.14/180.0))

//Result
printf("\n Ratio of number of turns of the tangent
   galvanometers %0.3f  ",m)
```

Chapter 11

classification of magnetic materials

Scilab code Exa 11.1 Equivalent magnetic moment

```
clear
//Given
e=1.6*10**-19
f=6.8*10**15
n=1
r=0.53*10**-10

//Calculation
//
I=e*f
M=n*I*%pi*r**2

//Result
printf("\n Equivalent magnetic moment is %0.1f
    *10**-24 Am**2",M*10**24)
```

Scilab code Exa 11.2 The magnetic flux density

```
clear
//Given
E=240
R=474.0
r=12.5*10**-2
N=500
ur=5000

//Calculation
//
I=E/R
I1=2*%pi*r
H=(N*I)/I1
u=4*%pi*10**-7
B=u*ur*H

//Result
printf("\n (i) The magnetising force is %0.0f  AT/m"
   ,H)
printf("\n (ii) The magnetic flux density is %0.2f
   Wb/m**2",B)
```

Scilab code Exa 11.3 Relative permeability

```
clear
//Given
r1=11
r2=12
B=2.5                          //T
a=3000
I=0.70                          //A

//Calculation
```

```
//
r=((r1+r2)/2.0)*10**-2
n=a/(2*%pi*r)
ur=B*2*%pi*r/(4*%pi*10**-7*a*I)

//Result
printf("\n Relative permeability is %0.1f  ",ur)
```

Scilab code Exa 11.5 Susceptibility of the material

```
clear
//Given
B=0.6
H=360.0

//Calculation
u=B/H
x=(u-1*4*%pi*10**-7)/(4.0*%pi*10**-7)

//Result
printf("\n (i) Permeability is %0.2f  *10**-3 T/A m"
    ,u*10**3)
printf("\n (ii) Susceptibility of the material is %0
    .0f  ",x)
```

Scilab code Exa 11.6 earths magnetisation

```
clear
//Given
M=8.0*10**22                    //Am**2
R=64*10**5                      //m

//Calculation
```

```
//
I=(3*M)/(4.0*%pi*R**3)

//Result
printf("\n earths magnetisation is %0.1f  A/m",I)
```

Scilab code Exa 11.7 Average magnetic moment per iron atom

```
clear
//given
N=1800
l=0.6
I=0.9                                //A
ur=500
n1=6.02*10**26
a=55.85
y=7850

//Calculation
n=N/l
H=n*I
I1=(ur-1)*H
B=4*%pi*10**-7*ur*H
x=(y*n1)/a
X=I1/x

//Result
printf("\n Average magnetic moment per iron atom is
   %0.2f *10**-23  A m**2",X*10**23)
```

Scilab code Exa 11.8 Energy dissipated per unit volume

```
clear
```

```
//Given
M=8.4                              //g
d=7200.0
f=50                                   //Hz
E=3.2*10**4
t=30*60.0

//Calculation
V=M/d
P=E/t
E1=P/(V*f)

//Result
printf("\n Energy dissipated per unit volume is %0.0
   f  J/m**3/cycle",E1)
```

Scilab code Exa 11.9 `Current should be sent through the solenoid`

```
clear
//Given
H=4*10**3                              //A/m
a=60
b=0.12

//Calculation
n=a/b
I=H/n

//Result
printf("\n Current should be sent through the
   solenoid is %0.3f  A", I)
```

Scilab code Exa 11.10 `Susceptibility`

```
clear
//Given
x=1.68*10**-4
T1=293
T2=77.4

//Calculation
x1=(x*T1)/T2

//Result
printf("\n Susceptibility is %0.2f  *10**-4",x1
   *10**4)
```

Scilab code Exa 11.11 Maximum possible dipole moment

```
clear
//Given
l=10**-6                          //m
d=7.9                             //g
a=6.023*10**23
n=55.0
M1=9.27*10**-24

//Calculation
V=l**2
M=V*d
N=(a*M)/n
Mmax=N*M1
Imax=Mmax/V*10**-4

//Result
printf("\n Number of iron atom is %0.2f  *10**10
   atoms",N*10**-10)
printf("\n Magnetisation of the dipole is %0.0f
   *10**5 A/m",Imax*10**5)
```

```
printf("\n Maximum possible dipole moment is %0.0f *10**-13 A m**2",Mmax*10**13)
```

Chapter 12

electromagnetic induction

Scilab code Exa 12.1 Average e m f induced in the coil

```
clear
//Given
a=20                          //mWb
a1=-20                        //mWb
t=2*10**-3                    //s
N=100

//Calculation
a2=(a1-a)*10**-3
e=(-N*a2)/t

//Result
printf("\n Average e.m.f induced in the coil is %0.3
    f  V", e)
```

Scilab code Exa 12.3 Magnitude of induced emf

```
clear
```

```
//Given
A=10**-2                                //m**2
a=45                                    //degree
B1=0.1                                  //T
R=0.5                                   //ohm
t=0.7                                   //S

//Calculation
//
a1=B1*A*cos(a*3.14/180.0)
a2=0
a3=a1-a2
e=a3/t
I=e/R

//Result
printf("\n Current during this time interval is %0.1
    f  *10**-3 A",I*10**3)
printf("\n Magnitude of induced emf is %0.0f
    *10**-3 V",e*10**3)
```

Scilab code Exa 12.4 Necessary rate

```
clear
//Given
I=1.2*10**-3                                 //A
N=1.0
R=10                                  //ohm

//Calculation
e=I*R
a=e/N

//Result
printf("\n Necessary rate is %0.3f  *10**-2 Wb/
```

```
second", a*10**2)
```

Scilab code Exa 12.5 Current induced in the coil

```
clear
//Given
r=10**-1                              //m
B=3.0*10**-5                             //T
t=0.25                                      //S
N=500
R=2                                            //ohm

//Calculation
//
a1=B*%pi*r**2*cos(0*3.14/180.0)
a2=B*%pi*r**2*cos(180*3.14/180.0)
a3=a1-a2
e=(N*a3)/t
I=e/R

//Result
printf("\n Magnitude of the emf is %0.1f  *10**-3 V"
   ,e*10**3)
printf("\n Current induced in the coil is %0.1f
   *10**-3 A",I*10**3)
```

Scilab code Exa 12.6 Rate of rotation of the blade

```
clear
//Given
e=10**-2                                  //V
B=5*10**-5                                //T
r=0.5                                    //m
```

```
N=1

//Calculation
//
A=%pi*r**2
n=(e*N)/(%pi*r**2*B)

//Result
printf("\n Rate of rotation of the blade is %0.1f revolutions/second",n)
```

Scilab code Exa 12.7 `The current induced in the coil`

```
clear
//Given
a=12
b=7
t=2

//Calculation
e=((a*t)+b)*10**-3

//Result
printf("\n (i) Magnitude of induced emf is %0.3f mV", e*10**3)
printf("\n (ii) The current induced in the coil will be anticlockwise")
```

Scilab code Exa 12.8 `emf induced in the conductor`

```
clear
//Given
B=1                          //T
```

```
l=0.5                         //m
v=40                          //m/s

//Calculation
//
e=B*l*v*sin(60*3.14/180.0)

//Result
printf("\n emf induced in the conductor is %0.2f  ",e)
```

Scilab code Exa 12.9 Potential difference between its end

```
clear
//Given
g=9.8
h=10
B=1.7*10**-5
l=1                 //m

//Calculation
//
v=sqrt(2*g*h)
e=B*l*v

//Result
printf("\n Potential difference between its end is %0.3f  *10**4 V",e*10**4)
```

Scilab code Exa 12.10 e m f generated in the axle of the car

```
clear
//Given
```

```
v=72 *(5/18.0)                                    //Km/h
B=40*10**-6                              //T
A=40
l=2                                      //m
t=1.0
N=1

//Calculation
A=l*v
a=B*A
e=N*a/t

//Result
printf("\n e.m.f generated in the axle of the car %0
   .3f  mV", e*10**3)
```

Scilab code Exa 12.11 e m f induced

```
clear
//Given
w=1000/60.0
r=0.3
B=0.5                                //T

//Calculation
v=w*r
vav=v/2.0
e=B*r*vav

//Result
printf("\n e.m.f induced is %0.3f  V",e)
```

Scilab code Exa 12.12 Magnitude of induced e m f between the axle and rim

```
clear
//Given
r=0.5                                    //m
n=2                                       //r.p.s
B=0.4*10**-4                              //T

//Calculation
//
w=2*%pi*n
e=0.5*B*r**2*w

//Result
printf("\n Magnitude of induced e.m.f between the
   axle and rim is %0.2f *10**-5 V",e*10**5)
```

Scilab code Exa 12.13 e m f between the centre and the matallic ring

```
clear
//Given
R=1                        //m
B=1
f=50

//Calculation
//
e=%pi*R**2*B*f

//Result
printf("\n e.m.f between the centre and the matallic
    ring is %0.1f  V",e)
```

Scilab code Exa 12.14 Inductance of the coil

```
clear
//Given
N=500
a=1.4*10**-4                              //Wb
l=2.5                                    //A

//Calculation
L=(N*a)/l

//Result
printf("\n Inductance of the coil is %0.3f  mH", L
   *10**3)
```

Scilab code Exa 12.15 `Direction oppose the increase in current`

```
clear
//Given
L=130*10**-3                              //H
I1=20                                      //mA
I2=28                                      //mA
t=140.0*10**-3                               //S

//Calculation
l=I2-I1
e=(-L*l)/t

//Result
printf("\n Magnitude of induced e.m.f is %0.2f
   *10**-3 V",e)
printf("\n Direction oppose the increase in current"
   )
```

Scilab code Exa 12.16 `Inductance of the solenoid`

```
clear
//Given
N=4000
l=0.6                                   //m
r=16*10**-4                             //m

//Calculation
u=4*%pi*10**-7
L=(u*N**2*((%pi*r)/4.0))/l
Liron=N*L

//Result
printf("\n Inductance of the solenoid is %0.0f  H",
    Liron)
```

Scilab code Exa 12.17 `Charge in magnetic flux`

```
clear
//Given
L=10.0                             //H
e=300                              //V
t=10**-2                             //S

//Calculation
dl=(e*t)/L
a=e*t

//Result
printf("\n Charge in magnetic flux is %0.3f  Wb", a)
```

Scilab code Exa 12.18 `Magnetic flux through the cross section of the coil`

```
clear
```

```
//Given
L=10*10**-3
I=4*10**-3
N=200.0

//Calculation
N1=L*I
a=N1/N

//Result
printf("\n Total flux linked with the coil is %0.3f
    Wb", N1)
printf("\n Magnetic flux through the cross section
    of the coil is %0.3f  Wb",a)
```

Scilab code Exa 12.19 New value of energy

```
clear
//Given
L=500*10**-3
I1=20*10**-3                  //A
I2=10*10**-3                  //A

//Calculation
U1=0.5*L*I1**2
U2=0.5*L*I2**2

//Result
printf("\n Magnetic energy stored in the coil is %0
    .3f  *10**-4 J",U1*10**6)
printf("\n New value of energy is %0.3f  J",U2)
```

Scilab code Exa 12.20 ENergy being stored in the magnetic field of inductor

```
clear
//Given
E=12
R=30.0                    //ohm
L=0.22

//Calculation
I0=E/R
I=I0/2.0
P=E*I
dl=(E-(I*R))/L
du=L*I*dl

//Result
printf("\n (i) Energy being delivered by the battery
    is %0.3f  W", P)
printf("\n (ii) ENergy being stored in the magnetic
    field of inductor is %0.3f  W",du)
```

Scilab code Exa 12.21 Amount of energy spent during the period

```
clear
//Given
L=2.0                         //H
i=2                              //A

//Calculation
U=0.5*L*i**2

//Result
printf("\n Amount of energy spent during the period
    is %0.3f  J", U)
```

Scilab code Exa 12.22 Mumtual induction between the two coils

```
clear
//Given
e=1500                                //V
dl=3                                      //A
dt=0.001                                      //s

//Calculation
M=(e*dt)/dl

//Result
printf("\n Mumtual induction between the two coils
    is %0.3f  H", M)
```

Scilab code Exa 12.23 Mutual induction between A and B

```
clear
//Given
N2=1000
I1=5.0                                  //A
a2=0.4*10**-4                         //Wb
dl=-24                                    //A
dt=0.02                                       //S

//Calculation
M=(N2*a2)/I1
eb=(-M*dl)/dt

//Result
printf("\n (i) Mutual induction between A and B is
    %0.3f  H", M)
```

Scilab code Exa 12.24 Induced e m f in the second coil

```
clear
//Given
N=1200
A=12*10**-4                                        //m**2
r=0.15                                                    //m
N2=300
a=0.05

//Calculation
//
u=4*%pi*10**-7
L=(u*N**2*A)/(2*%pi*r)
M=(u*N*N2*A)/(2*%pi*r)
dl=2/a
e=M*dl

//Result
printf("\n (i) Self inductance of the toroid is %0.1
   f  *10**-3 H",L*10**3)
printf("\n (ii) Induced e.m.f. in the second coil is
    %0.3f  V",e)
```

Scilab code Exa 12.25 Mutual induction between the two loops

```
clear
//Given
I=2.0
a1=20*10**-2
x=0.15
A2=0.3*10**-2

//Calculation
//
```

```
u=4*%pi*10**-7
B1=(u*I*a1**2)/(2.0*(a1**2+x**2)**1.5)
a=B1*%pi*A2**2
M=a/I

//Result
printf("\n (i) Flux linking the bigger loop is %0.1f
    ",a*10**11)
printf("\n (ii) Mutual induction between the two
   loops is %0.2f !0**-11 H",M*10**11)
```

Scilab code Exa 12.26 Mutual induction of the system

```
clear
//Given
l=0.5                          //m
n=20                           //turns
r=50                           //cm
A1=40*10**-4                    //m**2
n1=25
A2=25*10**-4                     //m**2

//Calculation
u=4*%pi*10**-7
N=n*r
N2=n1*r
M=(u*N*N2*A2)/l

//Result
printf("\n Mutual induction of the system is %0.2f
   *10**-3 H",M*10**3)
```

Chapter 13

alternating currents

Scilab code Exa 13.1 The instantaneous value

```
clear
//Given
I0=141.4                              //A
w=314
t=3*10**-3                                       //s

//Calculation
//
f=w/(2*%pi)
T=1/f
I=-I0*t*sin(314*180/3.14)

//Result
printf("\n (i) The maximum value is %0.3f  A",I0)
printf("\n (ii) Frequency is %0.0f  Hz",f)
printf("\n (iii) Time period is %0.2f  S",T)
printf("\n (iv) The instantaneous value is %0.2f  A"
   ,I*10**3)
```

Scilab code Exa 13.3 Average e m f during a positive half cycle

```
clear
//Given
E=220                              //V

//Calculation
//
E0=sqrt(2)*E
Emean=2*E0/%pi

//Result
printf("\n Average e.m.f during a positive half
   cycle is %0.0f  V",Emean)
```

Scilab code Exa 13.4 r m s Value of current

```
clear
//Given
A=2

//Calculation
//
I=sqrt(A**2)

//Result
printf("\n r.m.s Value of current is %0.3f  A", I)
```

Scilab code Exa 13.5 Time taken to reach 96 A for the first time

```
clear
//Given
I0=120                             //A
```

```
a=360.0
b=96
c=120.0

//Calculation
//
t=1/a
I=I0*sin(%pi/3.0)
a1=b/c
a2=asin(a1)
t=a2/(c*%pi)

//Result
printf("\n (i) Instantaneous value after 1/360
    second is %0.2f  A",I)
printf("\n (ii) Time taken to reach 96 A for the
    first time is %0.5f  S",t)
```

Scilab code Exa 13.7 Average value of a c over one cycle

```
clear
//Given
E0=60
R=20.0                          //ohm

//Calculation
//
Ev=E0/(sqrt(2))
Iv=Ev/R

//Result
printf("\n (i) A.C ammeter will %0.2f  A",Iv)
printf("\n (ii) Average value of a.c over one cycle
    is zero")
```

Scilab code Exa 13.8 `Average power`

```
clear
//Given
E0=250                          //V
I0=10                           //A

//Calculation
P=E0*I0
P1=P/2.0

//Result
printf("\n (i) Peak power is %0.3f  W", P)
printf("\n (ii) Average power is %0.3f  W",P1)
```

Scilab code Exa 13.9 `Resistance`

```
clear
//Given
Ev=120.0
P=1000                                  //W
Ev1=240

//Calculation
Iv=P/Ev
I0=sqrt(2)*Iv
R=Ev/Iv
P=Ev1**2/R

//Result
printf("\n Resistance is %0.3f ohm \nPeak current is
    %0.3f W",R,P)
```

Scilab code Exa 13.11 Frequency

```
clear
//Given
Xl=220                          //ohm
L=0.7                             //H

//Calculation
//
f=Xl/(2*%pi*L)

//Result
printf("\n Frequency is %0.0f  HZ",f)
```

Scilab code Exa 13.12 r m s value of p d across the coil

```
clear
//Given
f=50                            //Hz
I=1.4

//Calculation
//
E=2*%pi*f*I*2*cos(2*%pi*f)
Ev=E/sqrt(2)

//Result
printf("\n (i) Potential difference across the coil
    is %0.0f  cos 100*pai*t",E)
printf("\n (ii) r.m.s value of p.d across the coil
    is %0.1f  V",Ev)
```

Scilab code Exa 13.13 `Current flows when the inductance`

```
clear
//Given
f=50                    //Hz
L=2
Ev=12                 //V
L1=6

//Calculation
//
Xl=2*%pi*f*L
Iv=Ev/Xl
Xl1=2*%pi*f*L1
Iv1=Ev/Xl1

//Result
printf("\n Current flows when the inductance is
   changed to 6 H %0.4f  A",Iv1)
```

Scilab code Exa 13.14 `The value of inductance`

```
clear
//Given
Ev=200                  //V
I0=0.9                  //A
f=50                     //Hz

//Calculation
//
E0=sqrt(2)*Ev
Xl=E0/I0
```

```
L=Xl/(2*%pi*f)

//Result
printf("\n The value of inductance is %0.0f  H",L)
```

Scilab code Exa 13.16 Capacity of a condenser

```
clear
//Given
L=1                              //H
Xl=3142.0                         //ohm

//Calculation
//
f=Xl/(2*%pi*L)
C=1/(2.0*%pi*f*Xl)

//Result
printf("\n (i) Value of frequency is %0.0f  ohm",f)
printf("\n (ii) Capacity of a condenser is %0.2f
   micro F",C*10**6)
```

Scilab code Exa 13.17 The maximum energy stored in the capacitor

```
clear
//Given
C=50*10**-6                                //F
V=230                                       //V

//Calculation
//
q=C*V*sqrt(2)
E=0.5*C*(V*sqrt(2))**2
```

```
//Result
printf("\n (i) Maximum charge on the capacitor is %0
    .2f  *10**-3 C",q*10**3)
printf("\n (ii) The maximum energy stored in the
    capacitor is %0.2f  J",E)
```

Scilab code Exa 13.18 Capacitance of the capacitor

```
clear
//Given
I0=10                  //A
w=314
L=5

//Calculation
E=0.5*L*I0**2
E0=w*L*I0
C=(E*2)/(E0**2)

//Result
printf("\n Capacitance of the capacitor is %0.2f
    micro F",C*10**6)
```

Scilab code Exa 13.19 Time lag between voltage maximum and current maximum

```
clear
//Given
f=50
L=31.8*10**-3                          //H
R=7.0                                    //ohm
Ev=230                                     //V

```

```
//Calculation
//
Xl=2*%pi*f*L
Z=sqrt(R**2+Xl**2)
Iv=Ev/Z
T=Xl/R
a=atan(T)*180/3.14
a1=cos(a)*3.14/180.0
P=Iv**2*R
t=55*%pi/(180.0*3.14)

//Result
printf("\n (i) Circuit current is %0.2f A",Iv)
printf("\n (ii) Phase angle is %0.0f lag",a)
printf("\n (iii) Power factor is %0.3f lag",a1
    *10**3)
printf("\n (iv) Power consumed is %0.0f W",P)
printf("\n Time lag between voltage maximum and
    current maximum is %0.2f *10**-3 S",t*10**1)
```

Scilab code Exa 13.20 Inductance of the coil

```
clear
//Given
P=400                              //W
Ev=250                              //V
Iv=2.5                               //A
f=50

//Calculation
//
a=P/(Ev*Iv)
Z=Ev/Iv
R=Z*a
Xl=sqrt(Z**2-R**2)
```

```
L=Xl/(2*%pi*f)

//Result
printf("\n (i) The power factor is %0.3f  lag",a)
printf("\n (ii) Resistance of the coil is %0.3f  ohm
   ", R)
printf("\n (iii) Inductance of the coil is %0.3f  H"
   ,L)
```

Scilab code Exa 13.21 The phase angle

```
clear
//Given
Vr=150                    //V
R=75.0                       //ohm
f=50                         //Hz
L=318*10**-3                     //H

//Calculation
//
Iv=Vr/R
Xl=2*%pi*f*L
Vl=Iv*Xl
Z=sqrt(R**2+Xl**2)
Ev=Iv*Z
a=Xl/R
a1=atan(a)*180/3.14

//Result
printf("\n (i) The supply voltage is %0.0f  V",Ev)
printf("\n (ii) The phase angle is %0.2f  degree lag
   ",a1)
```

Scilab code Exa 13.22 Pure inductance

```
clear
//Given
P=60                    //W
Ev=100.0                      //V
Ev1=220                         //v
f=50                            //Hz

//Calculation
Iv=P/Ev
Vr=Ev1-Ev
R=Vr/Iv

Vl=sqrt(Ev1**2-Ev**2)
Xl=Vl/Iv
L=Xl/(2*%pi*f)

//Result
printf("\n (i) The value of non inductive resistance
    is %0.3f  ohm", R)
printf("\n (ii) Pure inductance is %0.2f  H",L)
```

Scilab code Exa 13.23 Inductance of the coil

```
clear
//Given
f1=50.0
L=1
E=100                                //V
I=1.0                                //A
Iv=0.5                               //A
f=0
Ev=100.0                      //V

```

```
//Calculation
//
Xl=2*%pi*f*L
R=E/I
Z=Ev/Iv
Xl1=sqrt(Z**2-R**2)
L=Xl1/(2.0*%pi*f1)

//Result
printf("\n The value of resistance is %0.3f  ohm",R
  )
printf("\n The value of impedence is %0.3f  ohm",Z)
printf("\n Inductance of the coil is %0.2f  H",L)
```

Scilab code Exa 13.25 Capcitance of a capacitor

```
clear
//Given
P=80                              //W
V=100.0                               //v
V1=200                                 //V
f=50                                   //Hz

//Calculation
//
Iv=P/V
Vc=sqrt(V1**2-V**2)
Xc=Vc/Iv
C=1/(2.0*%pi*f*Xc)

//Result
printf("\n Capcitance of a capacitor is %0.1f  micro
    F",C*10**6)
```

Scilab code Exa 13.26 Capacitance of the circuit

```
clear
//Given
Ev=200                                          //V
Iv=10.0
f=50                                    //Hz

//Calculation
z=Ev/Iv
R=z*cos(30*3.14/180.0)
Xc=z*sin(30*3.14/180.0)
C=1/(2.0*%pi*f*Xc)

//Result
printf("\n (i) Value of resistance is %0.2f  ohm",R)
printf("\n (ii) Capacitive reactance is %0.0f  ohm",
   Xc)
printf("\n (iii) Capacitance of the circuit is %0.0f
    micro F",C*10**6)
```

Scilab code Exa 13.27 Phase angle between circuit current and supply voltage

```
clear
//Given
Iv=5                  //A
R=10                  //ohm
Ev=60                 //V
C=400                 //micro F

//Calculation
//
```

```
Vr=Iv*R
Vc=sqrt(Ev**2-Vr**2)
Xc=Vc/Iv
f=1/(2.0*%pi*C*Xc)
a=Vc/Vr
a1=atan(a)*180/3.14

//Result
printf("\n The value of supplied frequency is %0.0f
    Hz",f*10**6)
printf("\n Phase angle between circuit current and
    supply voltage is %0.1f  degree lead",a1)
```

Scilab code Exa 13.28 Voltage across the resistor and capacitor

```
clear
//Given
R=200                    //ohm
C=15*10**-6                  //F
Ev=220                        //V
f=50                         //Hz

//Calculation
//
Xc=1/(2*%pi*f*C)
Z=sqrt(R**2+Xc**2)
Iv=Ev/Z
Vr=Iv*R
Vc=Iv*Xc
V=Vr+Vc
Vrc=sqrt(Vr**2+Vc**2)

//Result
printf("\n (a) The current in the circuit is %0.3f
    A",Iv)
```

```
printf("\n (b) Voltage across the resistor and capacitor is %0.3f  V",Vrc)
```

Scilab code Exa 13.29 Power consumed

```
clear
//Given
R1=10.0                        //ohm
R2=5.0                         //ohm
R3=15                          //ohm
Ev=200

//Calculation
//
R=R1+R2+R3
X=R3-(R1+R3)
Z=sqrt(R**2+R1**2)
Iv=Ev/Z
T=X/R
a=-atan(T)*180/3.14
b=cos(a*3.14/180.0)
P=Iv**2*R
printf("\n (i) Circuit current is %0.2f   A",Iv)
printf("\n (ii) Circuit phase angle is %0.2f  degree lead",a)
printf("\n (iii)Phase angle between applied voltage and circuit current  %0.3f  lead",b)
printf("\n (iv)Power consumed is %0.3f  W",P)
```

Scilab code Exa 13.30 Power consumed

```
clear
//Given
```

```
F=50                              //HZ
L=0.06
C=6.8
l=10**6
R=2.5
Ev=230                            //V

//Calculation
//
Xl=2*%pi*F*L
Xc=l/(2*%pi*F*C)
Z=sqrt(R**2+(Xl-Xc)**2)
Iv=Ev/Z
a=(Xl-Xc)/R
a2=-atan(a)*180.0/3.14
P=R/Z
P1=Ev*Iv*P

//Result
printf("\n (i) Circuit impedence is %0.1f  ohm",Z)
printf("\n (ii) Circuit current is %0.3f  A",Iv)
printf("\n (iii) Phase angle is  %0.1f  degree lead"
   ,a2)
printf("\n (iv) Power factor is %0.4f  lead",P)
printf("\n (v) Power consumed is %0.2f  W",P1)
```

Scilab code Exa 13.31 The value of R

```
clear
//Given
a=65                        //degree
b=20                        //degree
w=3000
L=0.01
E0=400                      //V
```

```
I=10
f=50

//calculation
//
a=a-b
Xl=w*L
Z=E0/(I*sqrt(2))
R=Z/sqrt(2)
Xc=Xl-R
C=1/(w*Xc*10**-6)

//Result
printf("\n  The value of C is %0.1f  microF",C)
printf("\n  The value of R is %0.3f  ohm",R)
```

Scilab code Exa 13.32 The vaue of capacitance

```
clear
//Given
f=50                          //Hz
L=0.03
R=8                            //ohm
Ev=240                         //V

//Calculation
//
Xl=2*%pi*f*L
Z=sqrt(R**2+Xl**2)
Iv=Ev/Z
P=Iv**2*R
a=R/Z
Xc=2*Xl
C=1/(2*%pi*f*Xc)

```

```
//Result
printf("\n (i) The value of current is %0.2f  A",Iv)
printf("\n  The value of power is %0.0f W",P)
printf("\n  Power factor is %0.2f lag",a)
printf("\n (ii) The vaue of capacitance is %0.0f micro F",C*10**6)
```

Scilab code Exa 13.33 The value of capacitance

```
clear
//Given
Vr=65                           //V
R=100.0                           //ohm
Vl=204
f=50                           //Hz
Vc=415

//Calculation
//
Iv=Vr/R
Xl=Vl/Iv
L=Xl/(2*%pi*f)
Xc=Vc/Iv
C=1/(2*%pi*f*Xc)

//Result
printf("\n (i) Circuit current is %0.3f A", Iv)
printf("\n (ii) Inductance is %0.0f H",L)
printf("\n (iii) The value of capacitance is %0.0f micro F",C*10**6)
```

Scilab code Exa 13.34 Voltage across L and C

```
clear
//Given
C=100*10**-12                                   //F
L=100*10**-6                                     //H
Ev=10
R=100.0                                             //ohm

//Calculation
//
fr=1/(2*%pi*sqrt(L*C))
Iv=Ev/R
Vl=Iv*2*%pi*fr*L
Vc=Iv/(2.0*%pi*fr*C)

//Result
printf("\n (i) Resonant frequency is %0.2f  *10**6 HZ",fr*10**-6)
printf("\n (ii) Current at resonance is %0.3f  A",Iv)
printf("\n (iii) Voltage across L and C is %0.3f  V", Vc)
```

Scilab code Exa 13.35 The voltage across inductance and capacitance

```
clear
//Given
f=50                          //Hz
L=0.5
Ev=100                             //v
R=4                                  //ohm

//Calculation
//
C=1/(4*%pi**2*f**2*L)
Ir=Ev/R
```

```
Vr=Ir*2*%pi*f*L
Vc=Ir/(2*%pi*f*C)

//Result
printf("\n (i) The capacitance is %0.2f  micro F",C
   *10**6)
printf("\n (ii) The voltage across inductance and
   capacitance is %0.0f  V",Vc)
```

Scilab code Exa 13.36 Total power consumed

```
clear
//Given
f=50                                //Hz
L=0.318                              //H
Iv=2.3
R=100                                  //ohm

//Calculation
//
C=1/((2*%pi*f)**2*L)
Vl=Iv*2*%pi*f*C*10**4
P=Iv**2*R

//Result
printf("\n (i) The value of capacitor is %0.1f
   micro F",C*10**6)
printf("\n (ii) Voltage across the inductor is %0.0f
     V",Vl)
printf("\n (iii)Total power consumed is %0.3f  W",P)
```

Scilab code Exa 13.37 d Power factor

```
clear
//Given
E0=283                              //V
f=50                                    //Hz
R=3.0                                   //ohm
L=25.48*10**-3                           //h
C=796*10**-6                               //F
Xl=8

//Calculation
//
Xc=1/(2*%pi*f*C)
Z=sqrt(R**2+(Xl-Xc)**2)
a=atan(Xc/R)*180/3.14
Iv=(E0/sqrt(2))/Z
P=Iv**2*R
a1=cos(a*180/3.14)

//Result
printf("\n (a) The inpedence of the circuit is %0.0f
    ohm",Z)
printf("\n (b) The phase difference is %0.1f  degree
  ",a)
printf("\n (c) The power dissipated is %0.0f  W",P)
printf("\n (d) Power factor is %0.1f  lag",a1)
```

Scilab code Exa 13.38 The power dissipated

```
clear
//Given
L=25.48*10**-3                              //H
C=796*10**-6
R=3.0                                            //ohm
E0=283

```

```
//Calculation
//
fr=1/(2.0*%pi*sqrt(L*C))
Iv=(E0/sqrt(2))/R
P=Iv**2*R

//Result
printf("\n (a) Frequency of the source is %0.1f  Hz"
    ,fr)
printf("\n (b) The value of impedence is %0.3f  ohm"
    ,R)
printf("\n The value of current is %0.1f  A",Iv)
printf("\n The power dissipated is %0.0f  W",P)
```

Scilab code Exa 13.39 Total energy

```
clear
//Given
C=1200*10**-12                              //F
E=500
L=0.075                      //H

//Calculation
//
q0=C*E
I0=q0/(sqrt(L*C))
f=1/(2*%pi*sqrt(L*C))
T=1/f
U=q0**2/(2.0*C)

//Result
printf("\n (i) The initial charge onthe capcitor is
    %0.3f  c",q0)
printf("\n (ii) The maximum current is %0.0f  mA",I0
    *10**3)
```

```
printf("\n (iii) The value of frequency is %0.0f
    *10**3 Hz",f*10**-3)
printf("\n Time period is %0.0f  *10**-5 S",T*10**5)
printf("\n (iv) Total energy is %0.3f  *10**-4 J",U
    *10**4)
```

Scilab code Exa 13.40 `Wavelength`

```
clear
//Given
L=8*10**-6             //H
C=0.02*10**-6               //F
c=3*10**8

//Calculation
f=1/(2*%pi*sqrt(L*C))
w=c/f

//Result
printf("\n Wavelength is %0.2f  *10**2 m",w*10**-2)
```

Chapter 14

electrical devices

Scilab code Exa 14.1 `Instantaneous value of e m f`

```
clear
//Given
N=100
A=10**-2                              //m**2
B=0.5                                 //T
f=500/60.0

//Calculation
//
w=2*%pi*f
E0=N*A*B*w
E=E0*sin(60*3.14/180.0)

//Result
printf("\n Maximum emf produced in the coil is %0.2f V",E0)
printf("\n Instantaneous value of e.m.f. is %0.1f V",E)
```

Scilab code Exa 14.3 Average value of induced e m f

```
clear
//Given
N=150
A=2*10**-2                                  //m**2
B=0.15                                      //T
f=60

//Calculation
//
w=2*%pi*f
E0=N*A*B*w

//Result
printf("\n Peak value of e.m.f is %0.0f  V",E0)
printf("\n Average value of induced e.m.f is zero")
```

Scilab code Exa 14.4 Maximum power dissipated in the coil

```
clear
//Given
N=100
A=3
B=0.04                       //T
w=60
R=500                              //ohm

//Calculation
E0=N*A*B*w
I0=E0/R
P=E0*I0

//Result
printf("\n Maximum power dissipated in the coil is
```

```
%0.3f  W", P)
```

Scilab code Exa 14.5 Maximum voltage generated in the coil

```
clear
//Given
N=100
A=0.10                              //m**2
f=0.5                               //Hz
B=0.01                              //T

//Calculation
//
w=2*%pi*f
E0=N*A*B*w

//Result
printf("\n Maximum voltage generated in the coil is
   %0.3f  V",E0)
```

Scilab code Exa 14.6 Value of back e m f

```
clear
//Given
V=240                               //V
I=5                                 //A
R=4                                 //ohm

//Calculation
Eb=V-(I*R)

//Result
printf("\n Value of back e.m.f is %0.3f  V", Eb)
```

Scilab code Exa 14.7 The back e m f

```
clear
//Given
I=20                          //A
R=2                           //ohm
n=0.5
P=2000                          //W

//Calculation
P1=P/n
V=P1/I
Eb=V-(I*R)

//Result
printf("\n The back e.m.f is %0.3f V \nSupply
   voltage is %0.3f V",Eb,V)
```

Scilab code Exa 14.8 Armature resistance

```
clear
//Given
V=100                                    //V
I=6                                      //A
V1=0.7

//Calculation
Pin=V*I
R=(V1*Pin)/I**2

//Result
printf("\n Armature resistance is %0.2f  ohm",R)
```

Scilab code Exa 14.10 `Efficiency of motor`

```
clear
//Given
V=200                         //V
I=5                           //A
R=8.5                          //ohm

//Calculation
Eb=V-(I*R)
Pi=V*I
P0=Eb*I
n=(P0*100)/Pi

//Result
printf("\n (i) Back e.m.f of motor is %0.3f  V", Eb)
printf("\n (ii) Power input is %0.3f  W",Pi)
printf("\n (iii) Output power is %0.3f  W",P0)
printf("\n (iv) Efficiency of motor is %0.3f
   percentage",n)
```

Scilab code Exa 14.11 `The current in the secondary`

```
clear
//Given
V=200                         //V
Vp=200                                //V
n=200.0
Ip=2                                //A

//Calculation
```

```
Vs=Vp*n
Is=(Ip*V)/Vs

//Result
printf("\n (i) Voltage developed in the secondary is
    %0.3f  V", Vs)
printf("\n (ii) The current in the secondary is %0.3
   f  A",Is )
```

Scilab code Exa 14.12 The power output

```
clear
//Given
Vp=220.0                                    //V
Is=5                                      //A
n=20

//Calculation
Vs=Vp*n
Ip=(Vs*Is)/Vp
P=Vs*Is

//Result
printf("\n (i) Voltage across secondary is %0.3f  V"
   ,Vs)
printf("\n (ii) The current in primary is %0.3f  A",
   Ip)
printf("\n (iii) The power output is %0.3f  K W",P
   *10**-3)
```

Scilab code Exa 14.13 Power loss at 24000 V

```
clear
```

```
//Given
P=120*10**3                                   //W
R=0.4                                         //ohm
Ev=240.0                                        //V
Ev1=24000.0                                     //V

//Calculation
Iv=P/Ev
P=Iv**2*R
Iv1=P/Ev1
P1=Iv1**2*R

//Result
printf("\n (i) Power loss at 240 V is %0.3f  K W", P
   *10**-3)
printf("\n (ii) Power loss at 24000 V is %0.0f  W",
   P1)
```

Scilab code Exa 14.14 Input power

```
clear
//Given
Np=5000
Vp=2200                                //V
Vs=220                                  //V
Pout=8                                  //K W
n=0.9

//Calculation
Ns=(Vs*Np)/Vp
Pin=Pout/n

//Result
printf("\n (ii) Input power is %0.1f  K W",Pin)
```

Scilab code Exa 14.15 `Current drawn`

```
clear
//Given
Vp=220.0                                //V
Vs=22                                   //V
Z=220                                   //ohm
Is=0.1

//Calclation
Ip=(Vs*Is)/Vp

//Result
printf("\n Current drawn is %0.3f  A", Ip)
```

Chapter 15

electromagnetic waves

Scilab code Exa 15.1 Displacement current

```
clear
//Given
e=8.854*10**-12                                   //C**2/N/m
    **2
A=10**-4                                          //m**2
E=3*10**6                                         //V/ms

//Calculation
Id=e*A*E

//Result
printf("\n Displacement current is %0.1f *10**-9 A",
    Id*10**9)
```

Scilab code Exa 15.2 Instantaneous current

```
clear
//Given
```

```
Id=1                        //A
C=10.0**-6                         //F

//Calculation
V=Id/C

//Result
printf("\n Instantaneous current is %0.3f  V/S", V)
```

Scilab code Exa 15.3 Distance

```
clear
//Given
I=0.15                        //A
R=0.12                        //m
r=0.065                        //m
r1=0.15                       //m

//Calculation
//
A=%pi*R**2
u=4*%pi*10**-7
B=(u*I*r)/(2*%pi*R**2)
B1=(u*I)/(2*%pi*r1)
Bmax=(u*I)/(2*%pi*R)

//Result
printf("\n (i) (a) Magnetic field on the axis is
    zero")
printf("\n (b) Magnetic field at r=6.5 cm is %0.2f
    *10**-7  T",B*10**7)
printf("\n (c) Magnetic field at r=15 cm is %0.3f  T
    ", B1)
printf("\n (ii) Distance is %0.3f  T", Bmax)
```

Scilab code Exa 15.5 Displacement current

```
clear
//Given
r=0.05                                  //m
E=10**12                                //V/m/s
e=8.854*10**-12

//Calculation
//
Id=e*%pi*r**2*E

//Result
printf("\n Displacement current is %0.4f  A",Id)
```

Scilab code Exa 15.8 Frequency

```
clear
//Given
E0=8*10**-4                                     //v
c=3.0*10**8
w=6*10**6

//Calculation
//
B0=E0/c
f=w/(2.0*%pi)
l=c/f

//Result
printf("\n Wavelength of the wave is %0.4f  m",l
   *10**-4)
```

```
printf("\n Frequency is %0.3f  *10**10 Hz",f*10**-6)
```

Scilab code Exa 15.9 B

```
clear
//Given
E=6.3                    //V/m
c=3.0*10**8

//Calculation
B=E/c

//Result
printf("\n B= %0.3f  K^ Tesla", B)
```

Scilab code Exa 15.10 Average force exerted on the surface

```
clear
//Given
f=18                              //W/cm**2
A=20                              //cm**2
t=30*60
c=3.0*10**8

//Calculation
U=f*A*t
P=U/c
F=P/t
P1=2*P
F1=P1/t

//Result
```

```
printf("\n Average force exerted on the surface is
    %0.3f  N", F1)
```

Chapter 16

reflection of light

Scilab code Exa 16.2 `Nature of the image`

```
clear
//Given
u=-15.0                                    //cm
f=-10                                     //cm
o=2.0                                      //cm

//Calculation
v=1/((1.0/f)-(1.0/u))
m=v/u
I=-m*o

//Result
printf("\n Position of the image is %0.3f  cm", v)
printf("\n Size of the image is %0.3f  cm",I)
printf("\n Nature of the image isreal and inverted "
   )
```

Scilab code Exa 16.3 `Image position`

```
clear
//Given
u=-10.0                                         //cm
f=-15.0

//Calculation
v=1/((1/f)-(1/u))
m=-v/u

//Result
printf("\n (i) Image position is %0.3f  cm", v)
```

Scilab code Exa 16.4 `Magnification`

```
clear
//Given
f=12.0
v=4.0

//Calculation
u=1/((1/f)-(1/v))
m=-v/u

//Result
printf("\n (i) Object position is %0.3f  cm", u)
printf("\n (ii) Magnification is %0.2f  ",m)
```

Scilab code Exa 16.5 `Position of the object`

```
clear
//Given
R=36                              //ohm

```

```
//Calculation
f=-R/2.0
u=(2*f)/3.0

//Result
printf("\n Position of the object is %0.3f  cm", u)
```

Scilab code Exa 16.6 Position of the image

```
clear
//Given
R=20                        //cm

//Calculation
f=R/2.0
u=-f
v=-u/2.0

//Result
printf("\n Position of the object is %0.3f  cm",u)
printf("\n Position of the image is %0.3f  cm",v)
```

Scilab code Exa 16.7 When the image

```
clear
//Given
f=-15.0

//Calculation
u=(1/(1/f)/3.0)*4
v=u/2.0

//Result
```

```
printf("\n Position of object is %0.3f  cm",u)
printf("\n When the image is virtual %0.3f  cm",v)
```

Scilab code Exa 16.8 The image

```
clear
//Given
R=30                          //ohm
u=-10.0
h1=5

//Calculation
f=R/2.0
v=1/((1/f)-(1/u))
h2=(-v*h1)/u

//Result
printf("\n Position of the image is %0.3f  cm", v)
printf("\n Size of the image is %0.3f  cm",h2)
printf("\n The image is virtual")
```

Scilab code Exa 16.9 Area enclosed by the image of the wire

```
clear
//Given
f=-10.0                                  //cm
u=-25.0                                   //cm
h1=3

//Calculation
v=1/((1/f)-(1/u))
h2=(-v*h1)/u
A=h2**2
```

```
//Result
printf("\n Area enclosed by the image of the wire is
    %0.3f  cm**2", A)
```

Chapter 17

refraction of the light

Scilab code Exa 17.1 Angle of refraction

```
clear
//Given
u1=1.50
u2=1.33

//Calculation
//
sinr=u1*sin(50*3.14/180.0)/u2
a=asin(sinr)*180/3.14

//Result
printf("\n Angle of refraction is %0.1f  degree",a)
```

Scilab code Exa 17.2 Angle of deviation

```
clear
//Given
u1=1.0
```

```
u2=1.526
i=45                        //degree
//Calculation
sinr=(u1*sin(i*3.14/180.0))/u2
r=asin(sinr)*180/3.14
d=i-r

//Result
printf("\n Angle of deviation is %0.2f  degree",d)
```

Scilab code Exa 17.3 Wavelength of light in glass

```
clear
//Given
c=3.0*10**8
u=1.5
f=6*10**14                              //Hz

//Calculation
v=c/u
l=c/f
lm=v/f

//Result
printf("\n (i) Wavelength of light in air is %0.3f m", l)
printf("\n (ii) Wavelength of light in glass is %0.1f *10**-7 m",lm*10**7)
```

Scilab code Exa 17.4 Speed of the light in glass

```
clear
//Given
```

```
ug=1.5
uw=1.3
vw=2.25*10**8

//Calculation
vg=(uw*vw)/ug

//Result
printf("\n Speed of the light in glass is %0.3f
   *10**8 m/s", vg*10**-8)
```

Scilab code Exa 17.5 Position of mark from the bottom

```
clear
//Given
u=1.6
t=8
t1=4.5
u1=1.5
t2=6
u2=1.33

//Calculation
d=t*(1-(1/u))
d1=t1*(1-(1/u1))
d2=t2*(1-(1/u2))
D=d+d1+d2

//Result
printf("\n Position of mark from the bottom is %0.0f
   cm",D)
```

Scilab code Exa 17.6 Angle of refraction in water

```
clear
//Given
uw=1.33
uo=1.20

//Calculation
//
uow=uw/uo
sinr=(sin(30*3.14/180.0))/uow
r=asin(sinr)*180/3.14

//Result
printf("\n Angle of refraction in water is %0.1f
   degree",r)
```

Scilab code Exa 17.7 Distance through which ink dot appears to be raised

```
clear
//Given
v=2.0*10**8                                     //m/s
c=3*10**8                                     //m/s
d=6.0                                         //cm

//Calculation
ug=c/v
a=d/ug
D=d-a

//Result
printf("\n Distance through which ink dot appears to
    be raised is %0.3f  cm", D)
```

Scilab code Exa 17.8 Critical angle

```
clear
//Given
ug=1.5
uw=1.33

//Calculation
u1=ug/uw
sinC=1/u1
C=asin(sinC)*180/3.14

//Result
printf("\n Critical angle is %0.2f  degree",C)
```

Scilab code Exa 17.9 `Value of critical angle`

```
clear
//Given
v=1.5*10**8
c=3.0*10**8

//Calculation
//
a=v/c
C=asin(a)*180/3.14

//Result
printf("\n Value of critical angle is %0.0f  Degree"
   ,C)
```

Scilab code Exa 17.10 `Angle of refraction`

```
clear
//Given
```

```
uw=1.33

//Calculation
a=1/uw
b=sin(a)*180/3.14

//Result
printf("\n Angle of refraction is %0.0f  degree",b)
```

Scilab code Exa 17.11 Refrective index of the liquid

```
clear
//Given
a=4
b=6.0

//Calculation
//
A=a/b
B=atan(A)*180/3.14
ur=1/(sin(B*3.14/180.0))

//Result
printf("\n Refrective index of the liquid is %0.1f
    ",ur)
```

Scilab code Exa 17.12 Angle of refrection

```
clear
//Given
a=52                                        //Degree
b=33                                         //Degree

```

```
//Calculation
//
u2=(sin(a*3.14/180.0))/(sin(b*3.14/180.0))
C=1/u2
A=asin(C)*180/3.14

//Result
printf("\n Angle of refraction is %0.1f  Degree",A)
```

Scilab code Exa 17.13 `Position of the image`

```
clear
//Given
u=-240.0
R=15.0                          //cm
u1=1.33
u2=1.5

//Calculation
v=1/((((u2-u1)/R)+(u1/u))/u2)

//Result
printf("\n Position of the image is %0.0f  cm",v)
```

Scilab code Exa 17.14 `The value of distance`

```
clear
//Given
u=-9.0                               //cm
y=1
y1=1.5
R=-15.0                              //cm

```

```
//Calculation
v=1/(((y-y1)/R)-(y1/-u))

//Result
printf("\n The value of distance is %0.3f  cm",v)
```

Scilab code Exa 17.15 Position of the image

```
clear
//Given
u=-15                    //cm
y1=1
y2=1.5
R=-7.5                   //cm

//Calculation
v=1/(((y1-y2)/R)-(y2/-u))

//Result
printf("\n Position of the image is %0.3f  cm",v)
```

Scilab code Exa 17.16 Power of the refracting surface

```
clear
//Given
u=-60.0                            //cm
R=25.0                             //cm
y1=1
y2=1.5

//Calcution
v=1/((((y2-y1)/R)+(y1/u))/y2)
P=(y2-y1)/(R*10**-2)
```

```
//Result
printf("\n Position of the image is %0.3f  cm", v)
printf("\n Power of the refracting surface is %0.3f
    dioptre", P)
```

Scilab code Exa 17.17 Distance of the object

```
clear
//Given
u1=1
u2=1.5
R=1

//Calculation
x=(u1+u2)/(u2-u1)

//Result
printf("\n Distance of the object is %0.3f  R", x)
```

Scilab code Exa 17.20 The object distance from the centre of curvature

```
clear
//Given
u1=1
u2=1.5
v=100                                   //cm
R=20.0                                   //cm
a=3
b=200.0

//Calculation
u1=(u2-u1)/R
```

```
u2=-1/(u1-(a/b))
d=-u2+R

//Result
printf("\n The object distance from the centre of
    curvature is %0.3f  cm", d)
```

Scilab code Exa 17.21 Focal length in air

```
clear
//Given
ug=1.5
R1=50.0                     //cm
R2=-50.0                    //cm
uw=9/8.0

//Calculation
f=1/((ug-1)*((1/R1)+(1/R1)))
f1=1/((uw-1)*((1/R1)+(1/R1)))

//Result
printf("\n (i) Focal length in air is %0.3f  cm", f)
```

Scilab code Exa 17.22 Change in focal length

```
clear
//Given
fa=20                              //cm
ug=9/8.0
uw=3/2.0

//Calculation
a=(uw-1)/(ug-1)
```

```
fw=a*fa
f=fw-fa

//Result
printf("\n Change in focal length is %0.3f  cm", f)
```

Scilab code Exa 17.23 Position of the image formed

```
clear
//Given
u=1.56
R1=20.0                          //cm
u1=-10.0                          //cm

//Calculation
f=1/((u-1)*(2/R1))
v=1/((1/u1)+(1/f))

//Result
printf("\n Position of the image formed is %0.2f  ",
    v)
```

Scilab code Exa 17.24 The liquid

```
clear
//Given
u=1.47

//Calculation
u1=u

//Result
```

```
printf("\n The liquid is not water because
   refractive index of water is 1.33")
```

Scilab code Exa 17.25 Radius of the curvature

```
clear
//Given
f=18                          //cm
u=1.5

//Calculation
R=(u-1)*f

//Result
printf("\n Radius of the curvature is %0.3f  cm", R)
```

Scilab code Exa 17.26 Size of the image

```
clear
//Given
u=-25.0                       //cm
f=10.0                        //cm
h1=5

//Calculation
v=1/((1/f)+(1/u))
h2=(v*h1)/u

//Result
printf("\n Position of the image is %0.2f  cm",v)
printf("\n Size of the image is %0.2f  cm",h2)
```

Scilab code Exa 17.27 The object

```
clear
//Given
f=-15.0                              //cm
v=-10.0                                //cm

//Calculation
u=1/((1/v)-1/f)

//Result
printf("\n The object is placed at a distance of %0
    .3f  cm", u)
```

Scilab code Exa 17.28 The lens

```
clear
//Given
v=-20.0                                  //cm
u=-60.0                                  //cm

//Calculation
f=1/((1/v)-(1/u))

//Result
printf("\n Focal length of the lens is %0.3f  cm", f
    )
printf("\n The lens is diverging")
```

Scilab code Exa 17.29 `Focal length`

```
clear
//Given
u=-10.0                              //cm
m=-3.0

//Calculation
v=m*u
f=1/((1/v)-(1/u))

//Result
printf("\n Image formed at %0.3f  cm",v)
printf("\n Focal length is %0.3f  cm",f)
```

Scilab code Exa 17.30 `Power of the combinationis`

```
clear
//Given
P1=6
P2=-2.0

//Calculation
P=P1+P2
f=1/P

//Result
printf("\n Focal length of the combination is %0.3f
    cm", f*10**2)
printf("\n Power of the combinationis %0.3f  D",P)
```

Scilab code Exa 17.31 `Power`

```
clear
//Given
f1=20.0                    //cm
f2=-40.0                      //cm

//Calculation
f=1/((1/f1)+(1/f2))
P=1/f

//Result
printf("\n Focal length is %0.3f  cm", f)
printf("\n Power is %0.3f  D",P*10**2)
```

Scilab code Exa 17.33 Position of the point

```
clear
//Given
f=-0.2                               //m
v=0.3                                //m

//Calculation
u=1/((1/v)-(1/f))

//Result
printf("\n Position of the point is %0.3f  m", u)
```

Chapter 18

dispersion of light

Scilab code Exa 18.1 `The angle of refraction`

```
clear
//Given
A=60                              //Degree

//Calculation
//
a=sqrt(2)*sin(30*3.14/180.0)
b=asin(a)*180/3.14
c=(b*2)-A
i=(A+c)/2.0
r=A/2.0

//Result
printf("\n (i) Angle of minimum deviation is %0.0f
   Degree",c)
printf("\n (ii) Angle of incidence is %0.0f  Degree"
   ,i)
printf("\n (iii) The angle of refraction is %0.3f
   Degree", r)
```

Scilab code Exa 18.2 The refractive index of the material

```
clear
//Given
a=51                                        //Degree
A=60                                        //Degree

//Calculation
//
b=(A+a)/2.0
c=A/2.0
u=(sin(b*3.14/180.0))/(sin(c*3.14/180.0))

//Result
printf("\n (i) The refracting angle of the prism is
    %0.3f  Degree", A)
printf("\n (ii) The refractive index of the material
     is %0.4f  ",u)
```

Scilab code Exa 18.3 Refractive index of the material

```
clear
//Given
i1=48                            //Degree
A=60                             //Degree

//Calculation
//
r=A/2.0
u=sin(i1*3.14/180.0)/sin(r*3.14/180.0)

//Result
```

```
printf("\n Refractive index of the material is %0.2f
    ",u)
```

Scilab code Exa 18.4 `Angle of incidence`

```
clear
//Given
a=2.0

//Calculation
//
a=sqrt(a)/a
i=asin(a)*180/3.14

//Result
printf("\n Angle of incidence is %0.0f  Degree",i)
```

Scilab code Exa 18.5 `Angle of the prism`

```
clear
//Given
u=1.5
a=6                                   //Degree

//Calculation
A=a/(u-1)

//Result
printf("\n Angle of the prism is %0.3f  Degree", A)
```

Scilab code Exa 18.7 Angular dispersion

```
clear
//Given
uv=1.68
ur=1.56
A=18                              //degree

//Calculation
A1=A*(uv-ur)

//Result
printf("\n Angular dispersion is %0.3f  Degree", A1)
```

Scilab code Exa 18.8 Dispersive power of the flint glass

```
clear
//Given
av=3.32                                   //Degree
ar=3.22                                   //Degree
a=3.27                                    //Degree

//Calculation
w=(av-ar)/a

//Result
printf("\n Dispersive power of the flint glass is %0
   .4f  ",w)
```

Scilab code Exa 18.9 Dispersive power of the crown glass

```
clear
//Given
```

```
ur=1.5155
uv=1.5245

//Calculation
u=(ur+uv)/2.0
w=(uv-ur)/(u-1)

//Result
printf("\n Dispersive power of the crown glass is %0
    .4f ",w)
```

Scilab code Exa 18.10 Refrective index for yellow colour

```
clear
//given
w=0.031
ur=1.645
ub=1.665

//Calculation
u=1+((ub-ur))/w

//Result
printf("\n Refrective index for yellow colour is %0
    .3f ",u)
```

Scilab code Exa 18.11 Angle of flint line

```
clear
//Given
A=5                             //Degree
uv=1.523
ur=1.515
```

```
uv1=1.688
ur1=1.650

//Calculation
u=(uv+ur)/2.0
u1=(uv1+ur1)/2.0
A1=-((u-1)*A)/(u1-1)

//Result
printf("\n Angle of flint line is %0.2f  degree",A1)
```

Scilab code Exa 18.12 Angle of the prism

```
clear
//Given
w=0.021
u=1.53
w1=0.045
u1=1.65
A1=4.20                                //Degree

//Calculation
A=-(w1*A1*(u1-1))/(w*(u-1))

//Result
printf("\n Angle of the prism is %0.2f  Degree",A)
```

Scilab code Exa 18.13 The ratio of dispersive power of crown glass and flint glass

```
clear
//Given
A=72                                   //Degree
ab=56.4                                //Degree
```

```
ar=53                               //Degree
ay=54.6                             //Degree
az=54
A11=60                              //Degree
ab1=52.8
A12=50.6
A13=51.9

//Calculation
//
A1=(A+ay)/2.0
A2=A/2.0
ub=(sin(A1*3.14/180.0))/(sin(A2*3.14/180.0))
A3=(A+ar)/2.0
ur=(sin(A3*3.14/180.0))/(sin(A2*3.14/180.0))
A4=(A+az)/2.0
uy=(sin(A4*3.14/180.0))/(sin(A2*3.14/180.0))
w=(ub-ur)/(uy-1)

//For flint glass prism
A5=(A11+ab1)/2.0
A51=A11/2.0
ub1=(sin(A5*3.14/180.0))/(sin(A51*3.14/180.0))
A6=(A11+A12)/2.0
ur1=(sin(A6*3.14/180.0))/(sin(A51*3.14/180.0))
A7=(A11+A13)/2.0
uy1=(sin(A7*3.14/180.0))/(sin(A51*3.14/180.0))
w1=(ub1-ur1)/(uy1-1)
w2=w/w1

//Result
printf("\n The ratio of dispersive power of crown
   glass and flint glass prism is %0.3f  ",w2)
```

Chapter 19

optical instruments

Scilab code Exa 19.1 Power of the lens

```
clear
//Given
v=-75.0
u=0

//Calculation
f=v
P=100/f

//Result
printf("\n Focal length is %0.3f  cm", f)
printf("\n Power of the lens is %0.2f  D",P)
```

Scilab code Exa 19.2 Power of the lens

```
clear
//Given
u=-25.0                               //cm
```

```
v=-150.0                              //cm

//Calculation
f=1/((1/v)-1/u)
P=100/f

//Result
printf("\n Focal length of the lens is %0.3f  cm", f
   )
printf("\n Power of the lens is %0.2f  D",P)
```

Scilab code Exa 19.3 Focal length

```
clear
//Given
u=-25.0                                   //cm
v=-50.0                                   //cm

//Calculation
f=1/((1/v)-1/u)

//Result
printf("\n Focal length is %0.3f  cm", f)
```

Scilab code Exa 19.4 The myopic person may have a normal near point He must keep t

```
clear
//Given
v=-80.0                               //cm

//Calculation
f=v
P=100/f
```

```

//Result
printf("\n (a) Power of the lens is %0.3f  D", P)
printf("\n (b) No the corrective lens is concave and
    it reduces the size of the image. Because it
   bring the object at the far point of the eye")
printf("\n (c) The myopic person may have a normal
   near point. He must keep the book at a distance
   greater than 25 cm.")
```

Scilab code Exa 19.5 A hypermetropic eye may have normal far point Hence the perso

```
clear
//Given
v=-75.0                               //cm
u=-25.0                               //cm

//Calculation
f=1/((1/v)-1/u)
P=100/f

//Result
printf("\n (a) Power of the lens is %0.2f  D",P)
printf("\n (b) The corrective lens produce a virtual
    imageof an object at 25 cm. The angular size of
   this image is the same as the object")
printf("\n (c) A hypermetropic eye may have normal
   far point.Hence the person prefers not to use the
    spectacles for distant object")
```

Scilab code Exa 19.6 The person can see objects lying between

```
clear
```

```
//Given
P=-0.8                       //d
v1=-15.0                     //cm
v2=-100.0                    //cm

//Calculation
f=100/P
u1=1/((1/v1)-1/f)
u2=1/((1/v2)-(1/f))

//Result
printf("\n The person can see objects lying between
   %0.0f cm and %0.3f cm",-u1,-u2)
```

Scilab code Exa 19.7 Distance

```
clear
//Given
u=-25                     //cm
p=3.0

//Calculation
f=100/p
v=1/((1/f)+1/u)

//Result
printf("\n Distance is %0.0f  m",v)
```

Scilab code Exa 19.8 Distance

```
clear
//Given
u=-25.0                     //cm
```

```
v=-90.0                    //cm

//calculation
f=1/((1/v)-1/u)
f1=(1/2.0)*10**2
u=1/((1/v)-1/f1)

//Result
printf("\n (i) focal length is %0.1f  cm",f)
printf("\n (ii) Distance is %0.1f  cm",u)
```

Scilab code Exa 19.10 Distance from the lens

```
clear
//Given
f=4.80                  //cm
a=1.20
v=-24.0                   //cm

//Calculation
D=f/(a-1)
u=1/((1/v)-1/f)

//Result
printf("\n (i) The least distance of distinct vision
    is %0.3f  cm",D)
printf("\n (ii) Distance from the lens is %0.3f  cm"
   ,-u)
```

Scilab code Exa 19.11 Magnifying power

```
clear
//Given
```

```
v0=15.0                              //cm
f0=3.0                                //cm
D=25
fe=9

//Calculation
u0=1/((1/v0)-1/f0)
M=-(v0*D)/(u0*fe)

//Result
printf("\n Magnifying power is %0.1f  ",M)
```

Scilab code Exa 19.14 Distance between the lenses when image

```
clear
//Given
f0=1.0
u0=-1.1                                      //cm
D=25
fe=5.0
ve=25.0

//Calculation
v0=1/((1/f0)+1/u0)
d=v0+fe
M=-(v0*D)/(u0*fe)
ue=-1/((1/ve)+1/fe)
D1=v0-ue
M1=-(v0/u0)*(1+(D/fe))

//Result
printf("\n (i) Distance between the lenses when
   image is at infinity %0.3f  cm", d)
printf("\n (ii) Distance between the lenses when
   image is at distinct vision %0.2f  cm",D1)
```

Scilab code Exa 19.16 Focal length of the lenses

```
clear
//Given
fe=3
M=4

//Calculation
f0=fe*M

//Result
printf("\n Focal length of the lenses is %0.3f cm
   and %0.3f cm",f0,fe)
```

Scilab code Exa 19.17 Separation between the objective and eyepiece

```
clear
//Given
u0=-200.0                               //cm
f0=30.0                                 //cm
fe=3

//Calculation
v0=1/((1/f0)+1/u0)
a=v0+fe

//Result
printf("\n Separation between the objective and
   eyepiece is %0.1f  cm",a)
```

Scilab code Exa 19.18 Angle subtended by the sun at the objective

```
clear
//Given
ve=24.0
fe=8.0
f0=250.0
a=10

//Calculation
ue=1/((1/ve)-(1/fe))
D=f0-ue
d=a/2.0
A=d/f0

//Result
printf("\n (i) Distance between objective and
   eyepiece is %0.3f  cm", D)
printf("\n (ii) Angle subtended by the sun at the
   objective is %0.3f  rad",A)
```

Scilab code Exa 19.19 Focal length of eyepiece

```
clear
//Given
M=-20
R=-120

//Calculation
f0=R/2.0
fe=f0/M

//Result
printf("\n Focal length of eyepiece is %0.3f  cm",
   fe)
```

Scilab code Exa 19.21 Saparation between the objective and eyepiece

```
clear
//Given
u0=-200.0                                //cm
fa=50.0                                  //cm
ve=-25.0                                   //cm
fe=5.0                                    //cm

//Calculation
v0=1/((1/fa)+1/u0)
M0=v0/u0
ue=1/((1/ve)-1/fe)
Me=ve/ue
D=v0-ue
M=M0*Me

//Result
printf("\n (i) Saparation between the objective and
   eyepiece is %0.2f  cm",D)
```

Chapter 20

photometry

Scilab code Exa 20.1 Luminous flux of the sun

```
clear
//Given
E=2.5*10**5                                    //lm/m**2
r=1.5*10**11                                   //m

//Calculation
//
l=E*r**2
a=4*%pi*l

//Result
printf("\n (i) Luminous intensity is %0.3f  cd", l)
printf("\n (ii) Luminous flux of the sun is %0.3f
   *10**28 lm",a*10**-28)
```

Scilab code Exa 20.2 Illumination

```
clear
```

```
//Given
I2=150
I1=75.0
E1=20

//Calculation
E2=(I2*E1)/I1

//Result
printf("\n Illumination is %0.3f  lux", E2)
```

Scilab code Exa 20.3 Power of the lamp

```
clear
//Given
I=35
e=5.0                                    //lumen/watt

//Calculation
//
a=4*%pi*I
P=a/e

//Result
printf("\n Power of the lamp is %0.0f  Watt",P)
```

Scilab code Exa 20.6 exposure time

```
clear
//Given
t1=2.5                       //second
r1=0.5
r2=1
```

```

//Calculation
t2=(t1*r2**2)/r1**2

//Result
printf("\n exposure time is %0.3f  s",t2)
```

Scilab code Exa 20.7 The luminous intensity of the first lamp

```
clear
//Given
i2=60
r2=105.0
r1=70

//Calculation
i1=(i2*r1**2)/r2**2

//Result
printf("\n The luminous intensity of the first lamp
   is %0.2f  cd",i1)
```

Scilab code Exa 20.8 percentage of light

```
clear
//Given
ra=60
rb=45.0
a=40.0

//Calculation
ia1=(ra**2)/(rb**2)
ia=(ra**2)/(a**2)
```

```
i=ia-ia1
A=(i*100)/ia

//Result
printf("\n percentage of light is absorbed by the glass is %0.0f percentage",A)
```

Scilab code Exa 20.10 `number of channels for video tv signal`

```
clear
//Given
L=800.0*10**-7
C=3.0*10**8
f1=4.5*10**6                    //Hz

//Calculation
f=C/L
d=(1/100.0)*f
E=d/L
G=d/f1

//Result
printf("\n (i) number of channels for audio signal is %0.1f *10**8",E*10**-14)
printf("\n (ii) number of channels for video tv signal is %0.1f *10**5",G*10**-3)
```

Scilab code Exa 20.11 `Height`

```
clear
//Given
R=6400*10**3                    //m
h=160
```

```

//Calculation
//
d=sqrt(2*R*h)
h2=4*h

//Result
printf("\n Height is %0.3f  m", h2)
```

Scilab code Exa 20.12 Population covered

```
clear
//Given
R=6.4*10**6                                   //m
h=110

//Calculation
//
d=(sqrt(2*R*h))*10**-3
P=%pi*d**2

//Result
printf("\n Population covered is %0.1f  *10**6",P
    *10**-3)
```

Scilab code Exa 20.13 Maximum distance

```
clear
//Given
R=6.4*10**6                       //m
hr=50                             //m
ht=32                            //m

```

```
//Calculation
//
d=sqrt(2*R*ht)+sqrt(2*R*hr)

//Result
printf("\n Maximum distance is %0.1f  Km",d*10**-3)
```

Chapter 21

huygen principle and interference

Scilab code Exa 21.1 Wavelength of light used

```
clear
//Goven
d=5*10**-3                                       //m
D=1.0                                             //m
b=0.1092*10**-3

//Calculation
l=(d*b)/D

//Result
printf("\n Wavelength of light used is %0.3f  A", l
   *10**10)
```

Scilab code Exa 21.2 Separation of the two slit

```
clear
```

```
//Given
l=6200*10**-10                          //m
D=0.8
b=2.8*10**-3/4.0

//Calculation
d=(l*D)/b

//Result
printf("\n Separation of the two slit is %0.1f  mm",
   d*10**3)
```

Scilab code Exa 21.3 `Fringes required`

```
clear
//Given
a=62
l=5893
l1=4358.0

//Calculation
n=(a*l)/l1

//Result
printf("\n Fringes required is %0.0f  ",n)
```

Scilab code Exa 21.4 `Distance of the second dark fringe`

```
clear
//Given
l=6000*10**-10                              //m
D=0.800                                      //m
d=0.200*10**-3                                //m
```

```

//Calculation
x2=(3*l*D)/(2.0*d)
x21=(2*D*l)/d

//Result
printf("\n (i) Distance of the second dark fringe is
    %0.3f  cm", x2*10**2)
printf("\n (ii) Distance of the second dark fringe
    is %0.3f  cm", x21*10**2)
```

Scilab code Exa 21.6 Deduce the ratio of intensity

```
clear
//Given
Imax=16
Imin=4

//Calculation
r=Imax/Imin

//Result
printf("\n Deduce the ratio of intensity is %0.3f
    :1", r)
```

Scilab code Exa 21.7 Fringe width

```
clear
//Given
b=2
u=1.33

//Calculation
```

```
b1=b/u

//Result
printf("\n Fringe width is %0.1f  mm",b1)
```

Scilab code Exa 21.8 Wavelength of the light

```
clear
//Given
b2=0.4
b1=0.6
l1=5000

//Calculation
l2=(b2*2*l1)/b1

//Result
printf("\n Wavelength of the light is %0.0f  A",l2)
```

Scilab code Exa 21.9 Separation between the fringes

```
clear
//Given
d=0.125*10**-3                          //m
l=4500*10**-10                           //m
D=1                                      //m

//Calculation
x2=(2*D*l)/d
d1=2*x2

//Result
```

```
printf("\n Separation between the fringes is %0.3f
    mm", d1*10**3)
```

Scilab code Exa 21.10 The ratio of intensity at the maxima and minima

```
clear
//Given
Imax=121
Imin=81.0

//Calculation
a=Imax/Imin

//Result
printf("\n The ratio of intensity at the maxima and
    minima is %0.2f  ",a)
```

Scilab code Exa 21.13 Width of each slit

```
clear
//Given
l=5.0                              //m
d=1                                   //mm

//Calculation
a=d/l

//Result
printf("\n Width of each slit is %0.3f  mm", a)
```

Chapter 22

diffraction and polarisation

Scilab code Exa 22.1 Width of the central maximum

```
clear
//Given
D=1                              //m
l=5*10**-7                         //m
d=0.1*10**-3                       //m

//Calculation
W=(2*D*l)/d

//Result
printf("\n Width of the central maximum is %0.3f  cm
   ", W*10**2)
```

Scilab code Exa 22.2 Width of the slit

```
clear
//Given
D=1.60                             //m
```

```
l=6328*10**-10                                    //m
w=4.0*10**-3

//Calculation
d=(2*D*l)/w

//Result
printf("\n Width of the slit is %0.2f  mm",d*10**3)
```

Scilab code Exa 22.3 `Width of central maximum`

```
clear
//Given
l=7500*10**-10
d=1.0*10**-6
c=20

//Calculation
//
a=l/d
b=asin(a)*180/3.14
A=2*b
x=c*tan(a*3.14/180.0)
w=2*x

//Result
printf("\n (i) Width of central maximum is %0.0f
   Degree",A)
printf("\n (ii) Width of central maximum is %0.0f
   cm",w*10**2)
```

Scilab code Exa 22.4 `Slit width`

```
clear
//Given
l=6.3*10**-7                                    //m
a=3.6                                           //Degree
n=10

//Calculation
//
d=(n*l)/sin(a*3.14/180.0)

//Result
printf("\n Slit width is %0.1f  mm",d*10**3)
```

Scilab code Exa 22.5 Angular deflection

```
clear
//Given
l=5500*10**-10
d=0.01

//Calculation
//
a=l/d
b=asin(a)*180/3.14

//Result
printf("\n Angular deflection is %0.4f  Degree",b)
```

Scilab code Exa 22.7 Spacing between the first maxima of two sodium lines

```
clear
//Given
l1=5890*10**-10                                 //m
```

```
l2=5896*10**-10
d=2.0*10**-6                                    //m
D=2                                           //m

//Calculation
x=(3*D*(l2-l1))/(2*d)

//Result
printf("\n Spacing between the first maxima of two
   sodium lines is %0.3f  *10**-4 m",x*10**4)
```

Scilab code Exa 22.8 Distance

```
clear
//Given
d=3*10**-3                              //m
l=500*10**-9                            //m

//Calculation
Z=d**2/l

//Result
printf("\n Distance is %0.3f  m",Z)
```

Scilab code Exa 22.10 Fresnel Distance

```
clear
//Given
d=2*10**-3                              //m
l=5000*10**-10

//Calculation
Z=d**2/l
```

```

//Result
printf("\n Fresnel Distance is %0.3f  m",Z)
```

Scilab code Exa 22.11 Minimum angular separation

```
clear
//Given
l=5.50*10**-7                              //m
D=5.1

//Calculation
a=(1.22*l)/D

//Result
printf("\n Minimum angular separation is %0.1f
    *10**-7 rad",a*10**7)
```

Scilab code Exa 22.13 Limt of resolution of a telescope

```
clear
//Given
l=6000*10**-8
D=254.0

//Calculation
a=(1.22*l)/D

//Result
printf("\n Limt of resolution of a telescope is %0.1
    f *10**-7 Radian",a*10**7)
```

Scilab code Exa 22.16 Resolving power of a microscope

```
clear
//Given
u=1
l=600*10**-9                    //,

//Calculation
//
rp=(2*u*sin(30*3.14/180.0))/l

//Result
printf("\n Resolving power of a microscope is %0.2f
    *10**6",rp*10**-6)
```

Scilab code Exa 22.17 Speed of star

```
clear
//Given
l1=15*10**-10                               //m
l=6563*10**-10
c=3*10**8                                   //m/s

//Calculation
v=(c*l1)/l

//Result
printf("\n Speed of star is %0.2f  *10**5 m/s",v
   *10**-5)
```

Scilab code Exa 22.18 Velocity of star

```
clear
//Given
l1=0.032
l=100.0
c=3*10**8

//Calculation
v=-(l1*c)/l

//Result
printf("\n Velocity of star is %0.3f  *10**4 m/s",v
   *10**-4)
```

Scilab code Exa 22.21 The refracting angle

```
clear
//Given
a=60                              //Degree
a1=90

//
A=tan(a*3.14/180.0)
ap=a1-a

//Result
printf("\n (i) Refractive index of the medium is %0
   .3f  ",A)
printf("\n (ii) The refracting angle is %0.3f
   degree",ap)
```

Scilab code Exa 22.22 Angle of incidence

```
clear
//Given
a=1.33

//Calculation
//
ap=atan(a)*180/3.14

//Result
printf("\n Angle of incidence is %0.0f  Degree",ap)
```

Scilab code Exa 22.23 Angle between the sun and the horizon

```
clear
//Given
u=1.33
a=90

//Calculation
//
ap=atan(u)*180/3.14
A=a-ap

//Result
printf("\n Angle between the sun and the horizon is
    %0.0f  Degree",A)
```

Scilab code Exa 22.26 Critical angle for this medium

```
clear
//Given
ap=60                          //Degree
u=3
```

```
//Calculation
//
a=1/sqrt(u)
C=asin(a)*180/3.14

//Result
printf("\n Critical angle for this medium is %0.2f
   Degree",C)
```

Chapter 23

dual nature of radiation and matter

Scilab code Exa 23.1 `Momentum of photon`

```
clear
//Given
h=6.62*10**-34
    //J
c=3*10**8
    //m/s
l=4.0*10**-7
                                                       //m

//Calculation
E=((h*c)/l)/1.6*10**-19
p=h/l

//Result
printf("\n Value of energy is %0.1f  ev",E*10**38)
printf("\n Momentum of photon is %0.3f  kg m/s",p)
```

Scilab code Exa 23.2 Frequency of the photon

```
clear
//Given
E=75*1.6*10**-19                                    //J
h=6.62*10**-34                                      //J  s
c=3*10**8
    //m/s


//Calculation
f=E/h
l=(12400/E)*1.6*10**-19
f=c/(l*10**10)

//Result
printf("\n Frequency of the photon is %0.0f *10**15
   Hz",f*10**5)
```

Scilab code Exa 23.3 Number of photons emitted per second

```
clear
//Given
h=6.62*10**-34                                     //Js
f=880*10**3                                        //Hz
E1=10*10**3

//Calculation
E=h*f
n=E1/E

//Result
printf("\n Number of photons emitted per second is
   %0.3f *10**31 ",n*10**-31)
```

Scilab code Exa 23.5 Rate at which photons strike the surface

```
clear
//Given
A=2*10**-4
I=30*10**-2
t=1
E=6.62*10**-19

//Calculation
n=(I*A)/E

//Result
printf("\n Rate at which photons strike the surface
   is %0.2f *10**13 photons/s",n*10**-13)
```

Scilab code Exa 23.6 Momentum of a photon

```
clear
//Given
h=6.62*10**-34                    //Js
c=3*10**8
l=4500*10**-10                    //m
w=2.3

//Calculation
E=(h*c)/l
E1=(E/1.6*10**-19)*10**38
K=E1-w
f0=(w*1.6*10**-19)/h
p=h/l

```

```
//Result
printf("\n (i) The energy of photon is %0.1f  ev",E1
   )
printf("\n (ii) The maximum kinetic energy of
   emitted electrons is %0.1f  ev",K)
printf("\n (iii) Threshold frequency for sodium is
   %0.1f *10**14 Hz",f0*10**-14)
printf("\n (iv) Momentum of a photon is %0.1f
   *10**-27 Kg m/s",p*10**27)
```

Scilab code Exa 23.7 Velocity

```
clear
//Given
l=36.0*10**-8                    //m
w0=2*1.6*10**-19                    //J
h=6.62*10**-34                      //Js
c=3*10**8
e=1.6*10**-19
m=9.0*10**-31

//Calculation
//
l0=(h*c)/w0
E=(h*c)/l
E1=(E/1.6*10**-19)*10**38
K=E1-2
v0=K
vmax=sqrt(e*v0*2/m)

//Result
printf("\n (i) Threshold wavelength is %0.0f  A",l0
   *10**10)
printf("\n (ii) Maximum kinetic energy of emitted
   photoelectrons is %0.3f  ev",K)
```

```
printf("\n (iii) Stopping potential is %0.3f Volts"
    ,v0)
printf("\n (iv) Velocity is %0.2f *10**5 m/s",vmax
    *10**-5)
```

Scilab code Exa 23.8 Wavelength of incident light

```
clear
//Given
h=6.62*10**-34
c=3*10**8
l0=24.8*10**-8
a=1.2
e=1.6*10**-19

//Calculation
w0=(h*c)/l0
w01=(w0/1.6*10**-19)*10**38
h1=w01+a
C=h1*e
l=(h*c)/C

//Result
printf("\n Wavelength of incident light is %0.0f A"
    ,l*10**10)
```

Scilab code Exa 23.11 Wavelength of incident light

```
clear
//Given
h=6.6*10**-34
c=3*10**8
l=2000*10**-10
```

```
w0=4.2*1.6*10**-19
e=1.6*10**-19

//Calculation
K=((h*c)/l)-w0
v0=K/e
l1=(h*c)/w0

//Result
printf("\n (i) Potential difference is %0.3f  V", v0
   )
printf("\n (ii) Wavelength of incident light is %0.0
   f  A",l1*10**10)
```

Scilab code Exa 23.12 Maximum value of B

```
clear
//Given
h=6.6*10**-34
c=3*10**8
w0=2.39*1.6*10**-19
f1=4000.0                    //A
f2=6000                      //A
m=9.1*10**-31
e=1.9*10**-19
d=0.1

//Calculation
//
l=(h*c)/w0
K=(12400/f1)-2.39
vmax=sqrt((2*K*1.6*10**-19)/m)
B=(m*vmax)/(e*d)

//Result
```

```
printf("\n Maximum value of B is %0.2f *10**-5 T",B
   *10**5)
```

Scilab code Exa 23.13 Wavelength of visible light

```
clear
//Given
w0=4.4

//Calculation
l=12400/w0

//Result
printf("\n Wavelength of visible light is %0.0f  A",
   l)
```

Scilab code Exa 23.14 Number of visible photons emitted per second

```
clear
//Given
h=6.625*10**-34
c=3*10**8
l=5600*10**-10
a=5

//Calculation
E=(h*c)/l
n=a/E

//Result
printf("\n Number of visible photons emitted per
   second is %0.2f *10**19 ",n*10**-19)
```

Scilab code Exa 23.15 Wavelength of an electron

```
clear
//Given
v=100

//Calculation
//
l=12.27/sqrt(v)

//Result
printf("\n Wavelength of an electron is %0.3f  A", l
  )
```

Scilab code Exa 23.16 De Broglie wavelength of protons

```
clear
//Given
h=6.62*10**-34
m=9*10**-31
v=10**5
mp=1.67*10**-27

//Calculation
l=h/(m*v)
lp=h/(mp*v)

//Result
printf("\n De-Broglie wavelength of electrons is %0
  .1f *10**-10 m",l*10**10)
printf("\n De-Broglie wavelength of protons is %0.4f
   *10**-10  m",lp*10**10)
```

Scilab code Exa 23.17 De Broglie wavelength

```
clear
//Given
E=500*1.6*10**-19
mp=1.67*10**-27
h=6.62*10**-34

//Calculation
//
l=h/(sqrt(2*mp*E))

//Result
printf("\n De-Broglie wavelength is %0.2f *10**-12 m
   ",l*10**12)
```

Scilab code Exa 23.18 De Broglie wavelength of neutron

```
clear
//Given
v=150.0
mn=1.675*10**-27                    //Kg
En=150*1.6*10**-19
h=6.62*10**-34

//Calculation
//
le=12.27/sqrt(v)
ln=h/sqrt(2*mn*En)

//Result
```

```
printf("\n (i) De-Broglie wavelength of electron is
    %0.0f  A",le)
printf("\n (ii) De-Broglie wavelength of neutron is
    %0.4f  A",ln*10**10)
```

Scilab code Exa 23.19 Momentum of electrons

```
clear
//Given
l=2.0*10**-10                         //m
h=6.62*10**-34

//Calculation
p=h/l

//Result
printf("\n Momentum of electrons is %0.3f  Kg m/s",
    p)
```

Scilab code Exa 23.20 Energy of the scattered electron

```
clear
//Given
l=1.4*10**-10                       //m
h=6.63*10**-34
l1=2.0*10**-10
c=3*10**8
    //m/s

//Calculation
E=h*c*(1/l-1/l1)

//Result
```

```
printf("\n Energy of the scattered electron is %0.2f
    *10**-16 J",E*10**16)
```

Scilab code Exa 23.22 The particles mass

```
clear
//Given
me=9.11*10**-31                         //Kg
lp=1.813*10**-4
vp=3

//Calculation
mp=me/(lp*vp)

//Result
printf("\n The particles mass is %0.3f *10**-27 Kg.
   The particle is proton",mp*10**27)
```

Scilab code Exa 23.23 Wavelength associated with the photoelectrons

```
clear
//Given
l=0.82*10**-10                        //m
h=6.6*10**-34
m=9.1*10**-31
c=3*10**8
   //m/s

//Calculation
//
le=sqrt((h*l)/(2*c*m))

//Result
```

```
printf("\n Wavelength associated with the
    photoelectrons is %0.4f  A",le*10**10)
```

Chapter 24

atoms

Scilab code Exa 24.1 The distance of the closest approach

```
clear
//Given
k=7.68*10**6*1.6*10**-19                           //J
e=1.6*10**-19
Z=29
m=9*10**9

//Calculation
r=(m*2*Z*e**2)/k

//Result
printf("\n The distance of the closest approach is
   %0.1f *10**-14 m",r*10**14)
```

Scilab code Exa 24.2 Impact parameter

```
clear
//Given
```

```
a=10                              //degree
e=1.6*10**-19
Z=79
m=9*10**9
a=5.0*1.6*10**-13

//Calculation
//
b=(Z*e**2*(1/(tan(5*3.14/180.0)))*m)/a

//Result
printf("\n Impact parameter is %0.1f *10**-13 m",b
   *10**13)
```

Scilab code Exa 24.3 Energy

```
clear
//Given
Z=79
m=9*10**9
e=1.6*10**-19
r=4.0*10**-14

//Calculation
K=(m*2*Z*e**2)/(r*1.6*10**-13)

//Result
printf("\n Energy is %0.2f  Mev",K)
```

Scilab code Exa 24.4 Distance of the closest approach

```
clear
//Given
```

```
v=2.1*10**7                                //m/s
a=4.8*10**7                                //C/Kg
Z=79
e=1.6*10**-19
m=9*10**9

//Calculation
r0=(2*m*Z*e*a)/v**2

//Result
printf("\n Distance of the closest approach is %0.1f
    *10**-14 m",r0*10**14)
```

Scilab code Exa 24.6 `e Scattering angle`

```
clear
//Given
Z=79
e=1.6*10**-19                          //C
v=1.6*10**-12
m=9*10**9

//Calculation
//
b=(m*Z*e**2*(1/(tan(45*3.14/180.0))))/v

//Result
printf("\n (a) Scattering angle is 180 degree")
printf("\n (b) The value of scattering angle
   decreases")
printf("\n (c) Impact parameter is %0.1f *10**-14 m"
   ,b*10**14)
printf("\n (e) Scattering angle is increase with
   decrease in impact parameter")
```

Scilab code Exa 24.7 Size of hydrogen atom

```
clear
//Given
e=8.854*10**-12
h=6.62*10**-34
m=9*10**-31
e1=1.6*10**-19

//Calculation
//
r1=((e*h**2)/(%pi*m*e1**2))*10**10
v1=e1**2/(2*e*h)
n=2*r1

//Result
printf("\n Radius of first orbit is %0.2f  A",r1)
printf("\n Velocity of electron is %0.1f  *10**6 m/s
  ",v1*10**-6)
printf("\n Size of hydrogen atom is %0.2f  A",n)
```

Scilab code Exa 24.8 Energy of the photon

```
clear
//Given
n=1.0
n1=2.0
n2=3.0
a=0.53*10**-10
Z=3.0

//Calculation
```

```
r1=(a*n)/Z
r2=(a*n1**2)/Z
r3=(a*n2**2)/Z
E1=(-13.6*Z**2)/n**2
E2=(-13.6*Z**2)/n1**2
E3=(-13.6*Z**2)/n2**2
E=E3-E1

//Result
printf("\n (i) Radii of three lowest allowed orbits
    is %0.2f A %0.2f A and %0.3f A",r1*10**10,r2
    *10**10,r3*10**10)
printf("\n (ii) Energy of three lowest allowed
    orbits is %0.3f ev %0.3f ev and %0.3f ev",E1,E2,
    E3)
printf("\n Energy of the photon is %0.3f  ev",E)
```

Scilab code Exa 24.9 Energies of two energy level

```
clear
//Given
n=2.0
n1=3.0

//Calculation
E2=-13.6/n**2
E3=-13.6/n1**2

//Result
printf("\n Energies of two energy level is %0.3f ev
    and %0.2f ev",E2,E3)
```

Scilab code Exa 24.10 Wavelength of second line

```
clear
//Given
Rh=1.097*10**7

//Calculation
l=9/(8.0*Rh)

//Result
printf("\n Wavelength of second line is %0.0f  A",l
   *10**10)
```

Scilab code Exa 24.11 Shortest wavelength

```
clear
//Given
Rh=1.097*10**7

//Calculation
l=4/Rh

//Result
printf("\n Shortest wavelength is %0.0f  A",l
   *10**10)
```

Scilab code Exa 24.12 Longest wavelength

```
clear
//Given
Rh=1.097*10**7

//Calculation
l=4/(3.0*Rh)

```

```
//Result
printf("\n Longest wavelength is %0.0f  A",l*10**10)
```

Scilab code Exa 24.13 Minimum wavelength

```
clear
//Given
n=1.0
h=6.62*10**-34
c=3*10**8
f=1.6*10**-19
Z=2

//Calculation
E1=(-13.6*Z**2)/n**2
l=-(h*c)/(E1*f)

//Result
printf("\n Minimum wavelength is %0.0f  A",l*10**10)
```

Scilab code Exa 24.15 Speed of the electron

```
clear
//Given
Z=2
e=1.6*10**-19
e1=8.854*10**-12
n=3
h=6.62*10**-34
c=3*10**8

//Calculation
v=(Z*e**2)/(2*e1*n*h)
```

```
a=v/c

//Result
printf("\n Speed of the electron is %0.3f  ",a)
```

Scilab code Exa 24.16 Radius of the earths orbit

```
clear
//Given
r=10**-10
R=10**-15
Rs=7*10**8

//Calculation
R1=r/R
Re=R1*Rs

//Result
printf("\n Radius of the earths orbit is %0.3f  m.
   Thus the earth would be much farther away from
   the sun",Re)
```

Scilab code Exa 24.17 Velocity of the electron

```
clear
//Given
E=-13.6*1.9*10**-19                //J
m=9*10**9
e=1.6*10**-19
n=1
c=3*10**8

//Calculation
```

```
r=(-e**2*m)/(2.0*E)
v=c/(137*n)

//Result
printf("\n Orbital radius is %0.1f *10**-11 m",r*10**11)
printf("\n Velocity of the electron is %0.1f  *10**6 m/s",v*10**-6)
```

Scilab code Exa 24.18 `Initial frequency of light`

```
clear
//Given
v=2.2*10**6
r=5.3*10**-11

//Calculation
//
f=v/(2*%pi*r)

//Result
printf("\n Initial frequency of light is %0.1f *10**15 Hz",f*10**-15)
```

Scilab code Exa 24.19 `Quantum number`

```
clear
//Given
m=10                    //Kg
T=2*60*60                //S
rn=8*10**6               //m
h=6.62*10**-34

```

```
//Calculation
//
vn=(2*%pi*rn)/T
n=(2*%pi*rn*vn)/h

//Result
printf("\n Quantum number is %0.1f *10**45 ",n
   *10**-44)
```

Scilab code Exa 24.20 `Wavelength`

```
clear
//Given
E2=18.70
E1=16.70
h=6.62*10**-34
c=3*10**8

//Calculation
E=E2-E1
l=(h*c)/(E*1.6*10**-19)

//Result
printf("\n Wavelength is %0.0f nm",l*10**9)
```

Scilab code Exa 24.21 `Wavelength of first member`

```
clear
//Given
n1=2
n2=3
lb=6563
a=20
```

```
b=108.0

//Calculation
l1=(lb*a)/b

//Result
printf("\n Wavelength of first member is %0.0f  A",
  l1)
```

Scilab code Exa 24.22 `Minimum energy`

```
clear
//Given
Rh=1.097*10**7                          ///m
h=6.63*10**-34
c=3*10**8
n=2.0
n1=4.0

//Calculation
E=(h*c*Rh*(1/n**2-1/n1**2))/1.6*10**-19

//Result
printf("\n Minimum energy is %0.2f  ev",E*10**38)
```

Scilab code Exa 24.23 `Wavelength`

```
clear
//Given
Rh=1.097*10**7
n2=4.0
n1=3.0

```

```
//Calculation
lm=1/(Rh*(1/n1**2-1/n2**2))
lm1=9/Rh

//Result
printf("\n Wavelength is %0.1f  nm. This wavelength
   is in infrared part",lm1*10**9)
```

Chapter 25

nuclei

Scilab code Exa 25.1 Nuclear radius of oxygen

```
clear
//Given
R0=1.2*10**-15                              //m
A=208
A1=16

//calculation
R=R0*A**0.33
R1=R0*A1**0.33

//Result
printf("\n Nuclear radius of lead is %0.1f  fm",R
    *10**15)
printf("\n Nuclear radius of oxygen is %0.0f  fm",R1
    *10**15)
```

Scilab code Exa 25.2 Equivalent energy of neutron

```
clear
//Given
me=9.1*10**-31
c=3*10**8
e=1.6*10**-19
mp=1.673*10**-27
mn=1.675*10**-27

//Calculation
E=(me*c**2)/e
E1=(mp*c**2)/e
E2=(mn*c**2)/e

//Result
printf("\n (i) Equivalent energy of electron is %0.2
    f  Mev",E*10**-6)
printf("\n (ii) Equivalent energy of proton is %0.1f
      Mev",E1*10**-6)
printf("\n (iii) Equivalent energy of neutron is %0
    .1f  Mev",E2*10**-6)
```

Scilab code Exa 25.5 Nuclear radius

```
clear
//Given
A2=235
A1=16.0
R1=3*10**-15                    //m

//Calculation
R=(A2/A1)**0.33
R2=R*R1

//Result
printf("\n Nuclear radius is %0.3f  fermi",R2
```

```
   *10**15)
```

Scilab code Exa 25.6 Nuclear density

```
clear
//Given
me=55.85
u=1.66*10**-27                         //Kg
R=1.2*10**-15

//Calculation
//
m=me*u
a=(3*u)/(4.0*%pi*R**3)

//Result
printf("\n Nuclear density is %0.2f *10**17 Kg/m**3"
   ,a*10**-17)
```

Scilab code Exa 25.7 Binding energy per nucleon

```
clear
//Given
M=4.001509                             //a.m.u
N=1.008666
N1=1.007277
a=1.66*10**-27
c=3*10**8
e=1.6*10**-19
n=4.0

//Calculation
A=2*N1+2*N
```

```
M1=A-M
Eb=M1*a*c**2/e
B=Eb/n

//Result
printf("\n (i)  Mass defect is %0.3f  a.m.u",M1)
printf("\n (ii) Binding energy is %0.1f  Mev",Eb
  *10**-6)
printf("\n  Binding energy per nucleon is %0.2f  Mev
  ",B*10**-6)
```

Scilab code Exa 25.8 Binding energy when two neutrons and two protons are combined

```
clear
//Given
ma=1.00893
m1=1.00813
m2=2.01473
a=931.5
a1=4.00389

//Calculation
m=ma+m1-m2
Eb=m*a
m3=2*ma+2*m1-a1
Eb1=m3*a

//Result
printf("\n (i) Binding energy when one neutron and
  one proton combined together is %0.2f  Mev",Eb)
printf("\n (ii) Binding energy when two neutrons and
   two protons are combined is %0.1f   Mev",Eb1)
```

Scilab code Exa 25.10 Energy equivalent of one atomic mass unit

```
clear
//Given
a=1.66*10**-27                    //Kg
c=3*10**8
mp=1.00727
mn=1.00866
mo=15.99053

//Calculation
E=(a*c**2)/1.6*10**-19
m1=8*mp+8*mn-mo
a1=m1*E

//Result
printf("\n Energy equivalent of one atomic mass unit
    is %0.1f  Mev/c**2",a1*10**32)
```

Scilab code Exa 25.11 Binding energy per nucleon

```
clear
//Given
mp=1.007825
mn=1.008665
m=39.962589
a2=931.5
Z=40.0

//Calculation
E=20*mp+20*mn
m1=E-m
Eb=m1*a2
B=Eb/Z

```

```
//Result
printf("\n Binding energy per nucleon is %0.3f  Mev/
    nucleon",B)
```

Scilab code Exa 25.12 The activity of sample after 5000 days

```
clear
//Given
t=5000                    //Days
t1=2000.0
a=0.693

//Calculation
//
dt=(a*t)/t1
N=log10(dt)
l=a*N/(t1)

//Result
printf("\n (i) The fraction remaining after 5000
    days is %0.3f  ",N)
printf("\n (ii) The activity of sample after 5000
    days is %0.1f  *10**8 Bq",l*10**5)
```

Scilab code Exa 25.13 Half life of radium

```
clear
//Given
N=3.67*10**10                    //dis/second
r=226.0
A=6.023*10**23

//Calculation
```

```
n=A/r
l=N/n
D=0.693/l
a=D/(3600.0*24.0*365.0)

//Result
printf("\n  Half life of radium is %0.0f  years",a)
```

Scilab code Exa 25.14 Half life

```
clear
//Given
N0=475
N=270.0
t=5.0

//Calculation
//
a=N0/N
l=log(a)/t
T=1/l
T1=0.693/l

//Result
printf("\n (i) The decay constant is %0.3f  /minute"
   ,l)
printf("\n (ii) Mean life is %0.2f  minute",T)
printf("\n (iii) Half life is %0.2f  minute",T1)
```

Scilab code Exa 25.15 Years will lose 1 mg

```
clear
//Given
```

```
t=1500
N=0.01
N0=0.999

//Calculation
//
T=t*log(N)/log(0.5)
T1=t*log(N0)/log(0.5)

//Result
printf("\n (i) Years will reduce to 1 centigram is
   %0.1f  years",T)
printf("\n (ii) Years will lose 1 mg is %0.2f  years
   ",T1)
```

Scilab code Exa 25.16 `Time required`

```
clear
//Given
a=2*10**12
b=9.0*10**12
T=80

//Calculation
//
c=log(a/b)
t=-(c*T)/0.693

//Result
printf("\n Time required is %0.0f  second",t)
```

Scilab code Exa 25.17 `Activity in the beginning and after one hour`

```
clear
//Given
T=6.0
A=6.023*10**23
W=99.0

//Calculation
//
l=0.693/T
N0=A*10**-12/W
A0=l*N0
N=N0*(1/log10(l))
A1=-(l*N)


//Result
printf("\n  Activity in the beginning and after one hour %0.3f  /h",A1*10**-8)
```

Scilab code Exa 25.18 `Time taken`

```
clear
//Given
T=30.0

//Calculation
//
l=0.693/T
T1=1/l
t=log(4)/l
t1=log(8)/l

//Result
printf("\n (i) average life is %0.4f  /day",l)
printf("\n (ii) The time taken for 3/4 of the
```

```
    original no. to disintegrate is %0.2f  days",T1)
printf("\n (iii) Time taken is %0.0f  days",t)
printf("\n (iv) Time taken is %0.0f  days",t1)
```

Scilab code Exa 25.19 The time during which three fourths of a sample will decay

```
clear
//Given
l=1620.0
l1=405.0

//Calculation
//
T=(1/l)+(1/l1)
t=log(4)/T

//Result
printf("\n The time during which three-fourths of a
    sample will decay is %0.0f  years",t)
```

Scilab code Exa 25.20 Mass ofuranium atoms disintegrated per second

```
clear
//Given
C=3.7*10**10                    //disintegrations/s
A=6.02*10**23
B=234

//Calculation
D=(C*B)/A

//Result
```

```
printf("\n Mass ofuranium atoms disintegrated per
    second is %0.3f *10**-11 g",D*10**11)
```

Scilab code Exa 25.21 `Half life of K 40`

```
clear
//Given
M=0.075                    //kg /mol
m=1.2*10**-6               //kg
A=6.0*10**23               ///mol
t=9.6*10**18
N=170

//Calculation
n=(A*m)/M
l=N/t
T=0.693/l

//Result
printf("\n Half life of K-40 is %0.3f  *10**9 years"
    ,T/(24.0*3600.0*365)*10**-9)
```

Scilab code Exa 25.22 `Speed of particle`

```
clear
//Given
mp=232.03714
mn=228.02873
m0=4.002603
a=931.5
A=232.0
e=1.6*10**-19
m=1.66*10**-27
```

```
//Calculation
M=mp-mn-m0
Q=M*a
K=(A-4)*Q/A
S=sqrt((2*K*e)/(4.0*m))

//Result
printf("\n (i) Kinetic energy is %0.1f  Mev",K)
printf("\n (ii) Speed of particle is %0.1f  *10**7 m
    /s",S*10**-4)
```

Scilab code Exa 25.23 The emission of alpha particle will reduce the mass number b

```
clear
//Given
b=238
c=206
d=92
e=82

//Calculation
a=(b-c)/4.0
A=-d+(2*a)+e

//Result
printf("\n (i) The emission of alpha particle will
    reduce the mass number by 4a  and charge number
    by 2a")
```

Scilab code Exa 25.27 Energy released in the reaction

```
clear
```

```
//Given
mp=10.016125
mn=4.003874
mp1=13.007490
mn1=1.008146
a=931.5

//Calculation
Mr=mp+mn
Mp=mp1+mn1
Md=Mr-Mp
A=a*Md

//Result
printf("\n Energy released in the reaction is %0.3f
    Mev",A)
```

Scilab code Exa 25.28 `Number of fission per second`

```
clear
//Given
a=10**6                      //J/s
E=200*10**6*1.6*10**-19

//Calculation
N=a/E

//Result
printf("\n Number of fission per second is %0.2f
   *10**16 ",N*10**-16)
```

Scilab code Exa 25.29 `Mass of uranium fissioned per hour`

```
clear
//Given
P=3*10**8                    //W
E=200*10**6*1.6*10**-19
a=235
m=6.023*10**23

//Calculation
E1=P*3600
N=E1/E
M1=(a*N)/m

//Result
printf("\n Mass of uranium fissioned per hour is %0
    .2f  g",M1)
```

Scilab code Exa 25.30 Power output

```
clear
//Given
m=6.023*10**26
a=235.0
t=30                           //Days
E=200*10**6*1.6*10**-19

//Calculation
N=(2/a)*m
A=N/(t*24*60.0*60.0)
P=E*A

//Result
printf("\n Power output is %0.1f  Mev",P*10**-6)
```

Scilab code Exa 25.31 Energy released

```
clear
//Given
m=1.0076
mp=4.0039
a=931.5*10**6                          //ev

//Calculation
Mr=4*m
Md=Mr-mp
E=Md*a*1.6*10**-19

//Result
printf("\n Energy released is %0.2f *10**-13 J",E
   *10**13)
```

Scilab code Exa 25.32 Energy liberated

```
clear
//Given
a=6*10**-3                          //Kg
c=3*10**8

//Calculation
E=a*c**2

//Result
printf("\n Energy liberated is %0.3f  J", E)
```

Chapter 26

semiconductors

Scilab code Exa 26.1 Intrinsic carrier conceentration

```
clear
//Given
a=0.47
ue=0.39                                   //m**2/volt sec
uh=0.19                                   //m**2/volt sec
e=1.6*10**-19

//Calculation
a1=1/a
ni=a1/(e*(ue+uh))

//Result
printf("\n Intrinsic carrier conceentration is %0.1f
    *10**19 /m**3",ni*10**-19)
```

Scilab code Exa 26.2 Donor concentration

```
clear
```

```
//Given
a=0.01
e=1.6*10**-19
ue=0.39

//Calculation
a1=1/a
Nd=a1/(e*ue)

//Result
printf("\n Donor concentration is %0.1f *10**21 /m
   **3",Nd*10**-21)
```

Scilab code Exa 26.3 Conductivity

```
clear
//Given
ni=2.5*10**19                                    ///m**3
e=1.6*10**19
ue=0.36                                          //m**2/volt
   sec
uh=0.17

//Calculation
a=ni*e*(ue+uh)

//Result
printf("\n Conductivity is %0.3f  S/m", a*10**-38)
```

Scilab code Exa 26.5 ne in the doped semiconductor

```
clear
//Given
```

```
ni=1.5*10**16                                    ///m**3
nh=4.5*10**22                                    ///m**3

//Calculation
ne=ni**2/nh

//Result
printf("\n ne in the doped semiconductor is %0.3f
   *10**9 /m**3",ne*10**-9)
```

Scilab code Exa 26.6 `Minimum energy`

```
clear
//Given
l=5890.0                                         //A

//Calculation
E=12400/l

//Result
printf("\n Minimum energy is %0.1f  ev",E)
```

Scilab code Exa 26.8 `Maximum wavelength of electromagnetic radiation`

```
clear
//Given
E=0.65
a=10**-10

//Calculation
l=(12400*a)/E

//Result
```

```
printf("\n Maximum wavelength of electromagnetic
    radiation is %0.1f *10**-6 m",l*10**6)
```

Scilab code Exa 26.9 Number density of donor atom

```
clear
//Given
a=5                    ///ohm/cm
ue=3900                 //cm**2/vs
e=1.6*10**-19

//Calculation
Nd=a/(ue*e)

//Result
printf("\n Number density of donor atom is %0.2f
    *10**15 /cm**3",Nd*10**-15)
```

Scilab code Exa 26.10 Number of holes

```
clear
//Given
ni=1.5*10**16                       ///m**3
a=5*10**28
b=10.0**6

//Calculation
Ne=a/b
nh=ni**2/Ne

//Result
printf("\n Number of Electrons is %0.3f  /m**3",Ne)
```

```
printf("\n Number of holes is %0.3f  *10**9 /m**3",
   nh*10**-9)
```

Scilab code Exa 26.11 Electric field

```
clear
//Given
d=4.0*10*-8                        //m

//Calculation
a=2/1.6*10**-19
E=-a/d

//Result
printf("\n Electric field is %0.0f  *10**7 V/m",E
   *10**22)
```

Chapter 27

semiconductor devices

Scilab code Exa 27.1 Value of resistance

```
clear
//Given
E=1.5                    //V
Vd=0.5                        //V
P=0.1                       //W

//Calculation
Imax=P/Vd
V=E-Vd
R1=V/Imax

//Result
printf("\n Value of resistance is %0.3f  ohm",R1)
```

Scilab code Exa 27.2 Current drawn from point B

```
clear
//Given
```

```
V=2                       //V
R=10.0                 //ohm
R1=20.0

//Calculation
I=V/R
I1=V/R1

//Result
printf("\n (i) Current drawn from battery is %0.3f
   A", I)
printf("\n (ii) Current drawn from point B is %0.3f
    A",I1)
```

Scilab code Exa 27.3 Zener rating required

```
clear
//given
Vl=15                       //V
Rl=2.0*10**3
Iz=10                          //mA
R1=20.0

//Calculation
Il=(Vl/Rl)*10**3
Ir=Iz+Il
Vr=Ir*10**-2*R1
V=Vr+Vl

//Result
printf("\n Voltage is %0.3f  V", V)
printf("\n Zener rating required is %0.3f  mA",Ir)
```

Scilab code Exa 27.4 Peak inverse voltage

```
clear
//Given
N=10.0
V=230                    //V

//Calculation
//
Vrpm=sqrt(2)*V
Vsm=Vrpm/N
Vdc=Vsm/%pi

//Result
printf("\n (i) The output dc voltage is %0.2f  V",
   Vdc)
printf("\n (ii) Peak inverse voltage is %0.2f  V",
   Vsm)
```

Scilab code Exa 27.5 Efficiency of rectification

```
clear
//Given
Vm=50                              //V
rf=20.0
Rl=800                                 //ohm

//Calculation
//
Im=(Vm/(rf+Rl))*10**3
Idc=Im/%pi
Irms=Im/2.0
P=(Irms/1000.0)**2*(rf+Rl)
P1=(Idc/1000.0)**2*Rl
V=Idc*Rl*10**-3
```

```
A=P1*100/P

//Result
printf("\n (i) Im= %0.0f mA \nIdc= %0.1f mA \nIrms=
   %0.1f mA",Im,Idc,Irms)
printf("\n (ii) a.c power input is %0.3f watt \nd.c.
    power is %0.3f watt",P,P1)
printf("\n (iii) d.c. output voltage is %0.2f  Volts
   ",V)
printf("\n (iv) Efficiency of rectification is %0.1f
     percentage",A)
```

Scilab code Exa 27.6 R M S value of load current

```
clear
//Given
rf=20                                    //ohm
Rl=980
V=50                                       //v

//Calculation
//
Vm=V*sqrt(2)
Im=(Vm/(rf+Rl))*10**3
Idc=(2*Im)/(%pi)
Irms=Im/sqrt(2)

//Result
printf("\n (i) load current is %0.1f  mA",Im)
printf("\n (ii) Mean load currant is %0.0f  mA",Idc)
printf("\n (iii) R.M.S value of load current is %0.3
   f  mA",Irms)
```

Scilab code Exa 27.7 peak inverse voltage

```
clear
//Given
N=5.0
A=230                    //V
B=2
Rl=100

//Calculation
//
V1=A/N
V2=V1*sqrt(2)
Vm=V2/B
Idc=2*Vm/(%pi*Rl)
Vdc=Idc*Rl

//Result
printf("\n (i) d.c voltage output is %0.1f  V",Vdc)
printf("\n (ii) peak inverse voltage is %0.0f  V",V2
   )
```

Scilab code Exa 27.8 The value of series resister Rs

```
clear
//Given
Il=4.0              //mA
Vz=6                //V
E=10.0              //V

//Calculation
Lz=5*Il
L=Il+Lz
Rs=E-Vz
Rs1=Rs/(L*10**-3)
```

```
//Result
printf("\n The value of series resister Rs %0.0f
   ohm",Rs1)
```

Scilab code Exa 27.9 A C resistance

```
clear
//Given
Vf=0.3              //V
If=4.3*10**-3       //A
Vc=0.35
Va=0.25
Ic=6*10**-3
Ia=3*10**-3

//Calculation
Rdc=Vf/If
Vf1=Vc-Va
If1=Ic-Ia
Rac=Vf1/If1

//Result
printf("\n (i) D.C. resistance is %0.2f  ohm",Rdc)
printf("\n (ii) A.C. resistance is %0.2f  ohm",Rac)
```

Scilab code Exa 27.10 Base current

```
clear
//Given
A=0.9
Ie=1            //mA

```

```
//Calculation
Ic=A*Ie
Ib=Ie-Ic

//Result
printf("\n Base current is %0.3f  mA",Ib)
```

Scilab code Exa 27.11 Ie

```
clear
//Given
B=50
Ib=0.02          //mA

//Calculation
Ic=B*Ib
Ie=Ib+Ic

//Result
printf("\n Ie = %0.3f  mA",Ie)
```

Scilab code Exa 27.12 The value of Ic using B

```
clear
//Given
B=49
Ie=12             //mA
Ib=240            //microA

//Calculation
A=(B/1+B)*10**-2
Ic=A*Ie
Ic1=B*Ib
```

```
//Result
printf("\n  The value of Ic using A is %0.3f  mA",Ic
   )
printf("\n  The value of Ic using B is %0.3f  mA",
   Ic1*10**-3)
```

Scilab code Exa 27.13 The base current for common emitter connection

```
clear
//Given
B=45.0
Ic=1         //V

//Calculation
Ib=Ic/B

//Result
printf("\n  The base current for common emitter
   connection is %0.3f  mA",Ib)
```

Scilab code Exa 27.14 Base current

```
clear
//Given
Vcc=8                    //V
V=0.5                    //V
Rc=800.0                 //ohm
a=0.96

//Calculation
Vce=Vcc-V
Ic=V/Rc*10**3
```

```
B=a/(1-a)
Ib=Ic/B

//Result
printf("\n (i) Collector-emitter voltage is %0.3f V
   ",Vce)
printf("\n (ii) Base current is %0.3f mA",Ib)
```

Scilab code Exa 27.15 The output resistance

```
clear
//Given
a=10
b=2
c=3

//Calculation
Vce=a-b
Ic=c-b
Ro=Vce/Ic

//Result
printf("\n The output resistance is %0.3f k ohm",Ro
   )
```

Scilab code Exa 27.17 The voltage gain

```
clear
//Given
Ri=665.0            //ohm
Ib=15.0             //micro A
Ic=2                //mA
Ro=5*10**3          //ohm
```

```
//Calculation
Bac=Ic/Ib*10**3
Av=Bac*(Ro/Ri)

//Result
printf("\n  The voltage gain is %0.0f  ",Av)
```

Scilab code Exa 27.18 `d c collector current`

```
clear
//Given
Vbb=2.0                                    //v
Rc=2000                                   //ohm
B=100
Vbe=0.6                                    //V

//Calculation
Ic=Vbb/Rc*10**3
Ib=Ic/B
Ib1=10*Ib
Rb=(Vbb-Vbe)/Ib
Ic=B*Ib1

//Result
printf("\n d.c. collector current is %0.3f  mA",Ic)
```

Scilab code Exa 27.20 `The value of power gain`

```
clear
//Given
a=200
b=50
```

```
c=17
d=5
e=4000

//Calculation
Ib=(a-b)*10**-3
Ic=c-d
B=Ic/Ib
D=e/B
Ap=B**2*D

//Result
printf("\n  The value of power gain is %0.3f  *10**5
   ",Ap*10**-5)
```

Scilab code Exa 27.21 Frequency of oscillation

```
clear
//Given
L1=58.6*10**-6                    //H
C1=300.0*10**-12                    //F

//Calculation
//
f=1/((2.0*%pi)*sqrt(L1*C1))

//Result
printf("\n Frequency of oscillation is %0.0f  KHz",f
   *10**-3)
```

Chapter 29

communication system

Scilab code Exa 29.1 `length of half wave dipole antenna at 3000 MHz`

```
clear
c=3*10**8
f=30.0*10**6
f1=300*10**6
f2=3000*10**6

//Calculation
l=c/f
l1=l/2.0
l2=c/f1
l3=l2/2.0
l4=c/f2
l5=l4/2.0

//Result
printf("\n (i) length of half wave dipole antenna at
    30 MHz is %0.3f m",l1)
printf("\n (ii) length of half wave dipole antenna
    at 300 MHz is %0.3f m",l3)
printf("\n (iii) length of half wave dipole antenna
    at 3000 MHz is %0.3f m",l5)
```

Scilab code Exa 29.6 `power of AM wave`

```
clear
//Given
Pc=500                  //watts

//Calculation
Ps=(1/2.0)*(Pc)
Pt=Pc+Ps

//Result
printf("\n (i) sideband power is %0.3f  W",Ps)
printf("\n (ii) power of AM wave is %0.3f  W",Pt)
```

Scilab code Exa 29.7 `total sideband at 10percentageis`

```
clear
//Given
Pc=50
Ma=0.8
Ma1=0.1

//Calculation
Ps=(1/2.0)*Ma**2*Pc
Ps1=(1/2.0)*Ma1**2*Pc

//Result
printf("\n total sideband at 80percentageis %0.3f
   KW",Ps)
printf("\n total sideband at 10percentageis %0.3f
   KW",Ps1)
```

Scilab code Exa 29.8 `bandwidth required`

```
clear
//Given
Fc=500                       //KHz
Fs=1                         //KHz

//Calculation
A1=Fc+Fs
A2=Fc-Fs
B=A1-A2

//Result
printf("\n sideband frequancies are %0.3f KHz and %0
   .3f KHz",A1,A2)
printf("\n bandwidth required is %0.3f  KHz",B)
```

Scilab code Exa 29.9 `No of telephones channels`

```
clear
//Given
F=10**10                     //Hz
D=8*10**3                    //Hz

//Calculation
B=2/100.0*10**10
C=B/D

//Result
printf("\n No. of telephones channels are %0.3f
   10**4",C*10**-4)
```

Scilab code Exa 29.14 5 MHz comes via ionospheric propogation and 100 MHz signal c

```
clear
//Given
h=300
R=6.4*10**6                                //m
N=10**12

//Calculation
//
d=sqrt(2*R*h)
fc=9*N**0.5

//Result
printf("\n fc= %0.3f  MHz", fc*10**-6)
printf("\n 5 MHz comes via ionospheric propogation.
   and 100 MHz signal comes via satellite
   transmission.")
```