Scilab Textbook Companion for Principles of Physics by F. J. Bueche[1]

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Book Description

Title: Principles of Physics

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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

Vectors and their use

Scilab code Exa 1.1 To add the given Displacements Graphically

```
//Example 1_1
clc();
clear;
//To add the given Displacements Graphically
d1=25    //units in cm
d2=10    //units in cm
d3=30    //units in cm
R=sqrt(d1^2+d2^2+d3^2)   //units in cm
theta1=30    //units in degrees
theta2=90   //units in degrees
theta3=120   //units in degrees
theta=360-(theta1+theta2+theta3)   //units in degrees
printf("The Resultant R=%.2f cm\n",R)
printf("Theta=%d degrees",theta)
//In text book the answer is printed wrong as R=49cm
    and theta=82 degrees but the correct answer is R
   =40.31cm and theta=120 degrees
```

Scilab code Exa 1.2 To add the given vector displacements

```
//Example 1_2
clc();
clear;
// To add the given vector displacements
a=1  //units in meters
b=3  //units in meters
c=5  //units in meters
d=6  //units in meters
theta1=90  //units in degrees
Rx_a=a*sin(theta1*%pi/180)   //units in meters
Rx_b=round(b*cos(theta1*%pi/180)) //units in meters
theta2=37   //units in degrees
Rx_c=-round(c*cos(theta2*%pi/180))     //units in meters
theta3=53  //units in degrees
Rx_d=-d*cos(theta3*%pi/180)
Ry_a=round(a*cos(theta1*%pi/180))   //units in meters
Ry_b=round(c*sin(theta2*%pi/180)) //units in meters
Ry_c=round(c*sin(theta2*%pi/180)) //units in meters
Ry_d=-(d*sin(theta3*%pi/180)) //units in meters
Rx=Rx_a+Rx_b+Rx_c+Rx_d     //units in meters
Ry=Ry_a+Ry_b+Ry_c+Ry_d     //units in meters
R=sqrt(Rx^2+Ry^2)  //units in meters
phi=round(atan(Ry/-(Rx))*180/%pi)    //units in degrees
phi=180-phi   //units in degrees
printf("The Resultant R=%.2f Meters\n",R)
printf("The Angle theta=%d degrees",phi)
```

Scilab code Exa 1.3 To subtract vector B from Vector A

```
//Example 1_3
clc();
clear;
//To subtract vector B from Vector A
Ax=8.7  //units in meters
Ay=5   //units in meters
Bx=-6   //units in meters
By=0   //units in meters
Rx=Ax-Bx      //units in meters
Ry=Ay-By       //units in meters
R=sqrt(Rx^2+Ry^2)     //units in meters
theta=round(atan(Ry/(Rx))*180/%pi)     //units in
   degrees
printf("Resultant R=%.1f Meters\n",R)
printf("Angle Theta=%d Degrees",theta)
```

Scilab code Exa 1.4 To calculate the Volume

```
//Example 1_4
clc();
clear;
//To calculate the Volume
r=3*10^-5  //units in meters
L=0.20  //units in meters
V=%pi*r^2*L  //Units in meter^3
printf("Volume V=")
```

```
disp(V)
printf("Meter^3")
```

Chapter 2

Static Equilibrium

Scilab code Exa 2.1 To find the tension in the other two Strings

```
//Example 2_1
clc();
clear;
//To find the tension in the other two Strings
//As Sigma(Fx)=0
F3=80    //units in Newtons
Fx1=F3*sin(37*%pi/180)   //units in Newtons
Fy1=F3*cos(37*%pi/180)   //units in Newtons
F2=round(Fy1+0)     //units in Newtons
F1=round(Fx1+0)    //units in Newtons
printf("Tension in String 1 is F1=%d N\n",F1)
printf("Tension in String 2 is F2=%d N",F2)
```

Scilab code Exa 2.2 To find the tension in the three cords that hold the object

```
//Example 2_2
clc();
clear;
//To find the tension in the three cords that hold the object
//As Sigma(Fx)=0
theta1=37   //units in degrees
theta2=53   //units in degrees
F1_F2=cos(theta2*%pi/180)/cos(theta1*%pi/180)
//As Sigma(Fy)=0
F3=400  //units in Newtons
F2=round((F3*cos(theta1*%pi/180))/(cos(theta1*%pi/180)^2+cos(theta2*%pi/180)^2)) //units in Newtons
F1=(cos(theta2*%pi/180)/cos(theta1*%pi/180))*F2   //units in Newtons
printf("Tension in string 1 is F1=%d N\n",F1)
printf("Tension in string 2 is F2=%d N\n",F2)
//In textbook the Answer for F2 is printed wrong as 320 N But the correct answer is 319 N
```

Scilab code Exa 2.3 To find the weight and the Tension in the cords

```
//Example 2_3
clc();
clear;
//To find the weight and the Tension in the cords
//As Sigma(Fx)=0
theta1=53  //units in degrees
theta2=37   //units in degrees
F1=100    //units in Newtons
F=F1/cos(theta1*%pi/180)   //units in Newtons
W=cos(theta2*%pi/180)*F    //units in Newtons
```

```
printf("The Weight W=%d N\n",W)
printf("Tension in the chord is F=%d N",F)
//In text book the answers are printed wrong as F=167N and W=133N but the correct answers are W=132N and F=166N
```

Scilab code Exa 2.4 To find the lever arms and torques for the forces

```
//Example 2_4
clc();
clear;
//To find the lever arms and torques for the forces
printf("For F1 it is Zero\n")
printf("For F2 it is a*F2 Counter clockwise\n")
printf("For F3 it is a*F3 Clock Wise\n")
printf("For F4 it is b*F4 Counter Clock wise")
```

Scilab code Exa 2.5 To find the Tension T in the Supporting Cable

```
//Example 2_5
clc();
clear;
//To find the Tension T in the Supporting Cable
//As Sigma(Fx)=0
theta1=30   //units in degrees
theta2=90-theta1  //units in degrees
H_T=sin(theta1*%pi/180)
W=2000   //Units in Newtons
T=W/sin(theta2*%pi/180)   //units in Newtons
```

```
H=T*H_T    //units in Newtons
printf("Tension in the Supporting Cable T=%d N",T)
//In textbook The answer is printed wrong as T=2310N but the correct answer is T=2309N
```

Scilab code Exa 2.6 To find the forces exerted bythe pedestals on the board

```
//Example 2_6
clc();
clear;
//To find the forces exerted bythe pedestals on the board
tou=900    //units in Newtons
d1=3   //units in Meters
d2=1.5   //Units in Meters
F1=-(tou*d1)/d2   //Units in Newtons
F2=tou-F1   //units in Newtons
printf("The First Force F1=%d N\n",F1)
printf("The Second Force F2=%d N\n",F2)
```

Scilab code Exa 2.7 To find tension in the supporting cable and Components of the force exerted by the hinge

```
//Example 2_7
clc();
clear;
//To find tension in the supporting cable and Components of the force exerted by the hinge
```

```
F1=50  //units in Newtons
d1=0.7   //units in meters
F2=100   //units  in Newtons
d2=1.4   //units in meters
d3=1   //units in meters
theta2=53   //units in degrees
T=round(((F1*d1)+(F2*d2))/(d3*cos(theta2*%pi/180)))   //units  in Newtons
theta1=37   //units in degrees
H=cos(theta1*%pi/180)*T   //units  in Newtons

V=F1+F2-(cos(theta2*%pi/180)*T)  //units in Newtons
printf("Tension T=%d N\n",T)
printf("H=%d N\n",H)
printf("V=%.2f N",V)
//In text book the answer is printed wrong as H=234N but the correct answer is H=232N
```

Scilab code Exa 2.8 To find the tension in the Muscle and the Component Forces at elbow

```
//Example 2_8
clc();
clear;
//To find the tension in the Muscle and the Component Forces at elbow
F1=65   //units in Newtons
d1=0.1  //units in Meters
F2=20   //Units in Newtons
d2=0.35   //units in meters
theta1=20   //units in degrees
d3=0.035   //units in Meters
Tm=((F1*d1)+(F2*d2))/(cos(theta1*%pi/180)*d3)   //
```

```
    units in Newtons
V=F1+F2-(Tm*cos(theta1*%pi/180))
H=Tm*sin(theta1*%pi/180)
printf("Tension T=%d N\n",Tm)
printf("H=%d N\n",H)
printf("V=%d N",V)
```

Scilab code Exa 2.9 To find the forces at the wall and the ground

```
//Example 2_9
clc();
clear;
  //To find the forces at the wall and the ground
    theta1=53  //units in degrees
    d1=3  //units in meters
    F1=200  //units in Newtons
    d2=4  //units in Meters
    F2=400  //units in Newtons
    theta2=37  //units in degrees
    d3=6   //units in meters
    P=((cos(theta1*%pi/180)*d1*F1)+(cos(theta1*%pi
       /180)*d2*F2))/(cos(theta2*%pi/180)*d3) //
       units in Newtons
    H=P //units in Newtons
    V=F1+F2   //units in Newtons
printf("Force P=%d N\n",P)
printf("Force V=%d N\n",V)
printf("Force H=%d N",H)
//In text book the answer is printed wrong as P=H
   =275N but the correct answer is P=H=276N
```

Chapter 3

Uniform accelerated motion

Scilab code Exa 3.1 To find the balls instantaneous velocity and Average Velocity

```
//Example 3_1
clc();
clear;
//To find the balls instantaneous velocity and
   Average Velocity
d1=8.6    //units in meters
t1=0.86    //units in sec
vp=d1/t1    //units in meters/sec
printf("The Instantaneous Velocity at P Vp=%d meters
   /sec\n",vp)
//The ball stops at position Q Hence vp=0 met/sec
vq=0  //units in meters/sec
printf("The Instantaneous Velocity at Q Vq=%d meters
   /sec\n",vq)
d2=-10.2    //units in meters
t2=1.02    //units in sec
vn=d2/t2    //units in meters/sec
printf("The Instantaneous Velocity at N Vn=%d meters
   /sec\n",vn)
d3=20    //units in meters
```

```
t3=2    //units in sec
vAQ=d3/t3    //units in meters/sec
printf("The Average Velocity between A and Q is VAQ= %d meters/sec\n",vAQ)
d4=0    //units in meters
t4=4    //units in sec
vAM=d4/t4    //units in meters/sec
printf("The Average Velocity between A and M is VAM= %d meters/sec\n",vAM)
```

Scilab code Exa 3.2 To calculate the Acceleration

```
//Example 3_2
clc();
clear;
//To calculate the Acceleration
v1=20   //units in meters/sec
v2=15   //units in meters/sec
t1=0   //units in sec
t2=0.5   //units in sec
c_v=v2-v1    //units in meters/sec
c_t=t2-t1    //units in sec
acceleration=c_v/c_t   //units in meters/sec^2
printf("Acceleration a=%d meters/sec^2",acceleration)
```

Scilab code Exa 3.3 To find acceleration and the distance it travels in time

```
//Example 3_3
```

```
clc();
clear;
//To find acceleration and the distance it travels
   in time
vf=5  //units in meters/sec
v0=0 //units in meters/sec
t=10  //units in sec
a=(vf-v0)/t   //units in meters/sec^2
v_1=(vf+v0)/2   //unis in meters/sec
x=v_1*t  //units in meters
printf("Acceleration is a=%.1f meters/sec\n",a)
printf("Distance travelled is x=%d meters",x)
```

Scilab code Exa 3.4 To find acceleration and time taken to stop

```
//Example 3_4
clc();
clear;
//To find acceleration and time taken to stop
v0=5  //units in meters/sec
vf=0   //units in meters/sec
v_1=(v0+vf)/2  //units in meters/sec
x=20   //units in meters
t=x/v_1   //units in sec
a=(vf-v0)/t  //units in meters/sec^2
printf("Acceleration is a=%.3f meters/sec^2\n",a)
printf("Time taken to stop t=%d sec",t)
```

Scilab code Exa 3.5 To calculate the speed and time to cover

```
//Example 3_5
clc();
clear;
//To calculate the speed and time to cover
a=4  //units in meters/sec^2
x=20   //units in meters
vf=sqrt(a*x*2)  //units in meters/sec
t=vf/a  //units in sec
printf("Speed vf=%.2f meters/sec\n",vf)
printf("Time taken T=%.2f sec",t)
```

Scilab code Exa 3.6 To find the time taken by a car to travel

```
//Example 3_6
clc();
clear;
//To find the time taken by a car to travel
x=98  //uniys in meters
a=4   //units in meters/sec^2
t=sqrt((2*x)/a)  //units in sec
printf("Time taken by a car to travel is T=%d sec",t
   )
```

Scilab code Exa 3.7 To calculate the time taken to travel

```
//Example 3_7
clc();
clear;
//To calculate the time taken to travel
```

```
v0=16.7  //units in meters/sec
a=1.5  //units in meters/sec^2
x=70  //units in meters
t=-((-v0)+sqrt(v0^2-(4*(a/2)*x)))/(2*(a/2))  //units in sec
printf("Time taken to travel T=%.1f sec",t)
```

Scilab code Exa 3.8 To calculate the acceleration

```
//Example 3_8
clc();
clear;
//To calculate the acceleration
vf=30  //units in meters/sec
v0=0  //units in meters/sec
t=9  //units in sec
a=(vf-v0)/t  //units in meters/sec^2
a=a*(1/1000)*(3600/1)*(3600/1)  //units in km/h^2
printf("Acceleration a=%d km/h^2",a)
```

Scilab code Exa 3.9 To find how above the water is the bridge

```
//Example 3_9
clc();
clear;
//To find how above the water is the bridge
v0=0  //units in meters/sec
t=3  //units in sec
a=-9.8  //units in meters/sec^2
```

```
y=(v0*t)+(0.5*a*t^2)   //units in meters
printf("The bridge is y=%d meters above the water",y
   )
```

Scilab code Exa 3.10 To find out how high does it goes and its speed and how long will it be in air

```
//Example 3_10
clc();
clear;
//To find out how high does it goes and its speed
   and how long will it be in air
vf=0  //units in meters/sec
v0=15  //units in meters/sec
a=-9.8  //units in meters/sec^2
y=(vf^2-v0^2)/(2*a)   //units in meters
printf("Distance it travels is y=%.1f meters\n",y)
vf=-sqrt(2*a*-y)  //units in meters/sec
printf("The speed is vf=%d meters/sec\n",vf)
t=vf/(0.5*a)  //units in sec
printf("Time taken is T=%.2f sec",t)
```

Scilab code Exa 3.11 To find out how fast a ball must be thrown

```

//Example 3_11
clc();
clear;
//To find out how fast a ball must be thrown
```

```
a=9.8  //units in meters/sec^2
t=3  //units in sec
v=(0.5*a*t^2)/t
printf("The speed by which the ball has to be thrown is v=%.1f meters/sec",v)
```

Scilab code Exa 3.12 To find out where the ball will hit the ground

```
//Example 3_12
clc();
clear;
//To find out where the ball will hit the ground
//Horizontal
y=2  //units in meters
a=9.8  //units in meters/sec^2
t=sqrt(y/(0.5*a))  //units in sec
v=15  //units in meters/sec
x=v*t  //units in sec
printf("The ball hits the ground at x=%.2f meters",x)
```

Scilab code Exa 3.12 To find out where the ball will hit the ground

```
//Example 3_12
clc();
clear;
//To find out where the ball will hit the ground
//Horizontal
y=2  //units in meters
a=9.8  //units in meters/sec^2
t=sqrt(y/(0.5*a))  //units in sec
```

```
v=15  //units in meters/sec
x=v*t  //units in sec
printf("The ball hits the ground at x=%.2f meters",x)
```

Scilab code Exa 3.13 To find out at what height above ground does it hit wall and is it still going up befor it hits or down

```
//Example 3_13
clc();
clear;
//To find out at what height above ground does it hit wall and is it still going up befor it hits or down
v_1=24  //units in meters/sec
x=15   //units in meters
t=x/v_1   //units in sec
v0=18  //units in meters/sec
a=-9.8  //units in meters/sec^2
y=(v0*t)+(0.5*a*t^2)  //units in meters
printf("The arrow hits y=%.1f meters above the straight point\n",y)
v=v0+(a*t)   //units in meters/sec
printf("The Vertical componet of velocity is v=%.1f meters/sec\n",v)
printf("As V is Positive the arrow is in its way up\n")
vtotal=sqrt(v^2+v_1^2)   //units in meters/sec
printf("The magnitude of velocity is vtotal=%.1f meters/sec",vtotal)
```

Chapter 4

Newtons law

Scilab code Exa 4.1 To calculate the force required

```
//Example 4_1
clc();
clear;
//To calculate the force required
vf=12  //units in meters/sec
v0=0   //units in meters/sec
t=8  //units in sec
a=(vf-v0)/t   //units in meters/sec^2
m=900  //units in Kg
F=m*a  //units in Newtons
printf("The force required is F=%d N",F)
```

Scilab code Exa 4.2 To find the friction force that opposes the motion

```
//Example 4_2
clc();
clear;
```

```
//To find the friction force that opposes the motion
F1=500  //units in Newtons
F2=800  //units in Newtons
theta=30  //units in degrees
Fn=F1+(F2*sin(theta*%pi/180))  //units in Newtons
u=0.6
f=u*Fn   //units in Newtons
printf("The Frictional force that is required is f=%d N",f)
```

Scilab code Exa 4.3 To find out at what rate the wagon accelerate and how large a force the ground pushing up on wagon

```
//Example 4_3
clc();
clear;
//To find out at what rate the wagon accelerate and how large a force the ground pushing up on wagon
F1=90   //units in Newtons
F2=60   //units in Newtons
P=F1-F2  //units in Newtons
F3=100   //units in Newtons
F4=sqrt(F3^2-F2^2)  //units in Newtons
a=9.8  //units in meters/sec^2
ax=(F4*a)/F1   //units in Meters/sec^2
printf("The wagon accelerates at ax=%.1f meters/sec^2\n",ax)
printf("Force by which the ground pushing is P=%d N",P)
```

Scilab code Exa 4.4 To calculate How far does the car goes

```
//Example 4_4
clc();
clear;
// To calculate How far does the car goes
w1=3300      //units in lb
F1=4.45     //units in Newtons
w2=1       //units in lb
weight=w1*(F1/w2)  //units in Newtons
g=9.8    //units in meters/sec^2
Mass=weight/g    //units in Kg
speed=38    //units in mi/h
speed=speed*(1.61)*(1/3600)    //units in Km/sec
stoppingforce=0.7*(weight)    //units in Newtons
a=stoppingforce/-(Mass)    //units in meters/sec^2
vf=0
v0=17    //units in meters/sec
x=(vf^2-v0^2)/(2*a)
printf("The car goes by x=%.1f meters",x)
//In text book the answer is printed wrong as x=20.9
    meters the correct answer is x=21.1 meters
```

Scilab code Exa 4.5 To find the acceleration of the masses

```
//Example 4_5
clc();
clear;
```

```
//To find the acceleration of the masses
w1=10    //units in Kg
w2=5    //units in Kg
f1=98    //units in Newtons
f2=49    //units in Newtons
w=w1/w2
T=round((f1+(w*f2))/(w+1))    //units in Newtons
a=(f1-T)/w1    //units in meters/sec^2
printf("Acceleration is a=%.1f meters/sec^2",a)
```

Scilab code Exa 4.6 To find the acceleration of the objects

```
//Example 4_6
clc();
clear;
//To find the acceleration of the objects
w1=0.4    //units in Kg
w2=0.2     //units in Kg
w=w1/w2
a=9.8    //units in meters/sec^2
f=0.098    //units in Newtons
c=w2*a    //units in Newtons
T=((w*c)+f)/(1+w)      //units in Newtons
a=(T-f)/w1    //units in meters/sec^2
printf("Acceleration a=%.1f meters/sec^2",a)
```

Scilab code Exa 4.7 To estimate the lower limit for the speed

```
//Example 4_7
```

```
clc();
clear;
//To estimate the lower limit for the speed
//In a practical situation u should be atleast 0.5
u=0.5
g=9.8   //units in meter/sec^2
x=7   //units in meters
v0=sqrt(2*u*g*x)   //units in meters/sec
printf("The lower limit of the speed v0=%.1f meter/
   sec",v0)
```

Scilab code Exa 4.8 To find acceleration in terms of m f and theta

```
//Example 4_8
clc();
clear;
//To find acceleration in terms of m,f and theta
printf("The acceleration a=(f/m)-g*sin(theta)")
printf("\n In special case when there is no friction
    f=0\n")
printf("So a=-g*sin(theta)\n")
printf("As theta=90 degrees\n")
printf("Acceleration a=-g")
```

Scilab code Exa 4.9 To calculate how large a force must push on car to accelerate

```
//Example 4_9
clc();
clear;
//To calculate how large a force must push on car to
    accelerate
m=1200  //units in Kg
g=9.8   //units in meters/sec^2
d1=4   //units in meters
d2=40   //units in meters
a=0.5   //units in meters/sec^2
P=((m*g)*(d1/d2))+(m*a)   //units in Newtons
printf("The force required is P=%d N",P)
//In text book the answer is printed wrong as P=1780
    N but the correct answer is P=1776 N
```

Scilab code Exa 4.10 To calculate the tension in the rope

```
//Example 4_10
clc();
clear;
//To calculate the tension in the rope
u=0.7
sintheta=(6/10)
w1=50   //units in Kg
g=9.8   //units in meter/sec^2
costheta=(8/10)
Fn=w1*g*costheta    //units in Newtons
f=u*Fn   //units in Newtons
T=f+(w1*g*sintheta)
printf("The tension in the rope is T=%d N",T)
```

Scilab code Exa 4.11 To find the acceleration of the system

```
//Example 4_11
clc();
clear;
//To find the acceleration of the system
w1=7    //units in Kg
a=9.8    //units in meters/sec^2
w2=5    //units in Kg
w=w1/w2
F1=29.4    //units in Newtons
F2=20    //units in Newtons
f=(F1+F2)    //units in Newtons
T1=w1*a    //units in Newtons
T=(T1+(w*f))/(1+w)    //units in Newtons
a=((w1*a)-T)/w1    //units in meters/sec^2
printf("Acceleration a=%.2f meters/sec^2",a)
```

Chapter 5

Work and energy

Scilab code Exa 5.1 To calculate the work done

```
//Example 5_1
clc();
clear;
//To calculate the work done
Fs=8    //units in meters
W=Fs*round(cos(%pi/2))    //units in Joules
printf("The work done is W=%d Joules",W)
```

Scilab code Exa 5.2 To calculate the work done when lifting object as well as lowering the object

```
//Example 5_2
clc();
clear;
//To calculate the work done when lifting object as
   well as lowering the object
Fs=1    //units in terms of Fs
```

```
theta=0    //units in degrees
W=Fs*cos(theta*%pi/180)    //units in terms of m, g and h
printf("Work done when lifting is W=mgh*%d\n",W)
theta=180    //units in degrees
W=Fs*cos(theta*%pi/180)    //units in terms of m, g and h
printf("Work done when downing is W=mgh*%d\n",W)
```

Scilab code Exa 5.3 To find the work done by the pulling force

```
//Example 5_3
clc();
clear;
//To find the work done by the pulling force
F=20    //units in Newtons
d=5    //units in meters
W=F*d    //units in joules
printf("Work done is W=%d Joules",W)
```

Scilab code Exa 5.4 To find out the power being developed in motor

```
//Example 5_4
clc();
clear;
//To find out the power being developed in motor
m=200   //units on Kg
g=9.8    //units in meters/sec^2
Fy=m*g    //units in Newtons
```

```
vy=0.03     //units in meter/sec
P=Fy*vy     //units in Watts
P=P*(1/746)   //units in hp
printf("Power developed P=%.5f hp",P)
```

Scilab code Exa 5.5 To calculate the average frictional force developed

```
//Example 5_5
clc();
clear;
//To calculate the average frictional force
   developed
m=2000   //units in Kg
vf=20    //units in meters/sec
d=100   //units in meters
f=(0.5*m*vf^2)/d    //units in Newtons
printf("Average frictional force f=%d N",f)
```

Scilab code Exa 5.6 To find out how fast the car is going

```
//Example 5_6
clc();
clear;
//To find out how fast the car is going
f=4000    //units in Newtons
s=50    //units in meters
theta=180    //units in degrees
m=2000     //units in Kg
v0=20    //units in meter/sec
```

```
vf=sqrt((2*((f*s*cos(theta*%pi/180))+(0.5*m*v0^2)))/
   m)     //units in meter/sec
printf("The speed of the car is vf=%.1f meters/sec",
   vf)
```

Scilab code Exa 5.7 To find the required tension in the rope

```
//Example 5_7
clc();
clear;
//To find the required tension in the rope
m=40    //units in Kg
g=9.8    //units in meters/sec^2
theta=0   //units in degrees
vf=0.3    //units in meters/sec
s=0.5    //units in meters
T=round((m*g)+((0.5*m*vf^2)/(s*cos(theta*%pi/180))))
      //units in Newtons
printf("Tension in the rope is T=%d N",T)
```

Scilab code Exa 5.8 To calculate the frictional force

```
//Example 5_8
clc();
clear;
//To calculate the frictional force
m=900   //units in Kg
v0=20    //units in meters/sec
s=30     //units in meters
```

```
f=(0.5*m*v0^2)/s    //units in Newtons
printf("Frictional force required is f=%d N",f)
```

Scilab code Exa 5.9 To find out how fast a a ball is going

```
//Example 5_9
clc();
clear;
//To find out how fast a a ball is going
m=3    //units in Kg
g=9.8    //units in meters/sec^2
hf=0    //units in meters
h0=4    //units in meters
vf=2*sqrt(((m*g*-(hf-h0))*0.5)/m)    //units in meters/sec
printf("The ball is moving with a speed of vf=%.2f meters/sec",vf)
```

Scilab code Exa 5.10 To calculate how large the average frictional force

```
//Example 5_10
clc();
clear;
//To calculate how large the average frictional force
a=9.8    //units in meters/sec^2
s=4    //units in meters
v=6    //units in meters/sec
m=3    //units on Kg
```

```
f=m*((a*s)-(0.5*v^2))/s    //units in Newtons
printf("The average frictional force f=%.1f N",f)
```

Scilab code Exa 5.11 To find out how fast a car is going at points B and C

```
//Example 5_11
clc();
clear;
//To find out how fast a car is going at points B and C
m=300  //units in Kg
g=9.8  //units in meters/sec^2
hb_ha=10   //units in meters
f=20   //units in Newtons
s=60   //units in meters
vf=2*sqrt((0.5*((m*g*(hb_ha))-(f*s))/m)    //units in meters/sec
printf("The car is going at a speed of vf=%.1f meters/sec at point B\n",vf)
hc_ha=2   //units in meters
vf=2*sqrt((0.5*((m*g*(hc_ha))-(f*s))/m)    //units in meters/sec
printf("The car is going at a speed of vf=%.2f meters/sec at point C\n",vf)
```

Scilab code Exa 5.12 How far the average velocity and how far beyond B does the car goes

```
//Example 5_12
clc();
clear;
//How far the average velocity and how far beyond B
   does the car goes
m=2000  //units in Kg
vb=5   //units in meters/sec
va=20    //units in meters/sec
hb_ha=8   //units in meters
g=9.8   //units in meters/sec^2
sab=100  //units in meters
f=-((0.5*m*(vb^2-va^2))+(m*g*(hb_ha)))/sab   //units
    in Newtons
printf("Average frictional force is f=%d N\n",f)
Sbe=(0.5*m*vb^2)/f   //units in meters
printf("The distance by which the car goes beyond is
    Sbe=%.1f meters",Sbe)
//In text book answer is printed wrong as f=2180 N
   but correct answer is f=2182N
```

Scilab code Exa 5.13 To find out how large the force is required

```
//Example 5_13
clc();
clear;
//To find out how large the force is required
m=2   //units in Kg
g=9.8   //units in meters/sec^2
hc_ha=10.03   //units in meters
sbc=0.030   //units in meters
f=(m*g*(hc_ha))/sbc   //units in Newtons
printf("The average force required is f=%d N",f)
//In text book answer is printed wrong as f=6550 N
```

```
correct answer is f=6552N
```

Scilab code Exa 5.14 To find out how fast the pendulum is moving

```
//Example 5_14
clc();
clear;
//To find out how fast the pendulum is moving
//At point A
hb_ha=0.35  //units in Meters
g=9.8   //units in meters/sec^2
vb=sqrt((g*hb_ha)/0.5)   //units in meters/sec
printf("The velocity of pendulum at point B is vb=%
   .2f meters/sec\n",vb)
printf("From A to C hc=ha and Vc=Va=0 so Frictional
   force is Negligible at point C")
```

Scilab code Exa 5.15 To find out how large a force is required

```
//Example 5_15
clc();
clear;
//To find out how large a force is required
m=2000 //units in Kg
vf=15   //units in meters/sec
f1=500   //units in Newtons
F=((0.5*m*(vf^2))/80)+f1   //units in Newtons
printf("Force required is F=%d N",F)
```

```
//In text book the answer is printed wrong as F=3300
    N but the correct answer is 3312 N
```

Scilab code Exa 5.16 To find IMA AMA and Efficiency of the system

```
//Example 5_16
clc();
clear;
//To find IMA AMA and Efficiency of the system
si=3
so=1
IMA=si/so
Fo=2000   //units in Newtons
Fi=800    //units in Newtons
AMA=Fo/Fi
effi=AMA/IMA*100
printf("IMA=%.2f\n",IMA)
printf("AMA=%.2f\n",AMA)
printf("Percentage of efficiency is %d percent",effi
   )
```

Chapter 6

Linear Momentum

Scilab code Exa 6.1 To calculate how large is the average force retarding its motion

```
//Example 6_1
clc();
clear;
//To calculate how large is the average force
   retarding its motion
m=1500  //units in Kg
vf=15   //units in meters/sec
v0=20   //units in meters/sec
t=3  //units in sec
f=((m*vf)-(m*v0))/t   //Units in Newtons
printf("The average retarding force is F=%d Newtons"
   ,f)
```

Scilab code Exa 6.2 To estimate the average stopping force the tree exerts on the car

```
//Example 6_2
clc();
clear;
//To estimate the average stopping force the tree exerts on the car
m=1200  //units in Kg
vf=0   //units in meters/sec
v0=20   //units in meters/sec
v=0.5*(vf+v0)   //units in meters/sec
s=1.5   //units in meters
t=s/v   //units in sec
f=((m*vf)-(m*v0))/t   //Units in Newtons
printf("The average stopping force the tree exerts on the car is F=")
disp(f)
printf("Newtons")
```

Scilab code Exa 6.3 To find out how fast and the direction car moving

```
//Example 6_3
clc();
clear;
//To find out how fast and the direction car moving
m1=30000   //units in Kg
m2=1200    //units in Kg
v10=10   //units in meters/sec
v20=-25   //units in meters/sec
vf=((m1*v10)+(m2*v20))/(m1+m2)   //unis in meters/sec
printf("The car is moving at vf=%.2f Meters/sec\n",vf)
printf("The positive sign of vf Indicate the car is moving in the direction the truck was moving")
```

Scilab code Exa 6.4 To find the recoil velocity of the gun vgf

```
//Example 6_4
clc();
clear;
//To find the recoil velocity of the gun vgf
//As we know that Momentum before = Momentum after
//((m*vb0)+(M*vg0))=((m*vbf)+(M*vgf))
// As vb0=vg0=0
printf("The recoil velocity of the gun is Vgf=-(m/M)
    *Vbf")
```

Scilab code Exa 6.5 To find the velocity of each ball after collision

```
//Example 6_5
clc();
clear;
//To find the velocity of each ball after collision
m1=0.04    //units in kg
m2=0.08    //units in kg
v1=0.3    //units in meters/sec
v2f=(2*m1*v1)/(m1+m2)       //units in meters/sec
v2f1=v2f*100    //units in cm/sec
printf("The velocity V2f=%.1f meters/sec or %d cm/
    sec\n",v2f,v2f1)
v1f=((m1*v1)-(m2*v2f))/m1   //units in meters/sec
v1f1=-v1f*100    //units in cm/sec
```

```
printf("The velocity V1f=%.1f meters/sec or %d cm/
    sec\n",v1f,v1f1)
```

Scilab code Exa 6.6 To calculate the speed of the pellet before collision

```
//Example 6_6
clc();
clear;
//To calculate the speed of the pellet before
    collision
h=0.30       //units in meters
g=9.8        //units in meters/sec^2
v=sqrt(2*g*h)      //units in meters/sec
m1=2    //units in Kgs
m2=0.010    //units in kgs
v10=((m1+m2)*v)/m2     //units in meters/sec
printf("The speed of the pelet before collision is
    V10=%d meters/sec",v10)
//In textbook the answer is printed wrong as V10=486
     meters/sec the correct answer is V10=487 meters/
    sec
```

Scilab code Exa 6.7 To calculate how large a forward push given to the rocket

```
//Example 6_7
clc();
clear;
```

```
//To calculate how large a forward push given to the rocket
m=1300   //units in Kgs
vf=50000   //units in meters/sec
v0=0      //units in meters/sec
F=((m*vf)-(m*v0))        //units in Newtons
printf("The Thrust is F=%d Newtons",F)
```

Scilab code Exa 6.8 To determine the velocity of the third piece

```

//Example 6_8
clc();
clear;
//To determine the velocity of the third piece
momentumbefore=0   //units in kg meter/s
m=0.33    //units in Kgs
vz=momentumbefore/m
printf("The Z component of velocity is Vz=%d meters/sec\n",vz)
m=0.33    //units in Kgs
v0=0.6    //units in meters/sec
vy=-(m*v0)/m    //interms of v0 and meters/sec
printf("The Y component of velocity is Vy=%.1f*V0\n",vy)
v01=1   //units in meters/sec
v02=0.8    //units in meters/sec
vx=-((v01+v02)*m)/m    //interms of v0 and units in meters/sec
printf("The X component of velocity is Vx=%.1f*V0",vx)
```

Scilab code Exa 6.9 To find out the velocity of second ball after collision

```
//Example 6_9
clc();
clear;
//To find out the velocity of second ball after
   collision
v1=5   //units in meters/sec
theta=50   //units in degrees
v2=2   //units in meters/sec
vx=v1/(v2*cos(theta*%pi/180))  //units in meters/sec
vy=-(v2*cos(theta*%pi/180))    //units in meters/sec
v=sqrt(vx^2+vy^2)    //units in meters/sec
printf("After the collision the second ball moves at
    a speed of v=%.2f Meters/sec",v)
//in textbook the answer is printed wrong as 4.01
   meters/sec the correct answer is 4.1 meters/sec
```

Scilab code Exa 6.10 To find the average speed of the nitrogen molecule in air

```
//Example 6_10
clc();
clear;
//To find the average speed of the nitrogen molecule
    in air
ap=1.01*10^5   //units in Newton/meter^2
nofmol=2.69*10^25   //Number of molecules
```

```
nitmass=4.65*10^-26    //units in Kg
v=sqrt((ap*3)/(nofmol*nitmass))    //units in meters/
   sec
printf("The average speed of the nitrogen molecule
   in air is V=%d meters/sec",v)
```

Chapter 7

Motion in a circle

Scilab code Exa 7.1 To convert angles to radians and revolutions

```
//Example 7_1
clc();
clear;
//To convert angles to radians and revolutions
theta=70    //units in degrees
deg=360   //units in degrees
rad=theta*2*%pi/deg    //units in radians
rev=1   //units in revolution
rev=theta*rev/deg     //units in revolution
printf("70 degrees in radians is %.2f radians \n 70
   degrees in revolutions it is %.3f revolutions",
   rad,rev)
```

Scilab code Exa 7.2 To find average angular velocity

```
//Example 7_2
clc();
```

```
clear;
//To find average angular velocity
theta=1800   //units in rev
t=60    //units in sec
w=(theta/t)   //units in rev/sec
w=w*(2*%pi)    //units in rad/sec
printf("Average angular velocity is w=%d rad/sec",w)
```

Scilab code Exa 7.3 To find average angular acceleration

```
//Example 7_3
clc();
clear;
//To find average angular acceleration
wf=240   //units in rev/sec
w0=0    //units in rev/sec
t=2   //units in minutes
t=t*60   //units in sec
alpha=(wf-w0)/t    //units in rev/sec^2
printf("Average angular acceleration is alpha=%d rev
   /sec^2",alpha)
```

Scilab code Exa 7.4 To find out how many revolutions does it turn before rest

```
//Example 7_4
clc();
clear;
```

```
//To find out how many revolutions does it turn before rest
wf=0   //units in rev/sec
w0=3    //units in rev/sec
t=18   //units in sec
alpha=(wf-w0)/t    //units in rev/sec^2
theta=(w0*t)+0.5*(alpha*t^2)        //units in rev
printf("Number of revolutions does it turn before rest is theta=%d rev",theta)
```

Scilab code Exa 7.5 To find the angular acceleration and angular velocity of one wheel

```
//Example 7_5
clc();
clear;
//To find the angular acceleration and angular velocity of one wheel
vtf=20   //units in meters/sec
r=0.4    //units in meters
wf=vtf/r    //units in rad/sec
vf=20   //units in meters/sec
v0=0    //units in meters/sec^2
t=9   //units in sec
a=(vf-v0)/t   //units in meters/sec^2
alpha=a/r     //units in rad/sec^2
printf("Angular accelertion is a=%.2f meters/sec^2\n",a)
printf("Angular velocity is alpha=%.2f rad/sec^2",alpha)
```

Scilab code Exa 7.6 To find out the rotation rate

```
//Example 7_6
clc();
clear;
//To find out the rotation rate
at=8.6    //units in meters/sec^2
r=0.2     //units in meters
alpha=at/r     //units in rad/sec^2
t=3    //units in sec
wf=alpha*t    //units in rad/sec
printf("The rotation rate is wf=%d rad/sec",wf)
//In textbook answer is printed wrong as 129 rad/sec
    but the correct answer is 128 rad/sec
```

Scilab code Exa 7.7 To calculate how large a horizontal force must the pavement exert

```
//Example 7_7
clc();
clear;
//To calculate how large a horizontal force must the
    pavement exert
m=1200    //units in Kg
v=8    //units in meters/sec
r=9     //units in meters
F=(m*v^2)/r         //units in Newtons
```

```
printf("The horizontal force must the pavement exerts is F=%d Newtons",F)
//In text book the answer is printed wrong as F=8530 N but the correct answer is 8533 N
```

Scilab code Exa 7.8 To find out the tension in the string when the ball is at point A

```
//Example 7_8
clc();
clear;
//To find out the tension in the string when the ball is at point A
//As (T+W)=((m*v^2)/r)
printf("Tension in the string is T=m*((v^2/r)-g)\n")
printf("If v^2/r==g then the tension in the string is zero\n")
printf("If v<sqrt(r*g) then the required centripetal force is less than the balls weight")
```

Scilab code Exa 7.9 To find out the angle where it should be banked

```
//Example 7_9
clc();
clear;
//To find out the angle where it should be banked
v=25   //units in meters/sec
r=60   //units in meters
g=9.8   //units in meters/sec^2
```

```
tantheta=v^2/(r*g)       //units in radians
theta=atan(tantheta)*180/%pi
printf("The angle where it should be banked is theta =%d degrees",round(theta))
```

Scilab code Exa 7.10 To find out the ratio of F and W

```
//Example 7_10
clc();
clear;
//To find out the ratio of F/W
G=6.67*10^-11    //units in Newton meter^2/Kg^2
m1=0.0080     //units in Kgs
m2=0.0080     //units in Kgs
r=2    //units in Meters
F=(G*m1*m2)/r^2     //units in Newtons
m=m1     //units in Kgs
g=9.8    //units in meter/sec^2
W=m*g    //units in Newtons
F_W=F/W
printf("The F/W Ratio is=")
disp(F_W)
```

Scilab code Exa 7.11 To find the mass of the sun

```
//Example 7_11
clc();
clear;
//To find the mass of the sun
```

```
t=3.15*10^7    //units in sec
r=1.5*10^11    //units in meters
v=(2*%pi*r)/t    //units in meters/sec
G=6.67*10^-11    //units in Newtons
ms=(v^2*r)/G          //Units in Kg
printf("The mass of the sun is Ms=")
disp(ms)
printf("Kg")
```

Scilab code Exa 7.12 To findout the orbital radius and its speed

```
//Example 7_12
clc();
clear;
//To findout the orbital radius and its speed
G=6.67*10^-11    //units in Newtons
me=5.98*10^24    //units in Kg
t=86400   //units in sec
r=((G*me*t^2)/(4*%pi^2))^(1/3)
printf("The orbital radius is r= %d meters\n",r)
v=(2*%pi*r)/t     //units in meters/sec
printf("The orbital speed is v=%d meters/sec",v)
//in textbook the answer is printed wrong as v=3070
    m/sec but the correct answer is v=3072 m/sec
```

Chapter 8

Rotational work energy and momentum

Scilab code Exa 8.1 To find the rotational kinetic energy

```
//Example 8_1
clc();
clear;
//To find the rotational kinetic energy
m=5.98*10^24     //units in Kg
r=6.37*10^6    //units in meters
I=(2/5)*m*r^2    //units in Kg meter^2
t=86400    //units in sec
w=(2*%pi)/(t) //units in rad/sec
KE=0.5*(I*w^2)        //units in joules
printf("The rotational kinetic energy is KE=")
disp(KE)
printf("Joules")
```

Scilab code Exa 8.2 To find the angular acceleration of the wheel

```
//Example 8_2
clc();
clear;
//To find the angular acceleration of the wheel
m=30   //units in Kg
k=0.25    //units in meters
I=m*k^2     //units in Kg meter^2
force=1.8   //units in Newtons
levelarm=0.40    //nits in meters
tou=force*levelarm    //units in Newton meter
alpha=tou/I    //units in rad/sec^2
printf("Angular acceleration is alpha=%.3f rad/sec^2
   ",alpha)
```

Scilab code Exa 8.3 To find out how long does it take to accelerate and how far does wheel turn in this time and the rotational kinetic energy

```
//Example 8_3
clc();
clear;
//To find out how long does it take to accelerate
   and how far does wheel turn in this time and the
   rotational kinetic energy
force=8   //units in Newtons
arm=0.25    //units in meters
tou=force*arm    //units in Newton meter
m=80    //units in Kg
b=arm    //units in meters
I=0.5*m*b^2       //units in Kg meter^2
alpha=tou/I       //units in rad/sec^2
wf=4*%pi      //units in rad/sec
```

```
w0=0        //units in rad/sec
t=(wf-w0)/alpha //units in sec
printf("The time taken is t=%.1f sec\n",t)
theta=0.5*(wf+w0)*t  //units in radians
printf("The wheel goes a distance of theta=%.1f rad\
   n",theta)
KE=0.5*I*wf^2        //units in Joules
printf("The rotational kinetic energy is KE=%d
   Joules",KE)
```

Scilab code Exa 8.4 To find out the angular acceleration and the distance the object falls

```
//Example 8_4
clc();
clear;
//To find out the angular acceleration and the
   distance the object falls
f1=29.4    //units in Newtons
r1=0.75    //units in meters
m1=40    //units in Kgs
r2=0.6    //units in meters
m2=3    //units in Kgs
alpha=(f1*r1)/((m1*r2^2)+(m2*r1^2))            //
   units in rad/sec^2
printf("The angular acceleration is alpha=%.2f rad/
   sec^2\n",alpha)
a=r1*alpha    //units in meters/sec^2
t=10    //units in sec
y=0.5*a*t^2    //units in meters
printf("The objects goes a distance of y=%.1f meters
   ",y)
```

Scilab code Exa 8.5 To find the speed of the object

```
//Example 8_5
clc();
clear;
//To find the speed of the object
m=3  //units in Kg
g=9.8    //units in meters/sec^2
h=0.80     //units in meters
m1=3    //units in Kg
m2=14.4    //units in Kg
r=0.75    //units in meters
v=sqrt((m*g*h)/((0.5*m1)+((0.5*m2)/r^2)))
printf("The object is moving at v=%.2f meters/sec",v
   )
```

Scilab code Exa 8.6 o find out how fast is the sphere moving when it reaches the bottom

```
//Example 8_6
clc();
clear;
//To find out how fast is the sphere moving when it
   reaches the bottom
//We know that 0.5*m*(vf^2-v0^2)+0.5*I*(wf^2-w0^2)+m
   *g*(hf-h0)=0
//And v0=w0=0 and I=(2/5)*m*r^2
```

```
printf("The sphere is moving at a speed of Vf=sqrt
   ((10*g*h)/7)")
```

Scilab code Exa 8.7 To find the ratio of perihelion to that at aphelion

```
//Example 8_7
clc();
clear;
//To find the ratio of perihelion to that at
   aphelion
//We know that (Ip*Wp)=(Ia*Wa) as I=m*r^2
//(Wp/Wa)=(ra/rp)^2   as Vt=w*r
printf("The ratio of perihelion to that at aphelion
   is (Vp/Va)=(ra/rp)")
```

Scilab code Exa 8.8 To find out how long does the sun take to complete one revolution

```
//Example 8_8
clc();
clear;
//To find out how long does the sun take to complete
    one revolution
ra_rb=10^5
noofrev=1/25     //units in rev/day
wafter=(ra_rb)^2*(noofrev)
t=86400    //units in sec
time=t/wafter    //units in sec
```

```
printf("The sun would take for one revolution in
    time=")
disp(time)
printf("sec")
```

Scilab code Exa 8.9 To find out the rotational speed

```
//Example 8_9
clc();
clear;
//To find out the rotational speed
m=0.3    //units in Kg
r=0.035    //units in meters
Iw=0.5*m*r^2     //units in Kg meter^2
Ibt=8*10^-4     //units in Kg meter^2
w0=2    //units in rev/sec
wf=(Ibt*w0)/(Ibt+Iw)    //units in rev/sec
printf("The rotational speed is Wf=%.2f rev/sec",wf)
```

Chapter 9

Mechanical Properties of Matter

Scilab code Exa 9.1 To find its mass and how large a cube of ice has the same mass

```
//Example 9_1
clc();
clear;
//To find its mass and how large a cube of ice has
   the same mass
pu=18680    //units in Kg/meter^3
s=2*10^-2    //units in meters
vu=s^3    //units in meter^3
mu=pu*vu     //units in Kg
printf("Mass Mu=%.3f Kg\n",mu)
pi=920    //units in Kg/meter^3
vi=mu/pi    //units in meter^3
ss=vi^(1/3)*10^2    //units in cm
printf("Side length of ice cube is=%.2f cm",ss)
```

Scilab code Exa 9.2 To calculate the cross sectional area and how far the ball will stretch the wire

```
//Example 9_2
clc();
clear;
//To calculate the cross sectional area and how far
   the ball will stretch the wire
m=40   //units in Kg
g=9.8   //units in meter/sec^2
F=m*g   //units in Kg meter/sec^2
stress=0.48*10^8   //units in Newton/meter^2
A=F/stress   //units in meter^2
r=sqrt(A/%pi)*10^3   //units in mm
printf("The radius of the wire should be r=%.1f mm
   and the cross sectional area is A=",r)
disp(A)
printf("meter^2")
y=200*10^9    //units in Newton/meter^2
strain=stress/y
L0=15   //units in meters
deltaL=strain*L0   //units in meters
deltaL=deltaL*10^3    //units in mm
printf("\nThe ball stretches the wire a distance of
   deltaL=%.2f mm",deltaL)
```

Scilab code Exa 9.3 To find out how large a force on the piston is needed to balance it

```
//Example 9_3
clc();
clear;
//To find out how large a force on the piston is
   needed to balance it
printf("According to the pascals principal F2=A2*
   deltaP=((F1)*(A2/A1))")
```

Scilab code Exa 9.4 To find out the density of the oil

```
//Example 9_4
clc();
clear;
//To find out the density of the oil
printf("The density of the oil is Po=(Pw*(Hw/Ho)\n
   Where Pw=1000 Kg Meter^3 and we can evaluate Po
   once Hw and Ho are measured")
```

Scilab code Exa 9.5 To find the apparent weight when it is submerged in a fluid of density

```
//Example 9_5
clc();
clear;
//To find the apparent weight when it is submerged
   in a fluid of density
printf("The apparent weight of the object is Wapp=Mg
   -Mg*(Pf/p)=W*(1-(Pf/P))\n")
```

```
printf("As Wapp=0 and Pf=p the object has an
    apparent weight of Zero")
```

Scilab code Exa 9.6 To find wheter the crown is solid gold

```

//Example 9_6
clc();
clear;
//To find wheter the crown is solid gold
m=1.3       //units in Kg
g=9.8       //units in meter/Sec^2
W=m*g     //units in Kg meter/Sec^2
w1=1.14       //units in Kg
Wapp=w1*g          //units in Kg meter/Sec^2
Pf=1000 //units in Kg/meter^3
P=Pf*(W/(W-Wapp))  //units in Kg/meter^3

printf("Density of gold in given substance is P=%d
    Kg/Meter^3\n But the density of original gold is
    19,300 Kg / Meter^3 so the Crown is either hallow
     or made of something",P)
```

Scilab code Exa 9.7 To find out by what factor the blood flow in an artery is reduced

```
//Example 9_7
clc();
clear;
```

```
//To find out by what factor the blood flow in an artery is reduced
r1_r2=1/2  //The ratio by which the radius is altered in arterys
R1_R2=1/r1_r2^4          //Ratio by which flow is altered
printf("The flow rate is reduced by a factor of %d",R1_R2)
```

Scilab code Exa 9.8 To find out the speed by which water flows from spigot

```
//Example 9_8
clc();
clear;
//To find out the speed by which water flows from spigot
//From the Bernoulis Equation P1+(p*g*h)=P2+(0.5*p*V2^2)+(p*g*h2)
printf(" Solving from the Bernoulis equation V2=sqrt(2*g*(h1-h2))")
```

Scilab code Exa 9.9 To compare the pressures at A and at B

```

//Example 9_9
clc();
clear;
//To compare the pressures at A and at B
```

```
p=1000     //Units in Kg/Meter^3
va=0.2    //units in meters/sec
vb=2    //units in meters/sec
Pa_Pb=-0.5*p*(va^2-vb^2)     //units in Pa
printf("Pressure Difference at A and B is Pa-Pb=%d
    Pa therefore pressure at A is High than at B",
    Pa_Pb)
```

Scilab code Exa 9.10 To find out how fast a raindrop becomes turbulent

```
//Example 9_10
clc();
clear;
//To  find out how fast a raindrop becomes turbulent
Nr=10    //Number of molecules
n=1.9*10^-5    //Units in PI
p=1.29    //Units in Kg/Meter^3
d=3*10^-3    //Units in meters
vc=(Nr*n)/(p*d)     //units in meters/sec
printf("The speed of the rain drop is Vc=%.3f meters
    /sec",vc)
```

Scilab code Exa 9.11 To find out what horsepower is required

```
//Example 9_11
clc();
clear;
//To find out what horsepower is required
p=1.29   //Units in Kg/Meter^3
```

```
Cd=0.45
af=2    //Units in Meter^2
v=20    //Units in meters/sec
M=1000    //units in Kg
F=(0.5*p*Cd*af*v^2)+((M/1000)*((110+(1.1*v))))    //Units in Newtons
Power=F*v    //Units in Watts
Power=Power/747.3061       //units in Horse Power
reqHPower=Power^2    //unis in Horse power
printf("The required power is=%d hp",reqHPower)
//In text book the answer is printed wrong as 80 Hp the correct answer is 95Hp
```

Scilab code Exa 9.12 To find out the sedimentation rate of sphrical particles

```

//Example 9_12
clc();
clear;
//To find out the sedimentation rate of spherical particles
b=2*10^-3    //units in cm
g=9.8     //Units in meters/sec^2
n=1    //units in m PI
Pp_Pt=1050    //units in Kg/Meter^3
vt=(((2*b^2*g)/(9*n))/(2*Pp_Pt))*10^6       //units in cm/sec
printf("Sedimentation is vt=")
disp(vt)
printf("cm/sec")
//in text book answer  is printed wrong as vt=4.36*10^-3 cm/sec but the correct answer is vt
```

```
=4.14*10^-3 cm/sec
```

Chapter 10

Gases and the Kinetic Theory

Scilab code Exa 10.1 To find out the pressure in Lungs

```
 //Example 10_1
clc();
clear;
//To find out the pressure in Lungs
h=6    //units in cm Hg
Pa=76     //Units in cm Hg
Pl=(h+Pa)        //units in cm Hg

Pl=Pl*10^-2    //units in Meters Hg
g=9.8     //Units in Meters/cm^2
H=13600    //Constant
Pl=Pl*H*g    //Units in Pa
printf("The pressure in the lungs is Pl=%.1f Pa",Pl)
```

Scilab code Exa 10.2 To find the mass of copper atom

```
//Example 10_2
clc();
clear;
//To find the mass of copper atom
maa=63.5     //Units in Kgs
n=6.022*10^26     //Units in number of atoms
Mass=maa/n      //units in Kg/atom
printf("The Mass per atom is=")
disp(Mass)
printf("Kg/Atom")
```

Scilab code Exa 10.3 To find the volume associated with mercury atom in liquid mercury

```

//Example 10_3
clc();
clear;
//To find te volume associated with mercury atom in
    liquid mercury
M=201    //Units in Kg/Kmol
n=6.02*10^26    //units in K mol^-2
mo=M/n     //units in Kg
n1=13600     //units in Kg/Meter^3
noatoms=n1/mo     //units in atoms/Meter^3
volume_atom=1/noatoms      //units in Meter^3/Atom
printf("The volume associated is ")
disp(volume_atom)
printf("Meter^3/Atom")
```

Scilab code Exa 10.4 To find the volume that one kilomole of an ideal gas occupies

```
//Example 10_4
clc();
clear;
//To find the volume that one kilomole of an ideal
   gas occupies
p=1.013*10^5   //units in Pa
t=273.15    //units in K
n=1  //units in K mol
R=8314    //units in J/Kmol K
v=(n*R*t)/p    //units in Meter^3/Kmol
printf("Volume occupied is V=%.1f Meter^3/Kmol",v)
```

Scilab code Exa 10.5 To find the gas pressure in the container

```
//Example 10_5
clc();
clear;
//To find the gas pressure in the container
v=5*10^-3   //units in meter^3
t=300    //units in K
m1=14*10^-6 //Units in Kg
M=28  //Units in Kg/Kmol
n=m1/M  //units in K mol
R=8314    //units in J/Kmol K
p=(n*R*t)/v    //units in Meter^3/Kmol
```

```
printf("The pressure in the container is P=%d Pa",p)
```

Scilab code Exa 10.6 To determine the mass of the air in flask

```
//Example 10_6
clc();
clear;
//To determine the mass of the air in flask
p=1.013*10^5    //Units in Pa
v=50*10^-6    //Units in meter^3
M=28     //Units in Kg/Mol
R=8314     //units in J/Kmol K
T=293     //units in K
m=(p*v*M)/(R*T)     //Units in Kg
printf("The mass of air in flask is=")
disp(m)
printf("Kg")
```

Scilab code Exa 10.7 To find out the final pressure in the drum

```
//Example 10_7
clc();
clear;
//To find out the final pressure in the drum
p1=1     //Units in atm
t2=333     //units in K
t1=293     //units in K
p2=p1*(t2/t1)    //units in atm
```

```
printf("The final pressure in the drum is P2=%.2f
   atm",p2)
```

Scilab code Exa 10.8 To find the final volume of gas

```
//Example 10_8
clc();
clear;
//To find the final volume of gas

t1=27    //Units in Centigrade
t1=t1+273     //Units in Kelvin
t2=547    //Units in Centigrade
t2=t2+273     //Units in Kelvin
t1=27    //Units in Centigrade
t1=t1+273     //Units in Kelvin
t1=27    //Units in Centigrade
t1=t1+273     //Units in Kelvin
p2=3700     //units in cm Hg
p1=74      //units in cm Hg
v1_v2=1/((t1/t2)*(p2/p1))      //In terms of V1
printf("The final volume of gas in terms of original
    volume is V2=%.5f*V1",v1_v2)
```

Scilab code Exa 10.9 To find the pressure after the car has been driven at high speed

```
//Example 10_9
clc();
```

```
clear;
//To find the pressure after the car has been driven
    at high speed
t2=308     //Units in K
t1=273     //Units in K
p2_p1=(t2)/t1      //In terms of P1
P1=190           //Units in K Pa
P2=101             //Units in K Pa
P2=p2_p1*(P1+P2)     //Units in K Pa
printf("The Final pressure is P2=%d K Pa",round(P2))
//In text book the answer is printed wrong as P2=329
    K Pa but the correct answer is 328 K Pa
```

Scilab code Exa 10.10 To findout how fast the nitrogen molecule moving in air

```
//Example 10_10
clc();
clear;
//To findout how fast the nitrogen molecule moving
    in air
M=28      //Units in Kg/Mol
Na=6.02*10^26     //Units in K mol^-1
mo=M/Na    //Units in Kg
k=1.38*10^-23     //units in J/K
T=27+273     //Units in K
v2=(3*k*T)/mo     //unit in Meter^2/Sec^2
v=sqrt(v2)      //Units in meter/sec
printf("The nitrogen molecule goes at a speed of V=
    %d meter/sec",v)
//In text book the answer is printed wrong as v=517
    m/sec the correct answer is v=516 meter/ sec
```

Chapter 11

Thermal Properties of Matter

Scilab code Exa 11.1 To find out how much heat is required to change the temperature

```
//Example 11_1
clc();
clear;
//To find out how much heat is required to change
   the temperature
//With 400 Grams of water
c=1     //units in cal/g Centigrade
m=400    //Units in gm
t=5      //Units in centigrade
q=c*m*t     //Units in Cal
printf("The heat required for 400 gm of water is Q=
   %d Cal\n",q)
//With 400 grams of copper
c=0.093     //units in cal/g Centigrade
m=400    //Units in gm
t=-5      //Units in centigrade
q=c*m*t     //Units in Cal
printf("The heat required for 400 gm of copper is Q=
   %d Cal\n",q)
```

Scilab code Exa 11.2 To findout how much water is released

```
//Example 11_2
clc();
clear;
//To findout how much water is released
//When it crystallizes
m=50     //Units in gm
h=80     //Units in Cal/gm
q=m*h     //Units in Cal
printf("When it crystallizes heat required is Q=%d
    Cal\n",q)
//When it Condenses
m=50     //Units in gm
h=539     //Units in Cal/gm
q=m*h     //Units in Cal
printf("When it condenses heat required is Q=%d Cal\
    n",q)
//In textbook answer is printed wrong as Q=27000 cal
     but the correct answer is Q=26950 Cal
```

Scilab code Exa 11.3 To findout the amount of Ice that has to be added

```
//Example 11_3
clc();
clear;
//To findout the amount of Ice that has to be added
m=200     //Units in gm
```

```
c=1        //Units in Cal/gm Centigrade
tf=60      //Units in Centigrade
to=98      //Units in Centigrade
change=m*c*(tf-to)      //units in Cal
tf=60 //Units in centigrade
to=0     //Units in centigrade
Hf=80      //Units in Cal/gm
change1=Hf+c*(tf-to)      //Units in Cal/gm
M=change/-(change1)
printf("The amount of ice that has to be added is M=
   %.1f gm",M)
```

Scilab code Exa 11.4 To findout the specific heat capacity of the metal

```
//Example 11_4
clc();
clear;
//To findout the specific heat capacity of the metal
m=400       //Units in gm
c=0.65        //Units in Cal/gm Centigrade
tf=23.1       //Units in Centigrade
to=18       //Units in Centigrade
oil=m*c*(tf-to)        //units in cal
m1=80       //Units in gm
tf=23.1       //Units in Centigrade
to=100      //Units in Centigrade
cm=m1*(tf-to)        //units in in terms of cm and gm
    Centigrade
cmm=oil/-cm           //Units in Cal/gm Centigrade
printf("The specific heat of metal is Cm=%.3f cal/gm
    C",cmm)
```

Scilab code Exa 11.5 To findout how long does the heater takes to heat

```
//Example 11_5
clc();
clear;
//To findout how long does the heater takes to heat
m=500       //Units in gm
c=0.033        //Units in Cal/gm Centigrade
tf=357      //Units in Centigrade
to=20      //Units in Centigrade
m1=30        //Units in gm
hv=65      //Units in cal/gm
Hg=((m*c*(tf-to))+(m1*hv))*4.1808135       //units
   in Joules
delivered=70      //Units in Joule/Sec
t=Hg/delivered     //Units in sec
printf("The time taken is t=%d sec",t)
//In textbook answer printed wrong as t=450 sec
   correct answer is t=448 sec
```

Scilab code Exa 11.6 To findout the rise in temperature

```
//Example 11_6
clc();
clear;
//To findout the rise in temperature
m=0.01    //Units in Kg
v=100        //Units in meters/sec
```

```
KE=(0.5*m*v^2)/4.1808135       //units in Cal
m=10     //units in gm
c=0.031 //units in cal/gm Centigrade
t=KE/(m*c)
printf("the rise in temperature is DeltaT=%.1f C",t)
```

Scilab code Exa 11.7 To estimate ho much energy a human body gives off

```
//Example 11_7
clc();
clear;
//To estimate ho much energy a human body gives off
printf("The amount of Heat generated is of order of
   2*10^6 cal")
```

Scilab code Exa 11.8 To findout how much longer is at 35 degrees

```
//Example 11_8
clc();
clear;
//To findout how much longer is at 35 degrees
alpha=10*10^-6 //Units in Centigrade
dist=20 //Unis in meters
t=50     //Units in centigrade
L=alpha*dist*t       //Units in meters
printf("The slab is longer by=%.3f meters",L)
```

Scilab code Exa 11.9 To findout how large a diameter when the sheet is heated

```
//Example 11_9
clc();
clear;
//To findout how large a diameter  when the sheet is
    heated
dist=2       //Units in cm
delta=19*10^-6       //Units in Centigrade^-1
t=200      //Units in centigrade
L=dist*delta*t          //Units in cm
printf("The new diameter of the hole is=%.4f cm",2+L
   )
```

Scilab code Exa 11.10 To findout the change in benzene volume

```
//Example 11_10
clc();
clear;
//To findout the change in benzene volume
delta=1.24*10^-3      //Units in Centigrade^-1
t=10      //Units in Centigrade
v10=100        //Units in cm^3
v20=delta*t+v10      //Units in cm^3
V=v20*delta*t    //Units in cm^3
v30=V+v20    //Units in cm^3
```

```
printf("The change in benzene volume is V30=%.3f cm^3",v30)
  //In textbook the answer is printed wrng as V3=0102.5 cm^3 the correct answer is V3=101.253 cm^3
```

Scilab code Exa 11.11 To findout how much ice melts each hour

```
//Example 11_11
clc();
clear;
//To findout how much ice melts each hour
s=30     //Units in cm
a=s*s*10^-4     //units in meter^2
k=0.032    //Units in W/K meter
t=25   //Units in K
l=0.040         //Units in meters
q_t=(6*k*((a*t)/l))/4.1808135     //Units in cal/sec
Q=3600*q_t     //Units in cal
qq=80     //Units in cal/gm
melted=Q/qq       //Units in gm
printf("The ice melts by %d gm",melted)
```

Scilab code Exa 11.12 To compare the energy emitted per unit area of our body to with the same emissivity

```
//Example 11_12
clc();
clear;
```

```
//To compare the energy emitted per unit area of our
    body to with the same emissivity
t1=37    //Units in Centigrade
t1=273+t1       //Units in K
t2=15    //Units in Centigrade
t2=273+t2       //Units in K
tb_tc=(t1/t2)^4       //Units in terms of (Tb/Tc)^4
tb_tc=tb_tc*100       //In terms of percentage
printf("The radiation defers by %d percent",tb_tc
   -100)

//In textbook answer is printed wrong as 40% the
   correct answer is 34%
```

Scilab code Exa 11.13 To findout how much heat is lost through it

```
//Example 11_13
clc();
clear;
//To findout how much heat is lost through it
a=15    //Unis in meter^2
t=30     //Units in K
R=2.2 //Units in Meter^2 K/W
q_t=(a*t)/R     //Units in W
T=3600      //Units in sec
Q=q_t*T        //Units in J
printf("The amount of hea lost is Q=%.1f J",Q)
```

Chapter 12

Thermodynamics

Scilab code Exa 12.1 To find the work done by the gas

```
//Example 12_1
clc();
clear;
//To find the work done by the gas
d1=800          //Units in meter^3
d2=500          //Units in meter^3
p1=5*10^5      //Units in Pa
w1=p1*(d1-d2)*10^-6    //Units in J
p2=2*10^5      //Units in Pa
d3=200*10^-6      //Units in meter^3
p3=3*10^5       //Units in Pa
w2=(p2*d3)+(0.5*p3*d3)      //Units in J
printf("The work done by the gas is=%d J",-(w1+w2))
```

Scilab code Exa 12.2 To estimate the Cv of nitric acid

```
//Example 12_2
```

```
clc();
clear;
//To estimate the Cv of nitric acid
r=8314        //Units in J/Kmol K
m=30        //Units in Kg/Kmol
Cv=2.5*(r/m)        //Units in J/Kg K
printf("The estimated Cv value of nitric acid is Cv=
    %d J/Kg K",Cv)
//in textbook the answer is printed wrong as Cv=690
    J/Kg K correct answer is 692 J/Kg K
```

Scilab code Exa 12.3 To find the final temperature

```

//Example 12_3
clc();
clear;
//To find the final temperature
t1=27     //units in Centigrade
t1=t1+273 //Units in K
gama=1.4   //Units in Constant
p1=1       //units in Pa
v1_v2=15    //Units of in ratio
logT2=log10(t1)-((gama-1)*(log10(p1)-log10(v1_v2)))
T2=10^logT2                  //Units in K
printf("The final temperature is T2=%d K",T2)
```

Scilab code Exa 12.4 To describe the Temperature changes of the gas

```
//Example 12_4
clc();
clear;
//To describe the Temperature changes of the gas
printf("This type of process is termed as throttling
    process and described by the equation Delta U=-
   Delta W\n")
printf("Where Delta W is the work done")
```

Scilab code Exa 12.5 To findout by how much the entropy of the system changes

```
//Example 12_5
clc();
clear;
//To findout by how much the entropy of the system
   changes
m=20        //Units in gm
alpha=80     //Units in cal/gm
t=4.184               //Units in J/Cal
Q=m*alpha*t       //Units in J
T=273       //Units in K
S=Q/T         //Units in J/K
printf("The entropy is Delta S=%.1f J/K",S)
```

Scilab code Exa 12.6 To findout how much electricity is needed

```
//Example 12_6
clc();
```

```
clear;
//To findout how much electricity is needed
Tc=278          //Units in K
Th=293        //Units in K
COP=Tc/(Th-Tc)           //Units in ratio
Qc=210000           //Units in J
W=Qc/COP                    //Units in J
printf("The amount of Electricity is required is
   Delta W=%d J",W)
```

Chapter 13

Vibration and waves

Scilab code Exa 13.1 To find the maximum velocity and acceleration and the same when x is 10cm

```
//Example 13_1
clc();
clear;
//To find the maximum velocity and acceleration and the same when x=10cm
xo=0.4      //Units in Meters
k=24.5        //Units in N/M
m=2              //Units in Kg
vmax=xo*(sqrt(k/m))         //Units in meters/sec
printf("Maximum velocity is Vmax=%.1f Meter/sec\n",vmax)
amax=(k*xo)/m               //Units in meter/sec^2
printf("Maximum acceleration is Amax=%.1f meter/sec^2\n",amax)
x=0.1             //Units in meters
v=sqrt((k/m)*(xo^2-x^2))         //Units in meters/Sec
printf("Velocity at x=0.1 meters is= %.2f meters/sec\n",v)
a=-(k*x)/m //Units in meter/sec^2
```

```
printf("Acceleration at x=0.1 meters is= %.2f meters
    /sec^2\n",a)
```

Scilab code Exa 13.2 To find the frequency of the vibrations

```
//Example 13_2
clc();
clear;
//To find the frequency of the vibrations
spring=24.5        //Units in N/m
m=2       //Units in Kg
f=(1/(2*%pi))*sqrt(spring/m)         //Units in Hz
printf("The frequency of vibrations is f=%.2f Hz",f)
```

Scilab code Exa 13.3 To find the tension required in string

```
//Example 13_3
clc();
clear;
//To find the tension required in string
m=0.002          //Units in Kg
l=0.6          //Units in meters
v=300      //Units in meters/sec
T=(m/l)*v^2      //Units in N
printf("Tension required in the string is T=%d N",T)
```

Scilab code Exa 13.4 To draw a picture on the first three resonance frequencies

```
//Example 13_4
clc();
clear;
//To draw a picture on the first three resonance
   frequencies
l=6       //Units in meters
n=1
lamda1=(2*l)/n       //Units in meters
n=2
lamda2=(2*l)/n       //Units in meters
n=3
lamda3=(2*l)/n       //Units in meters
speed=24        //Units in meters/sec
f1=speed/lamda1            //Units in Hz
f2=speed/lamda2            //Units in Hz
f3=speed/lamda3            //Units in Hz
printf("The first resonance frequency is F1=%d Hz\n"
   ,f1)
printf("The second resonance frequency is F2=%d Hz\n
   ",f2)
printf("The third resonance frequency is F3=%d Hz\n"
   ,f3)
```

Scilab code Exa 13.5 To find the speed of the wave

```
//Example 13_5
clc();
clear;
//To find the speed of the wave
l=300*10^-2      //Units in Meters
lamda3=(l*2)/3      //Units in meters
f=20        //Units in sec^-1 or Hz
v=f*lamda3        //Units in meters/sec
printf("The speed of the wave is v=%d meters/sec",v)
```

Scilab code Exa 13.6 To find the youngs modulus

```
//Example 13_6
clc();
clear;
//To find the youngs modulus
lamda=1.85     //Units in meters
f=2700      //units in sec^-1
v=lamda*f       //Units in meters/sec
density=7.86*10^3       //Units in Kg/meter^3
y=v^2*density    //Units in N/meters^2
printf("The youngs modulus is Y=")
disp(y)
printf("N/meters^2")
```

Chapter 14

Sound

Scilab code Exa 14.1 To find the speed of sound in neon

```
//Example 14_1
clc();
clear;
//To find the speed of sound in neon
gama=1.66        //units in Constant
r=8314       //Units in J/Kmol
t=273        //Units in K
m=20.18   //Units in Kg/Kmol
v=sqrt((gama*r*t)/m)       //Units in meters/sec
printf("The speed of the sound in neon is v=%d
   meters/sec",v)
```

Scilab code Exa 14.2 To find the sound level of a sound wave

```
//Example 14_2
clc();
clear;
```

```
//To find the sound level of a sound wave
i1=10^-5     //Units in W/meter^2
i2=10^-12     //Units in W/meter^2
level=10*log10(i1/i2)    //units in dB
printf("The sound level of the sound wave is=%d dB",
   level)
```

Scilab code Exa 14.3 To find the intensity of sound

```
//Example 14_3
clc();
clear;
//To find the intensity of sound
level=3.5 //Units in dB
i2=10^-12  //Units in W/meter^2
i=10^(level+log10(i2))   //Units in W/meter^2
printf("The intensity of sound is I=")
disp(i)
printf("W/meter^2")
```

Scilab code Exa 14.4 To find how far it has to be moved before the sound becomes weak

```
//Example 14_4
clc();
clear;
//To find how far it has to be moved before the
   sound becomes weak
lamda=70 //units in cm
```

```
lamda1=0.5*lamda    //Units in cm
printf("The distance it has to be moved is=%d cm",
    lamda1)
```

Scilab code Exa 14.5 To find the frequency heard and the receding

```
//Example 14_5
clc();
clear;
//To find the frequency heard and the receding
f=500  //Units in Hz
vw=340      //Units in meters/sec
dist=20     //Units in meters/sec
f1=f*(vw/(vw-dist))   //Units in Hz
printf("The frequency we hear is f=%d Hz\n",f1)
f1=f*(vw/(vw+dist))   //Units in Hz
printf("The frequency of the receding is f=%d Hz\n",
    f1)
```

Scilab code Exa 14.6 To find the difference between the frequency of wave reaching the officer and the car

```
//Example 14_6
clc();
clear;
//To find the difference between the frequency of
    wave reaching the officer and the car
fo=10^10       //Units in Hz
vw=3*10^8        //Units in meters/sec
```

```
vc=25    //Units in meters/sec
f1=fo*((vw+vc)/(vw-vc))        //Units in Hz
f1=f1-10^10         //Units in Hertz
printf("The difference between the both frequencies
   is=%d Hz",f1)
//In text book answer printed wrong as 1670 Hz
   correct answer is 1666 Hz
```

Chapter 15

Electric Forces and Fields

Scilab code Exa 15.1 To find the value of q and how many electrons must be removed and f

```
//Example 15_1
clc();
clear;
//To find the value of q and how many electrons must
   be removed and fraction of atoms lost
dist=2      //Units in meters
f=0.0294    //Units in N
s=9*10^9 //Units in N meter^2/C^2
q=sqrt((dist^2*f)/s)  //Units in C
printf("The value of q is=%.8f C\n",q)
charge=3.61*10^-6 //Units in C
c_elec=1.6*10^-19     //Units in C
n=charge/c_elec   //Units in number
printf("Number of electrons to be removed is=")
disp(n)
f1=3*10^22   //Units in number
fraction=n/f1   //Units of number
printf("Fraction of atoms lost is=")
disp(fraction)
```

Scilab code Exa 15.2 To find the force on the center charge

```
//Example 15_2
clc();
clear;
//To find the force on the center charge
k=9*10^9     //Units in N meter^2/C^2
q1=4*10^-6     //Units in C
q2=5*10^-6    //Units in C
r1=2           //Units in meters
r2=4       //Units in meters
q3=6*10^-6      //Units in C
f1=(k*q1*q2)/r1^2        //Units in N
f2=(k*q2*q3)/r2^2        //Units in N
f=f1-f2        //Units in C
printf("The force on the center charge is=%.5f N",f)
```

Scilab code Exa 15.3 To find the resultant force

```
//Example 15_3
clc();
clear;
//To find the resultant force
f1=6 //Units in N
f2=18      //Units in N
f=sqrt(f1^2+f2^2) //Units in N
theta=atan(f2/f1)*180/%pi  //Units in degrees
```

```
printf("The resultant force is f=%d N \n The resultant angle is theta=%.1f degrees",f,theta)
//In text book answer printed wrong as f=19 N correct answer is f=18N
```

Scilab code Exa 15.4 To find the resultant force on 20 micro C

```
//Example 15_4
clc();
clear;
//To find the resultant force on 20 micro C
f1=2 //Units in N
f2=1.8      //Units in N
theta=37        //Units in degrees
f2x=f2*cos(theta*%pi/180)       //Units in N
f2y=f2*sin(theta*%pi/180)       //Units in N
fy=f1+f2y      //Units in N
f=sqrt(fy^2+f2x^2) //Units in N
theta=atan(fy/f2x)*180/%pi   //Unitsta in degrees
printf("The resultant force is f=%.1f N \n The resultant angle is theta=%.1f degrees",f,theta)
```

Scilab code Exa 15.6 To find the electrical field strength

```

//Example 15_6
clc();
clear;
//To find the magnitude of E
```

```
k=9*10^9     //Units in N meter^2/C^2
q=3.6*10^-6       //Units in C
theta=37           //Units in degrees
r=10*sin(theta*%pi/180)*10^-2     //Units in meters
e1=(k*q)/r^2      //Units in N/C
q2=5*10^-6       //Units in C
theta=37           //Units in degrees
r1=10*10^-2 //Units in meters
e2=(k*q2)/r1^2      //Units in N/C
e1y=e1          //Units in N/C
e2x=e2*cos(theta*%pi/180)     //Units in N/C
e2y=-e2*sin(theta*%pi/180) //Units in N/C
ex=e2x       //Units in N/C
ey=e1y+e2y          //Units in N/C
e=sqrt(ex^2+ey^2)          //Units in N/C
printf("The magnitude of E is=")
disp(e)
printf("N/C")
//In text book the answer is printed wrong as E
   =7.26*10^6 N/C but the correct answer is E
   =7198876.9 N/C
```

Scilab code Exa 15.7 To find out how much charge occurs

```

//Example 15_7
clc();
clear;
//To find out how much charge occurs
e=3*10^6     //Units in N/C
r=0.050     //Units in meters
k=9*10^9 //Units in N meter^2/C^2
q=(e*r^2)/k      //Units in C
```

```
printf("The charge Occurred is q=%.9f C",q)
```

Scilab code Exa 15.8 To show using lines of force that a charge suspended with in cavity induces an equal and opposite charge on surface

```
//Example 15_8
clc();
clear;
//To show using lines of force that a charge suspended with in cavity induces an equal and opposite charge on surface
printf("Lines of force come out of positive charge q suspended in cavity.\nCavity \nsurface must possess a negative charge since lines of force go and terminate on q.\nTherefore a charge +q must exist on outer portions.")
```

Scilab code Exa 15.9 To find the speed just before the field strikes

```

//Example 15_9
clc();
clear;
//To find the speed just before the field strikes
e=6000    //Units in N/C
q=1.6*10^-19   //Units in C
f=e*q          //Units in N
m=1.67*10^-27        //Units in Kg
a=f/m      //Units in meters/sec^2
```

```
vo=0      //Units in meters/sec
x=2*10^-3       //Units in meters
v=sqrt(vo^2+(2*a*x))         //Units in meters/sec
printf("The field goes by a speed of %d meters/sec",
    v   )
//In text book answer printed wrong as v=48000
    meters/sec the correct answer is v=47952 meters/
    sec
```

Chapter 16

Electric Potential

Scilab code Exa 16.1 To find the magnitude of the electric field

```
//Example 16_1
clc();
clear;
//To find the magnitude of the electric field
v=12        //Units in V
d=5*10^-3        //units in Meters
e=v/d           //Units in V/meter
printf("The magnitude of electric field is E=%d V/
   meters",e)
```

Scilab code Exa 16.2 To calculate the speed of the proton

```
//Example 16_2
clc();
clear;
//To calculate the speed of the proton
q=1.6*10^-19     //Units in C
```

```
vab=45     //Units in V
m=1.67*10^-27       //Units in Kg
va=sqrt((2*q*vab)/m)      //Units in meters/sec
printf("The speed of the proton is Vab=%.2f meters/sec",va)
```

Scilab code Exa 16.3 To find the speed of an electron

```

//Example 16_3
clc();
clear;
//To find the speed of an electron
e=1.6*10^-19     //Units in C
vab=45     //Units in V
m=9.11*10^-31       //Units in Kg
va=sqrt((2*e*vab)/m)      //Units in meters/sec
printf("The speed of the electron is Vab=%.2f meters/sec",va)
```

Scilab code Exa 16.5 To find the work done in carrying a proton and for an electron

```
//Example 16_5
clc();
clear;
//To find the work done in carrying a proton and for an electron
q=1.6*10^-19 //Units in C
```

```
vab=9              //Units in V
work=q*vab         //Units in J
printf("The work done in carrying proton is=")
disp(work)
printf("Joules\n")
q=-1.6*10^-19 //Units in C
work=q*vab         //Units in J
printf("The work done in carrying electron is=")
disp(work)
printf("Joules\n")
```

Scilab code Exa 16.6 To calculate the speed just before it strikes it

```

//Example 16_6
clc();
clear;
//To calculate the speed just before it strikes it
va=8*10^6          //Units in meters/sec
q=1.6*10^-19           //Units in C
m=1.67*10^-27          //Units in Kg
vab=20000 //Units in V
vb=sqrt(va^2-((2*q*vab)/m))          //Units in meters/
   sec
printf("The speed of proton before it strikes is Vb=
   %.1f meters/sec",vb)
```

Scilab code Exa 16.7 To calculate the minimum value of Vab needed

```
//Example 16_7
clc();
clear;
//To calculate the minimum value of Vab needed
printf("Since each proton has a minimum energy of
   13.6 eV and a charge of 1.602*10^-19 C\n The
   required potential difference is=13.6 eV")
```

Scilab code Exa 16.8 To find out the speed of the proton

```
//Example 16_8
clc();
clear;
//To find out the speed of the proton
k=9*10^9          //Units in N meter^2/C^2
q=5*10^-6 //Units in C
r=0.5         //Units in meters
v1=(k*q)/r    //Units in V
q=1.6*10^-19          //Units in V
m=1.672*10^-27          //Units in Kg
v=sqrt((v1*q*2)/m)    //Units in V
printf("The speed of electron is v=%.2f meters/sec",
   v)
```

Scilab code Exa 16.9 To compute the absolute potential at B

```
//Example 16_9
clc();
clear;
```

```
//To compute the absolute potential at B
k=9*10^9          //Units in N meter^2/C^2
q=5*10^-8 //Units in C
r=0.1         //Units in meters
v1=(k*q)/r    //Units in V
q=8*10^-8 //Units in C
r=0.1         //Units in meters
v2=(k*q)/r    //Units in V
q=40*10^-8 //Units in C
r=0.2         //Units in meters
v3=-(k*q)/r    //Units in V
vb=v1+v2+v3            //Units in V
printf("Due to 5*10^-8 C V1=%d V\nDue to 8*10^-8 C
   V2=%d V\nDue to 40*10^-8 C V3=%d V\n Absolute
   potential at B is Vb=%d V",v1,v2,v3,vb)
```

Scilab code Exa 16.10 To find the absolute potential and how much energy is needed to pull the electrons from atom

```
//Example 16_10
clc();
clear;
//To find the absolute potential and how much energy
    is needed to pull the electrons from atom
k=9*10^9          //Units in N meter^2/C^2
q=1.6*10^-19 //Units in C
r=5.3*10^-11        //Units in meters
v=(k*q)/r    //Units in V
printf("The absolute potential is V=%.1f V\n",v)
Vinfinity=0              //Units in V
deltaV=Vinfinity-v          //Units in V
work=-q*deltaV            //Units in J
printf("The energy that is required is W=")
```

```
disp(work)
printf("J")
```

Chapter 17

DC Circuits

Scilab code Exa 17.1 To find number of electrons flow through bulb

```
//Example 17_1
clc();
clear;
//To find number of electrons flow through bulb
current=0.15          //Units in C
q=1.6*10^-19           //Units in C/electron
noe=current/q          //Units in number of Electrons
printf("The number of electrons that pass through
    bulb is=")
disp(noe)
printf("electrons")
```

Scilab code Exa 17.2 To find the resistance in bulb

```
//Example 17_2
clc();
clear;
```

```
//To find the resistance in bulb
v=1.55      //Units in V
i=0.08          //Units in A
r=v/i     //Units in Ohms
printf("The resistance in bulb is=%.1f Ohms",r)
```

Scilab code Exa 17.3 To find the resistance in wire

```
//Example 17_3
clc();
clear;
//To find the resistance in wire
row=1.7*10^-8       //Units in Ohm meter
l=40      //Units in meters
a=0.0331*10^-4        //Units in meters^2
r=(row*l)/a          //Units in Ohms
printf("The resistance in wire is=%.3f Ohms",r)
```

Scilab code Exa 17.4 To find the appropriate resistance of the wire

```
//Example 17_4
clc();
clear;
//To find the appropriate resistance of the wire
alpha=0.0045          //Units in Centigrade^-1
t=1780            //Units in Centigrade
deltaR=240      //Units in Ohms
ro=deltaR/(1+(alpha*t))      //Units in ohms
```

```
printf("The appropriate resistance in wire is Ro=%.1
   f Ohms",ro)
```

Scilab code Exa 17.5 To find out the amount of heat developed in bulb

```
//Example 17_5
clc();
clear;
//To find out the amount of heat developed in bulb
t=20*60        //Units in sec
pow=40    //Units in W
heat=t*pow     //Units in J
printf("Heat generated in bulb is=%d J",heat)
```

Scilab code Exa 17.6 To calculate the cost needed to operate

```
//Example 17_6
clc();
clear;
//To calculate the cost needed to operate
power=0.7       //Units in KW
time=0.5        //Units in h
heat=power*time   //Units in K Wh
cost=0.10        //Units in Dollars
tcost=cost*heat       //Units in Dollars
printf("Cost needed to operate is=%.4f Dollars",
   tcost)
```

Scilab code Exa 17.7 To find the current in circuit

```
//Example 17_7
clc();
clear;
//To find the current in circuit
v1=3      //Units in V
v2=12 //Units in V
r1=5     //Units in Ohms
r2=6  //Units in Ohms
i=(v1-v2)/(r1+r2)       //Units in A
printf("The current in circuit is I=%.2f A",i)
```

Scilab code Exa 17.8 To find the current in all wires

```
//Example 17_8
clc();
clear;
//To find the current in all wires
v=9  //Units in V
r1=18    //Units in Ohms
i2=-v/r1       //Units in A
v1=6     //Units in V
r2=12      //Units in Ohms
i3=(v+v1)/r2           //Units in A
i1=i3-i2      //Units in A
printf("Current in wire 1 is I1=%.2f A\nCurrent in
   wire 2 is I2=%.2f A\nCurrent in wire 3 is I3=%.2f
```

```
A\n",i1,i2,i3)
```

Scilab code Exa 17.9 To find the current I in the battery

```
//Example 17_9
clc();
clear;
//To find the current I in the battery
r1=3  //Units in Ohms
r2=6    //Units in Ohms
rbc=(r1*r2)/(r1+r2) //Units in Ohms
r3=4 //Units in Ohms
rac=r3+rbc          //Units in Ohms
v=12     //Units in V
i=v/rac         //Units in A
printf("The current I=%d A",i)
```

Scilab code Exa 17.10 To find the current in battery

```
//Example 17_10
clc();
clear;
//To find the current in battery
r1=3  //Units in Ohms
r2=6    //Units in Ohms
ra=(r1*r2)/(r1+r2) //Units in Ohms
r3=2          //Units in Ohms
r4=4     //Units in Ohms
rb=r3+r4        //Units in Ohms
```

```
r5=6                //Units in Ohms
rc=(r5*rb)/(r5+rb)     //Units in Ohms
r6=9                 //Units in Ohms
r=r6+rc                //Units in Ohms
v=6                    //Units in V
i=v/r                     //Units in Ohms
printf("The current in battery is I=%.2f A",i)
```

Scilab code Exa 17.11 To find the current in the wires

```
//Example 17_11
clc();
clear;
//To find the current in the wires
v1=12              //Units in V
r3=20           //Units in Ohms
v2=6            //Units in V
r2=10         //Units in Ohms
r1=5       //Units in Ohms
i3=((v1*r3)-(v2*r1))/((r2*r3)+(r1*r3)+(r1*r2))           //Units in A
i2=((r2*i3)+v2)/r3                //Units in A
i1=i3+i2              //Units in A
printf("Current in wire 1 is I1=%.1f A\nCurrent in wire 2 is I2=%.1f A\nCurrent in wire 3 is I3=%.1f A\n",i1,i2,i3)
```

Scilab code Exa 17.12 To find I1 I2 and I3 in the circuit

```
//Example 17_12
clc();
clear;
//To find I1, I2 and I3 in the circuit
v1=40          //Units in V
r1=10              //Units in Ohms
r2=30              //Units in Ohms
v2=60      //Units in V
r3=15          //Units in Ohms
v3=50          //Units in V
i1=((-v1*r2)+(-r3*v1)+(60*r3)+(v3*r2))/((r1*r2)+(r2*
    r3)+(r3*r1))      //Units in A
i=2             //Units in A
i2=(i-i1)/3           //Units in A
i3=i2-i1          //Units in A
printf("Current in wire 1 is I1=%.3f A\nCurrent in
    wire 2 is I2=%.3f A\nCurrent in wire 3 is I3=%.3f
     A\n",i1,i2,i3)
```

Scilab code Exa 17.13 To find the values of e R and I

```
//Example 17_13
clc();
clear;
//To find the values of e, R and I
i1=2          //Units in A
i2=0.5            //Units in A
i=i1+i2       //Units in A
v1=6   //Units in V
v2=16           //Units in V
r=-(v1-v2)/0.5          //Units in Ohms
v3=25       //Units in V
e=v2+v3             //Units in V
```

```
printf("The current I=%.1f A\n Resistance is R=%d
   Ohms\n The value E is=%d V",i,r,e)
```

Scilab code Exa 17.14 To find the I1 I2 I3 values and charge on the capacitor

```
//Example 17_14
clc();
clear;
//To find the I1,I2,I3 values and charge on the
   capacitor
v1=12       //Units in V
r1=6       //Units in Ohms
i1=v1/r1       //Units in A
v2=4         //Units in V
r2=8        //Units in Ohms
i3=(v1+v2)/r2          //Units in A
i2=i1+i3             //Units in A
printf("Current in wire 1 is I1=%d A\nCurrent in
   wire 2 is I2=%d A\nCurrent in wire 3 is I3=%d A\n
   ",i1,i2,i3)
v3=10                    //Units in V
vfg=-v3+(r1*i1)            //Units in V
c=5*10^-6                  //Units in F
q=c*vfg                    //Units in C
printf("The charge on the capacitor is q=%.5f C",q)
```

Scilab code Exa 17.15 To find the terminal potential of each battery

```
//Example 17_15
clc();
clear;
//To find the terminal potential of each battery
v=18          //Units in V
r=9            //Units in Ohms
i=v/r         //Units in A
r1=0.1       //Units in Ohms
v1=-i*r1       //Units in V
v2=24         //Units in V
v11=v1+v2          //Units in V
r2=0.9         //Units in Ohms
v3=i*r2       //Units in V
v4=6           //Units in V
v22=v3+v4       //Units in V
printf("The Potential difference between d to c is=%
   .1f V",v11)
printf("\nThe potential difference between b to a is
   =%.1f V",v22)
```

Scilab code Exa 17.16 To findout how large a a resistance must the recording device must have

```
//Example 17_16
clc();
clear;
//To findout how large a a resistance must the
   recording device must have
r1=10000          //Units in Ohms
percent=1             //Units in Percentage
vo=1/(r1*(percent*100))         //Units In terms of Ro
Ro=1/vo          //Units in Ohms
printf("The resistance of the recording device is=%d
```

Ohms" ,Ro)

Chapter 18

Magnetism

Scilab code Exa 18.1 To find the force on the wire

```
//Example 18_1
clc();
clear;
//To find the force on the wire
b=2*10^-4       //Units in T
i=20          //Units in A
l=0.3         //Units in meters
theta=53                //Units in degrees
thetaa=sin(theta*%pi/180)       //Units in Radians
f=b*i*l*thetaa              //Units in N
printf("The force on the wire is F=%.9f N",f)
```

Scilab code Exa 18.2 To find the magnitude of the magnetic field

```
//Example 18_2
clc();
clear;
```

```
//To find the magnitude of the magnetic field
m=1.67*10^-27          //Units in Kg
v=10^6          //Units in meters/sec
r=4*10^-2          //Units in Meters
q=1.6*10^-19          //Units in C or eV
b=(m*v)/(r*q)          //Units in T
printf("The magnitude of magnetic field is B=%.4f T"
    ,b)
```

Scilab code Exa 18.3 To show that the particles does not deflect from its straight line path

```
//Example 18_3
clc();
clear;
//To show that the particles does not deflect from
    its straight line path
printf("The magnetic field exerts a force of q*v*B
    upwards on the particle.\nThe particle doesnot
    deflect because the two forces are equal\nHence v
    =(E/B)\nA particle with this speed will pass
    through the region of the crossfields and
    undeflected")
```

Scilab code Exa 18.4 To calculate the value of B at a radial distance of 5 cm

```
//Example 18_4
clc();
```

```
clear;
//To calculate the value of B at a radial distance
   of 5 cm
u=4*%pi*10^-7       //Units in T m/A
i=30        //Units in A
r=0.05          //Units in Meters
b=(u*i)/(2*%pi*r)          //Units in T
b=b*10^4            //Units in G
printf("The value of B is=%.2f G",b)
```

Scilab code Exa 18.5 To find the magnetic moment of hydrogen atom

```
//Example 18_5
clc();
clear;
//To find the magnetic moment of hydrogen atom
r=0.53*10^-10       //Units in meters
a=%pi*r^2        //Units in meters^2
q=1.6*10^-19            //Units in C
f=6.6*10^15         //Units in sec^-1
i=q*f           //Units in A
u=i*a           //Units in A meter^2
printf("The magnetic moment of Hydrogen atom is=")
disp(u)
printf("A meters^2")
```

Chapter 19

Electromagnetic Induction

Scilab code Exa 19.1 To find how large is the average EMF induced

```
//Example 19_1
clc();
clear;
//To find the flux in the room
l=4        //Units in meters
b=0.8        //Units in meters
theta=20        //Units in degrees
a=l*b       //Units in meters^2
b=4*10^-5        //Units in T
thetaa=cos(theta*%pi/180)        //Units in radians
phi=b*thetaa*a        //Units in T meters^2
printf("The flux in the room is Phi=%.5f T meters^2"
   ,phi)
```

Scilab code Exa 19.2 To find how large is the average EMF induced

```
//Example 19_2
clc();
clear;
//To find how large is the average EMF induced
b=0.5          //Units in T
a=4*10^-4          //Units in meters^2
phi2=b*a           //Units in Wb
phi1=0           //Units in Wb
deltaPHI=phi2-phi1      //Units in Wb
n=100        //Units in Constant
deltaT=2*10^-2         //Units in sec
emf=(n*deltaPHI)/deltaT         //Units in V
printf("The average emf Induced is emf=%d V",emf)
```

Scilab code Exa 19.3 To findout how large an emf is generated

```
//Example 19_3
clc();
clear;
//To findout how large an emf is generated
m=0.5        //Units in H
i=1         //Units in A
t=0.01          //Units in sec
emf=m*(i/t)             //Units in V
printf("The emf generated is emf=%d V",emf)
```

Scilab code Exa 19.4 To Calculate the value of selfinductance

```
//Example 19_4
```

```
clc();
clear;
//To Calculate the value of selfinductance
printf("The Self Inductance is L=Uo*n^2*D*A")
```

Scilab code Exa 19.5 To find the time constant of the circuit and the final energy stored

```
//Example 19_5
clc();
clear;
//To find the time constant of the circuit and the
   final energy stored
l=0.5   //Units in H
r1=2        //Units in Ohms
r2=4            //Units in Ohms
r=r1+r2         //Units in Ohms
l_r=l/r  //Units in sec
i=2        //Units in A
ene=0.5*l*i^2
printf("The time constant is L/R=%.4f Sec\n The
   energy stored is=%d J",l_r,ene)
```

Scilab code Exa 19.6 To find the emf induced in the rod

```
//Example 19_6
clc();
clear;
//To find the emf induced in the rod
```

```
b=0.6*10^-4          //Units in T
v=3          //Units in meters/sec
d=5          //Units in meters
theta=53          //Units in degrees
thetaa=cos(theta*%pi/180)          //Units in radians
emf=b*v*d*thetaa          //Units in V
printf("The emf induced in the rod is emf=%.6f V",emf)
```

Scilab code Exa 19.7 To calculate the Back emf developed

```
//Example 19_7
clc();
clear;
//To calculate the Back emf developed
i=3          //Units in A
r=2          //Units in Ohms
v=110          //Units in Ohms
e=v-(i*r)          //Units in V
printf("The back emf developed is EMF=%d V",e)
```

Chapter 20

Alternating Currents and electronics

Scilab code Exa 20.1 To findout the time that it has to wait after turning off the set before it is safe to touch capacitor

```
//Example 20_1
clc();
clear;
//To findout the time that it has to wait after
   turning off the set before it is safe to touch
   capacitor
r=10^6          //Units in Ohms
c=10^-5              //Units in F
ti=r*c           //Units in Sec
printf("We have to wait for a time of t=%d sec",ti)
```

Scilab code Exa 20.2 To find the rms current in the circuit

```
//Example 20_2
clc();
clear;
//To find the rms current in the circuit
f=20        //Units in Hz
c=4*10^-7        //Units in F
xc=1/(2*%pi*f*c)          //Units in Ohms/sec
f=2*10^6        //Units in Hz
xc1=1/(2*%pi*f*c)          //Units in Ohms/sec
v=80          //Units in V
i=v/xc          //Units in A
i1=v/xc1          //Units in A
printf("The RMS current when f=20 Hz is=%.5f Ohms\nThe RMS current when f=2*10^6 Hz is=%.2f Ohms",i,i1)
```

Scilab code Exa 20.3 To find the current through the inductor

```
//Example 20_3
clc();
clear;
//To find the current through the inductor
f=60            //Units in Hz
l=15*10^-3          //Units in H
xl=2*%pi*f*l          //Units in Ohms
v=40          //Units in V
i=v/xl          //Units in A
printf("The current in the inductor when frequency =60 Hz is I=%.2f A",i)
f=6*10^5          //Units in Hz
l=15*10^-3          //Units in H
xl=2*%pi*f*l          //Units in Ohms
v=40          //Units in V
```

```
i=v/xl           //Units in A
printf("\nThe current in the inductor when frequency
    =6*10^2 Hz is I=%.6f A",i)
```

Scilab code Exa 20.4 To find current in circuit Voltmeter reading reading across capacitor and power loss

```
//Example 20_4
clc();
clear;
//To find current in circuit, Voltmeter reading,
    reading across capacitor and power loss
f=2000              //Units in Hz
c=0.6*10^-6             //Units in F
xc=1/(2*%pi*f*c)             //Units in Ohms
r=300           //Units in Ohms
z=sqrt(r^2+xc^2)         //Units in Ohms
v=80            //Units in V
i=v/z            //Units in A
vr=i*r      //Units in V
vc=i*xc          //Units in V
p=i^2*r           //Units in W
printf("The current in circuit is I=%.4f A\nVolt
    meter readings across resistor Vr=%.1f V\
    nReadings across capacitor is Vc=%.1f V\nPower
    loss in circuit is=%.1f W",i,vr,vc,p)
```

Scilab code Exa 20.5 To find the current in circuit and voltmeters reading across R C and L

```
//Example 20_5
clc();
clear;
//To find the current in circuit and voltmeters
    reading across R C and L
f=600           //Units in Hz
l=4*10^-3           //Units in H
xl=2*%pi*f*l          //Units in Ohms
c=10*10^-6          //Units in F
xc=1/(2*%pi*f*c)          //Units in Ohms
r=20        //Units in Ohms
z=sqrt(r^2+(xl-xc)^2)        //Units in Ohms
v=50           //Units in V
i=v/z          //Units in A
vr=i*r     //Units in V
vl=i*xl       //Units in V
vc=i*xc    //Units in V
printf("The current in circuit is I=%.2f A\nVolt
    meter reading across R Vr=%.1f V\nVolt meter
    reading across L Vl=%.1f V\nVolt meter reading
    across c Vc=%.1f V\n",i,vr,vl,vc)
```

Chapter 21

Electromagnetic waves

Scilab code Exa 21.1 To find the wavelength of the electromagnetic wave

```
//Example 21_1
clc();
clear;
//To find the wavelength of the electromagnetic wave
v=3*10^8        //Units in meters/sec
f=1.02*10^6         //Units in Hz
lamda=v/f    //Units in Meters
printf("The Wavelength of the Electromagnetic wave
   is lamda=%d meters",lamda)
```

Scilab code Exa 21.2 To find the value of magnetic field

```
//Example 21_2
clc();
clear;
//To find the value of magnetic field
eo=4.2*10^-3    //units in V/m
```

```
c=3*10^8              //Units in meters/sec
bo=eo/c          //Units in T
printf("The value of the magnetic field is Bo=")
disp(bo)
printf("T")
```

Scilab code Exa 21.3 To find the values of Eo and Bo in the wave

```
//Example 21_3
clc();
clear;
//To find the values of Eo and Bo in the wave
power=1000          //Units in W
r=10000          //units in meters
area=4*%pi*r^2        //units in meter^2
P_a=power/area          //unts in W/meter^2
c=3*10^8          //units in meters/sec
eeo=8.85*10^-12       //units in C^2/N*meter^2%.5f
eo=sqrt((2*P_a)/(c*eeo))               //units in N/C
bo=eo/c          //Units in T
printf("The value of Eo=%.5f N/C\n The value of Bo=",eo)
disp(bo)
printf("T")
```

Chapter 22

The properties of Light

Scilab code Exa 22.1 To find the position and size of the image

```
//Example 22_1
clc();
clear;
//To find the position and size of the image
d1=5      //units in cm
d2=30       //units in cm
i=(d1*d2)/(d2-d1)    //Units in cm
d3=2                //units in cm
I=(i/d2)*d3         //units in cm
printf("The position of the image is i=%d cm\nThe
   Size of the image is I=%.2f cm High",i,I)
```

Scilab code Exa 22.2 To find the location of the image

```
//Example 22_2
clc();
clear;
```

```
//To find the location of the image
d1=10     //units in cm
d2=5      //units in cm
i=(d1*d2)/(d2-d1)    //Units in cm
printf("The position of the image is i=%d cm",i)
```

Scilab code Exa 22.3 To find the location of the image and its relative size

```

//Example 22_3
clc();
clear;
//To find the location of the image and its relative
    size
r=100              //Units in cm
d1=-r/2     //units in cm
d2=75      //units in cm
i=(d1*d2)/(d2-d1)    //Units in cm
p=75     //units in cm
sizee=-i/p              //units in cm
printf("The location of the image is i=%d cm\n The
   relative size of the image is I_O=%.2f cm",i,
   sizee)
```

Scilab code Exa 22.4 To find the angle at which the light emerge in to the air

```
//Example 22_4
```

```
clc();
clear;
//To find the angle at which the light emerge in to
   the air
theta=37      //Units in degrees
n1=1.33     //Units in constant
n2=1     //Units in constant
thetaa=asin((n1*sin(theta*%pi/180))/n2)*180/%pi
            //units in degrees
printf("The angle at which the light emerges in air
   is theta=%d degrees",thetaa)
```

Scilab code Exa 22.5 At what angle does the light emerges from the bottom of the dish

```

//Example 22_5
clc();
clear;
//At what angle does the light emerges from the
   bottom of the dish
printf("We have Theta1=Theta4 \nWhich shows that A
   uniform layer of transparent material does not
   change the direction of the beam of light")
```

Scilab code Exa 22.6 To draw a ray diagram to locate the image

```
//Example 22_6
clc();
```

```
clear;
//To draw a ray diagram to locate the image
printf("From the diagram we notice that eyes will
   assume that the three rays come from image
   position indicated and as we see the image is
   virtual, erect and enlarged")
d1=10     //units in cm
d2=5      //units in cm
i=(d1*d2)/(d2-d1)    //Units in cm
printf("\nThe image is located at i=%.2f cm",i)
```

Scilab code Exa 22.7 To find the image position by means of the ray diagram

```
//Example 22_7
clc();
clear;
//To find the image position by means of the ray
   diagram
printf("From the ray diagram we have noticed that
   the image is virtual, erect and dimnished in size
   ")
d1=5     //units in cm
d2=-10      //units in cm
i=(d1*d2)/(d2-d1)    //Units in cm
printf("\nThe image is located at i=%.2f cm",i)
```

Scilab code Exa 22.8 To find the image positon and size

```
//Example 22_8
clc();
clear;
//To find the image positon and size
d1=-20     //units in cm
d2=40      //units in cm
i=(d1*d2)/(d2-d1)    //Units in cm
printf("\nThe image is located at i=%.2f cm",i)
d3=3           //units in cm
I=(-i*d3)/d2    //units in cm
printf("\nThe Size of the image is I=%d cm",I)
```

Chapter 23

Optical Devices

Scilab code Exa 23.1 To find the focal length of the reading glasses

```
//Example 23_1
clc();
clear;
//To find the focal length of the reading glasses
d1=25      //units in cm
d2=-75       //units in cm
f=(d1*d2)/(d2+d1)    //Units in cm
printf("The focal length of the reading glasses is f
   =%.2f cm",f)
```

Scilab code Exa 23.2 To find the focal length of the corrective lens

```
//Example 23_2
clc();
clear;
//To find the focal length of the corrective lens
d1=-50           //units in cm
```

```
f=-(d1)          //Units in cm
printf("The focal length of the corrective lens is f
    =%d cm",f)
```

Scilab code Exa 23.3 To find the focal length of the combination

```
//Example 23_3
clc();
clear;
//To find the focal length of the combination
d1=20             //units in cm
d2=-30             //units in cm
d3=60            //units in cm
p1=100/d1         //units in dipoters
p2=100/d2         //units in dipoters
p3=100/d3         //units in dipoters
p=1/(p1+p2+p3)          //Units in diopters
printf("The combined focal length is=%.1f cm",p)
```

Chapter 24

Interference and Diffraction

Scilab code Exa 24.1 To find the angle at which the reinforcement line occurs

```
//Example 24_1
clc();
clear;
//To find the angle at which the reinforcement line
   occurs
n=2    //units in constant
lamda=0.7       //units in cm
d=2         //units in cm
theta2=asin((n*lamda)/d)*180/%pi      //Units in
   degrees
printf("The angle at which the reinforcement line
   occurs is theta2=%d degrees",theta2)
```

Scilab code Exa 24.2 To find by how much does thickness of air gap increases

```
//Example 24_2
clc();
clear;
//To find by how much does thickness of air gap
   increases
lamda=589           //units in nm
gap=round(lamda/2)          //units in nm
printf("The thickness of air gap increases by=%d nm"
   ,gap)
```

Scilab code Exa 24.3 To find the thickness that should be coated for minimum reflection

```
//Example 24_3
clc();
clear;
//To find the thickness that should be coated for
   minimum reflection
lamda=550         //units in nm
n=1.38            //units in constant
L=(lamda/2)/(2*n)         //units in nm
printf("The thickness that should be coated for
   minimum reflection is L=%.1f nm",L)
```

Scilab code Exa 24.4 To find out the angle at which the line appears

```
//Example 24_4
clc();
clear;
```

```
//To find out the angle at which the line appears
line=5.89*10^-7          //Units in meters
noline=1/10^6        //units in Lines per meter
theta1=asin(line/noline)*180/%pi     //units in degrees
//For seond order
theta2=asin(2*line/noline)*180/%pi     //units in degrees
printf("For the first order theta1=%d degrees\nFor the second order theta2=%d degrees",theta1,theta2)
sinevalue=2*line/noline       //units in radians
printf("\n As it is impossible for the sine of angle that is=%.2f radians to be greater that unity this second order and higher order images doesnot exist",sinevalue)
```

Chapter 25

Three revolutionary concepts

Scilab code Exa 25.1 To find out how long does a particle lives when shooted

```
//Example 25_1
clc();
clear;
//To find out how long does a particle lives when
   shooted
l=2.6*10^-8        //units in sec
t=0.95         //units in c
life=l/sqrt(1-t^2)       //units in sec
printf("The particle lves by a time of=")
disp(life)
printf("Sec")
```

Scilab code Exa 25.2 How long it would take according to earth clock for a space ship to make a round trip

```

//Example 25_2
clc();
clear;
//How long it would take according to earth clock for a space ship to make a round trip
fac=0.9990            //Units in c
relfactor=sqrt(1-fac^2)       //units in constant
time1=4.5      //Units in Years
time=2*time1    //Units in Years
oritime=relfactor*time      //Units in years
printf("The original time that is required to complete a round trip is=%.1f Years or %d Months",oritime,round(12*oritime))
```

Scilab code Exa 25.3 To graph the relativistic factor and explain why we do not observe relativistic time delaton n everyfay phenomena

```
//Example 25_3
clc();
clear;
//To graph the relativistic factor and explain why we do not observe relativistic time delaton n everyfay phenomena
printf("In every day life our clocks never come any where close to such high speeds. The electrons in a beam such as that in television tube are easily accelerated to relativistic speeds")
```

Scilab code Exa 25.4 To find out what does the women notice about the length of the stick as she starts rotating

```
//Example 25_4
clc();
clear;
//To find out what does the women notice about the
   length of the stick as she starts rotating
printf("She notices there is no change in stick. The
    length contraction effect concerns objects
   moving at high speed relative to observer. The
   meter stick is at rest relative to observer.")
```

Scilab code Exa 25.5 To compare the energy that obtained by changing all mass to energy

```
//Example 25_5
clc();
clear;
//To compare the energy that obtained by changing
   all mass to energy
m=0.1        //units in Kg
c=3*10^8       //Units in meters/sec
e=m*c^2         //units in J
printf("The energy that is obtained by changing all
   mass to energy is E=")
disp(e)
printf("J")
```

Scilab code Exa 25.6 To find the apparent mass of a high speed electron

```
//Example 25_6
clc();
clear;
//To find the apparent mass of a high speed electron
rati=1/3  //units in constant
mo=9.6*10^-31       //units in Kg
m=mo/(sqrt(1-rati^2))   //Units in Kg
printf("The apparent mass of High speed electron is
   mo=")
disp(m)
printf("Kg")
//In textbook answer printed wrong as m=9.*10^-31 Kg
    the correct answer is m=1.018*10^-30
```

Scilab code Exa 25.7 To find the energy of the photon in a beam

```
//Example 25_7
clc();
clear;
//To find the energy of the photon in a beam
h=6.626*10^-34      //units in J
c=3*10^8     //units in meters/sec
lamda=1240*10^-9     //units in meters
e=(h*c)/lamda      //units in J
e=e/(1.6*10^-19)        //Units in eV
printf("The energy of photon is E=%d eV",e)
```

Scilab code Exa 25.8 To find the energy of photonn each case

```
//Example 25_8
clc();
clear;
//To find the energy of photonn each case
dist1=1240*10^-9      //units in meters
lamda1=100      //units in meters
e1=dist1/lamda1      //Units in eV
dist2=1240      //units in nano meters
lamda2=550      //units in meters
e2=dist2/lamda2      //Units in eV
dist3=1240      //units in nano meters
lamda3=0.2      //units in meters
e3=dist3/lamda3      //Units in eV
printf("The energy with radio waves is E1=")
disp(e1)
printf("eV\n")
printf("The energy with green light is E2=")
disp(e2)
printf("eV\n")
printf("The energy with photon is E3=")
disp(e3)
printf("eV\n")
```

Scilab code Exa 25.9 To find the value of work function for material

```
//Example 25_9
clc();
clear;
//To find the value of work function for material
h=6.63*10^-34      //units in J
c=3*10^8     //units in meters/sec
```

```
lamda=5*10^-7            //units in meters
vo=0.6            //units in V
e=1.6*10^-19       //units in eV
phi=((h*c)/lamda)-(vo*e)           //Units in J

phi=phi/(1.6*10^-19)    //units in eV

printf("The value of work function for material is
   Phi=%.2f eV",phi)
```

Scilab code Exa 25.10 To calculate the be broglies wavelength

```
//Example 25_10
clc();
clear;
//To calculate the be-broglies wavelength
h=6.63*10^-34      //units in J
c=5*10^7        //units in meters/sec
m=9.1*10^-31   //Units in Kg
lamda=h/(m*c)        //units in meters
printf("The be-broglies wavelength is lamda=")
disp(lamda)
printf("Meters")
```

Scilab code Exa 25.11 To describe the diffraction pattern that would be obtained by shooting bullet

```
//Example 25_11
clc();
```

```
clear;
//To describe the diffraction pattern that would be
   obtained by shooting bullet
h=6.63*10^-34     //units in J
m=10^-4      //Units in Kg
c=200     //units in meters/sec
p=m*c    //units in Kg meter/sec
lamda=h/p            //units in meters
width=0.2*10^-2     //units in meters
sintheta=lamda/width       //units in radians
printf("The diffraction pattern that would be
   obtained by shooting bullet is sin(theta)=")
disp(sintheta)
printf("Radians\n The diffraction angles are so
   small that the particles will travel essentially
   straight through the slit")
```

Chapter 26

Energy levels and spectra

Scilab code Exa 26.1 To find the ionization energy of the hydrogen atom

```
//Example 26_1
clc();
clear;
//To find the ionization energy of the hydrogen atom
e=13.6      //units in eV
printf("The ionization energy of the hydrogen atom
   is E=%.1f eV",e)
```

Scilab code Exa 26.2 To find the wavelength of fourth line in Paschen series

```
//Example 26_2
clc();
clear;
//To find the wavelength of fourth line in Paschen
   series
n1=3   //Units in constant
```

```
n2=7    //Units in constant
r=1.0974*10^7         //units in meter^-1
lamda=round((1/r)*((n1^2*n2^2)/(n2^2-n1^2))*10^9)
      //Units in nm
printf("The wavelength of fourth line in Paschen
   series is=%d nm",lamda)
```

Scilab code Exa 26.3 To draw the energy level diagram and the find the first line of balmer type series

```
//Example 26_3
clc();
clear;
//To draw the energy level diagram and the find the
   first line of balmer type series
n=1
e1=-54.4/n^2     //units in ev
n=2
e2=-54.4/n^2     //units in ev
n=3
e3=-54.4/n^2     //units in ev
printf("The energy associated with line 1 is E1=%.1f
    eV\nThe energy associated with line 2 is E2=%.1f
    eV\nThe energy associated with line 3 is E3=%.2f
    eV\n",e1,e2,e3)
e1=1      //units in eV
e2=7.6      //Units in eV
lamda1=1240        //units in nm
lamda=(e1/e2)*lamda1       //Units in nm
printf("The first line of balmer series is lamda=%d
   nm and belongs to the ultraviolet region",lamda)
```

Scilab code Exa 26.4 To find the longest wavelength of light capable of ionizing hydrogen atom

```
//Example 26_4
clc();
clear;
//To find the longest wavelength of light capable of ionizing hydrogen atom
//First method
R=1.097*10^7          //Units in meter^-1
lamda=(1/R)*10^9                    //Units in meters
//Second method
E=13.6       //units in eV
e1=1       //units in eV
lamda3=1240       //Units in eV
lamda2=(e1/E)*(lamda3)      //Units in nm
printf("The longest wavelength of light capable of ionizing hydrogen atom is lamda=%.1f nm",lamda2)
```

Scilab code Exa 26.5 To find the energy difference between the n is 1 and n is 2 level

```
//Example 26_5
clc();
clear;
//To find  the energy difference between the n is 1 and n is 2 level
e1=1       //Units in eV
```

```
lamda2=1240        //Units in eV
lamda3=0.07      //Units in eV
e2=lamda2/lamda3        //Units in eV
e=e2-e1            //Units in eV
printf("The energy difference between n=1 and n=2 level is E=%d eV",e)
//In textbook answer is prinred wrong as E=18000 eV the correct answer is E=17713 eV
```

Chapter 27

The atomic nucleus

Scilab code Exa 27.1 What fraction of atomic mass of Uranium is due to its electrons

```
//Example 27_1
clc();
clear;
//What fraction of atomic mass of Uranium is due to
   its electrons
n=92         //Units in constant
mass=0.000549       //Units in u
tmass=235       //units in u
per=(n*mass)/tmass        //Units in fractions
printf("The fraction of atomic mass of Uranium is
   due to its electrons is=%.6f",per)
```

Scilab code Exa 27.2 To find the density of gold nucleus

```
//Example 27_2
clc();
```

```
clear;
//To find the density of gold nucleus
r=6.97*10^-15            //Units in meters
a=197     //Units in u
v=(4/3)*%pi*r^3     //Units in meter^3
m1=1.66*10^-27       //Units in Kg/u
mass=a*m1         //Units in Kg
p=mass/v    //Units in Kg/meter^3
printf("The density of gold nucleus is p=")
disp(p)
printf("Kg/meter^3")
```

Scilab code Exa 27.3 To calculate the energy required to change the mass of a system

```
//Example 27_3
clc();
clear;
//To calculate the energy required to change the
   mass of a system
c=3*10^8         //units in meters/sec
m=1.66*10^-27     //Units in g
e=m*c^2         //Units in J
e=e/(1.6*10^-19)*10^-6       //Units in MeV
printf("The energy required to change the mass of a
   system is=%.1f MeV",e)
//In text book answer is printed wrong as e=931.5Mev
    the correct answer is933.7 MeV
```

Scilab code Exa 27.4 To compute the binding energy of deuterium

```
//Example 27_4
clc();
clear;
//To compute the binding energy of deuterium
m1=2.014102         //Units in u
m2=0.000549     //Units in u
total=m1-m2       //Unts in u
m3=1.007276     //Units in u
m4=1.008665         //Units in u
suma=m3+m4         //Units in u
massdefect=suma-total     //units in u
e1=931.5   //Units in MeV
m5=1            //Units iin eV
e=massdefect*e1/m5       //Units in MeV
printf("The binding energy of deuterium is E=%.2f
   MeV ",e)
```

Scilab code Exa 27.5 To find how much of the orignal I will still present

```
//Example 27_5
clc();
clear;
//To find how much of the orignal I will still
   present
d1=20      //Units in mg
d2=d1/2         //Units in mg
d3=d2/2         //Units in mg
d4=d3/2         //Units in mg
d5=d4/2         //Units in mg
d6=d5/2        //Units in mg
d7=d6/2            //Units in mg
```

```
printf("After 48 days only %.3f mg will remain",d7)
```

Scilab code Exa 27.6 To find how many radium atoms in the vial undergo decay

```
//Example 27_6
clc();
clear;
//To find how many radium atoms in the vial undergo
   decay
t1=5.1*10^10    //Units in sec
lamda=0.693/t1      //Units in sec^-1
n1=6.02*10^26         //Units in atoms/Kmol
n2=226 //Units in Kg/Kmol
m1=0.001       //Units in Kg
N=n1*m1/n2          //Units in number of atoms
deltat=1        //Units in sec
deltan=-lamda*N*deltat        //Units in Number
printf("The number of dis integrations per sec=")
disp(deltan)
```

Scilab code Exa 27.7 To find what fraction of uranium remains undecayed today

```
//Example 27_7
clc();
clear;
//To find what fraction of uranium remains undecayed
    today
```

```
t1=4.5*10^9    //Units in Years
lamda=0.693/t1      //Units in years^-1
t=4*10^9      //Units in Years
n_no=%e^(-lamda*t)           //Units in Fractions
printf("The fraction of uranium remains undecayed
   today is=%.2f",n_no)
```

Scilab code Exa 27.8 To calculate the decay constant and half life of substance

```
//Example 27_8
clc();
clear;
//To calculate the decay constant and half life of
   substance
n_no=0.9      //Units in constant
t=12    //Units in h
lamda=log(1/n_no)/t          //Units in h^-1
t1=round(0.693/lamda)          //Units in h
printf("The decay constant is lamda=%.7f h^-1\n The
   Half life is t0.5=%d h",lamda,t1)
```

Scilab code Exa 27.9 To fnd the approximate energy of the emitted alpha particle

```
//Example 27_9
clc();
clear;
```

```
//To fnd the approximate energy of the emitted alpha
    particle
m1=222.01753        //Units in u
m3=4.00263          //Units in u
m2=218.00893         //Units in u
massloss=m1-(m2+m3)        //Units in u
e1=931.5          //Units in MeV
e=e1/massloss*10^-5      //Units in MeV
printf("The approximate energy of the emitted alpha
   particle is E=%.2f MeV",e)
//In textbook answer s printed wrong as E=5.56eV the
    correct answer is E=1.56 eV
```

Scilab code Exa 27.10 To find the fraction of original amount still existence in earth

```

//Example 27_10
clc();
clear;
//To find the fraction of original amount still
   existence in earth
t1=1.41*10^10         //Units in Years
lamda=0.693/t1        //Units in year^-1
t=5*10^9       //Units in years
n_no=%e^-(lamda*t)        //Units in constant
n_no=n_no*100     //Units in percentage
printf("The percentage of original amount still
   remaining is N/No=%.3f Percent",n_no)
```

Scilab code Exa 27.11 To find the activity of sr

```
//Example 27_11
clc();
clear;
//To find the activity of sr
t1=28    //units in Years
t1=t1*86400*365    //Units in sec
acti=6.022*10^26      //Units of Bq
m1=90     //Units in Kg
m2=0.001    //Units in Kg
N=(m2/m1)*acti    //Units in constant
activity=0.693*N/t1    //Units in Bq
printf("The activity of sr=")
disp(activity)
printf("Bq")
```

Scilab code Exa 27.12 To estimate the age of the axe handle

```
//Example 27_12
clc();
clear;
//To estimate the age of the axe handle
n_no=0.034
t1=5730  //Units in Years
t=-(log(n_no)*t1)/0.693 //Units in Years
printf("The age of the axe handle is t=%d years",t)
```

```
//In textbook answer is printed wrong as t=28000 years correct answer is t=27958 years
```

Scilab code Exa 27.13 To find the energy released in the reaction

```
//Example 27_13
clc();
clear;
//To find the energy released in the reaction
m1=141.91635     //Units in u
m2=89.91972     //Units in u
m3=4.03466      //Units in u
n2=36           //Units in Constant
n1=56           //Units in Constant
n4=92         //units in constant
m5=236.04564           //Units in u
loss=m5-(m1+m2+m3)+n4-(n1+n2)                    //Units in u
e1=931.5         //units n MeV
energy=round(e1*loss)         //units in MeV
printf("The energy released in the reaction E=%d MeV",energy)
```