Scilab Textbook Companion for
Oscillations and Waves
by S. Prakesh[1]

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Book Description

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

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

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

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

Contents

List of Scilab Codes

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Chapter 1

Free Oscillations in One Dimension Simle Harmonic Oscillator

Scilab code Exa 1.1 frequency and time period

```
1 //Example 1 //   FREQUENCY AND TIME PERIOD
2 clc;
3 clear;
4 close;
5 format('v',6)
6 //ph=50*x^2+100 in joule/kg
7 m=10;//mass in kg
8 f=10^3/m;//joule/kg
9 w=sqrt(f);//oscillations
10 fr=w/(2*%pi);//oscillations/sec
11 tp=1/fr;//seconds
12 disp(fr,"frequency of oscillation is  ,(oscillations/
      seconds)=")
13 disp(tp,"time period is ,(seconds)=")
```

Scilab code Exa 1.3 total energy

```
1 //Example 3 // ENERGY
2 clc;
3 clear;
4 close;
5 ke=5;//joule
6 pe=5;//joule
7 rep=10;//joule
8 eo=rep+ke+pe;//joule
9 disp(eo,"energy of the oscillator is ,(joule)=")
```

Scilab code Exa 1.4 velocity and acceleration

```
1 //Example 4 //  peroid ,maximum velocity and
       acceleration
2 clc;
3 clear;
4 close;
5 a=3;//cm
6 b=4;//cm
7 A=sqrt(a^2+b^2);//cm
8 w=2;//sec^-1
9 T=(2*%pi)/w;//seconds
10 um=w*A;//cm/s
11 am=w^2*A;//cm/s^2
12 disp(T,"time period is  ,(seconds)=")
13 disp(um,"maximum velocity is ,(cm/s)=")
14 disp(am,"maximum acceleration is ,(cm/s^2)=")
```

Scilab code Exa 1.5 velocity and acceleration

```
1 //Example 5 // maximum velocity and acceleration
```

11

```
2  clc;
3  clear;
4  close;
5  A=5;//cm
6  T=31.4//seconds
7  w=(2*%pi)/T;//sec^-1
8  um=w*A;//cm/s
9  am=w^2*A;//cm/s^2
10 disp(um,"maximum velocity is ,(cm/s)=")
11 disp(am,"maximum acceleration is ,(cm/s^2)=")
```

Scilab code Exa 1.6 period

```
1  //Example 6 //  Period
2  clc;
3  clear;
4  close;
5  //given data :
6  g=9.8;// constant
7  l=1;// in m
8  theta_m1=60;// in degree
9  theta_m=%pi/3;// in radians
10 T0=round(2*%pi*sqrt(l/g));
11 disp(T0,"(a). Time period for small displacement ,T0(
       seconds) = ")
12 T=T0*(1+(theta_m^2/16));
13 disp(T,"(b).Time period ,T(seconds) = ")
```

Scilab code Exa 1.7 energy

```
1  //Example 7 // ENERGY
2  clc;
3  clear;
```

```
4  close ;
5  es =1;// joule
6  l =2;// metre
7  am =3;//cm
8  am1 =5;//cm
9  e1 =( am1^2/ am^2)* es ;// joules
10  l2 =1;// meter
11  e2 =( l/l2 )* es ;// joules
12  disp ( e1 ," energy  in  first  case  is ,( joules )=")
13  disp ( e2 ," energy  in  second  case  is ,( joules )= ")
```

Scilab code Exa 1.8 period of motion

```
1  //Example  8  //   Period  of  motion
2  clc ;
3  clear ;
4  close ;
5  // given  data  :
6  x =0.16;//  in  m
7  m1 =4;//  in  kg
8  g =9.8;
9  K= m1 *g/x ;
10  m =0.50;//  in  kg
11  T=2*% pi* sqrt (m/K );//
12  disp (T ," The  period  of  motion  ,T( seconds ) = ")
13  //  answer  is  wrong  in  textbook
```

Scilab code Exa 1.9 force constant period of oscillation amlitude and energy

```
1  //Example  9  // foce  constant ,displacement  ,
       acceleration  and  energy
2  clc ;
```

13

```scilab
3  clear;
4  close;
5  //given data :
6  x1=.10;// in m
7  F1=4;// in N
8  K=F1/x1;
9  x2=0.12;// in m
10 disp(K,"(a). The force constant ,K(N/m) = ")
11 F=-K*x2;
12 disp(F,"(b). The force ,F(N) = ")
13 m=1.6;// in kg
14 T=2*%pi*sqrt(m/K);
15 disp(T,"(c). Period of pscillation ,T(s) = ")
16 A=x2;
17 disp(A,"(d). Amplitude of motion ,A(m) = ")
18 alfa=A*K/m;
19 disp(alfa,"(e). Maximum acceleration , alfa(m/s^2) = "
        )
20 x=A/2;// in m
21 w=sqrt(K/m);
22 v=w*sqrt(A^2-x^2);
23 a=w^2*x;// in m/s^2
24 KE=(1/2)*m*v^2;// in J
25 PE=(1/2)*K*x^2;// in J
26 TE=KE+PE;
27 disp(v,"(f) velocity is ,(m/s) ")
28 disp(a,"(f). acceleration ,(m/s^2) = ")
29 disp(KE,"(f) Kinetic energy is ,(J)=")
30 disp(PE,"(f) Potential energy is ,(J)=")
31 disp(TE,"(g). Total energy of the oscillating system
        ,TE(J) = ")
32 // in textbook part f is inculded in the part e so
        their is the numbeing error in parts
```

Scilab code Exa 1.10 velocity

```
1  //Example 10 // ENERGY
2  clc;
3  clear;
4  close;
5  t=8/3;//seconds
6  v=-10*%pi*sin((35*%pi)/6)//cm
7  disp(v,"velocity is ,(cm)=")
```

Scilab code Exa 1.11 frequency energy and velocity

```
1  //Example 11 //
2  clc;
3  clear;
4  close;
5  //given data :
6  K1=3;// in N/m
7  K2=2;// in N/m
8  m=0.050;// in kg
9  w=sqrt((K1+K2)/m);
10 n=w/(2*%pi);
11 disp(n,"(i). The frequency ,n(oscillations/sec) = ")
12 A=0.004;// in m
13 E=(1/2)*A^2*(K1+K2);
14 disp(E,"(ii). The energy ,E(J) = ")
15 v=sqrt(2*E/m);
16 disp(v,"(iii). The velocity ,v(m/s) = ")
```

Scilab code Exa 1.12 rotational inertia

```
1  //Example 12 // Rotational inertia
2  clc;
3  clear;
4  close;
```

```
5  //given data :
6  M=0.1;// in m
7  l=0.1;// in m
8  I1=M*l^2/12;// in kg-m^2
9  T1=2;// in s
10 T2=6;// in s
11 I2=(I1*T2^2)/T1^2;
12 disp(I2,"Rotational inertia ,I2(kg.m^2) = ")
```

Scilab code Exa 1.13 period

```
1  //Example 13 // Time period
2  clc;
3  clear;
4  close;
5  //given data :
6  M=4;// in kg
7  R=0.10;// in m
8  I=(2/5)*M*R^2;// in kg.m^2
9  C=4*10^-3;// in Nm/radian
10 T=2*%pi*sqrt(I/C);
11 disp(T,"Time period ,T(s) = ")
12 // answer is wrong in textbook
```

Scilab code Exa 1.15 frequency and energy

```
1  //Example 15 // Energy
2  clc;
3  clear;
4  close;
5  //given data :
6  L=10*10^-3;// in H
7  C=20*10^-6;// in F
```

```
8  n=1/(2*%pi*sqrt(L*C));
9  V=10;//in V
10 U=(1/2)*C*V^2;
11 disp(n,"Frequency,n(cycles/s) = ")
12 disp(U,"Energy of oscillations ,U(J) = ")
13 //answer of frequency is calculated wrong in
        textbook
```

Scilab code Exa 1.16 distance binding energy and force constant

```
1  //Example 16 // distance ,binding energy and force
        constant
2  clc;
3  clear;
4  close;
5  disp("equilibrium inter-nuclear distance
        correspondes to lowest potential enegy is ro= 2*
         ")
6  pet=0;//eV
7  peb=-4;//eV
8  be=pet-peb;//eV
9  x1=-2;//eV
10 x2=-4;//eV
11 V=x1-x2;//eV
12 e=1.6*10^-19;//electronic charge
13 x=0.5;//armstrong
14 K=((2*V)/x^2);//eV/    ^2
15 k1=(K*e)/(10^-10)^2;//joule/m^2
16 disp(be,"binding energy is ,(eV)=")
17 disp(k1,"force constant is ,(newton/metre)=")
```

Scilab code Exa 1.17 possible values of r and energy

```
1  //Example 17 // possible values and energy
2  clc;
3  clear;
4  close;
5  r1=2;//from graph
6  r2=4.5;//units from graph
7  disp(" possible values of r are "+string(r1)+" units
       and "+string(r2)+" units")
8  osc=1-(-2.5);//units
9  disp("maximum energy of oscillations for r=2 units
       is "+string(osc)+" units ")
10 osc1=0.5-(-1);//units
11 disp("maximum energy of oscillations for r=4.5 units
        is "+string(osc1)+" units ")
12 t=1;//from graph
13 v=0;//from graph
14 e=t+v;//
15 disp(e,"total energy is ,( unit )=")
16 disp("at infinity V = "+string(v)+" therefore T = "+
       string(t)+" unit ")
```

Scilab code Exa 1.19 frequency and moment of inertia

```
1  //Example 19 // Frequency
2  clc;
3  clear;
4  close;
5  //given data :
6  m1=10;// in g
7  m2=90;// in g
8  K=10^3;// in N/m
9  mu=m1*m2*10^-3/(m1+m2);
10 n=round(sqrt(K/mu)/(2*%pi));
11 disp(n," The frequency ,n( oscillations /sec ) = ")
12 x1=0;//
```

```
13  x2 =10;//cm
14  xb =((m1*x1+m2*x2)/(m1+m2));//cm
15  mo =(m1*10^-3)*(xb*10^-2)^2+(m2*10^-3)*(1*10^-2)^2;//
16  disp(mo,"moment of inertia is  ,(kg-m^2)=")
```

Scilab code Exa 1.20 frequency and amlitude

```
1   //Example 20 // frequency and amplitude
2   clc;
3   clear;
4   close;
5   c=10^-4;//N-m
6   m1=9;//gm
7   m2=1;//gm
8   mu =((m1*m2)/(m1+m2))*10^-3;//kg
9   r=20;//cm
10  I=mu*(r*10^-2)^2;//kg-m^2
11  fr =((1/(2*%pi))*sqrt(c/I));//vibrations/sec
12  disp(fr,"frequency of vibration is  ,(vibrations/s)="
       )
13  e=10^-2;//joule
14  thmax=sqrt((2*e)/c);//radians
15  disp(thmax,"amplitude is ,(radians)=")
```

Scilab code Exa 1.21 frequency energy and velocity

```
1   //Example 21 // frequency ,energy and maximum
       velocity
2   clc;
3   clear;
4   close;
5   c=1;//N-m
6   m1=6;//gm
```

```
 7  m2=2;//gm
 8  mu=((m1*m2)/(m1+m2))*10^-3;//kg
 9  fr=((1/(2*%pi))*sqrt(c/mu));//vibrations/sec
10  disp(fr,"frequency of oscillations is ,(vibrations/s
       )=")
11  td= 1+(1/3);//cm
12  e=((1/2)*c*(td*10^-2)^2);//joule
13  disp(e,"energy is ,(joule)=")
14  y=((1/2)*m2*10^-3)+((1/2)*(1/3)^2*m1*10^-3);//
15  v1=sqrt((e/y));//m/sec
16  disp(v1,"maximum velocity of smaller mass is ,(m/
       seconds)=")
17  //velocity is calculated wrong in the book
```

Scilab code Exa 1.22 frequency

```
 1  //Example 22 // frequency
 2  clc;
 3  clear;
 4  close;
 5  k=100;//N/m
 6  m=100;//gm
 7  n1=((1/(2*%pi))*sqrt(k/(m*10^-3)));//sec^-1
 8  m1=100;//gm
 9  m2=200;//gm
10  mu=((m1*m2)/(m1+m2))*10^-3;//kg
11  fr=((1/(2*%pi))*sqrt(k/mu));//sec^-1
12  disp(n1,"in first case frequency is ,(sec^-1)=")
13  disp(fr,"in second case frequency is ,(sec^-1)=")
```

Scilab code Exa 1.23 force constant and work done

```
 1  //Example 23 // force constant and work done
```

```
2  clc;
3  clear;
4  close;
5  m1=1; //assume
6  m2=19; //assume
7  mh=1.66*10^-27; //kg
8  mu=((m1*m2)/(m1+m2))*mh; //kg
9  w=7.55*10^14; //radians/sec
10 k=mu*(w)^2; //N/m
11 disp(k,"force  constant  is ,(N/m)=")
12 x=0.5; //arngstrom
13 wh=((1/2)*k*(x*10^-10)^2); //joule
14 disp(wh,"work  done  is  ,(joule)=")
```

Scilab code Exa 1.24 frequency

```
1  //Example 24 // frequency
2  clc;
3  clear;
4  close;
5  m1=1; //a.m.u
6  m2=35; //a.m.u
7  mu1=((m1*m2)/(m1+m2)); //a.m.u
8  m3=2; //
9  mu2=((m3*m2)/(m3+m2)); //a.m.u
10 n1=8.99*10^13; //cycle/sec
11 n2=(sqrt(mu1/mu2))*n1; //c/s
12 disp(n2,"frequecy  of  vibrations  is  ,(c/s)=")
```

Chapter 2

Damped Harmonic Oscillator

Scilab code Exa 2.3 time damping force total distance

```
1 //Example 3 // relaxation time ,damping force ,time
     and total distance
2 clc;
3 clear;
4 close;
5 v=10; //cm/s
6 vo=100; //cm/s
7 t=23; //sec
8 x=-(log(v/vo))/t; //
9 t=(1/x)*1; //seconds
10 disp(round(t),"relaxation time is ,(seconds)=")
11 m=40; //gm
12 vx=50; //cm/sec
13 fd=((-x*m*10^-3*vx*10^-2)); //newton
14 disp(fd,"damping force is ,(newton)=")
15 tx=5*(log(10)); //
16 disp(tx,"time in which kinetic energy will reduce to
     1/10th of its value is ,(seconds)=")
17 xx=v*1; //
18 disp(xx,"distance travelled is ,(m)=")
```

Scilab code Exa 2.4 period

```
1  //Example 4 // period
2  clc;
3  clear;
4  close;
5  //given data :
6  m=2;// in g
7  k=30;// in dynes/cm
8  b=5;// in dynes/cm-sec^-1
9  r=b/(2*m);
10 w0=sqrt(k/m);
11 T=2*%pi/sqrt(w0^2-r^2);
12 disp(T,"The time period ,T(s) = ")
```

Scilab code Exa 2.5 time period

```
1  //Example 5 // time
2  clc;
3  clear;
4  close;
5  tr=50;//seconds
6  r=(1/(2*tr));//s^-1
7  t=1/r;//seconds
8  disp(t,"time in which amplitude falls to 1/e times
       the initial value is ,(seconds)=")
9  t2=tr;//
10 disp(t2,"time in which system falls to 1/e times the
        initial value is ,(seconds)=")
11 t3=2*(1/r);//
12 disp(t3,"time in which energy falls to 1/e^4 of the
       initial value is ,(seconds)=")
```

Scilab code Exa 2.6 relaxation time frequency energy and rate of loss

```
1 //Example 6 // relaxation time , frequency , energy ,
      time , rate and number of vibrations
2 clc ;
3 clear ;
4 close ;
5 k=20; //N/m
6 m=5 //N−s/m
7 wo=sqrt (k/m) ; //
8 v1 =2; //m/s
9 to=m/v1 ; // seconds
10 disp (to ,"relaxation time is ,( seconds )=")
11 w=wo *(1 -(1/(2* wo* to ) )^2 ) ; //
12 lf=w/(2*%pi) ; // vibration /s
13 disp (lf ,"linear frequency is ,( vibration /s )=")
14 a=1; //
15 e =((1/2) *m*a^2* wo^2) ; // joule
16 disp (e ,"energy is ,( joule )=")
17 tm=v1* to ; // seconds
18 disp (tm ,"time taken in fall of amlitude to 1/e value
       is ,( seconds )=")
19 disp (tm ,"time taken in fall of velocity amplitude to
       1/2 value is ,( seconds )=")
20 tr=to ; //
21 disp (tr ,"time taken in fall of energy to 1/e value
      is ,( seconds )=")
22 eng =(1/2) *m*a* v1^2*(2/ tm) ; //
23 disp ("rate of loss of energy at t=0 seconds is "+
      string (eng)+" J/s and at any time is "+string (eng
      )+"e^−2*t/"+string (tm)+" J/s ")
24 rel =((eng *2*%pi) /wo) ; //J/s
25 disp ("rate of loss of energy per cycle at t=0
      seconds is "+string (rel)+" J/s and at any time is
```

24

```
        "+string(rel)+"e^-2*t/"+string(tm)+" J/s ")
26  nv=tm/((2*%pi)/wo);//
27  disp(nv,"number of vibratios made are,=")
```

Scilab code Exa 2.7 time and distance

```
1  //Example 7 // time and distance
2  clc;
3  clear;
4  close;
5  b=5;//N-s/m
6  v=10;//m/s
7  to=b/v;//second
8  disp(to,"time in which velocity falls to 1/e times
       the initial value is ,(second)=")
9  t2=b*to;//
10 disp(t2,"time in which velocit falls to half the
       initial value is ,(second)=")
11 disp("diatnce traversed by the particle before the
       velocity falls to half the initial value is "+
       string(b)+"*(1-e^-(log)"+string((2*to)/to)+")")
12 x=b;//m
13 disp(x,"distance traversed by the particle it comes
       to rest is ,(m)=")
```

Scilab code Exa 2.8 time interval

```
1  //Example 8// time interval
2  clc;
3  clear;
4  close;
5  q=5*10^4;//quality factor
6  x=1/10;//
```

25

```
7  fr=300;//second^-1
8  to=q/(2*%pi*fr);//second
9  xm=((to*log(10)));//seconds
10 disp(xm,"time interval is ,(seconds)=")
```

Scilab code Exa 2.9 time

```
1  //Example 9 // Time
2  clc;
3  clear;
4  close;
5  //given data :
6  n=240;// in sec^-1
7  w=2*%pi*n;
8  Q=2*10^3;
9  tau=Q/w;
10 t=4*tau;
11 disp(t,"Time,t(s) = ")
```

Scilab code Exa 2.10 logarithmic decrement

```
1  //Example 10 // Logarithmic decrement
2  clc;
3  clear;
4  close;
5  //given data :
6  a=100;
7  l1=20;// in cm
8  l2=2;// in cm
9  l=l1/l2;
10 lamda=(1/100)*log(l);
11 disp(lamda," Logarithmic decrement , = ")
```

Scilab code Exa 2.12 frequency

```
1  //Example 12 // Frequency
2  clc;
3  clear;
4  close;
5  //given data :
6  C=10^-6;// in F
7  L=0.2;// in H
8  R=800;// in ohm
9  Rm=2*sqrt(L/C);
10 n=sqrt((1/(L*C))-(R^2/(4*L^2)))/(2*%pi);
11 disp(n,"The frequency ,n(cycles/s) = ")
```

Scilab code Exa 2.13 resistance

```
1  //Example 13 // Resistance
2  clc;
3  clear;
4  close;
5  //given data :
6  C=0.0012*10^-6;// in F
7  L=0.2;// in H
8  Rm=2*sqrt(L/C);
9  disp(Rm,"The maximum value of resistance ,Rm(ohms) =
      ")
```

Scilab code Exa 2.14 frequency and quality factor

27

```
1  //Example 14 // Q factor
2  clc;
3  clear;
4  close;
5  //given data :
6  C=5*10^-6;// in F
7  L=2*10^-3;// in H
8  R=0.2;// in ohm
9  w=round(sqrt((1/(L*C))-(R^2/(4*L^2))));
10 f=w/(2*%pi);
11 Q=w*L/R;
12 disp(f,"frequency is  ,(Hz)=")
13 disp(Q,"Quality factor ,Q = ")
```

Chapter 3

Forced Harmonic Oscillator and Resonance

Scilab code Exa 3.1 amlitude and phase displacement

```
1  //Example 1 // Phase  shift
2  clc;
3  clear;
4  close;
5  //given data :
6  F0=25;// in N
7  m=1;
8  f0=F0/m;
9  K=1*10^3;// in N/m
10 w0=sqrt(K/m);
11 b=0.05;// in N-s/m
12 r=b/(2*m);// in s^-1
13 A=f0*10^3/sqrt(9*w0^4+(16*r^2*(w0)^2));
14 disp(A,"The  amplitude ,A(mm) = ")
15 p=2*w0;
16 fi=atand(2*r*p/(w0^2-p^2));
17 disp("phase  shift  is  "+string(fi)+" degree  or  "+
       string(fi*(%pi/180))+" radian")
18 //phase  shift  is  converted  wrong  into  radians
```

29

Scilab code Exa 3.2 cosntant

```scilab
1  //Example 2 // A/Amax
2  clc ;
3  clear ;
4  close ;
5  x1 =[0.99;0.98;0.97]; //
6  wt =50; //
7  wo =1; // assume
8  fo =1; // assume
9  for i =1:3
10     a(i) =((fo /(( wo ^2) *((1 - x1(i)^2)^2+((1/ wt ^2) * x1(i)
           ^2))^(1/2)))); //
11     am(i) = fo /(( wo ^2) *(1/ wt ^2)^(1/2)); //
12     z(i) = a(i)/ am(i); //
13     disp (" for p/wo "+ string (x1(i))+" value of A/Amax
           is "+ string (z(i))+"")
14 end
```

Scilab code Exa 3.3 reactance and impedance

```scilab
1  //Example 3 // Reactance and impedence
2  clc ;
3  clear ;
4  close ;
5  //given data :
6  n =50; // in cycles
7  w =2*%pi*n ; // in rad/sec
8  L =1/%pi ; // in H
9  XL =w*L ;
10 disp (XL ,"The reactance ,XL(ohm) = ")
```

```
11  R=100;// in ohm
12  Z=sqrt(R^2+XL^2);
13  disp(Z,"The impedence ,Z(ohm) = ")
```

Scilab code Exa 3.4 current and capacitance

```
1   //Example 4 // Current and Capacity
2   clc;
3   clear;
4   close;
5   //given data :
6   E=110;// in V
7   R=10;// in ohm
8   L=1*10^-3;// in H
9   C=1*10^-6;// in F
10  n=10000;// in Hz
11  w=2*%pi*n;
12  I=E/sqrt(R^2+((w*L)-(1/(w*C)))^2);
13  disp(I,"The current ,I(A) = ")
14  L1=1/(w^2*C);
15  disp(L1,"The value of capacity ,L1(F) = ")
16  //Capacitance is calculated wrong in the textbook
```

Scilab code Exa 3.5 resonant frequency separation and sharpness

```
1   //Example 5 // Resonent frequency and Separation
2   clc;
3   clear;
4   close;
5   //given data :
6   L=1*10^-3;// in H
7   C=0.1*10^-6;// in F
8   w0=1/sqrt(L*C);
```

```scilab
 9  disp(w0,"Resonant frequency ,w0(rad/s) = ")
10  R=10;// in ohm
11  w2_w1=R/L;
12  disp(w2_w1,"the separation ,(rad/s) = ")
13  S=w0/w2_w1;
14  disp(S,"The sharpness is = ")
```

Chapter 4

Coupled Oscillator

Scilab code Exa 4.2 ratio of frequency

```
1 //Example 2 // ratio of Frequency
2 clc;
3 clear;
4 close;
5 k=1;//assume
6 m1=16;//a.m.u
7 m2=12;//a.m.u
8 m3=m1;//
9 rt=((m2+2*m1)/m2)^(1/2);//
10 disp(rt,"ratio of frequency is ,=")
```

Chapter 5

Wave Motion and Speed of Waves in Gaes

Scilab code Exa 5.1 wavelength

```
1 //Example 1 // wavelength
2 clc ;
3 clear ;
4 close ;
5 // given data :
6 v=960; // in m/s
7 n=3600/60; // in per sec
8 lamda=v/n ;
9 disp ( lamda ,"The wavelength , lamda (m) = ")
```

Scilab code Exa 5.2 frequency

```
1 //Example 2 // Frequency
2 clc ;
3 clear ;
4 close ;
```

```
5  //given data :
6  c=3*10^8;// in m/s
7  lamda=300;// in m
8  n=c*10^-6/lamda;
9  disp(n,"The frequency ,n(MHz) = ")
```

Scilab code Exa 5.3 velocity and direction

```
1  //Example 3 // velocity and direction
2  clc;
3  clear;
4  close;
5  //y=1.2*sin(3.5*t+0.5*x);//equation
6  w=3.5;//from equation
7  k=0.5;//from equation
8  v=w/k;//m/s
9  disp("wave velocity is "+string(v)+" m/s and
      direction of the wave is along negative X-axis")
```

Scilab code Exa 5.4 wave equation

```
1  //Example 4 //equation of wave propogation
2  clc;
3  clear;
4  close;
5  amp=0.02;//m
6  fr=110;//Hz
7  v=330;//m/s
8  w=2*%pi*fr;//s^-1
9  k=w/v;//constant
10 //y=a*sin(w*t-k*x);//refrence equation
11 disp("equation of wave is "+string(amp)+"*sin("+
      string(w)+"*t-"+string(k)+"*x)")
```

Scilab code Exa 5.5 path difference

```
1  //Example 5 //path difference
2  clc;
3  clear;
4  close;
5  v=360; //m/s
6  fr=500; //Hz
7  h=v/fr; //wavelength in metre
8  ang=60; //degree
9  angr=ang*(%pi/180); //radian
10 pth=(h)/(2*%pi); //metre
11 disp(pth,"path difference is ,(m)=")
```

Scilab code Exa 5.6 wavelength

```
1  //Example 6 //path difference
2  clc;
3  clear;
4  close;
5  pth=15; //cm
6  pd=(2*%pi)/3; //radians
7  h=(pth*2*%pi)/pd; //cm
8  disp(h,"wavelength is ,(cm)=")
```

Scilab code Exa 5.8 displacement velocity and acceleration

```
1  //Example 8 //displacement , particle velocity and
      acceleration
```

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```
2  clc;
3  clear;
4  close;
5  //y=a*sin*((2*%pi)/h)*(vt-x);//
6  v=1000;//cm/s
7  n=25;//vibrations
8  h=v/n;//cm
9  a=3;//cm
10  t=2;//seconds
11  x1=200;//cm
12  y=3*sind(((2*360)/h)*(v*t-x1));//
13  vl=2*%pi*a*n;//cm/s
14  acc=0;//
15  disp(y,"displacement is ,(cm)=")
16  disp(vl,"velocity is ,(cm/s)=")
17  disp(acc,"acceleration is ,(cm/s^2)=")
```

Scilab code Exa 5.9 amplitude frequency velocity and wavelength

```
1  //Example 9 //amplitude ,frequency ,velocity ,
      wavelength and speed
2  clc;
3  clear;
4  close;
5  //y=5*sin*(4t-0.02x);//given
6  a=5;//cm
7  h=(2*%pi)/0.02;//
8  v=0.02*10000;//cm/s
9  n=v/h;//cycles/seconds
10  disp(a,"amplitude is ,(cm)=")
11  disp(n,"frequency is ,(cycles/s)=")
12  disp(v,"velocity is ,(cm/s)=")
13  disp(h,"wavelength is ,(cm)=")
14  ma1x=a*4;//cm/s
15  disp(ma1x,"maximum speed is ,(cm/s)=")
```

Scilab code Exa 5.10 wave intensity

```
1 //Example 10 //wave intensity
2 clc;
3 clear;
4 close;
5 nt=1;//watt source
6 r=1;//n
7 is=(nt/(4*%pi*r^2));// joule/sec-m^2
8 disp(is,"intensity on the surface is ,(joule/sec-m
     ^2)=")
```

Scilab code Exa 5.14 energy flux

```
1 //Example 14 // Energy flux
2 clc;
3 clear;
4 close;
5 //given data :
6 A=.10;// in m
7 w=4;// in per sec
8 k=0.1;// in per cm
9 p=1.25*10^3;// in kg/m^3
10 v=w*10^-2/k;// in m/s
11 n=w/(2*%pi);
12 Ef=2*%pi^2*n^2*A^2*p*v;
13 disp(Ef,"Energy flux of the wave,Ef(W/m^2) = ")
```

Scilab code Exa 5.15 energy

```
1  //Example 15 // Energy radiated and energy current
2  clc;
3  clear;
4  close;
5  //given data :
6  p=1.29;// in kg/m^3
7  a=.15*10^-2;// in m/s
8  n=76;// in Hz
9  E=2*%pi^2*n^2*a^2*p;
10 disp(E,"(a). Energy radiated ,E(J/m^3) = ")
11 v=332;// in m/s
12 Ev=E*v;
13 disp(Ev,"(b). The energy  current ,Ev(W/s) = ")
14 // energy current is calculated wrong in the
       textbook
```

Scilab code Exa 5.16 pressure amplitude energy density and energy flux

```
1  //Example 16 // Pressure amplitude , Energy density
       and energy flux
2  clc;
3  clear;
4  close;
5  //given data :
6  a=10^-5;// in m
7  n=500;// in per sec
8  p=1.29;// in kg/m^3
9  v=340;// in m/s
10 Pa=2*%pi*a*n*v*p;
11 disp(Pa,"(i).Pressure amplitude ,Pa(N/m^2) = ")
12 Ed=2*%pi^2*a^2*n^2*p;
13 disp(Ed,"(ii). Energy density ,Ed(J/m^3) = ")
14 Ef=2*%pi^2*a^2*n^2*p*v;
15 disp(Ef,"(iii). The energy flux ,Ef(J/m^2-s) = ")
```

Scilab code Exa 5.17 pressure

```
1  //Example 17 // Pressure
2  clc;
3  clear;
4  close;
5  //given data :
6  gama=1.4;
7  u=10^-3;// in m/s
8  v=340;// in m/s
9  P=10^5;// in N/m^2
10 p=gama*P*u/v;
11 disp(p,"The pressure ,p(N/m^2) = ")
```

Scilab code Exa 5.18 speed of sound

```
1  //Example 18 //speed
2  clc;
3  clear;
4  close;
5  sa=332;//m/s
6  pa=16;//density of air
7  ph=1;//density of hydrogen
8  vn=sa*sqrt(pa/ph);//m/s
9  t1=0;//degree celsius
10 t2=546;//degree celsius
11 t1k=0+273;//kelvin
12 t2k=t2+273;//kelvin
13 v2=vn*sqrt(t2k/t1k);//m/s
14 disp(vn,"speed of sound in first case is ,(m/s)=")
15 disp(v2,"speed of sound in second case is ,(m/s)=")
```

Scilab code Exa 5.19 temperature

```
1  //Example 19 //temperature
2  clc;
3  clear;
4  close;
5  t1=0;//degree celsius
6  t1k=t1+273;//kelvin
7  rt=2;//
8  tk=rt^2*t1k;//Kelvin
9  t=tk-273;//degree celsius
10 disp(t,"temperature is ,(degree−celsius)=")
```

Scilab code Exa 5.20 temperature

```
1  //Example 20 //temperature
2  clc;
3  clear;
4  close;
5  rtd=16/14;//ratio of densities
6  tk=15+273;//degree celsius
7  x=(tk*rtd)-273;//degree celsius
8  disp(x,"temperature is ,(degree−celsius)=")
```

Scilab code Exa 5.21 speed of sound in nitrogen

```
1  //Example 21 //speed
2  clc;
3  clear;
```

```
4  close ;
5  rt =4/1; //
6  ss =332; //m/ s
7  rd =32/28; // ratio of densities
8  rt1 =((1+(1/ rt )* rd )/(1+(1/ rt ))); //
9  v1 = ss * sqrt ( rt1 ); //m/ s
10 disp ( v1 ," speed of sound in nitrogen is ,(m/ s )=")
```

Scilab code Exa 5.22 RMS velocity

```
1  // Example 22 // speed
2  clc ;
3  clear ;
4  close ;
5  gm =1.41; //
6  vs =330; //m/ s
7  vrms = sqrt (3/ gm )* vs ; //m/ s
8  disp ( vrms ," root mean square velocity of molecules of
       a gas is ,(m/ s )=")
```

Chapter 7

Superposition of Harmonic Waves Interference Beats Stationary Waves Phase and Group Velocities

Scilab code Exa 7.1 ratio

```
1  //Example 1 //   ratio
2  clc;
3  clear;
4  close;
5  ri=9/16;//ratio of intensities
6  ra=sqrt(ri);//ratio of amplitude
7  a1=1;//assume
8  a2=ra*a1;//
9  rim=(a1+a2)^2/(a1-a2)^2;//
10 disp("ratio of  maximum intensity and minimum
      intensity in fringe system is "+string(rim)+":"+
      string(a1)+"")
```

Scilab code Exa 7.2 intensity

```scilab
1  //Example 2 //    intensity
2  clc;
3  clear;
4  close;
5  I=1;//assume
6  a1=1*I;//
7  a2=4*I;//
8  ph1=0;//degree
9  i1=(a1+a2)+a2*cosd(ph1);//
10 disp("intensity where phase difference is zero is "+
       string(i1)+"*I")
11 ph2=90;//degree
12 i2=(a1+a2)+a2*cosd(ph2);//
13 disp("intensity where phase difference is pi/2 is "+
       string(i2)+"*I")
14 ph3=180;//degree
15 i3=(a1+a2)+a2*cosd(ph3);//
16 disp("intensity where phase difference is pi is "+
       string(i3)+"*I")
```

Scilab code Exa 7.3 wavelength and frequency

```scilab
1  //Example 3 //    Wavelength and frequency
2  clc;
3  clear;
4  close;
5  //given data :
6  d=30;// in cm
7  lamda=2*d*10^-2;
8  v=330;// in m/s
9  disp(lamda,"The wavelength ,(m) = ")
10 n=v/lamda;
11 disp(n,"The frequency ,n(vibrations/s) = ")
```

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Scilab code Exa 7.4 time interval

```
1 //Example 4 //  number of beats and time interval
2 clc;
3 clear;
4 close;
5 n1=300;//Hz
6 n2=303;//Hz
7 bfs=n2-n1;//
8 disp(bfs,"beat frequency per second is,=")
9 ti=1/bfs;//second
10 disp(ti,"time interval is ,(second)=")
```

Scilab code Exa 7.5 frequency

```
1 //Example 5 //  Frequency
2 clc;
3 clear;
4 close;
5 //given data :
6 n1=256;// in Hz
7 x=4;// in beats per sec
8 n2a=n1+x;
9 n2b=n1-x;
10 disp(n2a,"The frequency ,n2a(Hz) = ")
11 disp(n2b,"The frequency ,n2b(Hz) = ")
```

Scilab code Exa 7.6 frequency

```
1  //Example 6 //   Frequency
2  clc;
3  clear;
4  close;
5  //given data :
6  nA=256;// in Hz
7  x=5;// in beats per sec
8  nB=nA+x;
9  disp(nB,"The frequency ,nB(Hz) = ")
```

Scilab code Exa 7.7 frequency

```
1  //Example 7 //   Frequency
2  clc;
3  clear;
4  close;
5  //given data :
6  nB=512;// in Hz
7  x=5;// in beats per sec
8  nA=nB+x;
9  disp(nA,"The frequency of A,nA(Hz) = ")
```

Scilab code Exa 7.8 velocity

```
1  //Example 8 //   Velocity of sound
2  clc;
3  clear;
4  close;
5  //given data :
6  lamda1=1;// in m
7  lamda2=1.01;// in m
8  a=10/3;// in beats/sec
9  v=a/((lamda2-lamda1)/(lamda1*lamda2));
```

```
10  disp(v,"The  velocity  of  sound ,v(m/s )  = ")
```

Scilab code Exa 7.9 frequency

```
 1  //Example  9  //   Frequency
 2  clc;
 3  clear;
 4  close;
 5  n=273;//
 6  b1=4;// beats  per  second
 7  b2=b1-1;//
 8  t1=15;// degree  celsius
 9  t2=10;// degree  celsius
10  v1510=sqrt((n+t1)/(n+t2));//
11  n=((b2*v1510-b1)/(1-v1510));//
12  disp(n,"frequency  is ,(Hz)=")
```

Scilab code Exa 7.10 frequency

```
 1  //Example  10  //   Frequency
 2  clc;
 3  clear;
 4  close
 5  b1=10;// beats  per  second
 6  f1=300;//Hz
 7  b2=15;// beats  per  second
 8  f2=325;//Hz
 9  n1=f1-b1;//Hz
10  n2=f1+b1;//Hz
11  n3=f2-b2;//Hz
12  n4=f2+b2;//Hz
13  disp(n2,"frequency  is ,(Hz)=")
```

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Scilab code Exa 7.11 velocity

```
1  //Example 11 //   Velocity of sound
2  clc;
3  clear;
4  close;
5  //given data :
6  lamda1=5;// in m
7  lamda2=5.5;// in m
8  a=6;// beats/sec
9  v=a/((lamda2-lamda1)/(lamda1*lamda2));
10 disp(v,"The velocity of sound,v(m/s) = ")
```

Scilab code Exa 7.12 frequency

```
1  //Example 12 //   Frequency
2  clc;
3  clear;
4  close
5  b1=5;//beats per second
6  fr=384;//Hz
7  fo=fr-b1;//Hz
8  disp(fo,"frequency is ,(Hz)=")
```

Scilab code Exa 7.13 frequency

```
1  //Example 13 //   Frequency
2  clc;
3  clear;
```

```
4 close
5 b1=4;//beats per second
6 fr=256;//Hz
7 fo=fr+b1;//Hz
8 disp(fo,"frequency is ,(Hz)=")
```

Scilab code Exa 7.18 frequency wavelength velocity and amlitude

```
1 //Example 18 //Frequency, wavelength, velocity and
      amplitude
2 clc;
3 clear;
4 close;
5 //given data :
6 a=6;// in cm
7 lamda=10;// in cm
8 T=1/10;// in sec
9 disp(lamda,"Wavelength of progressive wave,(cm) = ")
10 n=1/T;
11 disp(n,"Frequency of progressive wave,n(per sec)")
12 v=n*lamda;
13 disp(v,"The velocity ,v(cm/s) = ")
14 disp(a,"The amplitude ,a(cm) = ")
```

Scilab code Exa 7.24 group velocity

```
1 //Example 24 //Velocity
2 clc;
3 clear;
4 close;
5 //given data :
6 c=3*10^8;// in m/s
7 lamda1=4000;// in Angustrom
```

```
 8  lamda2 =5000; // in  Aungustrom
 9  mu1 =1.540;
10  mu2 =1.530;
11  vg=c *(( mu1 * lamda1 ) -( mu2 * lamda2 ))/( mu1 * mu2 *( lamda1 -
       lamda2 ));
12  disp (vg ,"The  velocity  , vg (m/s ) = ")
```

Scilab code Exa 7.25 group velocity

```
 1  //Example  25  //Velocity
 2  clc ;
 3  clear ;
 4  close ;
 5  //given  data :
 6  v =1.8*10^8; // in  m/s
 7  lamda =3.6*10^ -7; // in  m
 8  dv_dlamda =3.8*10^13; // in  per  sec
 9  vg=v -( lamda * dv_dlamda );
10  disp (vg ,"The  group  velocity  , vg (m/s ) = ")
```

Chapter 8

Vibrations of Strings and Membranes

Scilab code Exa 8.1 speed

```
1  //Example 1 // Speed
2  clc;
3  clear;
4  close;
5  //given data :
6  m1=0.1;// in kg
7  g=9.81;// in m/s^2
8  T=m1*g;// N
9  A=10^-6;// in m^2
10 p=9.81*10^3;// in kg/m^3
11 m=A*p;// in kg/m
12 v=sqrt(T/m);
13 disp(v,"The speed of transverse waves,v(m/s) = ")
```

Scilab code Exa 8.2 tensile stress

```
1  //Example 2 // tensile stress
2  clc;
3  clear;
4  close;
5  //given data :
6  p=8000;// in kg/m^3
7  v=340;// in m/s
8  TbyA=v^2*p*10^-2;
9  disp(TbyA,"Tensile stress ,(N/m^2) = ")
```

Scilab code Exa 8.3 tension

```
1  //Example 3 // Tension
2  clc;
3  clear;
4  close;
5  //given data :
6  M=2*10^-3;// in kg
7  l=35*10^-2;// in m
8  n=500;// in Hz
9  m=M/l;// in kg/m
10 T=4*n^2*l^2*m;
11 disp(T,"Tension ,T(N) = ")
```

Scilab code Exa 8.4 frequency

```
1  //Example 4 // Frequency
2  clc;
3  clear;
4  close;
5  //given data :
6  T=625;// in N
7  T1=100;// in N
```

```
8  l=1/2;
9  n=240;// in Hz
10 n1=1/l*(sqrt(T1/T))*n;
11 disp(n1,"The frequency ,n1(Hz) = ")
```

Scilab code Exa 8.5 initial tension

```
1  //Example 5 // initial tension
2  clc;
3  clear;
4  close;
5  rt=2/3;//ratio
6  mi=5;//kg wt
7  M=((1/rt)^2)-1;//
8  mo=mi/M;//kg wt
9  disp(mo,"initial tension in string is  ,(kg-wt)=")
```

Scilab code Exa 8.6 speed stress and percentage change

```
1  //Example 6// speed ,stress and change in frequency
2  clc;
3  clear;
4  close;
5  n=175;//Hz
6  l=1.5;//m
7  v=2*n*l;//m/s
8  d=7.8*10^3;//kg/m^3
9  st=v^2*d;//N/m^2
10 per=3;//% increament
11 T=1;//assume
12 td=(1+per/100)*T;//
13 x=(((1/2)*(per/100)));//
14 td=x*100;//
```

```
15  disp(v,"velocity is ,(m/s)=")
16  disp(st,"stress is ,(N/m^2)=")
17  disp(td,"percentage change in frequency is ,(%)=")
```

Scilab code Exa 8.7 frequency

```
1  //Example 7 // Frequency
2  clc;
3  clear;
4  close;
5  //given data :
6  l=.50;// in m
7  m1=25;// in kg
8  m2=1.44*10^-3;// in kg
9  g=9.81;// in m/s^2
10 T=m1*g;
11 m=m2/l;
12 p=2;
13 n=(p/(2*l))*sqrt(T/m);
14 disp(n,"The frequency ,n = ")
```

Scilab code Exa 8.8 frequency

```
1  //Example 8// frequency
2  clc;
3  clear;
4  close;
5  l1=90;//cm
6  d1=0.05;//cm
7  d2=0.0625;//cm
8  l2=60;//cm
9  n1=200;//Hz
10 n2=((l1*d1*n1)/(l2*d2));//Hz
```

```
11  disp(n2,"frequency is ,(Hz)=")
```

Scilab code Exa 8.9 tension

```
1  //Example 9// tension
2  clc;
3  clear;
4  close;
5  n21=3/2;//
6  r21=3/4;//
7  t1=2.048;//kg. wt
8  t2=(n21*r21)^2*t1;//kg weight
9  n31=9/4;//
10 r31=2/4;//
11 t3=(n31*r31)^2*t1;//kg-weight
12 n41=27/8;//
13 r41=1/4;//
14 t4=(n41*r41)^2*t1;//kg-weight
15 disp(t2,"tension (T2) is ,(kg weight)=")
16 disp(t3,"tension (T3) is ,(kg weight)=")
17 disp(t4,"tension (T4) is ,(kg weight)=")
```

Scilab code Exa 8.10 velocity

```
1  //Example 10// velocity
2  clc;
3  clear;
4  close;
5  l1=20;//cm
6  v1=600;//cm^-1
7  n1=v1/4;//
8  v1=2*n1*l1*10^-2;//m/sec
9  v2=sqrt(2)*v1;//m/s
```

```
10  disp(v1,"velocity of the waves is ,(m/s)=")
11  disp(round(v2),"velocity of waves when tension of
        the string is doubled is ,(m/s)=")
```

Scilab code Exa 8.11 frequency

```
1  //Example 11// frequency
2  clc;
3  clear;
4  close;
5  nb=6;//beats
6  l1=20;//cm
7  l2=21;//cm
8  x=l2/l1;//
9  n=(x*nb+nb)/(x-1);//
10  disp(n,"frequency is ,(Hz)=")
```

Scilab code Exa 8.12 frequency

```
1  //Example 12// frequency
2  clc;
3  clear;
4  close;
5  nb=4;//beats
6  l1=70;//cm
7  l2=70-1;//cm
8  x=l2/l1;//
9  n=(x*nb)/(1-x);//
10  disp(n,"frequency is ,(Hz)=")
```

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Scilab code Exa 8.13 length

```
1  //Example 13// length
2  clc;
3  clear;
4  close;
5  n123=1/3/15;//
6  tl=105;//cm
7  l123=15/5/1;//
8  k=tl/21;//
9  l1=15*k;//cm
10 l2=5*k;//cm
11 l3=k;//cm
12 disp(l1,"l1 length is ,(cm)=")
13 disp(l2,"l2 length is ,(cm)=")
14 disp(l3,"l3 length is ,(cm)=")
15 //length l2 is calculated wrong in the textbook
```

Scilab code Exa 8.14 wavelength

```
1  //Example 14// wave−length
2  clc;
3  clear;
4  close;
5  //y=ym*sin*2*%pi(nt−(x/h));//given
6  disp("wavelength is  (%pi*ym)/2")
```

Scilab code Exa 8.15 FREQUENCY

```
1  //Example 15// frequency
2  clc;
3  clear;
4  close;
```

```
5  l=2.5;//m
6  m1=0.001;//kg
7  tn=4;//N
8  m=m1/l;//kg/m
9  n=((1/(2*l))*sqrt(tn/m));//Hz
10 disp(n,"frequency is  ,(Hz)=")
11 disp("frequencies stopped are "+string(5*n)+" Hz,"+
       string(10*n)+" Hz,"+string(15*n)+" Hz")
```

Scilab code Exa 8.16 frequency and relative amplitude

```
1  //Example 16// frequency
2  clc;
3  clear;
4  close;
5  l=1;//m
6  m1=0.5;//kg
7  tn=200;//N
8  m=m1/l;//kg/m
9  n=((1/(2*l))*sqrt(tn/m));//Hz
10 disp(n,"frequency is  ,(Hz)=")
11 w=2*%pi*n;//
12 disp("ratio of three frequencies is "+string(w)+" :
       "+string(2*w)+" : "+string(3*w)+"")
```

Chapter 9

Longitudinal Acoustic Waves in Air

Scilab code Exa 9.1 pressure amplitude energy density and energy lux

```
1  //Example 1 // Pressure amplitude, Energy density
        and Energy flux
2  clc;
3  clear;
4  close;
5  //given data :
6  A=1*10^-5;// in m
7  n=500;// in per sec
8  v=340;// in m/s
9  p=1.29;// in kg/m^3
10 Pa=2*%pi*n*v*p*A;
11 disp(Pa,"Pressure amplitude ,Pa(N/m^2) = ")
12 Ed=2*%pi^2*n^2*p*A^2;
13 disp(Ed,"Energy density ,Ed(J/m^3) = ")
14 Ev=Ed*v;
15 disp(Ev,"Energy flux ,Ev(J/m^2-s) = ")
```

Scilab code Exa 9.2 pressure

```
1  //Example 2// Pressure
2  clc;
3  clear;
4  close;
5  //given data :
6  gama=1.4;
7  u=10^-3;// in m/s
8  v=340;// in m/s
9  P=10^5;// in N/m^2
10 p=gama*P*u/v;
11 disp(p,"The pressure ,p(N/m^2) = ")
```

Scilab code Exa 9.3 amplitude

```
1  //Example 3// The amplitude
2  clc;
3  clear;
4  close;
5  //given data :
6  n=350;// in Hz
7  v=330;// in m/s
8  p=1.293;// in kg/m^3
9  I=1*10^-6;// in W/m^2
10 A=sqrt(I/(2*%pi*n^2*p*v));
11 disp(A,"The amplitude of wave,A(m) = ")
```

Scilab code Exa 9.4 velocity wavelength and amplitude

```
1  //Example 4// Velocity , Amplitude of pressure and
      particle velocity amplitude
2  clc;
```

```
3  clear;
4  close;
5  //given data :
6  gama=1.4;
7  P=1.013*10^5;
8  p1=1.29;// in kg/m^3
9  A=2.5*10^-7;// in m
10 v=sqrt(gama*P/p1);
11 disp(v,"The velocity ,v(m/s) = ")
12 n=1000;// in Hz
13 lamda=v/n;
14 disp(lamda,"Wavelength ,lamda(m) = ")
15 p=p1*v*2*%pi*n*A;
16 disp(p,"Amplitude of pressure ,p(N/m^2) = ")
17 u=2*%pi*n*A;
18 disp(u,"Particle velocity amplitude ,u(m/s) = ")
```

Scilab code Exa 9.5 BULK MODULUS AMPLITUDE AND PRESSURE VARIATION

```
1  //Example 5// Amplitude
2  clc;
3  clear;
4  close;
5  //given data :
6  v=(1/3)*10^3;// in m/s
7  p=1.25;// in kg/m^3
8  E=v^2*p;
9  n=10^4;// in rad/sec
10 disp(E,"Bulk modulus of medium ,E(N/m^2) = ")
11 I=10^-12;// in W/m^2
12 A=sqrt(I/(2*%pi^2*n^2*p*v));
13 disp(A,"Amplitude of wave ,A(m ) = ")
14 P=sqrt(2*I*p*v);
15 disp(P,"Pressure amplitude ,P(N/m^2) = ")
```

```
16  // answer A and E is wrong in textbook
```

Scilab code Exa 9.6 velocity

```
1  //Example 6// Root mean squre velocity
2  clc;
3  clear;
4  close;
5  //given data :
6  vs=330;// in m/s
7  gama=1.41;
8  c=round(sqrt(3/gama)*vs);
9  disp(c,"The root mean square velocity of modulus,c(m
       /s) = ")
```

Scilab code Exa 9.7 power

```
1  //Example 7// Acoustic power entering
2  clc;
3  clear;
4  close;
5  //given data :
6  A=1*2;// in m^2
7  a=80;// in dB
8  I0=10^-12;// in W/m^2
9  IbyI0=10^(80/10);
10 I=I0*IbyI0;
11 Ape=I*A;
12 disp(Ape,"Acoustic power entering the room,(Watt) =
       ")
```

Scilab code Exa 9.8 intensity level

```
1  //Example 8// Acoustic intensity level
2  clc;
3  clear;
4  close;
5  //given data :
6  Pr=3;// in W
7  r=15;// in m
8  I=Pr/(4*%pi*r^2);// in W/m^2
9  I0=10^-12;// in W/m^2
10 L=round(10*log10(I/I0));
11 disp(L,"Acoustic intensity level ,L(dB) = ")
```

Scilab code Exa 9.9 frequency

```
1  //Example 9// frequency
2  clc;
3  clear;
4  close;
5  n2=200;//second^-1
6  l21=2;//
7  f=l21*n2;//
8  disp(f,"frequency is ,( second^-1)=")
```

Scilab code Exa 9.10 length

```
1  //Example 10// length
2  clc;
3  clear;
4  close;
5  l1=66;//cm
6  v=330;//m/s
```

```
7  nbs=5;//beats/sec
8  x=(2*(v-(nbs*2*l1*10^-2))/(v*2*l1*10^-2));//
9  l2=1/x;//cm
10 disp(l2*100,"length is ,(cm)=")
```

Scilab code Exa 9.11 fundamental frequency and length

```
1  //Example 11// length
2  clc;
3  clear;
4  close;
5  f=110;//Hz
6  v=330;//m/s
7  l=v/(2*f);//m
8  disp(f,"fundamental frequency is ,(Hz)=")
9  disp(l,"length is  ,(m)=")
```

Scilab code Exa 9.12 wave equation frequency amplitude wavelength and distance

```
1  //Example 12// equation ,frequency ,amplitude  ,
       wavelength and distance
2  clc;
3  clear;
4  close;
5  //y=6*(sin(2*%pi*x)/6)*cos(160*%pi*t);// given
       equation
6  a=3;//cm
7  T=(2*%pi)/(160*%pi);//sec
8  h=((2*%pi*6)/(2*%pi));//cm
9  disp("wave equation is  3*sin((160*%pi*t)+(2*%pi*x)
       /6)")
10 disp(a,"amplitude is  ,(cm)=")
```

```
11  disp (1/T,"frequency is  ,(Hz)=")
12  disp (h,"wavelength is ,(cm)=")
13  db=h/2;//
14  disp (db,"distance between consecutive antinodes is ,(
       cm)=")
```

Scilab code Exa 9.13 length pressure amplitude

```
1  //Example 13// length ,amlitude ,pressure
2  clc;
3  clear;
4  close;
5  f=440;//Hz
6  v=330;//m/s
7  l=((5*v)/(4*f))*100;//cm
8  disp (l,"length (L) is  ,(cm)=")
9  ang=cos((2*%pi)/8);//
10 disp ("maximum pressure variation is at node =  P o *"
       +string(ang)+" and minimum at antinode =0")
11 pmax=0;//
12 pmin=0;//
13 disp ("at antinode pressure variation is Pmax= "+
       string(pmax)+" and Pmin= "+string(pmin)+"")
```

Chapter 10

Waves in SolidsWaves in Solids

Scilab code Exa 10.1 youngs modulus

```
1 //Example 1 // Young's modulus of steel
2 clc;
3 clear;
4 close;
5 //given data :
6 p=7.8*10^3;// in kg/m^3
7 v=5200;// m/s
8 Y=p*v^2;
9 disp(Y,"Young modulus of steel ,Y(N/m^2) = ")
```

Scilab code Exa 10.2 wavelength and velocity

```
1 //Example 2 // Velocity and wavelength
2 clc;
3 clear;
4 close;
5 //given data :
6 Y=8*10^10;// in N/m^2
```

```
7  p=5000;// in kg/m^3
8  v=sqrt(Y/p);
9  disp(v,"(1). The velocity ,v(m/s) = ")
10 f=400;// in vibration/sec
11 lamda=v/f;
12 disp(lamda,"(2). The wavelength ,(m) = ")
```

Scilab code Exa 10.3 velocity and wavelength

```
1  //Example 3 // Velocity and wavelength
2  clc;
3  clear;
4  close;
5  //given data :
6  Y=7*10^10;// in N/m^2
7  p=2.8*10^3;// in kg/m^3
8  v=sqrt(Y/p);
9  disp(v,"(1). The velocity ,v(m/s) = ")
10 f=500;// in vibration/sec
11 lamda=v/f;
12 disp(lamda,"(2). The wavelength ,(m/s) = ")
```

Scilab code Exa 10.4 youngs modulus

```
1  //Example 4 // Young's modulus
2  clc;
3  clear;
4  close;
5  //given data :
6  l=3;// in m
7  n=600;// in Hz
8  p=8.3*10^3;// in kg/m^3
9  Y=p*n^2*(2*l)^2;
```

```
10  disp (Y, " Youngs  modulus ,Y(N/m^2)  =  ")
```

Scilab code Exa 10.5 frequency

```
1  //Example 5 // Frequency
2  clc ;
3  clear ;
4  close ;
5  //given data :
6  Y=2*10^11;// in N/m^2
7  p=8*10^3;// in kg/m^3
8  l=0.25;// in m
9  n=sqrt(Y/p)/(2*l);
10  disp (n," The  frequency ,n( vibrations /s)  =  ")
```

Scilab code Exa 10.6 AREA

```
1  //Example 6 // Area  of  cross  section
2  clc ;
3  clear ;
4  close ;
5  //given data :
6  n1BYn2 =20;
7  T=20*9.8;// in N
8  Y=19.6*10^10;// in N/m^2
9  alfa=n1BYn2^2*T/Y;
10  disp (alfa," Area  of  cross  section , alfa (m^2)  =  ")
```

Scilab code Exa 10.7 velocity

```
1  //Example  7  //  Velocity  and  Young  modulus
2  clc;
3  clear;
4  close;
5  //given  data  :
6  n=2600;//  in  Hz
7  l=1;//  in  m
8  p=7.8*10^3;//  kg/m^3
9  v=2*n*l;
10  disp(v,"The  velocity ,v(m/s)  =  ")
11  Y=v^2*p;
12  disp(Y,"Youngs  modulus ,Y(N/m^2)  =  ")
```

Scilab code Exa 10.8 frequency

```
1  //Example  8  //  Frequencies
2  clc;
3  clear;
4  close;
5  //given  data  :
6  Y=7.1*10^10;//  in  N/m^2
7  p=2700;//in  kg/m^3
8  l=1.5;//  in  m
9  r1=1;
10  r2=3;
11  r3=5;
12  n1=(r1/(4*l))*sqrt(Y/p);
13  n2=(r2/(4*l))*sqrt(Y/p);
14  n3=(r3/(4*l))*sqrt(Y/p);
15  disp(n1,"frequency  of  first  harmonic ,n1(Hz)  =  ")
16  disp(n2,"frequency  of  first  harmonic ,n1(Hz)  =  ")
17  disp(n3,"frequency  of  first  harmonic ,n1(Hz)  =  ")
```

Scilab code Exa 10.9 frequency

```
1  //Example 9 // Frequency
2  clc;
3  clear;
4  close;
5  //given data :
6  l=1.2;// in m
7  v=5150;// in m/s
8  d=0.006;// in m
9  k=d/sqrt(12);
10 v1=%pi*v*k*3.011^2/(8*l^2);
11 disp(v1,"The frequency ,v1(Hz) = ")
```

Scilab code Exa 10.10 frequency

```
1  //Example 10 // Frequencies
2  clc;
3  clear;
4  close;
5  //given data :
6  l=2;// in m
7  v=3560;// in m/s
8  r=0.004;// in m
9  k=r/2;
10 v1=%pi*v*k*3.011^2/(8*l^2);
11 disp(v1,"The frequency ,v1(Hz) = ")
12 v2=%pi*v*k*5^2/(8*l^2);
13 disp(v2,"The frequency of first overtone ,v2(Hz) = ")
14 v3=%pi*v*k*7^2/(8*l^2);
15 disp(v3,"The frequency of second overtone ,v3(Hz) = "
      )
```

Scilab code Exa 10.11 frequency

```
1 //Example 11 // Frequency
2 clc;
3 clear;
4 close;
5 //given data :
6 Y=7.1*10^10;// in N/m^2
7 p=2.7*10^3;// in kg/m^3
8 r=0.005;// in m
9 vu=sqrt(Y/p);
10 k=r/2;
11 v=vu/(2*%pi*k);
12 disp(v," The frequency ,v(Hz) = ")
```

Chapter 11

Lissajous Figures

Scilab code Exa 11.1 frequency

```
1 //Example 1// Frequencies
2 clc;
3 clear;
4 close;
5 //given data :
6 t=2;// in sec
7 n1=100;// in vibrations/sec
8 n2a=n1+(1/t);
9 n2b=n1-(1/t);
10 disp(n2a,"frequency ,n2a= ")
11 disp(n2b,"frequency ,n2b = ")
```

Scilab code Exa 11.2 frequency

```
1 //Example 2// Frequencies
2 clc;
3 clear;
4 close;
```

```
5  //given data :
6  t1=15;// in sec
7  t2=10;// in sec
8  n2=400;// in vibrations/sec
9  n1a=n2+(1/t1);
10  n1b=n2-(1/t1);
11  disp(n1a,"frequency ,n1a(Hz) = ")
12  disp(n1b,"frequency ,n1b(Hz) = ")
13  n_1a=n2+(1/t2);
14  n_1b=n2-(1/t2);
15  disp(n_1a,"frequency ,n_1a(Hz) = ")
16  disp(n_1b,"frequency ,n_1b(Hz) = ")
```

Scilab code Exa 11.3 frequency

```
1  //Example 3// Frequencies
2  clc;
3  clear;
4  close;
5  //given data :
6  t1=15;// in sec
7  t2=10;// in sec
8  n2=256;// in vibrations/sec
9  n1a=(2*n2)+(1/t1);
10  n1b=(2*n2)-(1/t1);
11  disp(n1a,"frequency ,n1a(Hz) = ")
12  disp(n1b,"frequency ,n1b(Hz) = ")
13  n_1a=(2*n2)+(1/t2);
14  n_1b=(2*n2)-(1/t2);
15  disp(n_1a,"frequency ,n_1a(Hz) = ")
16  disp(n_1b,"frequency ,n_1b(Hz) = ")
```

Chapter 12

Dopplers Effect

Scilab code Exa 12.1 speed

```
1 //Example 1// Speed
2 clc;
3 clear;
4 close;
5 //given data :
6 vl=166;//m/s
7 v=(2*vl);//m/s
8 disp(v,"speed is ,(m/s)")
```

Scilab code Exa 12.2 frequency

```
1 //Example 2// frequency
2 clc;
3 clear;
4 close;
5 //given data :
6 f1=90;//vibrations/second
7 f2=(1+(1/10))*f1;//vibrations/s
8 disp(f2,"frequency is ,(vibrations/s)=")
```

Scilab code Exa 12.3 frequency

```
1  //Example  3//  frequency
2  clc ;
3  clear ;
4  close ;
5  //given  data :
6  N =400; //hZ
7  V =340; //M/S
8  VS =60; //M/S
9  N2 =((V/(V-VS))*N); //Hz
10 disp ( round ( N2 ) ," frequency  when  engine  is  approaching
       to  the  listner  is ,( Hz )=")
11 N3 =((V/(V+VS))*N); //Hz
12 disp ( N3 ," frequency  when  engine  is  moving  away  from
       the  listner  is ,( Hz )=")
```

Scilab code Exa 12.4 wavelength

```
1  //Example  4//WAVELENGTH
2  clc ;
3  clear ;
4  close ;
5  x =1/5; //
6  h =60; //cm
7  h1 =((1-x)*h); //cm
8  h2 =((1+x)*h); //cm
9  disp ( h1 ," wavelength  of  waves  in  north-direction  is ,(
       cm )=")
10 disp ( h2 ," wavelength  of  waves  in  south-direction  is ,(
       cm )=")
```

Scilab code Exa 12.5 frequency

```
1  //Example 5// frequency
2  clc;
3  clear;
4  close;
5  v=340; //m/s
6  n=600; //Hz
7  vs=36; //km h^-1
8  vs1=vs*(1000/3600); //m/s
9  apf=((v)/(v-vs1))*n; //Hz
10 vs2=54; //km h^-1
11 vs3=vs2*(1000/3600); //m/s
12 apf1=((v)/(v+vs3))*n; //Hz
13 disp("two apparent frequencies are "+string(apf)+"
       Hz and "+string(apf1)+" Hz")
14 df=apf-apf1; //Hz
15 disp(df,"difference in frequencies is ,(Hz)=")
16 //second apparent frequency and difference is
       calculated wrong in the textbook
```

Scilab code Exa 12.6 frequency

```
1  //Example 6// frequency
2  clc;
3  clear;
4  close;
5  v=330; //m/s
6  n=500; //Hz
7  vs=30; //km h^-1
8  vs1=vs*(1000/3600); //m/s
9  n3=((v+vs1)/(v-vs1))*n; //Hz
```

```
10  disp ( round ( n3 ) ,” frequency  when  cars  are  approaching
        is   ,( Hz )=” )
11  n1 = (( v - vs1 ) / ( v + vs1 ) ) * n ; //Hz
12  disp ( round ( n1 ) ,” frequency  when  cars  have  crossed    is
          ,( Hz )=” )
```

Scilab code Exa 12.7 frequency

```
1  //Example  7// frequency
2  clc ;
3  clear ;
4  close ;
5  v =330; //m/ s
6  n =600; //Hz
7  vs =20; //m/ s
8  apf = (( v ) / ( v + vs ) ) * n ; //Hz
9  disp ( round ( apf ) ,” frequency  when  source  is  moving
        away  from  the  observer  is   ,( Hz )=” )
10  apf1 = (( v ) / ( v - vs ) ) * n ; //Hz
11  disp ( round ( apf1 ) ,” frequency  when  siren  reaching  at
        the  cliff  is   ,( Hz )=” )
12  bf = apf1 - apf ; //Hz
13  disp ( round ( bf ) ,” beat  frequency  is   ,( Hz )=” )
```

Scilab code Exa 12.8 frequency

```
1  //Example  8// frequency
2  clc ;
3  clear ;
4  close ;
5  r =3; //m
6  w =10; // s ^ −1
7  vs = r * w ; //m/ s
```

```
8  A =6; //m
9  fd =5/%pi ; // s ^ −1
10  vmax = A *2* %pi * fd ; //m/ s
11  v =330; //m/ s
12  n =340; //Hz
13  nmax =(( v + vmax )/( v - vs ))* n ; //Hz
14  nmin =(( v - vmax )/( v + vs ))* n ; //Hz
15  disp ( nmax ," maximum  frequency  is ,( Hz )=" )
16  disp ( nmin ," minimum  frequency  is  ,( Hz )=" )
```

Scilab code Exa 12.9 speed

```
1  // Example  9// speed
2  clc ;
3  clear ;
4  close ;
5  n12 =3; //
6  n =340; //Hz
7  v =340; //m/ s
8  vs =(( n12 * v )/(2* n )); //m/ s
9  disp ( vs ," speed  is  ,( m/ s )=" )
```

Scilab code Exa 12.10 frequency

```
1  // Example  10// frequency
2  clc ;
3  clear ;
4  close ;
5  sa =1.5; //km
6  oa =1; //km
7  so = sqrt ( oa ^2+ sa ^2); //km
8  csd = sa / so ; //
9  v =0.33; //km/ s
```

```
10  n =400; //Hz
11  vlov =120*(1000/3600); //m/ s
12  vs1 =(1/30)*csd; //km/ s
13  nd =((v)/(v-vs1))*n; // vibrations /sec
14  disp(round(nd),"apparent frequency is ,(vibrations/
        second )=")
```

Scilab code Exa 12.11 frequency and distance

```
1  //Example 11// frequency
2  clc;
3  clear;
4  close;
5  v =1200; //km/h
6  w =40; //km/h
7  vs =40; //km/h
8  n =580; //Hz
9  nd =((v+vs)/((v+vs)-vs))*n; //Hz
10  disp(nd,"frequency of the whistle as heared by an
        observer on the hill is ,(Hz)=")
11  x =29/30; //km
12  disp(x*1000,"distance is ,(m)=")
13  ndd =((v-w)+vs)/((v-w))*nd; //Hz
14  disp(ndd,"frequency heared by driver is ,(Hz)=")
15  //distance is calculated wrong in the textbook
```

Scilab code Exa 12.12 Doppler shift and velocity

```
1  //Example 12// doppler shift and velocity
2  clc;
3  clear;
4  close;
5  h1 =6010; //
```

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```
 6 h2=6000;//
 7 ds=h1-h2;//
 8 disp(ds,"doppler shift is ,( )=")
 9 c=3*10^8;//m/s
10 v=((ds/h2)*c);//m/s
11 disp(v,"speed is ,(m/s)=")
```

Scilab code Exa 12.13 velocity

```
 1 //Example 13//doppler shift and velocity
 2 clc;
 3 clear;
 4 close;
 5 h1=3737;//
 6 h2=3700;//
 7 ds=h1-h2;//
 8 disp(ds,"doppler shift is ,( )=")
 9 c=3*10^8;//m/s
10 v=((ds/h2)*c);//m/s
11 disp(v,"speed is ,(m/s)=")
12 //speed is calculated wrong in the textbook
```

Scilab code Exa 12.14 speed

```
 1 //Example 14//speed
 2 clc;
 3 clear;
 4 close;
 5 dv=10^3;//Hz
 6 v=5*10^9;//Hz
 7 c=3*10^8;//m/s
 8 v=((dv)/(2*v))*c;//m/s
 9 disp(v,"velocity is ,(m/s)=")
```

Chapter 13

Elementary Theory of Filters

Scilab code Exa 13.1 inductance and capacitance

```
1  //Example 1 //   design  loss  pass  constant  K−filter
2  clc;
3  clear;
4  close;
5  k=600; //ohms
6  fc=2500; //Hz
7  l=(k/(%pi*fc)); //H
8  c=((1/(%pi*fc*k))); //farad
9  disp(l*10^3,"inductance  is  ,(mH)=")
10 disp(c*10^6,"capacitance  is  ,(micro−F)=")
```

Scilab code Exa 13.2 inductance and capacitance

```
1  //Example 2 //   T−type  band  pass  filter
2  clc;
3  clear;
4  close;
5  //given  data :
```

```
6  K=500;// in ohm
7  f1=4;// in kHz
8  f2=1;// in kHz
9  L1=K/(%pi*(f1-f2));
10 Ls=L1/2;
11 disp(Ls,"Inductance in each series arm,Ls(mH) = ")
12 C1=(f1-f2)*10^3/(4*%pi*K*f1*f2);
13 Cs=2*C1;
14 disp(Cs,"Capacity in each series arm,Cs(micro-F) = "
      )
15 L2=((f1-f2)*K)/(4*%pi*f1*f2);
16 disp(L2,"Shunt arm inductance ,L2(mH) = ")
17 Csh=1*10^6/(%pi*(f1-f2)*10^3*K);
18 disp(Csh,"Capacity in shunt arm,Csh(micro-F) = ")
```

Chapter 14

Ultrasonics

Scilab code Exa 14.1 frequency

```
1  //Example 1 // Fundamental frequency
2  clc;
3  clear;
4  close;
5  //given data :
6  t=1.6*10^-3;// in m
7  lamda=2*t;// in m
8  v=5760;// in m/s
9  n1=v*10^-6/lamda;
10 disp(n1,"Fundamental frequency,n1(MHz) = ")
```

Scilab code Exa 14.2 Length

```
1  //Example 2 //  distance
2  clc;
3  clear;
4  close;
5  //given data :
```

```
6  th =40; //cm
7  t1 =30; // micro−seconds
8  t2 =80; // micro seconds
9  x =((2* th *10^ -2* t1 *10^ -6) /(2* t2 *10^ -6) ) *100; //cm
10 disp (x ," d i s t a n c e is  ,(cm)=")
```

Scilab code Exa 14.3 thickness

```
1  //Example 3 // Thickness
2  clc ;
3  clear ;
4  close ;
5  //given data :
6  v =5000; // in m/s
7  N =50000; // in Hz
8  t=v /(2* N );
9  disp (t ," Thickness of steel plate ,t (m) = ")
```

Scilab code Exa 14.4 capacitance

```
1  //Example 4 //  Capacitance
2  clc ;
3  clear ;
4  close ;
5  //given data :
6  L =1; // in H
7  n =10^6; // in Hz
8  C =1*10^12/(4*%pi ^2* n ^2* L );
9  disp (C ," The capacitance ,C( micro−F) = ")
```

Chapter 15

Musical Sound and Acoustic of Bulidings

Scilab code Exa 15.1 levels by which intensity will decrease

```
1 //Example 1 // decibles
2 clc;
3 clear;
4 close;
5 //given data :
6 i1=4;//assume
7 i2=4*i1;//
8 dl=10*log10(i2/i1);//db
9 disp(dl,"decibles by which intensity level will
     decrease is ,(db)=")
```

Scilab code Exa 15.2 ratio of amplitudes

```
1 //Example 2 // ratio of amlitudes
2 clc;
3 clear;
```

```
4  close ;
5  // given data :
6  l1 =10; // db
7  l2 =40; // db
8  dl = l2 - l1 ; // db
9  x =(10^( dl /10)) ; //
10 x1 = sqrt ( x ) ; //
11 disp ( x1 ," ratio of amplitudes is ,=")
```

Scilab code Exa 15.3 frequency

```
1  // Example 3 // frequency
2  clc ;
3  clear ;
4  close ;
5  // given data :
6  x =264; // key note
7  g = x *(3/2) ; //
8  disp (g ," frequency of note G is ,=")
9  cd1 = x *2; //
10 disp ( cd1 ," frequency of note C is ,=")
```

Chapter 17

Electromagnetic Waves

Scilab code Exa 17.1 poynting vector

```
1 //Example 1 // magnitude
2 clc;
3 clear;
4 close;
5 //given data :
6 R=7*10^8;// in m
7 P=3.8*10^26;// in Watt
8 S=P/(4*%pi*R^2);
9 disp(S,"Magnitude of poynting vector ,S(W/m^2) = ")
```

Scilab code Exa 17.2 poynting vector

```
1 //Example 2 // Poynting vector
2 clc;
3 clear;
4 close;
5 //given data :
6 R=1.5*10^11;// in m
```

```
7  P=3.8*10^26;// in Watt
8  S=P/(4*%pi*R^2);// in W/m^2
9  Se=round(S*60/(4.2*10^4));
10 disp(Se,"Poynting vector ,Se(cal/cm^2 -min) = ")
```

Scilab code Exa 17.3 amplitudes of electric and magnetic field radiation

```
1  //Example 3 // Amplitude and magnetic field
2  clc;
3  clear;
4  close;
5  //given data :
6  S=2;// in cal/cm^2- min
7  EH=S*4.2*10^4/60;// joule/m^2 sec
8  mu0=4*%pi*10^-7;
9  epsilon0=8.85*10^-12;
10 EbyH=sqrt(mu0/epsilon0);
11 E=sqrt(EH*EbyH);
12 H=EH/E;
13 E0=E*sqrt(2);
14 H0=H*sqrt(2);
15 disp(E,"E is  ,(V/m)=")
16 disp(H,"H is  ,(Amp-turn/m)=")
17 disp(E0,"Amplitude of electric fields of radiation ,
      E0(V/m) = ")
18 disp(H0,"Magnetice field of radition  ,H0(Amp-turn/m)
      = ")
```

Scilab code Exa 17.4 amplitudes of electric and magnetic field radiation

```
1  //Example 4 // electric and magnetic field
2  clc;
3  clear;
```

```
4 close;
5 //given data :
6 r=2;// in m
7 mu0=4*%pi*10^-7;
8 epsilon0=8.85*10^-12;
9 EbyH=sqrt(mu0/epsilon0);
10 EH=1000/(4*r^2*%pi^2);// in W/m^2
11 E=sqrt(EH*EbyH);
12 H=(EH/E);
13 disp(E,"Intensities of electric ,E(V/m) = ")
14 disp(H,"Magnetic field of radiation ,H(Amp-turn/m) =
      ")
```

Scilab code Exa 17.5 polarisation degree

```
1 //Example 5 // Degree of polarization
2 clc;
3 clear;
4 close;
5 //given data :
6 thetai=45;// in degree
7 n=1.5;/// index
8 thetar=asind(sind(thetai)/n);
9 Rl=sind(thetai-thetar)^2/sind(thetai+thetar)^2;
10 Rp=tand(thetai-thetar)^2/tand(thetai+thetar)^2;
11 D=((Rl-Rp)/(Rl+Rp))*100;
12 disp(D,"Degree of polarization ,D(%) = ")
13 // answer is wrong in the textbook
```

Scilab code Exa 17.6 frequency

```
1 //Example 6 // Frequency
2 clc;
```

```
3  clear;
4  close;
5  //given  data :
6  del=1; // in m
7  mu=4*%pi*10^-7; // in H/m
8  sigma=4; // in siemen/m
9  v=1*10^-3/(%pi*del^2*mu*sigma);
10  disp(v,"Frequency ,v(kHz) = ")
```