Scilab Textbook Companion for
Basic Electrical and Electronics Engineering
by R. Muthusubramanian and S. Salivahanan[1]

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

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

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

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

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Chapter 1

FUNDAMENTALS OF ELECTRICITY AND DC CIRCUITS

Scilab code Exa 1.1 RESISTANCE

```
1  //Chapter −1, Example 1.1, Page 18
2  //
   _____

3  clc ;
4  clear ;
5  //INPUT DATA
6  // details for the first wire
7  l1 =1; //length in m
8  R1 =2; //resistance in ohms
9  x=R1 ; //say
10 d =1; //say
11 p =1; //say
12 d1 =d; //say diameter in m
13 p1 =p; //say specific resistance of wire
14 //details for the second wire
15 l2 =3; //length in m
```

```
16  d=1;//say
17  p=1;//say
18  d2=2*d;//say diameter in m
19  p2=2*p;//say specific resistance of wire
20  //CALCULATIONS
21  R1=p1*l1/(%pi*d*d/4);//(R1=p1*l1/a1), where a1 is
        cross sectional area of first wire with diameter
        d as (%pi*d*d/4)————————————equation 1
22  R2=p2*l2/(%pi*(4*d*d)/4);//(R2=p2*l2/a2), where a2
        is cross sectional area of second wire with
        diameter 2d as (%pi*((2*d)*(2*d))/4)————————
        equation 2
23  //dividing equation 1 by equation 2
24  z=R1/R2;
25  R2=x/z;
26  //OUTPUT
27  mprintf("Thus the resistance of second wire is %1.0f
        ohm \n",R2);
28
29  //======================================END OF PROGRAM
        =============================
```

Scilab code Exa 1.2 RESISTANCE

```
1  //Chapter −1, Example 1.2, Page 18
2  //
        ================================================================

3  clc;
4  clear;
5  //INPUT DATA
6  l1=20;//length in cm for first case
7  l2=0.4;//length in cm for second case
8  w=0.1;//width in cm
9  t=0.4;//thickness in cm
```

```
10  p=1.7*10^-6//resistivity of copper in ohm cm
11  a1=0.1*0.4//area(w*t) in cm^2 for first case
12  a2=0.1*20//area(l*t) in cm^2 for second case
13  //CALCULATIONS
14  R1=p*l1/a1;//resistance in ohms for first case
15  R2=p*l2/a2;//resistance in ohms for second case
16  //OUTPUT
17  mprintf("Thus the resistance in first and second
        cases are %g ohms and %g ohms\n",R1,R2);
18
19  //==================================END OF PROGRAM
        ====================================
```

Scilab code Exa 1.3 DIAMETER

```
1  //Chapter −1, Example 1.3, Page 19
2  //
        ===============================================
3  clc;
4  clear;
5  //INPUT DATA
6  la=1000;//length  of aluminium wire in cm
7  da=0.2;//diameter in cm
8  pa=2.6*10^-6;//specific resistance of aluminium in
        ohm cm
9  pc=1.6*10^-6;//specific resistance of copper in ohm
        cm
10  lc=600;//length  of copper wire in cm
11  i=2;//current in A passing through combination
12  ia=1.25;//current in A passing through aluminium
        wire
13  //CALCULATIONS
14  ic=i-ia;//current in A passing through copper wire
15  //resistance of aluminium wire in ohms
```

```
16 Ra=pa*la/(%pi*(da*da)/4);//(Ra=pa*la/a), where a is
       cross sectional area of aluminum wire with
       diameter da
17 Rc=ia/ic*Ra;//resistance of copper wire
18 dc=sqrt(4*pc*lc/Rc);//diameter of copper wire
19 //OUTPUT
20 mprintf("Thus the diameter of copper wire  is %1.3f
      cm \n",dc);
21 //note:The answer given for diameter in text book is
        wrong.please check the calculations
22
23 //=======================================END OF PROGRAM
      ============================
```

Scilab code Exa 1.4 RESISTANCE

```
1 //Chapter -1, Example 1.4, Page 20
2 //
   ====================================================

3 clc;
4 clear;
5 //INPUT DATA
6 l=10000;//length drawn from 10cc of copper in cm
7 p=1.7*10^-6;//Resistivity of copper in ohm cm
8 v=10;//volume of copper in cc
9 s1=10;//square sheet side in second case in cm
10 //CALCULATIONS
11 a=v/l;//area of cross-section in cm^2 in first case
12 R1=p*l/a;//resistance of wire in first case in ohm
13 a1=s1*s1;//area of cross-section in cm^2 in second
      case
14 l1=v/a1;//thickness in case 2 in cm
15 R2=p*l1/a1;//resistance of wire in second case in
      ohm
```

```
16  //OUTPUT
17  mprintf("Thus the resistance in first and second
        cases are %g ohms and %g ohms\n",R1,R2);
18
19  //=========================================END OF PROGRAM
        ==============================
```

Scilab code Exa 1.5 TEMPERATURE COEFFICIENT

```
1  //Chapter −1, Example 1.5, Page 21
2  //
     ===========================================================
3  clc;
4  clear;
5  //INPUT DATA
6  t1=40;//temperature in degree centigrade
7  t2=100;//temperature in degree centigrade
8  R1=3.146;//resistance of platinum coli at t1
9  R2=3.767;//resistance of platinum coli at t2
10  //CALCULATIONS
11  x=R1/R2;
12  a0=((R1-R2)/(R2*t1-R1*t2));//temperature coefficient
        at 0 degree centigrade
13  R0=R1/(1+(a0*t1));//resistance at zero degree
        centigrade
14  a40=a0/(1+(a0*t1));//temperature coefficient at 40
        degree centigrade
15  //OUTPUT
16  mprintf("Thus the temperature coefficient at 0
        degree centigrade,resistance at zero degree
        centigrade,temperature coefficient at 40 degree
        centigrade are %f /degree centigrade ,%f ohms,%f
        /degree centigrade respectively \n",a0,R0,a40);
17
```

```
18
19 //═══════════════════════════════════════END OF PROGRAM
      ═══════════════════════════════════
```

Scilab code Exa 1.6 RESISTANCE

```
1 //Chapter −1, Example  1.6 ,  Page  21
2 //
      ════════════════════════════════════════════════════════════════

3 clc ;
4 clear ;
5 //INPUT DATA
6 t1 =12;// temperature  in  degree  centigrade
7 t2 =50;// temperature  in  degree  centigrade
8 R1 =0.4;// copper  coil  resistance  in  ohms
9 a0 =0.004;// temperature  coefficient  of  copper  at  zero
       degree  centigrade
10 //CALCULATIONS
11 a12 =1/((1/ a0 )+t1 ) ;// temperature  coefficient  at  12
      degree  centigrade
12 R2=R1 *[1+( a12 *( t2 - t1 ) ) ];// resistance  of  copper  wire
       in  ohm  at  52  degree  centigrade
13 //OUTPUT
14 mprintf (" Thus  the  resistance  copper  wire  at  52
      degree  centigrade  is  %1.2 f   ohm  \n" ,R2 ) ;
15
16 //═══════════════════════════════════════END OF PROGRAM
      ═══════════════════════════════════
```

Scilab code Exa 1.7 TEMPERATURE

```
1 //Chapter −1, Example  1.7 ,  Page  22
```

```
 2 //
    ================================================================

 3 clc;
 4 clear;
 5 //INPUT DATA
 6 t1=20;//temperature in degree centigrade
 7 R1=45;//shunt motor resistance at t1
 8 R2=48.5;//new shunt resistance at t2
 9 a0=0.004;//temperature coefficient of resistance at
      0 degree centigrade
10 //CALCULATIONS
11 x=R1/R2;
12 t2=((1+(a0*t1)-x)/(a0*x));
13 //OUTPUT
14 mprintf("Thus the temperature for new resistance is
      %d degree centigrade \n",t2);
15
16 //==================================END OF PROGRAM
      ==============================
```

Scilab code Exa 1.8 TEMPERATURE RISE

```
 1 //Chapter −1, Example 1.8 , Page 22
 2 //
    ================================================================

 3 clc;
 4 clear;
 5 //INPUT DATA
 6 V=180;//supply voltage in volts
 7 I1=4;//initial current of coil in A
 8 t1=20;//initial temperature
 9 I2=3.4;//new decreased current of coil in A at
      temperature t2
```

```
10  a0 =0.0043; //temperature  coefficient  in  per  degree
        centigrade
11  //CALCULATIONS
12  R1=V/I1 ; //initial  resistance  of  coil  in  ohms
13  R2=V/I2 ; //resistance  of  coil  after  some  time  in  ohms
14  x=R1/R2 ;
15  t2=(1+(a0*t1)-x)/(a0*x) ;
16  t=t2-t1; //temperature  rise
17  //OUTPUT
18  mprintf(" Thus  the  temperature  rise  is  %2.2 f  degree
        centigrade  \n",t);
19
20  //==========================================END  OF  PROGRAM
        =============================
```

Scilab code Exa 1.9 CURRENT

```
1  //Chapter −1, Example  1.9 , Page  23
2  //
        ===================================================

3  clc ;
4  clear ;
5  //INPUT DATA
6  t2=2750; //temperature  in  degree  centigrade  for
        tungsten  lamp
7  P=150; //power  in  watts
8  V=230; //voltage  in  volts
9  t1=16; //temperature  in  degree  centigrade
10  a0=0.0047; //temperature  coefficient  of  tungsten  in
        per  degree  centigrade
11  //CALCULATIONS
12  R2=(V*V)/P ;
13  a1=1/((1/a0)+t1) ; //temperature  coefficient  of
        resistant  at  16  degree  centigrade
```

```
14  R2=(V*V)/P;//Resistance of the filament of the lamp
        under normal working condition
15  R1=R2/[1+(a1*(t2-t1))];//resistance of copper wire
        in ohm at 52 degree centigrade
16  I2=V/R2;//normal current taken by lamb
17  I1=V/R1;//current taken at the moment of switching
        on
18  //OUTPUT
19  mprintf("Thus the normal current taken by lamb and
        current taken at the moment of switching on are
        %1.4f A and %1.4f A respectively ",I2,I1);
20
21  //=======================================END OF PROGRAM
        ===============================
```

Scilab code Exa 1.10 EFFICIENCY

```
1  //Chapter -1, Example 1.10, Page 23
2  //
        =====================================================
3  clc;
4  clear;
5  //INPUT DATA
6  m1=2;//mass of water in kg
7  theta1=20;//temperature 20 degree centigrade
8  theta2=100;//temperature 100 degree centigrade(
        boiling point of water)
9  t=1/10;//time taken to boil water in hr
10  x=40;//cost of energy of 1kwh in paise for one unit
11  y=12;//cost of energy consumed
12  S=1;//specific heat of water
13  //CALCULATIONS
14  H=m1*S*(theta2-theta1);//heat energy required to
        raise temperature from theta1 to theta2 in kcals
```

```
15  H=H/860;//heat energy in Kwh
16  E=(12/40);//electrical energy or input energy to
        kettle in Kwh
17  n=H/E*100;//efficiency of kettle in percentage;
18  P=E/t;//power rating of kettle
19  //OUTPUT
20  mprintf("Thus the efficiency of kettle in percentage
            and power rating of kettle is %d and %1.0f Kw",
        n,P);
21
22
23  //===================================END OF PROGRAM
        ===============================
```

Scilab code Exa 1.11 RESISTANCE

```
1  //Chapter −1, Example 1.11, Page 24
2  //
        ================================================
3  clc;
4  clear;
5  //INPUT DATA
6  m=2;//mass of water in kg
7  theta1=20;//temperature 20 degree centigrade
8  theta2=100;//temperature 100 degree centigrade(
        boiling point of water)
9  t=0.25;//time taken to boil water in hr
10  V=240;//power supply in volts
11  n=80;//efficiency of kettle in percentage
12  S=1;//specific heat of water
13  //CALCULATIONS
14  H=m*S*(theta2-theta1);//output energy from the
        kettle in kcal
15  H=H/860;//output energy from the kettle in kwh
```

```
16  n=n/100;
17  E=H/n;//electrical energy or input energy to kettle
       in Kwh
18  P=E/t;//power rating of kettle in Kw
19  P=P*1000;//power rating of kettle in w
20  R=(V*V)/P;//resistance of heating element in ohms
21  //OUTPUT
22  mprintf("Thus the resistance of heating element is
       %2.2f ohms",R);
23
24
25  //================================END OF PROGRAM
       ==============================
```

Scilab code Exa 1.12 TIME

```
1  //Chapter−1, Example 1.12 , Page 24
2  //
       ================================================
3  clc;
4  clear;
5  //INPUT DATA
6  m=20;//mass of aluminium in kg
7  S=0.896;//specific heat of aluminium in KJ/Kg degree
        centigrade
8  L=402;//latent heat of fusion of aluminium in KJ/Kg
9  theta2=657;//final temperature
10  theta1=20;//initial temperature(assumed)
11  P=25;//power of furnace in Kw
12  n=80;//efficiency of kettle in percentage
13  //CALCULATIONS
14  H=m*S*(theta2-theta1)+(m*L);//heat energy required
       to melt aluminium or energy output from the
       furnace in Kj
```

```
15  H=H/4.186;//heat  energy  required  to  melt  aluminium
       or  energy  output  from  the  furnace  in  Kcal
16  H=H/860;//heat  energy  required  to  melt  aluminium  or
       energy  output  from  the  furnace  in  KWh
17  n=n/100;
18  E=H/n;//electrical  energy  or  input  energy  to  kettle
       in  Kwh
19  t=E/P;//time  taken  to  melt  the  aluminium  in  hr
20  t=t*60;//  time  taken  to  melt  the  aluminium  in  min
21  //OUTPUT
22  mprintf("Thus  the  time  taken  to  melt  the  aluminium
       is  %2.2f  min",t);
23
24
25  //===================================END  OF  PROGRAM
       ==================================
```

Scilab code Exa 1.13 ENERGY

```
1  //Chapter−1,  Example  1.13 ,  Page  25
2  //
       =========================================================
3  clc;
4  clear;
5  //INPUT DATA
6  m=80000;//mass  of  water  lifted  by  pump  in  Kg/min
7  g=9.81;//gravity  constant  in  m/sec^2
8  h=2;//pump  is  in  operation  for  two  hours  a  day
9  d=30;//pump  is  in  operation  for  30  days
10  T=h*d;//total  time  for  which  pump  is  in  operation  in
        hrs
11  n=70;//efficeincy  in  percentage
12  h=12;//the  height  in  m  to  which  pump  lifts  water
13  C=50;//cost  of  energy  in  paise/Kwh
```

```
14  //CALCULATIONS
15  P=m*g*h;//potential energy possessed by water per
        minute or workdone by motor pump/minute measured
        in joules
16  P=P/60;//potential energy possessed by water per
        minute or workdone by motor pump/minute  measured
         in joules/sec or watts.
17  O=P/1000;//output power of motor in Kw
18  n=n/100;
19  E=O/n;//input power of motor in Kw
20  Et=E*T;//total energy supplied or energy consumption
        in Kwh
21  C=C/100;//cost of energy in Rs/Kwh
22  Ct=C*Et;//Total cost of energy
23  //OUTPUT
24  mprintf("Thus the total cost of energy is  Rs %4.0f"
        ,Ct);
25
26
27  //═══════════════════════════════════END OF PROGRAM
        ═══════════════════════════════
```

Scilab code Exa 1.14 VOLUME

```
1  //Chapter −1, Example 1.14 , Page 26
2  //
        ═══════════════════════════════════════════════════════

3  clc;
4  clear;
5  //INPUT DATA
6  P=100;//power of power station in MW
7  g=9.81;//gravity constant in m/sec^2
8  h=200;//effective head of power station in m
9  n=80;//efficiency of station in percentage
```

```scilab
10 t=10; //operation time of power station
11 //CALCULATIONS
12 E1=P*t; // energy output from the station in 10 hours
       measured in MWh
13 n=n/100;
14 E2=P*t/n; //energy input to the station in 10 hours
       measured in MWh
15 E2=E2*10^6*60*60; //energy input to the station in 10
       hours measured in Wsec or joules
16 //energy input to the station is equal to potential
       energy supplied by water to station
17 m=E2/(g*h); //mass in kg of water used
18 d=1000; //density of water in kg/m^3
19 V=m/d; //volume of water used in 10 hours
20 //OUTPUT
21 mprintf("Thus the volume of water used in 10 hours
       is %e cubic metre",V);
22
23
24 //===================================END OF PROGRAM
       ==============================
```

Scilab code Exa 1.15 VELOCITY

```scilab
1 //Chapter-1, Example 1.15, Page 26
2 //
       ===================================================

3 clc;
4 clear;
5 //INPUT DATA
6 I=20; //current in A
7 V=8; //supply voltage in V
8 t=3600; //1hr=3600sec
9 m=1000; //mass in kg(1 tonne= 1000 kg)
```

```
10 //kinetic energy = energy dissipated in the
      resistance———eqn(1)
11 //CALCULATIONS
12 E=V*I*t;// energy dissipated in resistance in joules
13 v=sqrt(E/(0.5*m));//kinetic energy possesed by body(
      K=0.5*m*v*v) and using eqn(1),we found out
      velocity in m/sec
14 //OUTPUT
15 mprintf("Thus the velocity is %2.2f m/sec",v);
16
17
18 //==================================END OF PROGRAM
      ==============================
```

Scilab code Exa 1.16 RESISTIVITY

```
1 //Chapter−1, Example 1.16, Page 27
2 //
      ========================================================

3 clc;
4 clear;
5 //INPUT DATA
6 I=7.9;//current in A
7 V=240;//supply voltage in V
8 t=55;//temperature in degree centigrade
9 a0=0.00029;//temperature coefficient in ohm/ohm/
      degree centigrade
10 l=15.6;//length of wire in m
11 a=12;//cross−sectional area in mm^2
12 //CALCULATIONS
13 R=V/I;//resistance of wire in ohm
14 p=R*a/l;//resistivity of wire in ohm metre
15 Rt=R*(1+(a0*t));//resistance at 55 degree centigrade
      in ohm
```

```
16  I1=V/Rt;//current through wire at temperature 55
        degree centigrade in A
17  //OUTPUT
18  mprintf("Thus the resistivity and current through
        wire at temperature 55 degree centigrade are %2.2
        f micro ohm meter and %2.2f A respectively",p,I1)
        ;
19
20
21  //=================================END OF PROGRAM
        =============================
```

Scilab code Exa 1.17 RESISTANCE

```
1  //Chapter -1, Example 1.17, Page 27
2  //
        =========================================================

3  clc;
4  clear;
5  //INPUT DATA
6  R1=0.031;//resistance of wire in ohm
7  d1=11.7;//diameter of wire in mm in case 1
8  r1=d1/2;//radius of wire in mm in case 1
9  d2=5;//diameter of wire in mm in case 2
10 r2=d2/2;//radius of wire in mm in case 2
11 // we know that resistance is inversely proportional
        to square of area of cross-section
12 //CALCULATIONS
13 R2=R1*(((%pi*r1*r1)/(%pi*r2*r2)))^2;//resistance of
        wire in case 2
14 //OUTPUT
15 mprintf("Thus the new resistance of wire is %1.4f
        ohms",R2);
16
```

```
17
18 //================================END OF PROGRAM
      ================================
```

_____

Scilab code Exa 1.18 RESISTANCE

```
1 //Chapter −1, Example 1.18 , Page 27
2 //
      ==================================================================
3 clc ;
4 clear ;
5 //INPUT DATA
6 p20 =1.724*10^ -8;// specific resistance of copper in
      ohm m
7 a=0.0043;// temperature coefficient of copper at 0
      degree centigrade measured in per degree
      centigrade
8 r1 =8;// inner radius of copper circular ring in cm
9 r2 =6;// axial thickness in cm
10 r3 =4;// radial thickness in cm
11 a1=r2*r3*10^ -4;// area of cross−section of ring in m
      ^2
12 r2=r2*2;
13 l=%pi *(( r1+r2)/2)/100;// length of semicircular ring
      between faces in m
14 t1 =20;// temperature 20 degree centigrade
15 t2 =50;// temperature 50 degree centigrade
16 //CALCULATIONS
17 R20=p20 *( l/a1 );// resistance of ring at 20 degree
      centigrade in ohm
18 R50=R20 *[(1+( a*t2 ))/(1+( a*t1 ))];// resistance of ring
       at 50 degree centigrade in ohm
19 //OUTPUT
20 mprintf (" Thus the resistance of wire at 50 degree
```

```
        centigrade is %g ohms",R50);
21
22
23 //===================================END OF PROGRAM
      ==============================
```

Scilab code Exa 1.19 RESISTIVITY

```
1 //Chapter −1, Example 1.19, Page 28
2 //
      ================================================================
3 clc;
4 clear;
5 //INPUT DATA
6 l1=0.5;//length of copper rod in m
7 a=0.00426;//temperature coefficient of copper
      measured in per degree centigrade
8 R1=4.25*10^-4;//resistance of wire at 15 degree
      centigrade in ohm
9 d1=5*10^-3;//diameter of copper rod in m in case 1
10 r1=0.5*d1;//radius of copper rod in m in case 1
11 a1=%pi*((r1)^2);//area of cross−section in m^2 in
      case 1
12 t1=15;//temperature in degree centigrade
13 t2=50;//temperature in degree centigrade
14 //CALCULATIONS
15 p=R1*a1/l1;//resistivity in ohm−m
16 d2=1*10^-3;//diameter of copper rod in m in case 2
17 r2=d2/2;//radius of copper rod in m in case 2
18 a2=%pi*(r2)^2;//area of cross−section in m^2 in case
       2
19 R15=(a1/a2)^2*R1;//resistance at 15 degree
      centigrade
20 R50=R15*((1+(a*t2))/(1+(a*t1)));
```

27

```
21  //OUTPUT
22  mprintf("Thus the resistance of wire at 50 degree
         centigrade is %1.4f ohm",R50);
23
24
25  //================================END OF PROGRAM
         ==========================
```

_____

Scilab code Exa 1.20 DIAMETER

```
 1  //Chapter-1, Example 1.20, Page 28
 2  //
         ================================================
 3  clc;
 4  clear;
 5  //INPUT DATA
 6  l1=7.5;//length of aluminium wire in m
 7  d1=1*10^-3;//diameter of aluminium wire in m
 8  r1=0.5*d1;//radius of aluminium wire in m
 9  a1=%pi*((r1)^2);//area of cross-section in m^2 for
          aluminium wire
10  p1=0.028;//resistivity of aluminium in micro ohm-m
11  l2=6;//length of copper wire in m
12  p2=0.017;//resistivity of copper in micro ohm-m
13  I=5;//current through parallel combination in A
14  I1=3;//current through aluminium wire in A
15  I2=I-I1;//current through copper wire in A
16  //CALCULATIONS
17  R1=p1*l1/a1;//resistance of aluminium wire in ohm
18  V1=I1*R1;//voltage drop across the end of Al wire in
          V
19  //since the wires are connected in parallel,so V1=V2
20  a2=I2*p2*l2/V1;//area of cross-section in m^2 for
          copper wire
```

```
21  d2=sqrt(4*a2/%pi);//diameter  of  copper  wire  in  m
22  //OUTPUT
23  mprintf("Thus  the  diameter  of  copper  wire  is  %g m",
        d2);
24
25  //==================================END  OF  PROGRAM
        ========================
```

Scilab code Exa 1.22 TEMPERATURE RISE

```
1  //Chapter−1, Example  1.22 , Page  29
2  //
      ===========================================================
3  clc;
4  clear;
5  //INPUT DATA
6  R20=100;//resistance  of  coil  at  20  degree  centigrade
        in  ohms
7  R45=110;//resistance  of  coil  at  45  degree  centigrade
        in  ohms
8  Rt=124;//resistance  of  coil  at  t  degree  centigrade
      in  ohms
9  t1=20;//temperature  in  degree  centigrade
10  t2=15;//temperature  in  degree  centigrade
11  a=R45/R20;
12  //CALCULATIONS
13  a0=(a-1)/(45-(20*a));//temperature  coefficient  of
        coil  at  0  degree  centigrade
14  x=(Rt/R20);
15  t=(x)*(1+(a0*t1));
16  t=t-1;
17  t=(t)*(1/a0);////temperature  of  coil  when  Rt=124
        ohms  measured  in  degree  centigrade
18  deltat=t-t2;//mean  temperature  rise
```

```
19 //OUTPUT
20 mprintf("Thus the mean temperature rise is %2.0f
       degree centigrade",deltat);
21
22
23 //=================================END OF PROGRAM
       ==============================
```

Scilab code Exa 1.23 TEMPERATURE RISE

```
1 //Chapter −1, Example 1.23 , Page 30
2 //
       ================================================================
3 clc ;
4 clear ;
5 //INPUT DATA
6 R20 =18; // resistance of coil at 20 degree centigrade
       in ohms
7 R50 =20; // resistance of coil at 50 degree centigrade
       in ohms
8 Rt =21; // resistance of coil at t degree centigrade in
        ohms
9 t1 =20; // temperature in degree centigrade
10 t2 =50; // temperature in degree centigrade
11 t3 =15; // temperature in degree centigrade
12 a= R50 / R20 ;
13 //CALCULATIONS
14 a0 =( a -1) /(50 -(20* a )); // temperature coefficient of
       coil at 0 degree centigrade
15 x =( Rt / R50 ) ;
16 t =( x ) *(1+( a0 * t2 )) ;
17 t=t -1;
18 t =( t ) *(1/ a0 );////// temperature of coil when Rt =21 ohms
        measured in degree centigrade
```

```
19  deltat=t-t3;//mean temperature rise
20  //OUTPUT
21  mprintf("Thus the mean temperature rise is %2.0f
        degree centigrade",deltat);
22
23
24  //=======================================END OF PROGRAM
        ==============================
```

_____

Scilab code Exa 1.24 CURRENT

```
1  //Chapter −1, Example 1.24, Page 40
2  //
        ====================================================

3  clc;
4  clear;
5  //INPUT DATA
6  R1=4;//resistance in ohms
7  R2=6;////resistance in ohms
8  I=30;//current through parallel combination in A
9  //CALCULATIONS
10 I1=I*(R2/(R1+R2));//current through resistor1 in A
11 I2=I-I1;//current through resistor2 in A
12 //OUTPUT
13 mprintf("Thus the current through resistor1 and
        resistor2 are %d A and %d A  respectively",I1,I2)
        ;
14  //=======================================END OF PROGRAM
        ==============================
```

_____

Scilab code Exa 1.25 POWER

```
1  //Chapter −1, Example 1.25, Page 41
2  //
     _____

3  clc;
4  clear;
5  //INPUT DATA
6  R1=2;//resistance1 in ohms
7  R2=3;//resistance2 in ohms
8  R3=4;//resistance3 in ohms
9  R4=5;//resistance4 in ohms
10 P=100;//total power absorbed in watts
11 //CALCULATIONS
12 RT=((R2*R3*R4)+(R1*R3*R4)+(R1*R2*R4)+(R1*R2*R3))/(R1
     *R2*R3*R4);
13 RT=1/RT;//equivalent resistance of parallel
     combination of R1,R2,R3,R4 Resistors
14 V=sqrt(P*RT);//voltage in volts that has to be
     applied to absorb 100w of power
15 //OUTPUT
16 mprintf("Thus the voltage in volts that has to be
     applied to absorb 100w of power is %1.3f V ",V);
17  //═══════════════════════════════════END OF PROGRAM
     ════════════════════════════
```

Scilab code Exa 1.26 RESISTANCE

```
1  //Chapter −1, Example 1.26, Page 41
2  //
     _____

3  clc;
4  clear;
5  //INPUT DATA
6  V=230;//supply voltage in volts
```

```
7  I1=12;//initial current in A
8  I2=16;//final current in A
9  //CALCULATIONS
10 I=I2-I1;//current through the resistance placed in
       parallel in A
11 R=V/I;//resistance in ohms by ohm's law
12 //OUTPUT
13 mprintf("Thus the resistance placed in parallel is
       %2.1f ohm ",R);
14 //========================================END OF PROGRAM
       ==============================
```

_____

Scilab code Exa 1.27 CURRENT

```
1  //Chapter-1, Example 1.27, Page 41
2  //
       ===========================================================

3  clc;
4  clear;
5  //INPUT DATA
6  I=12.1;//current in A entering the parallel
       combination of resistors
7  I1=7.2;//current in A in resistor 1
8  R1=50;//resistance1 in ohm
9  R2=100;//resistance2 in ohm
10 //CALCULATIONS
11 V=I1*R1;//supply voltage in volts by ohms law(V=I*R)
12 I2=V/R2;//current through R2 in A  by ohms law
13 I3=I-I1-I2;//current through resistance3 R3 in A by
       ohms law
14 R3=V/I3;//resistance in ohm
15 //OUTPUT
16 mprintf("Thus the value of third resistance placed
       is %3.2f ohm ",R3);
```

```
17   //=====================================================END OF PROGRAM
     =================================
```

Scilab code Exa 1.28 RESISTANCE

```
1  //Chapter −1, Example 1.28 , Page 42
2  //
     =================================================================

3  clc ;
4  clear ;
5  //INPUT DATA
6  R1 =3.6;// resistance in ohm
7  R2 =4.56;// resistance in ohm
8  RT =6;// resistance in ohm
9  //CALCULATIONS
10 X=RT -(R2);
11 R3 =(X*R1)/(R1-X);
12 //OUTPUT
13 mprintf ("Thus the value of third resistance placed
     is %1.1f ohm ",R3);
14   //=====================================================END OF PROGRAM
     =================================
```

Scilab code Exa 1.29 RESISTANCE

```
1  //Chapter −1, Example 1.29 , Page 42
2  //
     =================================================================

3  clc ;
4  clear ;
5  //INPUT DATA
```

```
6  P=70;//total power dissipated in circuit in watts
7  V=22;//applied voltage in volts
8  I=P/V;//total current through the circuit in Amps
9  R1=12;//resistance 1 of parallel combination in ohms
10 R2=8;//resistance 2 of parallel combination in ohms
11 //CALCULATIONS
12 RP=(R1*R2)/(R1+R2);//equivalent resistance of
       parallel combination in ohms
13 VP=I*RP;//voltage across parallel combination in
       volts
14 VR=V-VP;//voltage across the resistance R# in volts
15 R3=VR/I;//by ohm's law
16 //OUTPUT
17 mprintf("Thus the value of third resistance placed
       is %1.2f ohms ",R3);
18  //════════════════════════════════════END OF PROGRAM
       ════════════════════════════
```

Scilab code Exa 1.30 EMF

```
1  //Chapter -1, Example 1.30, Page 43
2  //
       ══════════════════════════════════════════════════════

3  clc;
4  clear;
5  //INPUT DATA
6  P=70;//total power dissipated in circuit in watts
7  V1=6;//since applied voltage  E is 6V,as per the
       characteristics of parallel circuit P.D across R1
        is
8  V2=6;//V1=V2,in volts
9  R1=12;//resistance1 in parallel combination in ohms
10 R2=6;//resistance2 in parallel combination in ohms
11 R3=6.25//resistance3 in series with parallel
```

```
        combination in ohms
12  I1=V1/R1;// current through the resistance R1 in
        Amps
13  I2=V2/R2;//current through the resistance R2 in Amps
14  r=0.25;//internal resistance in ohm
15  //CALCULATIONS
16  I=I1+I2;//total current through parallel combination
17  E=(I*r)+(I*R3)+V2;//emf of battery in Volts
18  //OUTPUT
19  mprintf("Thus the value of emf of battery in Volts
        is %2.2f volts ",E);
20    //==================================END OF PROGRAM
        ============================
```

Scilab code Exa 1.31 CURRENT

```
1  //Chapter −1, Example 1.31, Page 44
2  //
     =======================================================
3  clc;
4  clear;
5  //INPUT DATA
6  E=12;//emf of battery in volts
7  R1=3;//resistance1 in parallel combination in ohms
8  R2=4;//resistance2 in parallel combination in ohms
9  R3=6;//resistance3 in parallel combination in ohms
10 R4=4;//resistance4 in series with parallel
        combination in ohms
11 r=6;//internal resistance in ohm
12 //CALCULATIONS
13 RP=((R2*R3)+(R3*R1)+(R1*R2))/(R1*R2*R3);
14 RP=1/RP;//equivalent resistance of parallel
        combination in ohms
15 RT=RP+R4+r;//total circuit resistance in ohms
```

```
16  I=E/RT;//total circuit current in A
17  V=E-(I*r);//terminal voltage of battery in volts
18  //OUTPUT
19  mprintf("Thus the terminal voltage of battery is %1
        .3f volts ",V);
20  //==================================END OF PROGRAM
        ================================
```

Scilab code Exa 1.32 CURRENT

```
1  //Chapter −1, Example 1.32 , Page 45
2  //
     ================================================

3  clc;
4  clear;
5  //INPUT DATA
6  V=24;//supply voltage of battery in volts
7  Rab=13;//resistance between A and B points in ohms
8  Rbc=11;//resistance between B and C points in ohms
9  Rbe=18;//resistance between B and E points in ohms
10 Rce=14;//resistance between C and E points in ohms
11 Red=9;//resistance between E and D points in ohms
12 Rcd=5;//resistance between C and D points in ohms
13 Rae=22;//resistance between A and E points in ohm
14 Rx=Rae;
15 Ry=Rbe;
16 Raf=1;//resistance between A and F points in ohms
17 //CALCULATIONS
18 Rce=((Rcd+Red)*(Rce))/(Rcd+Red+Rce);//equivalent
      resistance of Rce in ohms
19 Rbe=((Rbc+Rce)*(Rbe))/(Rbc+Rce+Rbe);//equivalent
      resistance of Rbe in ohms
20 Rae=((Rab+Rbe)*(Rae))/(Rab+Rbe+Rae);//equivalent
      resistance of Rae in ohms
```

```
21  RT=Rae+Raf;//total equivalent circuit resistance in
        ohms
22  Iaf=V/RT;//current through resistance Raf in A
23  Vae=V-(Iaf*Raf);//P.D across AE in volts
24  Iae=Vae/Rx;//current in AE in A
25  Iab=Iaf-Iae;//current in AB in A
26  Vab=Rab*Iab;//P.D across AB in volts
27  Vbe=Vae-Vab;//Voltage across branch BE in volts
28  Pbe=((Vbe)^2)/(Ry);//power absorbed in branch Be in
        watts
29  Ibe=Vbe/Ry;//current in BE in A
30  Ibc=Iab-Ibe;//current in BC in A
31  Icde=(Ibc)/(2);//current in CDE in A
32  Vcd=Icde*(Rcd);//P.D across CD
33  //OUTPUT
34  mprintf("Current in branch AF is %d A \n Power
        absorbed in BE is %1.1f watts \n P.D across CD is
        %1.2f volts ",Iaf,Pbe,Vcd);
35  //=================================END OF PROGRAM
        ==============================
```

Scilab code Exa 1.33 CURRENT

```
1  //Chapter-1, Example 1.33, Page 46
2  //
        =================================================

3  clc;
4  clear;
5  //INPUT DATA
6  V1=25;//supply voltage1 of battery in volts
7  V2=45;//supply voltage2 of battery in volts
8  R1=6;//resistance1 in ohms
9  R3=4;//resistance2 in ohms
10 R2=3;//resistance3 in ohms
```

```
11  //let  I1  be  the  current  in  loop1  and  I2  current  be
        in  loop2
12  //CALCULATIONS
13  //V1=((R1+R3)*(I1)-(R3*I2));//applying  KVL  in  loop1
        ------------eqn(1)
14  //V2=((R3)*(I1)-(R2+R3)*(I2));//applying  KVL  in
        loop2  ------------eqn(2)
15  //solving  both  eqn(1)  and  eqn(2)
16  [a]=[(R1+R3),-R3;(R3),-(R2+R3)]
17  [b]=[V1;-V2]
18  [c]=inv(a)*(b)//ax=b
19  c1=c(1);//c1  is  current  in  branch  FABC  measured  in  A
20  c2=c(2);//c2  is  current  in  branch  CDEF  measured  in  A
21  c3=c1-c2;//current  in  branch  CF  in  A
22  //OUTPUT
23  mprintf("Current  in  R1  is  %1.4f  A  \n  current  in  R2
        is  %2.3f  A  \n   current  in  R3  is  %1.3f  A\n ",c1,c2
        ,c3);
24   //==============================END  OF  PROGRAM
        =============================
```

Scilab code Exa 1.34 CURRENT

```
1  //Chapter-1,  Example  1.34,  Page  46
2  //
        =========================================================
3  clc;
4  clear;
5  //INPUT DATA
6  V=4.5;//supply  voltage  of  battery  in  volts
7  RAB=1000;//resistance  between  A  and  B  points  in  ohms
8  RBC=100;//resistance  between  B  and  C  points  in  ohms
9  RAD=5000;//resistance  between  A  and  D  points  in  ohms
10  RCD=450;//resistance  between  C  and  D  points  in  ohms
```

```
11  Rg=500;//resistance of galvanometer in ohms
12  //let I1 be the current across RAB and I1−Ig across
        RBC and I2 across RAD and I2+Ig across RCD and I
        be the total current
13  //where I=I1+I2
14  //CALCULATIONS
15  //(−(RAB∗I1)−(Rg∗Ig)+(RAD∗I2))=0;//applying KVL to
        loop ABDA ————————eqn(1)
16  //(−(RBC∗I1)+((Rg+RCD+RBC)∗(Ig))+(RCD∗I2))=0;//
        applying KVL to loop BCDB ————————eqn(2)
17  //((RAD+RCD)∗I2)+(RCD∗Ig))=V;//applying KVL to loop
        EADCFE————————eqn(3)
18  //solving  eqn(1),eqn(2) and eqn(3)
19  [a]=[-RAB,-Rg,RAD;-RBC,(Rg+RCD+RBC),RCD;0,RCD,(RAD+
        RCD)];
20  [b]=[0;0;V];
21  [c]=inv(a)*(b)//ax=b
22  I1=c(1);//c1 is current in branch FABC measured in A
23  Ig=c(2);//c2 is current in branch CDEF measured in A
24  I2=c(3);//current in branch CF in A
25  //OUTPUT
26  mprintf("Current through galvanometer is %g A \n
        since the answer is positive our assumed
        direction is correct ",Ig);
27   //================================END OF PROGRAM
        ==============================
```

Scilab code Exa 1.35 CURRENT

```
1  //Chapter−1, Example 1.35, Page 47
2  //
        ========================================================
3  clc;
4  clear;
```

```
5  //INPUT DATA
6  V1=8;//supply voltage of battery in loop1 in volts
7  V2=4;//supply voltage of battery in loop2 in volts
8  RED=200;//resistance between E and D points in ohms
9  RAD=20;//resistance between A and D points in ohms
10 RCD=50;//resistance between C and D points in ohms
11 //let I1 be the current across path AFED and I2
        across AD and I1-I2 across path DCBA
12 //CALCULATIONS
13 //((RCD*I1)-((RAD+RCD)*I2))=4;//applying KVL to loop
        ADCBA ---------------eqn(1)
14 //((RED*I1)+(RAD*I2))=8;//applying KVL to loop AFEDA
        ---------------eqn(2)
15 //solving  eqn(1)and eqn(2)
16 [a]=[RCD,-(RAD+RCD);RED,RAD];
17 [b]=[4;8];
18 [c]=inv(a)*(b)//ax=b
19 I1=c(1);//c1 is current across path AFED in A
20 I2=c(2);//c2 is current across AD in A
21 //OUTPUT
22 mprintf("Current in 20 ohm resistor  is %f A \n
        since the answer is negative ,the current actually
        flows from A to D ",I2);
23  //===================================END OF PROGRAM
        ==============================
```

Scilab code Exa 1.36 RESISTANCE

```
1  //Chapter-1, Example  1.36 , Page  48
2  //
        =====================================================
3  clc;
4  clear;
5  //INPUT DATA
```

```
6  Rs=25;//total  resistance  when  two  resistances  are
      connected  in  series  in  ohms
7  Rp=6;//total  resistance  when  two  resistances  are
      connected  in  parallel  in  ohms
8  //let  individual  resistances  be  R1  and  R2  ohms
9  //CALCULATIONS
10 //Rs=(R1+R2)----eqn(1)
11 //Rp=((R1*R2)/(R1+R2))----eqn(2)
12 //let  (R1*R2)=x
13 //let(R1-R2)=y
14 //solving  eqn(1)and  eqn(2)
15 x=Rs*Rp;//in  ohms
16 y=sqrt((Rs)^2-(4*x));//eqn---(3)
17 //solving  eqn(1)  and  eqn(3)
18 z=Rs+y;
19 R1=z/2;//resistance1  in  ohms
20 R2=Rs-R1;//resistance2  in  ohms
21 //OUTPUT
22 mprintf("Thus  the  individual  resistances  are  R1=%d
      ohms  and  R2=%d  ohms  ",R1,R2);
23  //============================END  OF  PROGRAM
      =============================
```

Scilab code Exa 1.37 CURRENT

```
1  //Chapter-1,  Example  1.37,  Page  48
2  //
      =================================================
3  clc;
4  clear;
5  //INPUT DATA
6  P=16;//total  power  dissipated  in  circuit  in  Watts
7  R1=4;//resistance  R1  in  Ohms
8  R2=2;//resistance  R2  in  Ohms
```

```
9   R3 =8;//resistance R3 in Ohms
10  V =8;//supply voltage in volts
11  //let resistance parallel to R1 is R ohms
12  //CALCULATIONS
13  Reff =(((V)^2)/P);//total effective resistance of
        circuit in ohms
14  x =((R2*R3)/(R2+R3));//effective resistance of 2nd
        parallel circuit in ohms
15  z =(Reff -x);//effective resistance of 1st parallel
        circuit where z=((R1*R)/(R1+R)) in ohms————eqn
        (1)
16  //solving for R in eqn(1)
17  R =(R1*z)/(R1-z);
18  Reff =((R1*R)/(R1+R))+(x);//in ohms
19  I =V/Reff;//total current in A
20  mprintf("Thus the total current is I=%d A ",I);
21   //======================================END OF PROGRAM
        ==============================
```

Scilab code Exa 1.38 CURRENT

```
1  //Chapter −1, Example 1.38, Page 49
2  //
       ===========================================================

3  clc;
4  clear;
5  //INPUT DATA
6  R1 =2;//resistance R1 in Ohms
7  R2 =12;//resistance R2 in parallel circuit measured
        in ohms
8  R3 =20;//resistance R3 in parallel circuit measured
        in ohms
9  R4 =30;//resistance R4 in parallel circuit measured
        in ohms
```

```scilab
10  R5 =2;//resistance  R5  in  ohms
11  V =100;//supply  voltage  in  volts
12  //CALCULATIONS
13  Reff =(R1)+((1)/((1/R2)+(1/R3)+(1/R4)))+(R5);//total
        effective  resistance  of  circuit  in  ohms
14  I=V/Reff;//total  current  in  A
15  //  let  individual  currents  in  3  parallel  resistance
        network  be  I1,I2,I3  respectively
16  //Then  I1+I2+I3=I——eqn(1)
17  //where  I2=(I1*R1/R2)  and  I3=(I1*R1/R3)
18  //solving  for  I1  in  eqn(1)
19  I1=I/2;//in  A
20  I2 =(I1*R2/R3);//in  A
21  I3 =(I1*R2/R4);//in  A
22  mprintf(" I1=%d  A  \n  I2=%1.0f  A  \n  I3=%1.0f  A",I1,I2,
        I3);
23   //===============================END  OF  PROGRAM
        ==========================
```

Scilab code Exa 1.39 RESISTANCE

```scilab
1  //Chapter −1,  Example  1.39,  Page  49
2  //
        ==================================================

3  clc;
4  clear;
5  //INPUT DATA
6  V =100;//supply  voltage  in  volts
7  I=10;//total  current  in  A
8  P1 =600;//power  dissipated  in  coil  in  Watts
9  //CALCULATIONS
10  //Reff=((R1*R2)/(R1+R2))  is  total  effective
        resistance  of  circuit  in  ohms——eqn(1)
11  Reff=V/I;;//total  effective  resistance  of  circuit  in
```

```
        ohms
12  R1=((V)^2)/(P1);//in ohms———eqn(2)
13  //solving  for  R2  in  eqn(1)
14  R2=((Reff*R1)/(R1-Reff));//in  ohms
15  mprintf("R1=%2.2f  Ohms  \n  R2=%1.0f  Ohms  ",R1,R2);
16    //═══════════════════════════════════END OF PROGRAM
        ═══════════════════════════════
```

Scilab code Exa 1.40 CURRENT

```
1  //Chapter −1, Example  1.40 ,  Page  50
2  //
      ════════════════════════════════════════════════════

3  clc;
4  clear;
5  //INPUT DATA
6  R1=5;//resistance  in  ohms
7  P=20;//power  dissipated  in  R1  in  Watts
8  R2=10;//Resistance  parallel  to  R1
9  //CALCULATIONS
10 I1=sqrt(P/R1);//current  through  R1  in  A
11 I=((R1+R2)/(R2))*(I1);//total  supply  current  in  A
12 mprintf("I=%d A",I);
13   //═══════════════════════════════════END OF PROGRAM
       ═══════════════════════════════
```

Scilab code Exa 1.41 RESISTANCE

```
1  //Chapter −1, Example  1.41 ,  Page  50
2  //
      ════════════════════════════════════════════════════
```

```
3  clc;
4  clear;
5  //INPUT DATA
6  I1=2;//current through R1 in A
7  I3=1.5;//current through R3 in A
8  I5=0.5;//current through R5 in A
9  P2=75;//power dissipated in R2 in W
10 P4=30;//power dissipated in R4 in W
11 V=200;//supply voltage in volts
12 //let the current through R2 and R4 be I2 and I4
       respectively
13 //CALCULATIONS
14 I2=I1-I3;//current through R2 in A
15 I4=I3-I5;//current through R4 in A
16 R2=P2/(I2)^2;//resistance R2 in Ohms
17 R4=P4/(I4)^2;//resistance R4 in Ohms
18 R5=(R4*I4)/(I5);//resistance R5 in Ohms
19 //(R1*I1)+(R2*I2)=200
20 //(R3*I3)+(R4*I4)=(R2*I2)
21 R1=((V-(R2*I2))/I1);//resistance R1 in Ohms
22 R3=((R2*I2)-(R4*I4))/(I3);//resistance R3 in Ohms
23 //OUTPUT
24 mprintf("R1=%d ohms \n R2=%d ohms \n R3=%d ohms \n
       R4=%d ohms \n R5=%d ohms ",R1,R2,R3,R4,R5);
25   //===================================END OF PROGRAM
       ==============================
```

Scilab code Exa 1.42 CURRENT

```
1  //Chapter−1, Example 1.42, Page 50
2  //
       ===============================================================
3  clc;
4  clear;
```

```
5  //INPUT DATA
6  VA=0.2;//voltage across ammeter A in Volts
7  VB=0.3;//voltage across ammeter B in volts
8  I=20;//total current in A
9  //CALCULATIONS
10 RA=VA/I;//resistance through ammeter A in ohms
11 RB=VB/I;//resistance through ammeter B in ohms
12 IA=((RB*I)/(RA+RB));//current through ammeter A in
      amps
13 IB=I-IA;//current through ammeter B in amps
14 //OUTPUT
15 mprintf("IA=%1.0f Amps \n IB=%d Amps \n ",IA,IB);
16   //=================================END OF PROGRAM
       =============================
```

Scilab code Exa 1.43 RESISTANCE

```
1  //Chapter-1, Example 1.43, Page 51
2  //
       ========================================================
3  clc;
4  clear;
5  //INPUT DATA
6  R1=10;//resistance R1 in ohms
7  R2=20;//resistance R2 in ohms
8  R3=40;//resistance R3 in ohms
9  //after certain manipulations the resultant network
      can be evaluated as parallel combinaton of R1,R2,
      R3
10 //CALCULATIONS
11 RAD=1/((1/R1)+(1/R2)+(1/R3));//resultant resistance
      in Ohms
12 //OUTPUT
13 mprintf("Resultant resitance RAD is %1.3f ohms",RAD)
```

```
       ;
14    //==================================END OF PROGRAM
       ==============================
```

Scilab code Exa 1.44 RESISTANCE

```
1  //Chapter −1, Example  1.44 , Page  51
2  //
       ================================================
3  clc ;
4  clear ;
5  //INPUT DATA
6  V =200; //supply  voltage  in  volts
7  I =25; //total  current  in  A
8  P1 =1500; //power  dissipated  in  watts
9  //CALCULATIONS
10 R1 =( V ) ^2/( P1 ) ; //Resistance  R1  in  Ohms
11 Reff =( V )/( I ) ; //total  effective  resitance  of  R1  and
        R2  in  parallel  in  Ohms
12 R2 =( Reff * R1 )/( R1 - Reff ) ; //Resitance  R2  in  Ohms
13 //OUTPUT
14 mprintf ( " R1=%2.3 f  ohms  \n  R2= %2.3 f  ohms " , R1 , R2 ) ;
15   //==============================END OF PROGRAM
       ==============================
```

Scilab code Exa 1.45 RESISTANCE

```
1  //Chapter −1, Example  1.45 , Page  52
2  //
       ================================================
3  clc ;
```

```
4  clear ;
5  //INPUT DATA
6  V =15; //supply voltage in volts
7  VAB =5; //voltage across AB in volts
8  R1 =5; //resitance in ohms
9  R2 =10; //resitance in ohms
10 R3 =10; //resitance in ohms
11 //CALCULATIONS
12 VAC =(( R1 ) /( R1+R3 ) )*V ; //Volatge across AC terminals
       in Volts
13 //VBC=(((R)/(R+2))*V)——————————eqn(1) by ohm's
       law
14 //VAB=(VAC−((VBC)*(R2−(((R1+R2)*R)/(R+2)))
       ————————————eqn(2) by ohm's law
15 //solving equation 2 with Vab=5V
16 R =10/10; //resistance R in ohms
17 //OUTPUT
18 mprintf("R=%d ohms",R);
19  //==================================END OF PROGRAM
       ========================
```

Scilab code Exa 1.46 CURRENT

```
1  //Chapter −1, Example 1.46, Page 52
2  //
       ================================================

3  clc ;
4  clear ;
5  //INPUT DATA
6  Ra =4; //Resistance in ohms
7  Rb =9; //Resistance in ohms
8  Rc =18; //Resistance in ohms
9  Rd =2; //Resistance in ohms
10 Re =7; //Resistance in ohms
```

```
11  Rf=15;//Resistance in ohms
12  V=125;//voltage in volts
13  //CALCULATIONS
14  R1=((Ra)+((Rb*Rc)/(Rc+Rb)));//resistance in branch1
        in ohms
15  R2=((Rd)+(Re));//resistance in branch2 in ohms
16  Reff=((R1*R2)/(R1+R2))+Rf;//effective resistance in
        ohms
17  I=V/Reff;//current in Rf resistor in Amps
18  I1=(I)*(Rb)/(Rb+R1);//current in resistor Ra in Amps
19  Ix=(I1)*(Rb/(Rb+Rc)) ;//current in resistor Rc in
        Amps
20  V2=(Ix)*(Rc);//voltage across Rc in volts
21  I2=I-I1;//current across Re in Amps
22  P4=(I2)^2*Re;//power dissipated across Re in W
23  //OUTPUT
24  mprintf("current across 15 ohm resistor is %1.2f
        amps \n voltage across 18 ohm resistor is %dV \n
        power dissipated in 7 ohm resistor is %2.1f Watts
        ",I,V2,P4);
25  //========================================END OF PROGRAM
        ==============================
```

Scilab code Exa 1.47 CURRENT

```
1  //Chapter -1, Example 1.47, Page 53
2  //
        =====================================================
3  clc;
4  clear;
5  //INPUT DATA
6  R1=20;//Resistance in ohms
7  R2=50;//Resistance in ohms
8  R3=30;//Resistance in ohms
```

```
9  R4=15;//Resistance in ohms
10 V=100;// supply voltage in volts
11 //applying KVL to meshes I and II
12 //R1*(I1)+(R3)*(I1−I2)=V;−−−−−−−eqn(1)
13 //(R2+R4)*(I2)+(R3)*(I2−I1)=0;−−−−−−−−−eqn(2)
14 //solving eqn(1) and eqn(2)
15 //CALCULATIONS
16 [a]=[R2,-R3;-R3,(R3+R4+R2)];
17 [b]=[V;0];
18 [c]=inv(a)*(b);
19 I1=c(1);//current in mesh1 in A
20 I2=c(2);//current in mesh2 in A
21 //OUTPUT
22 mprintf("current across 15 ohm resistor is %1.4f
     amps",I2);
23 //======================================END OF PROGRAM
     ==============================
```

Scilab code Exa 1.48 CURRENT

```
1 //Chapter−1, Example 1.48, Page 53
2 //
     =========================================================
3 clc;
4 clear;
5 //INPUT DATA
6 RAB=1;//Resistance across AB in ohms
7 ROB=4;//Resistance across OB in ohms
8 RBC=2;//Resistance across BC in ohms
9 RAC=1.5;//resistance across AC in ohms
10 V=10;// supply voltage in volts
11 //let ROC is R ohms
12 //applying KVL to meshes I,II and III
13 //RAB*(I1)+0+ROB*(I1−I3)=0−−−−−−−eqn(1)
```

```
14  //RAC*(I2)+ROC*(I2-I3)=0-----------eqn(2)
15  //ROB*(I3-I1)+R*(I3-I2)+RBC*I3=10------eqn(3)
16  //solving eqn(1) we get it as (I2=I1) and applying
        it in eqn(2) we get R as 6 ohms
17  R=6;//Resistance ROC
18  //solving eqn(1),(2)and (3)
19  //CALCULATIONS
20  [a]=[RAB+ROB,0,-ROB;0,(RAC+R),-R;-ROB,-R,(RBC+R+ROB)
        ];
21  [b]=[0;0;10];
22  [c]=inv(a)*(b);
23  I1=c(1);//current in mesh1 in A
24  I2=c(2);//current in mesh2 in A
25  I3=c(3);//current in mesh3 in A
26  I=(I3-I2);//current flowing through R
27  //OUTPUT
28  mprintf("current across resistor R is %1.1f amps",I)
        ;
29  //===============================END OF PROGRAM
        ==============================
```

Scilab code Exa 1.49 CURRENT

```
1  //Chapter-1, Example 1.49, Page 54
2  //
        ===============================================

3  clc;
4  clear;
5  //INPUT DATA
6  R1=5;//Resistance in ohms
7  R2=15;//Resistance in ohms
8  R3=10;//Resistance in ohms
9  R4=8;//resistance in ohms
10  R5=12;//resistance in ohms
```

```
11  V1=4;// supply voltage in volts
12  V2=6;//supply voltage in volts
13  //let currents in mesh I,II and III is I1,I2,I3
        respectively
14  //applying KVL to meshes I,II and III
15  //(R1+R2)*(I1)-R2*(I2)=V1--------eqn(1)
16  //R2*(I1)-(R2+R3+R4)*(I2)+(R4)*(I3)=0----------eqn(2)
17  //R4*(I2)-(R4+R5)=V2--------eqn(3)
18  //solving eqn(1) we get it as (I2=I1) and applying
        it in eqn(2) we get R as 6 ohms
19  R=6;//Resistance ROC
20  //solving eqn(1),(2)and (3)
21  //CALCULATIONS
22  [a]=[R1+R2,-R2,0;R2,-(R2+R3+R4),R4;0,R4,-(R4+R5)];
23  [b]=[V1;0;V2];
24  [c]=inv(a)*(b);
25  I1=c(1);//current in mesh1 in A
26  I2=c(2);//current in mesh2 in A
27  I3=c(3);//current in mesh3 in A
28  I=(I2-I3);//current flowing through R4 in Amps
29  //OUTPUT
30  mprintf("current across 8 ohm resistor is %1.3f amps
        ",I);
31    //================================END OF PROGRAM
        ============================
```

Scilab code Exa 1.50 CURRENT

```
1  //Chapter-1, Example 1.50, Page 55
2  //
       ====================================================
3  clc;
4  clear;
5  //INPUT DATA
```

```
6  RAB =25;// Resistance  in  ohms
7  RBC =10;// Resistance  in  ohms
8  RAD =20;// Resistance  in  ohms
9  RCD =15;// resistance  in  ohms
10 RG =50;// resistance  of  galvanometer  in  ohms
11 REF =2;// internal  resistance  in  ohms
12 V =25;//  supply  voltage  in  volts
13 // let  currents  in  mesh  I ,II  and  III  is  I1 ,I2 ,I3
      respectively
14 // applying  KVL  to  meshes  I ,II  and  III
15 // (RAB+RG+RAD)*( I1 )−(RG)*( I2 )−(RAD)*( I3 )=0−−−−−−−eqn
      (1)
16 // −(RG)*( I1 )−(RG+RCD+RBC)*( I2 )−(RCD)*( I3 )=0−−−−−−−−−
      eqn (2)
17 // −(RAD)*( I1 )−(RCD)*( I2 )+(RAD+RCD+REF)=−V−−−eqn (3)
18 // solving  eqn (1) ,(2) and  (3)
19 // CALCULATIONS
20 [a]=[RAB+RG+RAD ,-RG ,-RAD ;-RG ,(RG+RCD+RBC) ,-RCD ;-RAD
      ,-RCD ,(RAD+RCD+REF)];
21 [b]=[0;0;-V];
22 [c]=inv(a)*(b);
23 I1=c(1);// current  in  mesh1  in  A
24 I2=c(2);// current  in  mesh2  in  A
25 I3=c(3);// current  in  mesh3  in  A
26 I=(I1-I2);// currentthrough  galvanometer  in  Amps
27 // OUTPUT
28 mprintf("current  across  galavanometer  is  %1.5 f  amps"
      ,I);
29  //==============================END  OF  PROGRAM
      ==========================
```

Scilab code Exa 1.51 CURRENT

```
1 // Chapter −1,  Example  1.51 ,  Page  56
2 //
```

```
      ═══════════════════════════════════════════

 3  clc ;
 4  clear ;
 5  //INPUT DATA
 6  V1 =100; // source1  voltage  in  volts
 7  V2 =50; // source2  voltage  in  volts
 8  R1 =10; // Resistance  in  ohms
 9  R2 =20; // resistance  in  ohms
10  R3 =30; // resistance  in  ohms
11  R4 =40; // resistance  in  ohms
12  // let  currents  in  mesh  I ,II  is  I1 ,I2  respectively
13  // applying  KVL  to  meshes  I ,II
14  // (R1+R3+R4) *( I1 )-(R3) *( I2 )=V1————————eqn (1)
15  // (R3) *( I1 )-(R2+R3) *( I2 )=-V2————————eqn (2)
16  // solving  eqn (1) ,(2)
17  //CALCULATIONS
18  [a]=[(R1+R3+R4) ,-R3;R3 ,-(R2+R3) ];
19  [b]=[V1;-V2];
20  [c]=inv(a)*(b);
21  I1 =c (1) ;// current  in  mesh1  in  A
22  I2 =c (2) ;// current  in  mesh2  in  A
23  I =(I2 -I1) ;// current  through  R3  in  Amps
24  //OUTPUT
25  mprintf (" current  across  30  ohm  resistor  is  %1.3 f
        amps" ,I);
26   //══════════════════════════════════END  OF  PROGRAM
        ══════════════════════════════
```

Scilab code Exa 1.52 POWER

```
 1  // Chapter -1,  Example  1.52 ,  Page  57
 2  //
      ═══════════════════════════════════════════
```

```scilab
 3  clc;
 4  clear;
 5  //INPUT DATA
 6  V1=10;//source1 voltage in volts
 7  V2=5;//source2 voltage in volts
 8  V3=5;//source3 voltage in volts
 9  RAH=2;//Resistance in ohms
10  RAB=3;//resistance in ohms
11  RBE=5;//resistance in ohms
12  REG=5;//resistance in ohms
13  RED=5;//resistance in ohms
14  RBC=7;//resistance in ohms
15  RCD=3;//resistance in ohms
16  RDF=5;//resistance in ohms
17  RHG=5;//resistance in ohms
18  //let currents in mesh I,II,III is I1,I2,I3
        respectively
19  //applying KVL to meshes I,II
20  //(RAH+RHG+RAB+RBE+REG)*(I1)-(RBE)*(I2)-(REG)*(I3)=
        V1--------eqn(1)
21  //-(RBE)*(I1)+(RBC+RCD+RBE+RED)*(I2)-(RDF)*(I3)=-V2
        ----------eqn(2)
22  //-(REG)*(I1)-(RED)*(I2)+(REG+RED+RDF)*(I3)=-V3
        ----------eqn(3)
23  //solving eqn(1),(2) and (3)
24  //CALCULATIONS
25  [a]=[(RAH+RHG+RAB+RBE+REG),-RBE,-REG;-REG,(RBC+RCD+
        RBE+RED),-(RDF);-REG,-RED,(REG+RED+RDF)];
26  [b]=[V1;-V2;-V3];
27  [c]=inv(a)*(b);
28  I1=c(1);//current in mesh1 in A
29  I2=c(2);//current in mesh2 in A
30  I3=c(3);//current in mesh3 in A
31  P1=V1*I1;//power output from V1 in W
32  P2=V2*I2;//power output from V2 in W
33  P3=V3*I3;//power output from V3 in W
34  //OUTPUT
35  mprintf("power output from 10V is %1.1f W\n from 5V
```

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```
        is %1.2fW\n from  5V  is  %1.2fW  ",P1,-P2,-P3);
36  //==================================END  OF  PROGRAM
        ============================
```

_____

Scilab code Exa 1.54 RESISTANCE

```
 1  //Chapter −1, Example  1.54 ,  Page  61
 2  //
        ================================================================
 3  clc ;
 4  clear ;
 5  //INPUT DATA
 6  RAC =10; // Resistance  in  ohms
 7  RCD =10; // resistance  in  ohms
 8  RCF =50; // resistance  in  ohms
 9  RDH =50; // resistance  in  ohms
10  RDF =30; // resistance  in  ohms
11  RHF =10; // resistance  in  ohms
12  // using  star  to  delta  conversion , the  star  point  D  is
        eliminated
13  //CALCULATIONS
14  RCF1 =(( RCD * RDF )+( RDF * RDH )+( RDH * RCD ))/( RDH ) ; //by
        using  star  to  delta  conversion  technique
15  RFH =(( RCD * RDF )+( RDF * RDH )+( RDH * RCD ))/( RCD ) ; //by  using
        star  to  delta  conversion  technique
16  RHC =(( RCD * RDF )+( RDF * RDH )+( RDH * RCD ))/( RDF ) ; //by  using
        star  to  delta  conversion  technique
17  RCF2 =( RCF * RCF1 )/( RCF + RCF1 );
18  RCF = RCF2 ; // equivalent  resistance  of  RCF  in  ohms
19  RHF1 =( RHF * RFH )/( RHF + RFH );
20  RHF = RHF1 ; // equivalent  resistance  of  RHF  in  ohms
21  RAB =( RAC )+( RHC *( RCF + RHF ))/( RHC + RCF + RHF ) ; // equivalent
        resistance  of  AB  in  ohms
22  //OUTPUT
```

```
23  mprintf("Thus equivalent resistance of AB is %f ohms
       ",RAB);
24  //note:given final answer is wrong in textbook.
       Please check the calculations
25  //═══════════════════════════════════════════END OF PROGRAM
       ═══════════════════════════════════
```

Scilab code Exa 1.55 RESISTANCE

```
1  //Chapter −1, Example 1.55, Page 62
2  //
       ════════════════════════════════════════════════════════════════════

3  clc;
4  clear;
5  //INPUT DATA
6  RAB=1;//Resistance in ohms
7  RBE=2;//resistance in ohms
8  RED=3;//resistance in ohms
9  REF=3;//resistance in ohms
10  RDF=3;//resistance in ohms
11  RAD=2;//resistance in ohms
12  RAC=1;//resistance in ohms
13  RBC=1;//resistance in ohms
14  RFC=2;//resistance in ohms
15  //CALCULATIONS
16  //Delta DEF is converted into equivalent star where
       RDN=REN=RFN=1 ohm
17  //series branches of inner star network are added
18  //Star ABCN is converted to equivalent delta
19  RDN=1;
20  REN=RDN;
21  RFN=REN;
22  RAN=RAD+RDN;RBN=RBE+REN;RCN=RFC+RFN
23  RAB1=((RAN*RBN)+(RBN*RCN)+(RCN*RAN))/(RCN);//by
```

```
        using  star  to  delta  conversion  technique
24  RBC1 =(( RAN * RBN )+( RBN * RCN )+( RCN * RAN ))/( RAN ); // by
        using  star  to  delta  conversion  technique
25  RCA1 =(( RAN * RBN )+( RBN * RCN )+( RCN * RAN ))/( RBN ); // by
        using  star  to  delta  conversion  technique
26  // parallel  resistances  in  each  branch  are  converted
        to  single  resistance
27  RAB2 =( RAB * RAB1 )/( RAB + RAB1 );
28  RAB = RAB2 ; // equivalent  resistance  of RAB in  ohms
29  RBC2 =( RBC * RBC1 )/( RBC + RBC1 );
30  RBC = RBC2 ; // equivalent  resistance  of RBC in  ohms
31  RCA2 =( RAC * RCA1 )/( RAC + RCA1 );
32  RCA3 =(( RCA2 )*( RAB + RBC ))/( RBC + RAB + RCA2 );
33  RCA = RCA3 ;
34  // OUTPUT
35  mprintf (" Thus  equivalent  resistance  of CA is  %1.1 f
        ohms " , RCA );
36  // TO FIND EQUIVALENT RESISTANCE BETWEEN DF
37  //
        _____

38  // node A is  eliminated  using  star  to  delta
        conversion
39  RBC =( RAB * RAD )+( RAD * RAC )+( RAC * RAB )/( RAD ); // by  using
        star  to  delta  conversion  technique
40  RCD =( RAB * RAD )+( RAD * RAC )+( RAC * RAB )/( RAB ); // by  using
        star  to  delta  conversion  technique
41  // node C is  eliminated  using  star  to  delta
        conversion
42  RDB =(0.72*5)+(5*2)+(2*0.72)/2;
43  RBF1 =(0.72*5)+(5*2)+(2*0.72)/5;
44  RFD =(0.72*5)+(5*2)+(2*0.72)/0.72;
45  // parallel  branches  between  nodes B and D and  nodes
        D and F are  reduced  as
46  RBD =( RDB *5)/( RDB +5);
47  RDF =( RFD *3)/( RFD +3);
48  // node E is  eliminated  using  star  to  delta
        conversion  technique
```

```
49  RBF=((2*3)+(3*3)+(3*2))/3;
50  RFD=((2*3)+(3*3)+(3*2))/2;
51  RDB=((2*3)+(3*3)+(3*2))/3;
52  RDF1=4.2;//(R'=RDB+RDF)
53  RDF=((RDF1)*(RDF1/2))/(RDF1+(RDF1/2));
54  //OUTPUT
55  mprintf("\n Thus equivalent resistance of DF is %1.1
       f ohms",RDF);
56   //==========================================END OF PROGRAM
       ==============================
```

Scilab code Exa 1.56 CURRENT

```
1  //Chapter−1, Example 1.56, Page 66
2  //
       ==================================================
3  clc;
4  clear;
5  //INPUT DATA
6  RAB=6;//Resistance in ohms
7  RBC=3;//resistance in ohms
8  RBD=4;//resistance in ohms
9  V1=25;//source voltage in volts
10 V2=45;//source voltage in volts
11 //CALCULATIONS
12 //applying kirchoff's current law at node B
13 //−I1−I2+I3=0
14 //I1=(V1−VB)/RAB
15 //I2=(V3−VB)/RBC
16 //I3=VB/RBD
17 VB=((V1/RAB)+(V2/RBC))/((1/RAB)+(1/RBC)+(1/RBD));
18 I1=(V1-VB)/(RAB);//current across AB
19 I2=(V2-VB)/(RBC);//current across BC
20 I3=(VB)/(RBD);//current across BD
```

```
21  //OUTPUT
22  mprintf("Thus currents I1,I2,I3 are %1.1f A %1.2f A
        %1.1f A",I1,I2,I3);
23  //=================================END OF PROGRAM
        ===============================
```

Scilab code Exa 1.57 VOLTAGE

```
1  //Chapter-1, Example 1.57, Page 67
2  //
        ==========================================================

3  clc;
4  clear;
5  //INPUT DATA
6  I1=25;//current source in A
7  I2=6;//current source in A
8  I3=5;//current source in A
9  RAB=5;//Resistance in ohms
10 RAC=10;//Resistance in ohms
11 RBC=2;//Resistance in ohms
12 //let currents across AC and BC and AB are Ix,Iy and
        Iz respectively
13 //applying kirchoff's current law at node A
14 //-I1+Ix+I3+Iz=0-------eqn(1)
15 //applying kirchoff's current law at node B
16 //-Iz-I3+Iy+I2=0-------eqn(2)
17 //CALCULATIONS
18 [a]=[((1/RAC)+(1/RAB)),(-1/RAB);(-1/RAB),((1/RAB)
        +(1/RBC))];
19 [b]=[20;-1];
20 [c]=inv(a)*(b)
21 VA=c(1);//voltage at node A
22 VB=c(2);//voltage at node B
23 //OUTPUT
```

```
24  mprintf("Thus voltages at node A and B are %2.1f V
        and %2.1f V",-VA,VB);
25  //===============================END OF PROGRAM
        ==============================
```

Scilab code Exa 1.58 RESISTANCE

```
1  //Chapter −1, Example 1.58, Page 68
2  //
        _____

3  clc;
4  clear;
5  //INPUT DATA
6  RAB=1;//Resistance in ohms
7  RAD=1;//Resistance in ohms
8  RDC=2;//Resistance in ohms
9  RCB=1;//Resistance in ohms
10  RAC=1;//Resistance in ohms
11  //delta DAC has been converted to star DAC where RDN
        =0.5 ohms,RNA=0.25 ohms,RNC=0.5 ohms
12  //CALCULATIONS
13  RDN=0.5;
14  RNA=0.25;
15  RNC=0.5
16  RBD=((RDN)+(((RNA+RAB)*(RNC+RCB))/(RNA+RAB+RNC+RCB))
        );//equivalent resistance across BD
17  //OUTPUT
18  mprintf("Thus equivalent resistance across BD is %1
        .2f ohms",RBD);
19  //===============================END OF PROGRAM
        ==============================
```

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Scilab code Exa 1.59 RESISTANCE

```
1  //Chapter -1, Example 1.59, Page 69
2  //
    ==================================================================
3  clc;
4  clear;
5  //INPUT DATA
6  RAB =9; // Resistance in ohms
7  RBC =1; // Resistance in ohms
8  RCA =1.5; // Resistance in ohms
9  RAD =6; // Resistance in ohms
10 RBD =4; // Resistance in ohms
11 RCD =3; // Resistance in ohms
12 // star ABC has been converted to delta AnBnCn where
       RABn=18 ohms ,RBCn=9 ohms ,RCAn=13.5 ohms
13 //CALCULATIONS
14 RABn =18;
15 RBCn =9;
16 RCAn =13.5;
17 RAB1 =(( RAB * RABn )/( RAB + RABn )); // equivalent resistance
        across AB
18 RBC1 =(( RBC * RBCn )/( RBC + RBCn )); // equivalent resistance
        across BC
19 RAC1 =(( RCA * RCAn )/( RCA + RCAn )); // equivalent resistance
        across AC
20 // there are two parallel paths across points A and B
    .
21 //(a) one directly from A to B having a resistance of
       6 ohms and
22 //(b) The other via C having a total resistance
23 RBA =(( RBC1 + RAC1 ) *( RAB1 ))/( RBC1 + RAC1 + RAB1 ); // final
       equivalent resistance across AB
24 RCB =(( RAC1 + RAB1 ) *( RBC1 ))/( RAC1 + RAB1 + RBC1 ); // final
       equivalent resistance across BC
25 RCA =(( RAB1 + RBC1 ) *( RAC1 ))/( RAB1 + RBC1 + RAC1 ); // final
       equivalent resistance across AC
```

```
26  //OUTPUT
27  mprintf("Thus final equivalent resistance across AB,
       BC and CA are %1.2f ohms,%1.2f ohms,%1.2f ohms",
       RBA,RCB,RCA);
28  //note:answer given for RCA is wrong.Please check
       the calculations
29  //================================END OF PROGRAM
       =============================
```

Chapter 2

MAGNETIC CIRCUITS

Scilab code Exa 2.1 MMF

```
1  //Chapter-2, Example 2.1, Page 89
2  //_____

3  clc;
4  clear;
5  //INPUT DATA
6  N=2000;//no of turns
7  I=10;//current in A
8  Rm=25;//mean radius in cm
9  d=6;//diameter of each turn in cm
10 //CALCULATIONS
11 MMF=N*I;//magneto motive force in A
12 l=2*%pi*(Rm/100);//circumference of coli in m
13 u=(4*%pi*10^-7);//permeability (U=Ur*U0)
14 a=(%pi*d*d*10^-4)/4;
15 reluctance=(l/(a*u));//reluctance in At/Wb
16 flux=(MMF)/(reluctance);//flux in Wb
17 fluxdensity=(flux/a);//flux density in Wb/m^2 or
        tesla
18 //OUTPUT
```

```
19  mprintf("Thus MMF, flux, flux density   are %d A, %g Wb
        ,%g Wb/m^2 or Tesla respectively ",MMF,flux,
     fluxdensity);
20  //═══════════════════════════════════════════END OF PROGRAM
        ═══════════════════════════════════
```

Scilab code Exa 2.2 FLUX DENSITY

```
1  //Chapter −2, Example 2.2, Page 90
2  //
        ══════════════════════════════════════════════════════════════════════════

3  clc;
4  clear;
5  //INPUT DATA
6  phi=5*10^-2;//flux in wb
7  a=0.2;//area of cross−section in m^2
8  lg=1.2*10^-2;//length of air gap in m
9  ur=1;//permeability
10 u=ur*4*%pi*10^-7;//permeability
11 //CALCULATIONS
12 B=(phi/a);//flux density in wb/sq.m
13 H=(B/(4*%pi*10^-7*ur));//magnetic flux density in A/
     m
14 S=lg/(a*u);//reluctance of air gap in A/wb
15 permeance=1/S;//permenace in A/wb
16 mmf_in_airgap=phi*S;//mmf in A
17 //OUTPUT
18 mprintf("Thus B,H,S,permeance,MMF in air gap   are %1
     .2f Wb/sq.m, %g A/m ,%f A/wb ,%g Wb/A ,%d A
     respectively ",B,H,S,permeance,mmf_in_airgap);
19  //═══════════════════════════════════════════END OF PROGRAM
        ═══════════════════════════════════
```

Scilab code Exa 2.3 PERMEABILITY

```scilab
1  //Chapter −2, Example 2.3, Page 90
2  //
     ================================================================
3  clc;
4  clear;
5  //INPUT DATA
6  phi=0.1*10^-3;//flux in wb
7  a=1.7*10^-4;//area of cross−section in m^2
8  lg=0.5*10^-3;//length of air gap in m
9  Rm=15/2;//radius of ring in cm
10 u0=4*%pi*10^-7;//permeability in free space in henry
     /m
11 N=1500;//no of turns of ring
12 //CALCULATIONS
13 B=(phi/a);//flux density in wb/sq.m
14 H=(B/(4*%pi*10^-7));//magnetic flux density in A/m
15 ampere_turns_provided_fo=H*lg;
16 total_ampere_turns_provi=N*1;
17 Available_for_iron_path=N-(H*lg);
18 length_of_iron_path=(2*Rm*%pi*10^-2)-(lg);//length
     of iron path in m
19 H_for_iron_path=((N-(H*lg)))/(length_of_iron_path);
20 ur=(B/(u0*H_for_iron_path));//relative permeability
     of iron
21 //OUTPUT
22 mprintf("Thus relative permeability of iron is %d",
     ur);
23  //==================================END OF PROGRAM
     ===============================
```

Scilab code Exa 2.4 CURRENT

```scilab
1  //Chapter-2, Example 2.4, Page 91
2  //
       ================================================================
3  clc;
4  clear;
5  //INPUT DATA
6  li=0.5;//iron path length in m
7  lg=10^-3;//length of air gap in m
8  phi=0.9*10^-3;//flux in wb
9  a=6.66*10^-4;//area of cross-section of iron in m^2
10 N=400;//no of turns
11 //CALCULATIONS
12 B=(phi/a);//flux density in wb/sq.m
13 Hg=(B/(4*%pi*10^-7));//magnetic flux density in A/m
14 AT_required=Hg*lg;//AT required for air path
15 Hi=1000;//magnetic flux density in A/m
16 AT_required_for_iron_pat=Hi*li;
17 total_AT_required=(Hg*lg)+(Hi*li);
18 I=((Hg*lg)+(Hi*li))/(N);
19 //OUTPUT
20 mprintf("Thus exciting current required is %1.2f A",
       I);
21  //================================END OF PROGRAM
       ================================
```

Scilab code Exa 2.5 CURRENT

```scilab
1  //Chapter-2, Example 2.5, Page 92
```

```scilab
2  //
      _____

3  clc;
4  clear;
5  //INPUT DATA
6  r=0.01;//radius in m
7  lg=10^-3;//length of air gap in m
8  Rm=(30/2)*10^-2;//mean radius in m
9  ur=800;//relative permeability of iron
10 ur2=1;//relative permeability of air gap
11 N=250;//no of turns
12 phi=20000*10^-8;//flux in Wb
13 u0=4*%pi*10^-7;//permeability in free space
14 a=%pi*(r)^2;//area of cross-section in m
15 leakage_factor=1.1
16 //CALCULATIONS
17 Reluctance_of_air_gap=(lg/(u0*ur2*a));//reluctance
      of air gap in A/wb
18 li=(%pi*(2*r)-(lg));//length of iron path in m
19 Reluctance_of_iron_path=((%pi*0.3)-(lg))/(4*%pi
      *10^-7*800*a);//in A/wb
20 total_reluctance=Reluctance_of_air_gap+
      Reluctance_of_iron_path;//in A/wb
21 MMF=phi*total_reluctance;//in Ampere turns
22 current_required=(MMF)/(N);//in A
23 //OUTPUT
24 mprintf("Thus current required is %1.2f A \n",
      current_required);
25  //Including leakage
26  //CALCULATIONS
27  MMF_of_airgap=phi*Reluctance_of_air_gap;//in A/wb
28  Total_flux_in_ironpath=leakage_factor*phi;//in Wb
29  MMF_of_ironpath=Total_flux_in_ironpath*
      Reluctance_of_iron_path;//in A
30  Total_MMF=MMF_of_ironpath+MMF_of_airgap;//in A/wb
31  current_required2=Total_MMF/(N);//in A
32 //OUTPUT
```

```
33  mprintf("Thus current required is %1.3f A",
        current_required2);
```
_____

Scilab code Exa 2.6 CURRENT

```
1  //Chapter −2, Example 2.6, Page 93
2  //
   ═══════════════════════════════════════════════════════════

3  clc;
4  clear;
5  //INPUT DATA
6  l1=0.1;//length in m
7  l2=0.18;//length in m
8  l3=0.18;//length in m
9  lg=1*10^-3;//airgap length in mm
10  a1=6.25*10^-4;//area in m^2
11  a2=3*10^-4;//area in m^2
12  ur=800;//relative permeability of iron path
13  ur2=1;//relative permeability in free space
14  u0=4*%pi*10^-7
15  N=600;
16  phi=10^-4;//airgap flux in Wb
17  //CALCULATIONS
18  //for the airgap
19  Bg=(phi/(a1));//fluxdensity in Tesla
20  Hg=(Bg/(u0*ur2));//magnetising force in A/m
21  MMF1=Hg*lg;//in A
22  //for path I1
23  B1=0.16;// flux density in tesla
24  H1=(B1/(ur*u0));//magnetising force in A/m
25  MMF2=H1*l1;//in A
26  //since paths l2 and l3 are similar,the total flux
        divide equally between these two paths.Since
        these paths are in parallel,consider only one of
```

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```
        them
27  //for path l2
28  flux=50*10^-6;//flux in wb
29  B2=(flux/a2);//fluxdensity in tesla
30  H2=(B2/(ur*u0));//magnetising force in A/m
31  MMF3=H2*l2;//in A
32  totalmmf=MMF1+MMF2+MMF3;//in A
33  I=(totalmmf/N);//current required in A
34  //OUTPUT
35  mprintf("Thus current required is %1.3f A",I);
36   //==================================END OF PROGRAM
        ==========================
```

Scilab code Exa 2.7 CURRENT

```
1  //Chapter-2, Example 2.7, Page 95
2  //
    ===============================================
3  clc;
4  clear;
5  //INPUT DATA
6  Dm=0.1//diameter in m
7  a=10^-3;//area of cross-section im m^2
8  N=150;//no of turns
9  ur=800;//permeability of iron ring
10  B=0.1;//in Wb/m^2
11  u0=4*%pi*10^-7;//permeability of free space
12  //CALCULATIONS
13  S=(%pi*Dm)/(a*ur*u0);//reluctance
14  I=(B*a*S)/(N);//current in A
15  //OUTPUT
16  mprintf("Thus current is %f A",I);
17   //==================================END OF PROGRAM
        ==========================
```

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Scilab code Exa 2.8 RELUCTANCE

```
1  //Chapter-2, Example  2.8 ,  Page  95
2  //
      =========================================================
3  clc;
4  clear;
5  //INPUT DATA
6  l=0.3;//length  in  m
7  d=1.5*10^-2;//diameter  in  m
8  N=900;//no  of  turns
9  ur=1;//relative  permeability  in  free  space
10 u0=4*%pi*10^-7;//permeability  in  free  space
11 I=5;//current  in  A
12 //CALCULATIONS
13 a=(%pi*(d)^2/4);//in  m^2
14 S=(l)/(a*ur*u0);//reluctance
15 //OUTPUT
16 mprintf("Thus  reluctance  is  %f A/wb",S);
17   //================================END OF PROGRAM
        ===============================
```

Scilab code Exa 2.9 MMF

```
1  //Chapter-2, Example  2.9 ,  Page  95
2  //
      =========================================================
3  clc;
4  clear;
```

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```
5  //INPUT DATA
6  lg=10^-3;//length of air gap in m
7  B=0.9;//flux density in wb/m^2
8  li=0.3;//length of ironpath in m
9  Hi=800;//magnetic flux density in AT/m
10 u0=4*%pi*10^-7;//permeabilty in free space
11 //CALCULATIONS
12 //for iron path
13 MMF_required1=Hi*li;//magnetic motive force in AT
14 //for air gap
15 MMF_required2=(B/u0)*lg;//magnetic motive force in
      AT
16 Totalmmf=MMF_required1+MMF_required2
17 //OUTPUT
18 mprintf("Thus total MMF required is %d AT",Totalmmf)
      ;
19  //===================================END OF PROGRAM
      ===========================
```

Scilab code Exa 2.10 FLUX DENSITY

```
1  //Chapter-2, Example 2.10, Page 96
2  //===========================================================

3  clc;
4  clear;
5  //INPUT DATA
6  li=0.5;//length of iron ring mean length in m
7  N=220;//no of turns
8  I=1.2;//current in A
9  lg=1.2*10^-3;//length of airgap in m
10 ur=350;//relative permeability of iron
11 u0=4*%pi*10^-7;//permeability in free space
12 //CALCULATIONS
```

```
13  MMF_produced=N*I;
14  Si=li/(u0*ur);//reluctance of iron path
15  Sg=lg/(u0);//reluctance of air gap
16  S=Si+Sg;//total reluctance
17  Flux_density=(MMF_produced)/(S);
18  //OUTPUT
19  mprintf("Thus fluxdensity is %1.3f Wb/m^2",
       Flux_density);
20   //===================================END OF PROGRAM
      ==========================
```

Chapter 3

ELECTROMAGNETIC INDUCTION

Scilab code Exa 3.1 VOLTAGE

```
1  //Chapter-3, Example 3.1, Page 109
2  //
   _____
3  clc;
4  clear;
5  //INPUT DATA
6  P=4;//no of poles
7  N1=500;//no of turns per pole
8  phi=0.02;//magnetic flux in wb/pole
9  t=0.02;//time in sec
10 rphi=0.002;//residual flux in wb/pole
11
12 //CALCULATIONS
13 N=P*N1;//total no of turns
14 di=P*phi;//total initial flux in wb
15 dR=P*rphi;//total residual flux in wb
16 dphi=di-dR;//change in flux in wb
17 dt=0.02;//time of opening the circuit in sec
```

```
18  E=N*(dphi/dt);//induced emf  in  volts
19  //OUTPUT
20  mprintf("Thus the average voltage that is induced
        across field terminals is %4.0f volts \n",E);
21  mprintf("The direction of this emf is the same as
        that of the original direction of the exciting
        current");
22
23  //==================================END OF PROGRAM
        ==============================
```

Scilab code Exa 3.2 AVERAGE EMF

```
1  //Chapter−3, Example 3.2, Page 109
2  //
       ========================================================

3  clc
4  clear
5
6  //INPUT DATA
7  R=150;//Resistance of the coil in ohms
8  phi1=0.1;//magnetic flux in milli webers
9  N=500;//no of turns
10  Rgal=450;//resistance of galvanometer in ohms
11  dt=0.1;//time in sec required to move coil from
        given field(m) to another field (m2)
12  phi2=0.3;//magnetic flux of new field in milli
        webers
13  //CALCULATIONS
14  dphi=phi2-phi1;//change of flux in milli webers
15  E=N*(dphi/dt)*10^-3;//average induced emf in volts(V
        )
16  I=E/(R+Rgal);//average induced current in coil in
        amperes(A)
```

```
17
18  //OUTPUT
19  mprintf('Average induced emf and current are %1.0f V
        and %1.4f A',E,I);
20
21  //===================================END OF PROGRAM
        ==============================
```

Scilab code Exa 3.3 FORCE

```
1  //Chapter-3, Example 3.3, Page 110
2  //
        ==================================================
3  clc
4  clear
5
6  //INPUT DATA
7  l=0.1;//conductor length (10 cm)=(0.1 m)
8  I=60;//current in amperes (A)
9  H=1000;//magnetic field strength in ampere/metre (A/
        m)
10 v=1;//conductor speed in metre/second(m/s)
11 u0=4*%pi*10^-7;//permeability in free space in henry
        /m
12 //CALCULATIONS
13 B=u0*1000;//magnetic flux density in (wb/m^2)
14 F=B*I*l;//force in Newtons(N)
15 P=F*v;//power in watt
16 E=B*l*v;//emf induced in conductor
17 //OUTPUT
18 mprintf("The force acting on conductor %1.4f N \n",F
        );
19 mprintf("The mechanical power to move this conductor
        is %1.4f watt \n",P);
```

```
20  mprintf("The induced emf in conductor is %1.5f V \n"
        ,E);
21
22  //================================END OF PROGRAM
        ==========================
```

Scilab code Exa 3.4 INDUCTANCE

```
1  //Chapter-3, Example 3.4, Page 110
2  //
        ============================================================
3  clc
4  clear
5
6  //INPUT DATA
7  l=0.3;//mean length of toroidal coil in meters (30cm
        =0.3m)
8  N=480;//no of turns of coil
9  a=5*10^-4;//cross sectional area in metres (1 cm
        ^2=10^-4 m^2)
10  I=4;//current in amps
11  dt=60*10^-3;//time in sec
12  u0=4*%pi*10^-7;//permeability in free space in henry
        /m
13  ur=1;//relative permeability for air
14  //CALCULATIONS
15  L=(u0*ur*a*N*N)/(l);//inductance of coli in henry
16  di=I-(-I);//change in current in amps
17  E=L*(di/dt);//average induced emf
18  //OUTPUT
19  mprintf('The inductance of the coil is %1.6f H \n',L
        )
20  mprintf('average induced emf is %1.3f V \n',E)
21
```

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Scilab code Exa 3.5 MUTUAL INDUCTANCE

```
1  //Chapter−3, Example 3.5, Page 111
2
3  //
       ═══════════════════════════════════════════════════════
4  clc
5  clear
6  //INPUT DATA
7  L1=0.25;//self inductance of coil in henry(H)
8  N1=500;//no of turns of coil 1
9  N2=10500;//no of turns of coil 2
10 phi2=0.6*L1;//60 % of flux of first coil(m1) is
       linked with second coil(m2)
11 z=100;//rate of change of current(dii/dt) in A/sec
12
13 //CALCULATIONS
14 x=L1/N1;//flux/ampere in first coil(phi1/I1)
15 y=0.6*(x);//flux linking the second coil(phi2/I1)
16 M=N2*(y);//mutual inductance between the two coils
       in H
17 E=M*(z);//induced emf in V
18 //OUTPUT
19 mprintf("Thus the mutual inductance between two
       coils is %1.2f H \n",M);
20 mprintf("The induced emf in second coil when current
        changes in first coil is %3.0f V \n",E);
21
22 //══════════════════════════════════END OF PROGRAM
    ════════════════════════════
```
_____

Scilab code Exa 3.6 INDUCTANCE

```
1  //Chapter −3, Example 3.6, Page 111
2  //
       _____

3  clc
4  clear
5  //INPUT DATA
6  N1=250;//no of turns in a coil
7  I1=2;//current in coil in A
8  phi1=0.3;//flux in coil in wb
9  dt=2//time in  millisec
10 Em2=63.75//induced voltage in V
11 K=0.75
12 //CALCULATIONS
13 L1=N1*(phi1/I1);//self inductance of first coil in H
14 M=Em2*(dt/I1);//mutual inductance of two coils in H
15 L2=((Em2/K)^2)/(L1);//self inductance of second coil
      in H
16 phi2=K*phi1;//flux in second coil in wb
17 N2=(Em2*dt)/phi2;//no of turns in second coil
18 //OUTPUT
19 mprintf("Thus the self inductance of first coil is
      %2.1f mH \n",L1);
20 mprintf("mutual inductance of two coils %2.2f mH \n"
      ,M);
21 mprintf("self inductance of second coil %4.0f mH \n"
      ,L2);
22 mprintf("no of turns in second coil %3.0f turns \n",
      N2);
23 //note:the answer given  for N2 in textbook is wrong
      .please check the calculations
24
```

25 //═══════════════════════════════════END OF PROGRAM
     ═══════════════════════════════

Scilab code Exa 3.7 EMF

```scilab
1  //Chapter −3, Example 3.7, Page 112
2  //
         ══════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  l=1;//length of wire in m
7  v=50;//velocity in m/sec
8  B=1;//magnetic flux density in wb/m^2
9  theta1=90;//the angle of conductor in degrees to the
         field in case 1
10 theta2=30;//the angle of conductor in degrees to the
         field in case 2
11 //CALCULATIONS
12 E1=B*l*v*sin (theta1*%pi/180);//emf induced in
      conductor in case 1(1 degree =3.14/180 radians)
13 E2=B*l*v*sin ((360+theta2)*%pi/180);//emf induced in
      conductor in case 2(1 degree =3.14/180 radians)
14 //OUTPUT
15 mprintf("Thus the emf induced in case 1 is %2.0f
      volts \n",E1);
16 mprintf("Thus the emf induced in case 2 is %2.0f
      volts \n",E2);
17 //note:convert angle in degrees to radians and
      compute it.
18 //═══════════════════════════════════END OF PROGRAM
     ══════════════════════════════
```

Scilab code Exa 3.8 AVERAGE INDUCTANCE

```
1  //Chapter −3, Example 3.8, Page 112
2  //
   ================================================================
3  clc
4  clear
5  //INPUT DATA
6  N=1000;//no of turns in a coil
7  a=10*10^-4;//crossectional area in m^2
8  i1=4.2;//current in A in case 1
9  i2=9.2;//current in A in case 2
10 B1=1;//flux density in wb/m^2 when current is i1
11 B2=1.42;//flux density in wb/m^2 when current is
12 dt=0.05;//time in sec where current reduces from 9.2
      A to 4.2A
13 //CALCULATIONS
14 db=(B2-B1)//difference in flux densities
15 di=(i2-i1);//difference in currents
16 di1=(i1-i2);//difference in currents
17 L=N*a*(db)/di;//average inductance between the
      limits in H
18 E=-(L*di1/dt);//emf induced
19 //OUTPUT
20 mprintf("Thus the average inductance between the
      limits is %1.3f H \n",L);
21 mprintf("emf induced is %1.1f volts\n",E);
22
23 //================================================END OF PROGRAM
   ===============================
```

Scilab code Exa 3.9 MUTUAL INDUCTANCE

```
1  //Chapter -3, Example 3.9, Page 113
2  //
   _____

3  clc
4  clear
5  //INPUT DATA
6  N1=1600;//no of turns of solenoid
7  l=0.5;//length of wire of solenoid in m
8  N2=600;//no of turns of second coil
9  a=18*10^-4;//area of second coil in m^2
10 u0=4*%pi*10^-7;//permeability in free space
11 z=300;//rate of change of current(di1/dt) in A/sec
12 //CALCULATIONS
13 B=(u0*N1)/(l);//flux density in solenoid
14 M=(B*a*N2);//mutual inductance in mH
15 E=M*(z);//voltage induced
16 //OUTPUT
17 mprintf("Thus the mutual inductance is %f H \n",M);
18 mprintf("Thus the voltage induced is %f V \n",E);
19 //note:answer given for voltage in text book is
      wrong.please check the calculations
20 //=======================================END OF PROGRAM
   ===============================
```

Scilab code Exa 3.10 MUTUAL INDUCTANCE

```
1  //Chapter -3, Example 3.10, Page 113
2  //
   _____

3  clc
4  clear
```

```scilab
5  //INPUT DATA
6  NA=15000;//no of turns in coil A
7  IA=6;//current in coil A in Amp(A)
8  phiA=0.05*10^-3;//flux in coil A in wb
9  NB=12000;//no of turns in coil B
10 IB=6;//current in coil B in Amp(A)
11 phiB=0.08*10^-3;//flux in coil B in wb
12 phiAB=0.55*0.05*10^-3;//mutual flux in wb
13 //CALCULATIONS
14 LA=phiA*NA/IA;//self inductance of coil A in H
15 LB=phiB*NB/IB;//self inductance of coil B in H
16 LAB=phiAB*NB/IB;//mutual inductance of coils in H
17 K=LAB/sqrt(LA*LB);//coefficient of coupling
18 //OUTPUT
19 mprintf("Thus the self inductance of coil A  is %1.3
      f H\n",LA);
20 mprintf("Thus the self inductance of coil B is %1.2f
      H \n",LB);
21 mprintf("Thus the mutual inductance of coils is %1.3
      f H \n",LAB);
22 mprintf("Thus the coefficient of coupling is %1.3f \
      n",K)
23
24 //===================================END OF PROGRAM
      ============================
```

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Chapter 4

AC FUNDAMENTALS

Scilab code Exa 4.1 FORM FACTOR

```
1  //Chapter-4, Example 4.1, Page 126
2  //
     _____

3  clc
4  clear
5  //CALCULATIONS
6  //for WAVEFORM 1
7  //Average Value
8  b1=2;
9  h1=5;
10 area1=0.5*b1*h1;//area under one complete cycle(area
        of a triangle)
11 av0=area1/2;//average value
12 //rms value
13 area2=0.33*(h1)^2*b1;
14 rms=sqrt(area2/b1);//rms value
15 //form factor
16 ff=rms/av0;//form factor
17 //peak factor
18 Kp=h1/rms;//peak factor
```

```scilab
19  mprintf("WAVEFORM 1\n");
20  mprintf("average value=%1.1f amps,rms value=%1.3f
        amps,formfactor=%1.3f ,peak factor=%1.3f\n",av0,
        rms,ff,Kp);
21  //for WAVEFORM 2
22  //Average Value
23  T=1;//assuming time period is 1
24  h2=100;
25  h3=-50;
26  area3=(h2+h3)*(T/2);//area under one complete cycle(
        area of a rectangle)
27  av=area3/T;//average value
28  //rms value
29  area_under_squared_curve=((h2)^2+(h3)^2)*(T/2);
30  rms1=sqrt(area_under_squared_curve/T);//rms value
31  //form factor
32  ff1=rms1/av;//form factor
33  //peak factor
34  Kp1=h2/rms1;//peak factor
35  mprintf("WAVEFORM 2\n");
36  mprintf("average value=%d volts ,rms value=%2.3f volt
        ,formfactor=%1.2f ,peak factor=%1.2f\n",av,rms1,
        ff1,Kp1);
37  //for WAVEFORM 3
38  //Average Value
39  Vm=1;//assuming mean voltage is 1
40  a1=0.5*Vm*(%pi/3);//area of the triangle from 0 to (
        pi/3)
41  a2=Vm*(%pi/3);//area of the rectangle for period (pi
        /3) to (2*pi/3)
42  a3=0.5*Vm*(%pi/3);//area of the triangle from (2*pi
        /3) to pi
43  a=a1+a2+a3;
44  av2=(a/%pi);//average value
45  //rms value
46  area_under_squared_curv2=((Vm)^2*(%pi/3)*(5/3))
47  rms2=sqrt(area_under_squared_curv2/(%pi));//rms
        value
```

```scilab
48  //form factor
49  ff2=rms2/av2;//form factor
50  //peak factor
51  Kp2=Vm/rms2;//peak factor
52  mprintf("WAVEFORM 3\n");
53  mprintf("average value=%1.3f volts,rms value=%1.3f
        volt,formfactor=%1.2f ,peak factor=%1.3f\n",av2,
        rms2,ff2,Kp2);
54  //for WAVEFORM 4
55  //Average Value
56  T2=1;//let timeperiod=1
57  av3=(100*(T2/2))/(T2/2);//average
58  //rms value
59  area_under_squared_curv3=((100)^2*(T2/2));
60  rms3=sqrt((area_under_squared_curv3)/(T2/2));//rms
        value
61  //form factor
62  ff3=rms3/av3;//form factor
63  //peak factor
64  Kp3=100/rms3;//peak factor
65  mprintf("WAVEFORM 4\n");
66  mprintf("average value=%d volts,rms value=%d volt,
        formfactor=%d ,peak factor=%d\n",av3,rms3,ff3,Kp3
        );
67  //==================================END OF PROGRAM
        =============================
```

Scilab code Exa 4.2 FORM FACTOR

```scilab
1  //Chapter−4, Example 4.2, Page 130
2  //
        ==================================================
3  clc
4  clear
```

```
5  //CALCULATIONS
6  //for halfwave rectifier
7  Im=1;//assume peak value is 1
8  //for (0 to pi) value is (Im*sin(theta)) for (pi to
      2*pi) value is 0
9  function y1=f1(x),y1=(Im^2)*(sin(x))^2,endfunction
10 a1=(intg(0,%pi,f1));
11 a=(a1)/(2*%pi);//mean square value
12 rms=sqrt(a);//rms value
13 function y3=f3(x),y3=(Im)*(sin(x)),endfunction
14 a3=(intg(0,%pi,f3));
15 av=a3/(2*(%pi));//average value
16 ff=rms/av;//form factor
17 pf=Im/rms;//peak factor
18 mprintf("for half wave rectifier\n");
19 mprintf("form factor=%1.2f,peak factor=%d\n",ff,pf);
20 //for fullwave rectifier
21 function y4=f4(x),y4=(Im^2)*(sin(x))^2,endfunction
22 a4=(intg(0,%pi,f4));
23 a4=a4/(%pi);
24 rms2=sqrt(a4);//rms value
25 function y5=f5(x),y5=(Im)*(sin(x)),endfunction
26 av2=(intg(0,%pi,f5))/(%pi);//average value
27 ff2=rms2/av2;//form factor
28 pf2=Im/rms2;//peak factor
29 mprintf("for full wave rectifier\n");
30 mprintf("form factor=%1.2f,peak factor=%1.2f",ff2,
      pf2);
31 //================================END OF PROGRAM
      ==============================
```

Scilab code Exa 4.3 RMS

```
1  //Chapter-4, Example 4.3, Page 132
2  //
```

```
3  clc
4  clear
5  //CALCULATIONS
6  v1=0;v2=5;v3=10;v4=20;v5=50;v6=60;v7=50;v8=20;v9=10;
      v10=5;v11=0;v12=-5;v13=-10;
7  Vm=60;
8  V=((v1^2)+(v2^2)+(v3^2)+(v4^2)+(v5^2)+(v6^2)+(v7^2)
      +(v8^2)+(v9^2)+(v10^2))
9  V=sqrt(V/10);
10 Vav=(v1+v2+v3+v4+v5+v6+v7+v8+v9+v10)/10; //average
      value
11 Kf=V/Vav; //form factor
12 Kp=Vm/V; //peak factor
13 rms2=Vm/(sqrt(2)); //rms voltage value with the same
      peak value
14 mprintf("rms1 =%2.2f volts\n average value=%d volts
      \n form factor= %2.2f \n peak factor= %1.3f \n
      rms2 value is %2.2f volts",V,Vav,Kf,Kp,rms2);
15 //=================================END OF PROGRAM
   ================================
```

Scilab code Exa 4.4 TIME

```
1  //Chapter−4, Example 4.4 , Page 133
2  //
   ================================================
3  clc
4  clear
5  //CALCULATIONS
6  f=60;
7  Im=120;
8  i=96;
```

```
9  t=asin(i/Im)/(2*%pi*60);
10 mprintf("time is %1.5f sec",t)
11 //==================================END OF PROGRAM
   ==============================
```

_____

Scilab code Exa 4.5 RATE OF CHANGE OF CURRENT

```
1  //Chapter−4, Example 4.5, Page 133
2  //
   _____

3  clc
4  clear
5  funcprot(0)
6  //CALCULATIONS
7  Im=100;//current in amps
8  f=50;//freq in hz
9  w=2*%pi*50;//angular freq in rad/sec
10 //at t=0.0025
11 function f=myfun(t)
12   f=Im*sin(w*t(1));
13 endfunction
14 t=[0.0025];
15 g=numdiff(myfun,t)//by using numdiff function the
     calculated value will defer to observed value by
     15
16 //at t= 0.005
17 function f1=myfun(t1)
18   f1=Im*sin(w*t1(1));
19 endfunction
20 t1=[0.005];
21 g1=numdiff(myfun,t1);
22 //at t= 0.01
23 function f2=myfun(t2);
24   f2=Im*sin(w*t2(1));
```

```
25  endfunction
26  t2 =[0.01];
27  g2= numdiff ( myfun , t2 );
28  mprintf (" rate  of  change  of  current  at  t =0.025, t
        =0.005, t =0.01  sec  are  %d A/ sec  %d A/ sec  %d A/ sec
        respectively ",g,g1,g2 );
29  // ═══════════════════════════════════════ END  OF  PROGRAM
        ════════════════════════════
```

Scilab code Exa 4.6 EMF

```
1  // Chapter −4,  Example  4.6 ,  Page  134
2  //
        ════════════════════════════════════════════════════════════════════════════

3  clc
4  clear
5  // INPUT DATA
6  N =200; // no  of  turns
7  a =250; // area  of  cross −section  in  sq.cm
8  Bm =0.5; // magnetic  field  strength  in  Tesla
9  speed =1200; // in  r.p.m
10  // CALCULATIONS
11  w=2*% pi *( speed /60) ;// angular  freq  in  rad / sec
12  phi = Bm * a *10^ -4; // area  taken  in  sq.m
13  Em = N * w * phi ;// maximum  value  of  induced  Emf
14  mprintf (" maximum  value  of  induced  Emf  is  %d  volts \n"
        , Em );
15  // equation  for  instantaneous  induced  emf  is  e=Em*sin
        (w* t )
16  // when   plane  of  coil  is  parallel  to  field  , theta  is
         90  degrees
17  e1 = Em * sin (% pi /2) ;// converted  degrees  to  radians
18  mprintf (" when   plane  of  coil  is  parallel  to  field ,
        induced  Emf  is  %d  volts \n",e1 );
```

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```
19  //when plane of coil is parallel to field ,theta is
       0 degrees
20  e2=Em*sin(0);
21  mprintf("when  plane of coil is perpendicular to
       field , induced Emf is %d volts\n",e2);
22  //when plane of coli is inclined at 45 degrees to
       the field
23  e3=Em*sin(%pi/4);
24  mprintf("when  plane of coil is at 45 degrees to
       field , induced Emf is %d volts\n",e3);
25  //================================END OF PROGRAM
       =============================
```

Scilab code Exa 4.7 RMS

```
1  //Chapter−4, Example 4.7, Page 135
2  //
       =================================================
3  clc
4  clear
5  //INPUT DATA
6  I=10;//direct current in A
7  Im=10;//peak value of sinusoidal current in A
8  //CALCULATIONS
9  function y1=f1(x),y1=(I+Im*sin(x))^2,endfunction
10  a1=(intg(0,2*%pi,f1));
11  a1=a1/(2*%pi);//mean square value in A
12  rms=sqrt(a1);//rms value in A
13  mprintf("rms value is %2.2f A",rms);
14  //================================END OF PROGRAM
       =============================
```

Scilab code Exa 4.8 RELATIVE HEATING EFFECTS

```
1 //Chapter -4, Example 4.8, Page 136
2 //
   _____
3 clc
4 clear
5 //let the current peak value of sinusoidal and
      rectangular waves are Im.
6 //CALCULATIONS
7 Im=1;//let im current value be 1(just for
      calculation purposes)
8 rms1=sqrt(((Im)^2*%pi)/(%pi));//rms current value of
       rectangular wave
9 function y1=f1(x),y1=(Im^2)*(sin(x))^2,endfunction
10 a1=(intg(0,%pi,f1));
11 a1=a1/(%pi);//mean square value in A
12 rms=sqrt(a1);//rms value in A
13 z=((rms)^2/(rms1)^2);//relative heating effects
14 mprintf("relative heating effects is %1.1f",z);
15 //=============================END OF PROGRAM
   =============================
```

Scilab code Exa 4.9 RMS CURRENT

```
1 //Chapter -4, Example 4.9, Page 137
2 //
   _____
3 clc
4 clear
5 //CALCULATIONS
6 //for subdivision a
7 funcprot(0);
```

```
8  max =40;
9  rms = max / sqrt (2) ;
10 mprintf (" max and rms values are %d  units and %2.2 f
      units respectively \n", max , rms ) ;
11 // for subdivision b
12 //max=A+B
13 // rms =(A+B) / sqrt (2)
14 // for subdivision c
15 max1 = sqrt ((( 10 ) ^2 ) +(( 17 . 3 ) ^2 ) ) ;
16 rms1 = max1 / sqrt (2) ;
17 mprintf (" max and rms values are %2.2 f units and %2.2
      f units respectively ", max1 , rms1 ) ;
18 // note : in textbook for sub div (c) square root has
      not taken for maximum value computed
19 //=================================END OF PROGRAM
      ===========================
```

Scilab code Exa 4.10 TIME

```
1  // Chapter −4, Example 4.10 , Page 137
2  //
      ===================================================

3  clc
4  clear
5  // INPUT DATA
6  f =50; // freq in c/s
7  I =20; // current in A
8  Im=I/ sqrt (2) ;
9  t =0.0025; // time in sec
10 // equation for instantaneous emf
11 i =(20* sqrt (2) ) * sin (2*%pi*f*t ) ;
12 t1 =0.0125;
13 i1 =(20* sqrt (2) ) * sin (2*%pi*f*t1 ) ;
14 i2 =14.14;
```

```
15  x=(i2)/(20*(sqrt(2)));
16  y=asin(x);
17  z=(2*%pi*50);
18  t=y/z;
19  mprintf("current when t is 00025 sec and 0.0125 sec
        are %d A and %d A respectively\n",i,i1);
20  mprintf("time when value of instantaneous cureent
        14.14 is %g sec",t);
21  //note:in textbook for sub div (c) square root has
        not taken for maximum value computed
22  //══════════════════════════════════END OF PROGRAM
        ════════════════════════════
```

Scilab code Exa 4.11 RMS CURRENT

```
1  //Chapter −4, Example 4.11, Page 137
2  //
        ═══════════════════════════════════════════════
3  clc
4  clear
5  //INPUT DATA
6  I1=5;//current in A
7  I=10;//current in A
8  I2=I/sqrt(2);
9  //CALCULATIONS
10 i3=sqrt(((2*I1)^2)+(I2^2));
11 mprintf("rms value of current is %1.2f A
        respectively\n",i3);
12 //══════════════════════════════════END OF PROGRAM
        ════════════════════════════
```

Scilab code Exa 4.12 CURRENT

```
1  //Chapter−4, Example 4.12, Page 138
2  //
       ════════════════════════════════════════════════════

3  clc
4  clear
5  //CALCULATIONS
6  Im=141.4;//instantaneous current
7  f=50;//freq in hz
8  w=2*%pi*f;//angular freq in rad/sec
9  //instantaneous current equation is i=141.4*sin(w*t)
       ;
10 function f=myfun(t)
11    f=Im*sin(w*t(1));
12 endfunction
13 t=[0.0025];
14 g=numdiff(myfun,t)
15 mprintf("rate of change of current is %d A/sec \n",g
       );
16 function f1=myfun(t1)
17    f1=Im*sin(w*t1(1));
18 endfunction
19 t1=[0.005];
20 g1=numdiff(myfun,t1)
21 mprintf("rate of change of current is %d A/sec \n",
       g1);
22 function f2=myfun(t2)
23    f2=Im*sin(w*t2(1));
24 endfunction
25 t2=[0.01];
26 g2=numdiff(myfun,t2)
27 mprintf("rate of change of current is %d A/sec \n",
       g2);
28 //note:answer given in textbook for section c is
       wrong
29 //════════════════════════════════════════END OF PROGRAM
       ════════════════════════════════════
```

Scilab code Exa 4.13 CURRENT

```scilab
1  //Chapter-4, Example 4.13, Page 138
2  //
   _____

3  clc
4  clear
5  //INPUT DATA
6  R=60;//resistance in ohms
7  Rf=50;//resistance in ohms
8  Rr=500;//resistance in ohms
9  V=120;//supply voltage in volts
10 f=50;//freq in hz
11 //CALCULATIONS
12 peak=V*sqrt(2);//peak value of applied voltage
13 peak1=peak/(R+Rf);//peak value of current in forward
       direction
14 peak2=peak/(R+Rr);//peak value of current in reverse
       direction
15 i=((2*peak1)-(2*peak2))/(2*%pi);//current in moving
      coil ammeter over the period 0 to 2*(%pi)
16 i1=((%pi/2)*((peak1)^2+(peak2)^2))/(2*(%pi));//mean
      current over the period 0 to 2*(%pi)
17 rms=sqrt(i1);//rms value in hot wire ammeter
18 mprintf("rms value in hot wire ammeter is %1.3f A\n"
      ,rms);
19 If=(peak1)/(sqrt(2));//rms value in forward
      direction
20 mprintf("rms value in forward direction is %1.2f A\n
      ",If);
21 Ir=(peak2)/(sqrt(2));//rms value in reverse
      direction
22 mprintf("rms value in reverse direction is %1.2f A\n
```

```
     ",Ir);
23  av=((R+Rf)*((If)^2)+(R+Rr)*((Ir)^2))/(2);
24  mprintf("average power dissipated is %2.2f W\n",av);
25  pf=((Rf)*((If)^2)+(Rr)*((Ir)^2))/(2);
26  mprintf("power dissipated in rectifier is %2.1f W\n"
       ,pf);
27  //===================================END OF PROGRAM
       ==========================
```

Scilab code Exa 4.14 CURRENT

```
1  //Chapter −4, Example 4.14, Page 144
2  //
       ================================================
3  clc
4  clear
5  //given voltage applied is 100*sin(w*t)
6  //CALCULATIONS
7  R=10;//resisitance in ohms
8  //i=(100)*sin(w*t)/10=10*sin(w*t)
9  //instantaneous power=1000*(sin(w*t))^2
10 E=(100)/sqrt(2);//average value of voltage in volts
11 I=(10)/sqrt(2);//average value of current in amps
12 P=E*I;//average power in Watts
13 mprintf("thus average power is %1.0f W",P);
14 //===================================END OF PROGRAM
       ==========================
```

Scilab code Exa 4.15 POWER

```
1  //Chapter −4, Example 4.15, Page 144
```

```
 2 //
    _____

 3 clc
 4 clear
 5 //given voltage applied is e=340*sin(314*t)
 6 //given current applied is i=42.5*sin(314*t)
 7 //CALCULATIONS
 8 R=340/42.5;//resisitance in ohms
 9 E=(340)/sqrt(2);//average value of voltage in volts
10 I=(42.5)/sqrt(2);//average value of current in amps
11 P=E*I;//average power in Watts
12 mprintf("thus average power is %1.0f W",P);
13 //==================================END OF PROGRAM
    ==============================
    _____
```

Scilab code Exa 4.16 INSTANTANEOUS CURRENT

```
 1 //Chapter−4, Example 4.16, Page 145
 2 //
    _____

 3 clc
 4 clear
 5 //given voltage applied is e=100*sin(314*t)
 6 //CALCULATIONS
 7 E=100/sqrt(2);
 8 w=314;
 9 L=0.2;//inductannce in henry
10 // indefinitely integrating e and later dividing by
      L we get it as
11 //i=−1.592*cos(314*t);//instantaneous current
12 //instantaneous power=e*i=−79.6*sin(628t)
13 P=0;//average power=0
14 Xl=w*L;//inductance in ohms
```

```
15  I=(E)/(Xl);//rms current
16  mprintf("inductive reactance and rms current is %2.1
       f ohms and %1.3f amps respectively",Xl,I);
17  //note:We cannot compute symbolic or indefinite
       integration in scilab.In order to verify your
       results use wxmaxima software.
18  //=================================END OF PROGRAM
       =============================
```

Scilab code Exa 4.17 INDUCTIVE REACTANCE

```
1  //Chapter −4, Example 4.17, Page 145
2  //
       ================================================================

3  clc
4  clear
5  //CALCULATIONS
6  L=0.225;//inductance in henry
7  e=120;//voltage in volts
8  f=50;//frequency in c/s
9  Xl=(2*%pi*f*L);//inductive reactance in ohms
10 mprintf("Inductive reactance in ohms is %2.2f ohms\n
       ",Xl);
11 L=0.2;//inductance in henry
12 Im=2.4;//peak value of current in A
13 //instantaneous voltage equation is e=(sqrt(2)*120*
       sin(314*t))
14 // indefinitely integrating e and later dividing by
       L we get it as
15 //i=−2.4*cos(314t);//instantaneous current in A
16 I=Im/(sqrt(2));//in A
17 mprintf("Current is %1.3f A\n",I);
18 m=(e*sqrt(2)*Im)/2;//maximum power delivered in
       watts
```

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```
19  mprintf("Maximum power delivered to inductor is %3.2
        f watts\n",m);
20  mprintf("average power is zero\n")
21  mprintf("equation for voltage and current are
        169.68*sin(314*t) and -2.4*cos(314*t)
        respectively");
22  //note:We cannot compute symbolic or indefinite
        integration in scilab.In order to verify your
        results use wxmaxima software.
23  //================================END OF PROGRAM
        ======================
```

_____

Scilab code Exa 4.18 INDUCTIVE REACTANCE

```
1  //Chapter-4, Example 4.18, Page 146
2  //
        ==================================================

3  clc
4  clear
5  //CALCULATIONS
6  L=0.01;//inductance in henry
7  //equation of current is 10*cos(1500*t)
8  w=1500;//angular freq in rad/sec
9  Xl=(w*L);//inductive reactance in ohms
10 mprintf("inductive reactance is  %1.1f ohms\n",Xl);
11 function f=myfun(t)
12    f=10*cos(w*t);
13 q=derivative(f);
14 endfunction//derivation yields e=-150*sin(1500*t)
15 mprintf("equation for voltage across is e=-150*sin
        (1500*t)")
16 X2=40;//given new inductance in ohms
17 f2=X2/(2*%pi*L);//freq in hz
18 mprintf("thus at freq %d hz inductance will be 40
```

101

```
   ohms",f2)
19  //note:answer given for inductive reactance is wrong
        .Please check the calculations
20  //═══════════════════════════════════════END OF PROGRAM
        ═══════════════════════════════════
```

Scilab code Exa 4.19 CAPACITIVE REACTANCE

```
1  //Chapter −4, Example 4.19, Page 146
2  //
        ════════════════════════════════════════════════════════════

3  clc
4  clear
5  //CALCULATIONS
6  C=135;//capacitance in uF
7  E=150;//voltage in volts
8  f=50;//freq in c/s
9  Xc=1/(2*3.14*f*C*10^-6);//capacitive reactance in
        ohms
10  //equation for current is i=8.99*sin(314*t+(%pi/2))A
11  //instantaneous power is P=E*I*sin(2*w*t)
12  P=0;//average power
13  Im=8.99;//peak value of instantaneous current
        equation
14  I=(Im)/(sqrt(2));//rms current in amps
15  M=E*sqrt(2)*I*sqrt(2);//maximum power delivered in
        Watts
16  mprintf("thus capacitive reactance ,Rms current and
        Maximum power delivered are %2.3f ohms ,%1.2f
        Amps,%1.0f Watts respectively",Xc,I,M);
17  //═══════════════════════════════════════END OF PROGRAM
        ═══════════════════════════════════
```

Scilab code Exa 4.20 IMPEDANCE

```
1  //Chapter-4, Example 4.20, Page 147
2  //
    ================================================================
3  clc
4  clear
5  //CALCULATIONS
6  //given voltage eqn is v=100+(100*sqrt(2))*sin(314*t
      ) volts
7  W=314;//freq in rad/sec
8  R=5;//resistance in ohms
9  X=12;//reactance in ohms
10 Z=R+((%i)*(X));//impedance in ohms
11 Idc=100/R;//dc current in A
12 Iac=(100)/(sqrt((R)^2+(X)^2));//rms value of ac
      component of current
13 Pt=(R*(Idc^2))+(R*(Iac^2));//total power in Watts
14 V1=sqrt((100)^2+(100)^2);//supplied voltage in Rms
      in volts
15 I1=sqrt((20)^2+(7.69)^2);//current in Rms in Amps
16 Z1=V1/I1;//circuit impedance in ohms
17 Pf=Pt/(V1*I1);//Power factor
18 mprintf("thus circuit impedance,Power expended and
      Power factors are %1.1f Ohms ,%1.0f W and %1.3f
      respectively",Z1,Pt,Pf);
19 //==============================END OF PROGRAM
    ==============================
```

Scilab code Exa 4.21 CURRENT AND PHASE

103

```
1  //Chapter−4, Example 4.21, Page 147
2  //_____

3  clc
4  clear
5   function [polar] = r2p(x,y)//function to convert
        rectangular to polar
6   polar = ones(1,2)
7   polar(1) = sqrt ((x ^2) +(y^2))
8   polar(2) = atan (y/x)
9   polar(2) =(polar (2)*180)/%pi
10   endfunction
11   function [ rect ] = p2r(r,theta)//function to
        convert polar to rectangular
12   rect = ones(1 ,2)
13   theta =( theta *%pi) /180
14   rect (1)=r* cos(theta)
15   rect (2)=r* sin(theta)
16   endfunction
17  //CALCULATIONS
18  I1=p2r(300,0);
19  disp(I1);
20  I2=p2r(350,30);
21  disp(I2);
22  I=I1+I2;
23  disp(I);
24  i3=r2p(I(1),I(2))
25  disp(i3);
26  mprintf("Thus resultant current is 627.9 A and it
        leads 300 A by 16 degrees")
27  //note:here direct functions for converson are not
        available and hence we defined user defined
        functions for polar to rect and rect to polar
        conversions
28  //═══════════════════════════════════END OF PROGRAM
    _____
```

Scilab code Exa 4.22 POWER

```
1  //Chapter −4, Example 4.22, Page 147
2  //
        =================================================
3  clc
4  clear
5  funcprot(0)
6  function [polar] = r2p(x,y)//function to convert
       rectangular to polar
7   polar = ones(1,2)
8   polar(1) = sqrt((x ^2) +(y^2))
9   polar(2) = atan (y/x)
10   polar(2) =(polar (2)*180)/%pi
11   endfunction
12   function [ rect ] = p2r(r,theta)//function to
        convert polar to rectangular
13   rect = ones(1 ,2)
14   theta =( theta *%pi) /180
15   rect (1)=r* cos(theta)
16   rect (2)=r* sin(theta)
17   endfunction
18  //v=230*sin (100*%pi*t)
19  //CALCULATIONS
20  R=100;//resistance in ohms
21  L=319;//inductance in mH
22  Xl=(100*%pi*L*10^-3);//inductive reactance in ohms
23  Z=R+((%i)*(Xl));//impedance in ohms
24  Z=r2p(R,Xl);//impedance in polar form
25  disp(Z);
26  Z1=p2r(Z(1),Z(2));
27  disp(Z1);
28  //i=230/1.414*sin (100*%3.14*t−45)=1.626*sin (100*%3
```

```
      .14*t−45)
29  i=(1.626/(sqrt(2)));//rms current in A
30  P=(i)^2*R;//power taken by the coil in W
31  mprintf("power taken by the coil is %3.1f W",P);
32  //note:here direct functions for converson are not
       available and hence we defined user defined
       functions for polar to rect and rect to polar
       conversions
33  //======================================END OF PROGRAM
    ==========================================================
```

Scilab code Exa 4.23 RMS CURRENT

```
1  //Chapter−4, Example 4.23, Page 148
2  //
    ==========================================================

3  clc
4  clear
5  function [polar] = r2p(x,y)//function to convert
       rectangular to polar
6   polar = ones(1,2)
7   polar(1) = sqrt ((x ^2) +(y^2))
8   polar(2) = atan (y/x)
9   polar(2) =(polar (2)*180)/%pi
10  endfunction
11  function [ rect ] = p2r(r,theta)//function to
       convert polar to rectangular
12  rect = ones(1 ,2)
13  theta =( theta *%pi) /180
14  rect (1)=r* cos(theta)
15  rect (2)=r* sin(theta)
16  endfunction
17  //e1=230*sin (w*t)
```

```
18  //e2=230*sin(w*t*%pi/6)
19  //CALCULATIONS
20  E1=p2r(230,0);//impedance in rectangular form
21  disp(E1);
22  E2=p2r(230,30);
23  disp(E2);
24  E=E1+E2;
25  E=E/sqrt(2);
26  E=r2p(E(1),E(2));
27  disp(E)
28  Z=r2p(8,6);
29  disp(Z);
30  I1=E(1)/Z(1);
31  disp(I1)
32  theta=E(2)-Z(2);
33  disp(theta);
34  phi=cos(theta*%pi/180)
35  disp(phi)
36  P1=(E(1))*(I1)*(phi);//power supplied in Watts
37  mprintf("Thus Rms current and power supplied are %2
        .1f A and %f W respectively",I1,P1);
38  //note here power calculated my vary as we took many
         decimal values for calculation.Please check the
        calculations
39  //note:here direct functions for converson are not
        available and hence we defined user defined
        functions for polar to rect and rect to polar
        conversions
40  //==================================END OF PROGRAM
    ================================================
```

Scilab code Exa 4.24 CURRENT

```
1  //Chapter-4, Example 4.24, Page 148
```

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```scilab
3  clc
4  clear
5  //CALCULATIONS
6  //e1=230*sin(100*%pi*t)
7  C=20*10^-6;//capacitance in F
8  //e2=230*sin(700*%pi*t)
9  Vm1=230;//peak voltage for e1
10 Vm2=35;//peak voltage for e2
11 I1=Vm1*(100*%pi*C)/(sqrt(2));//current due to
        component e1
12 I2=Vm2*(700*%pi*C)/(sqrt(2));//current due to
        component e2
13 mprintf("thus current due to component e1 and e2 are
        %1.2fA and %1.2fA respectively",I1,I2);
14 //=======================================END OF PROGRAM
```
‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗

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Scilab code Exa 4.25 RMS CURRENT

```scilab
1  //Chapter-4, Example 4.25, Page 149
2  //
```
‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗‗

```scilab
3  clc
4  clear
5  funcprot(0)
6  function [polar] = r2p(x,y) //function to convert
        rectangular to polar
7   polar = ones(1,2)
8   polar(1) = sqrt((x ^2)+(y^2))
9   polar(2) = atan(y/x)
```

```scilab
10   polar(2) =(polar (2)*180)/%pi
11   endfunction
12   function [ rect ] = p2r(r,theta)//function to
        convert polar to rectangular
13   rect = ones(1 ,2)
14   theta =( theta *%pi) /180
15   rect (1)=r* cos(theta)
16   rect (2)=r* sin(theta)
17   endfunction
18   //CALCULATIONS
19   //v=230*sin(314*t)+60*sin(942*t)
20   V=230;//voltage in volts
21   V1=60;//voltage of harmonic in volts
22   R=10;//resistance in ohms
23   L=0.3;//inductance in henry
24   C=100*10^-6;//capacitance in F
25   //Branch with Resistor (R)
26   I1m=V/R;//current in A
27   I1m=I1m/(sqrt(2));//rms current in A
28   I3m=V1/R;//current in A
29   I3m=I3m/(sqrt(2));//rms current in A
30   I=sqrt((I1m)^2+(I3m)^2);//rms current in A
31   Pr=((I)^2)*(R);//power in Watts
32   //Branch with inductor(L)
33   Z1=(10+((%i)*(314*0.03)));//impedance to fundamental
        component
34   M=sqrt((10)^2+(9.42)^2);//magnitude of Z1 in polar
      form
35   theta=atan(9.42/10)*(180/%pi);//angle of Z1 in polar
      form
36   I2m=V/M;//fundamental current in A
37   I2m=I2m/(sqrt(2));//rms current in A
38   I4m=V1/M;//third harmonic component of current
39   I4m=I4m/(sqrt(2));//rms current in A
40   I1=((I2m)^2+(I4m)^2);//total rms current in A
41   Pr1=(I1)*(R);//Power in Watts
42   //branch with capacitor
43   X1=1/(314*10^-4);//reactance to fundamental
```

```
              component in ohms
44  I5m=V/(X1); //current in A
45  I5m=I5m/(sqrt(2)); //rms current in A
46  X2=1/(942*10^-4); //reactance to third harmonic
              component in ohms
47  I6m=V1/X2; //current in A
48  I6m=I6m/(sqrt(2)); //rms current in A
49  I2=sqrt((I5m)^2+(I6m)^2); //total rms current in A
50  Pr2=0; //power in watts
51  T=Pr+Pr1+Pr2; //total power dissipated in W
52  //calculation of total current
53  Im=(p2r(16.26,0)+p2r(11.84,43.29)+p2r(5.1,90)); //pol
              to rect
54  disp(Im); //fundamental component of current in A
55  Im1=(p2r(4.24,0)+p2r(3.09,-43.29)+p2r(4,90)); //pol
              to rect
56  disp(Im1); //third harmonic component of current in A
57  T1=sqrt((Im(1))^2+(Im1(1))^2); //total rms current in
              A
58  V2=(sqrt((V)^2+(V1)^2))/sqrt(2); //voltage applied in
              rms
59  pf=T/((T1)*(V2)); //power factor
60  mprintf("thus total current ,power input and power
              factor are %2.2f A ,%f W,%1.2f respectively",T1,T
              ,pf);
61  //═════════════════════════════════END OF PROGRAM
    ════════════════════════════════════════════════
```

Chapter 5

SINGLE PHASE AC CIRCUITS

Scilab code Exa 5.1 POLAR

```
1 //Chapter-5, Example 5.1, Page 157
2 //
     ===============================================
3 clc
4 clear
5  function [polar] = r2p(x,y)//function to convert
      rectangular to polar
6  polar = ones(1,2)
7  polar(1) = sqrt ((x ^2) +(y^2))
8  polar(2) = atan (y/x)
9  polar(2) =(polar (2)*180)/%pi
10  endfunction
11  function [ rect ] = p2r(r,theta)//function to
      convert polar to rectangular
12  rect = ones(1 ,2)
13  theta =( theta *%pi) /180
14  rect (1)=r* cos(theta)
15  rect (2)=r* sin(theta)
```

```
16   endfunction
17  //CALCULATIONS
18  I1=r2p(7,-5);
19  disp(I1);
20  I2=r2p(-9,6);
21  I2(2)=I2(2)+(180);//this belongs to quadrant 2 and
        hence 180 degrees should be added
22  disp(I2);
23  I3=r2p(-8,-8);
24  I3(2)=I3(2)+(180);//this belongs to quadrant 3 and
        hence 180 degrees should be added
25  disp(I3);
26  I4=r2p(6,6);
27  disp(I4);
28  //note:here direct functions for converson are not
        available and hence we defined user defined
        functions for polar to rect and rect to polar
        conversions
29  //==============================END OF PROGRAM
    ==============================
```

Scilab code Exa 5.2 POLAR

```
1  //Chapter −5, Example 5.2, Page 157
2  //
    ==============================
3  clc
4  clear
5   function [polar] = r2p(x,y)//function to convert
        rectangular to polar
6   polar = ones(1,2)
7   polar(1) = sqrt ((x ^2) +(y^2))
8   polar(2) = atan (y/x)
```

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```scilab
9    polar(2) =(polar (2)*180)/%pi
10   endfunction
11   function [ rect ] = p2r(r,theta)//function to
         convert polar to rectangular
12   rect = ones(1,2)
13   theta =( theta *%pi) /180
14   rect (1)=r* cos(theta)
15   rect (2)=r* sin(theta)
16   endfunction
17   //CALCULATIONS
18   //for subdivision 1
19   I1=p2r(10,60);
20   I2=p2r(8,-45);
21   I3=I1+I2;
22   disp(I3);
23   I4=r2p(I3(1),I3(2));
24   disp(I4)
25   //for subdivision 2
26   I5=r2p(5,4);
27   I6=r2p(-4,-6);
28   I7(1)=(I5(1))*(I6(1));
29   I7(2)=(I5(2)+I6(2));
30   I7(2)=I7(2)-180;
31   disp(I7);
32   //for subdivision 3
33   I8=r2p(-2,-5);
34   I9=r2p(5,7);
35   I10(1)=I8(1)/I9(1);
36   I10(2)=I8(2)-I9(2);
37   I10(2)=I10(2)-180
38   disp(I10);
39   //note:here direct functions for converson are not
         available and hence we defined user defined
         functions for polar to rect and rect to polar
         conversions
40   //================================END OF PROGRAM
     ===================================
```

_____

Scilab code Exa 5.3 IMPEDANCE

```
1 //Chapter−5, Example 5.3, Page 160
2 //
  ═══════════════════════════════════════════════

3 clc
4 clear
5 //given i(t)=5*sin(314*t+(2*%pi/3))&& v(t)=20*sin
      (314*t+(5*%pi/6))
6 //CALCULATIONS
7 P1=2*(%pi/3);//phase angle of current in radians
8 P1=P1*(180/%pi);//phase angle of current in degrees
9 P2=5*(%pi/6);//phase angle of voltage in radians
10 P2=P2*(180/%pi);//phase angle of voltage in degrees
11 P3=P2-P1;//current lags voltage by P3 degrees
12 P4=P3*%pi/180;
13 pf=cos(P4);//lagging pf
14 Vm=20;//peak voltage
15 Im=5;//peak current
16 Z=Vm/Im;//impedance in ohms
17 R=(Z)*cos(P4);//resistance in ohms
18 Xl=sqrt((Z)^2-(R)^2);//reactance
19 W=314;
20 L=Xl/W;//inductance in henry
21 V=Vm/sqrt(2);//average value of voltage
22 I=Im/sqrt(2);//average value of current
23 av=(V*I)*cos(P4);//average power in watts
24 mprintf("thus impedance,resistance,inductance,
      powerfactor and average power are %d ohms,%1.2f
      ohms,%g H,%1.3f and %2.1f W respectively",Z,R,L,
      pf,av);
25 //═══════════════════════════════════END OF PROGRAM
  ═══════════════════════════════════════════════
```

Scilab code Exa 5.4 IMPEDANCE

```
1 //Chapter −5, Example 5.4, Page 161
2 //================================================================
3 clc
4 clear
5 //INPUT DATA
6 I=10;//given current in A
7 P=1000;//power in Watts
8 V=250;//voltage in volts
9 f=25;//frequency in Hz
10 //CALCULATIONS
11 R=P/((I)^2);//resistance in ohms
12 Z=V/I;//impedance in ohms
13 Xl=sqrt((Z)^2-(R)^2);//reactance in ohms
14 L=Xl/(2*%pi*f);//inductance in Henry
15 Pf=R/Z;//power factor , lagging , pf=cos(phi)
16 mprintf("thus impedance , resistance , inductance ,
      reactance and powerfactor are %d ohms,%d ohms,%1
      .3f H,%2.2f ohms and %1.1f respectively",Z,R,L,Xl
      ,Pf);
17 //================================END OF PROGRAM
================================================================
```

Scilab code Exa 5.5 IMPEDANCE

```
1 //Chapter −5, Example 5.5, Page 162
```

```
2  //
   ═══════════════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  V=250;//supply voltage in volts
7  f=50;//frequency in hz
8  Vr=125;//voltage across resistance in volts
9  Vc=200;//voltage across coil in volts
10 I=5;//current in A
11 //CALCULATIONS
12 R=Vr/I;//resistance in ohms
13 Z1=Vc/I;//impedance of coil in ohms
14 //Z1=sqrt((R1)^2+(Xl)^2)————eqn(1)
15 Z=V/I;//total impedance in ohms
16 //Z=sqrt((R+R1)^2+(Xl)^2)————eqn(2)
17 //solving eqn(1)and eqn(2) we get R1 as follows
18 R1=(((Z)^2-(Z1)^2)-(R)^2)/(2*R);//in ohms
19 Xl=sqrt((Z1)^2-(R1)^2);//reactance of coil in ohms
20 P=((I)^2*R1);//power absorbed by the coil in Watts
21 Pt=((I)^2)*(R+R1);//total power in Watts
22 mprintf("thus impedance,resistance,reactance are %d
      ohms,%d ohms,%2.2f ohms respectively\n",Z1,R,Xl);
23 mprintf("power absorbed and total power are %3.1f W
      and %3.1f W respectively",P,Pt)
24
25 //═══════════════════════════════════════════════════END OF PROGRAM
   ═══════════════════════════════════════════════════════════
```

Scilab code Exa 5.6 RESISTANCE

```
1  //Chapter −5, Example 5.6 , Page 163
2  //
```

```scilab
 3  clc
 4  clear
 5  //INPUT DATA
 6  V=240;//supply voltage in volts
 7  Vl=171;//voltage across inductor in volts
 8  I=3;//current in A
 9  phi=37;//power factor laggging in degrees
10  //CALCULATIONS
11  Zl=Vl/I;//impedance of coil in ohms
12  //Zl=sqrt((R1)^2+(Xl)^2)------eqn(1)
13  Z=V/I;//total impedance in ohms
14  //Z=sqrt((R+R1)^2+(Xl)^2)-----eqn(2)
15  pf=cos(phi*%pi/180);//powerfactor
16  Rt=pf*Z;//total resistance in ohms//Rt=(R+R1)
17  //substituting Rt value in eqn(2) we find Xl as
         follows
18  Xl=sqrt((Z)^2-(Rt)^2);//reactance of inductor in
         ohms
19  //ubstituting Xl value in eqn(1) we find R1 as
         follows
20  R1=sqrt((Zl)^2-(Xl)^2);//resistance of inductor in
         ohms
21  R=Rt-R1;//resistance of resistor in ohms
22  mprintf("Thus resistance of resistor  is %2.2f ohms\
        n",R);
23  mprintf("Thus resisitance and reactance of inductor
         are %2.2f ohms and %2.2f ohms respectively",R1,Xl
        )
24
25  //================================END OF PROGRAM
```

Scilab code Exa 5.7 CURRENT

```
1  //Chapter−5, Example 5.7, Page 164
2  //======================================================
3  clc
4  clear
5  //INPUT DATA
6  V=100;//supply voltage in volts
7  //for COIL A
8  f=50;//frequency in Hz
9  I1=8;//current in A
10 P1=120;//power in Watts
11 //for COIL B
12 I2=10;//current in A
13 P2=500;//power in Watts
14 //CALCULATIONS
15 //FOR COIL A
16 Z1=V/I1;//impedance of coil A in ohms
17 R1=P1/(I1)^2;//resistance of coil A in ohms
18 X1=sqrt(((Z1)^2-(R1)^2));//reactance of coil A in
       ohms
19 //FOR COIL B
20 Z2=V/I2;//impedance of coil B in ohms
21 R2=P2/(I2)^2;//resistance of coil B in ohms
22 X2=sqrt(((Z2)^2-(R2)^2));//reactance of coil B in
       ohms
23 //When both COILS A and B are in series
24 Rt=R1+R2;//total resistance in ohms
25 Xt=X1+X2;//total reactance in ohms
26 Zt=sqrt((Rt)^2+(Xt)^2);//total impedance in ohms
27 It=V/Zt;//current drawn in A
28 P=((It)^2)*(Rt);//power taken in watts
29 mprintf("Thus current drawn and power taken in watts
        are %2.2f A and %3.2f W respectively",It,P);
30 //=====================================END OF PROGRAM
   ======================================================
```

Scilab code Exa 5.8 IMPEDANCE

```
1  //Chapter-5, Example 5.8, Page 167
2  //=================================================================
3  clc
4  clear
5  //INPUT DATA
6  R=100;//resistance in ohms
7  C=50*10^-6;//capacitance in F
8  V=200;//voltage in Volts
9  f=50;//frequency in Hz
10 //Z=R-(%i)*(Xc)------->impedance
11 Xc=1/(2*%pi*f*C);//capacitive reactance in ohms
12 Z=sqrt((R)^2+(Xc)^2);//impedance in ohms
13 I=V/Z;//current in A
14 pf=R/Z;//power factor ------->cos(phi)----->leading
15 phi=acos(0.844);//phase angle in radians
16 phi=phi*180/%pi;//phase angle in degrees
17 Vr=(I)*(R);//voltage across resistor
18 Vc=(I)*(Xc);//votage across capacitor
19 mprintf("Thus impedance,current,powerfactor and
       phaseangle are %3.2f ohms,%1.2f A,%1.3f and %2.2f
        degrees respectively\n",Z,I,pf,phi);
20 mprintf("voltage across resistor and capacitor are
      %d V and %3.2f V respectively",Vr,Vc)
21
22 //=============================END OF PROGRAM
   =================================================================
23
24 ;
```

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Scilab code Exa 5.9 POWER FACTOR

```
1  //Chapter−5, Example 5.9, Page 169
2  //
      ═══════════════════════════════════════════════════════════════
3  clc
4  clear
5  //INPUT DATA
6  phi=40;//phase in degrees
7  V=150;//voltage in Volts
8  I=8;//current in A
9  //the applied voltage lags behind the current .That
      means the current leads the voltage
10 //hence pf is leading
11 //CALCULATIONS
12 pf=cos(phi*%pi/180);//in degrees−−−>leading
13 //hence it is a capacitive circuit
14 pa=V*I*pf;//active power in W
15 pr=V*I*sin(phi*%pi/180);//reactive power in VAR
16 mprintf("Thus active and reactive power are %3.1f W
      and %3.1f VAR respectively",pa,pr);
17 //═══════════════════════════END OF PROGRAM
      ═══════════════════════════════════════════════════════════════

18
19 ;
```

Scilab code Exa 5.10 IMPEDANCE

```
1  //Chapter−5, Example 5.10, Page 169
```

```
2  //
    _____

3  clc
4  clear
5  //INPUT DATA
6  //given  v=141.4*sin(314*t)
7  P=700;//power in Watts
8  pf=0.707;//powerfactor--------->leading--------->cos(phi)
9  Vm=141.4;//maximum value of supply voltage
10 //CALCULATIONS
11 Vr=Vm/(sqrt(2));//rms value of supply voltage
12 I=P/(Vr*pf);//current in A
13 Z=Vr/I;//impedance in ohms
14 R=(Z)*(pf);//resistance in ohms
15 phi=acos(pf*180/%pi);//angle in degrees
16 Xc=(Z)*(sin(phi));//reactance in ohms
17 C=1/(3.14*7.13);//Capacitance in F
18 mprintf("Thus resistance and capacitance are %1.2f
       ohms and %g F respectively",R,C);
19 //=======================================END OF PROGRAM
    _____

20
21 ;
    _____
```

Scilab code Exa 5.11 RESISTANCE

```
1  //Chapter-5, Example 5.11, Page 169
2  //
    _____

3  clc
4  clear
5  //INPUT DATA
```

```
6  V=200; // supply  voltage  in  volts
7  f=50; // freq  in  hz
8  P=7000; // power  in  Watts
9  Vr=130; // volatge  across  resistor  in  volts
10 P=7000; // power  in  Watts
11 //CALCULATIONS
12 R=((Vr)^2)/P; // resistance  in  ohms
13 I=Vr/R; // current  in  A
14 Z=V/I; // total  impedance  in  ohms
15 Xc=sqrt((Z)^2-(R)^2);
16 C=1/(2*%pi*f*Xc); // Capacitance  in  F
17 pf=R/Z; // power  factor —————>leading
18 phi=acos(pf); // angle  in  radians
19 phi=phi*180/%pi; // angle  in  degrees
20 Vm=V*sqrt(2); // maximum  value  of  voltage
21 // voltage  equation  v=Vm*sin(2*%pi*f*t)—————>282.84*
       sin(314.16*t)
22 // current  leads  voltage  by  phi
23 // current  equation  —————>i=76.155*sin(314.16*t+phi)
24 mprintf("Thus  current ,resistance ,p.f ,capacitance ,
       impedance  are  %2.2 f  A  ,%1.2 f  ohms,%2.1 f  ,%g  F  and
       %1.2 f  ohms  respectively",I,R,pf,C,Z);
25 //================================END  OF  PROGRAM
   ============================================
```

```
26
27 ;
```

Scilab code Exa 5.12 IMPEDANCE

```
1  //Chapter −5,  Example  5.12 ,  Page  170
2  //
   ============================================

3  clc
```

```
4  clear
5  //INPUT DATA
6  C=50;//capacitance in uf
7  R=100;//resistance in ohms
8  V=200;//supply voltage in volts
9  f=50;//freq in hz
10 //CALCULATIONS
11 Xc=1/(2*%pi*f*C*10^-6);//capacitive reactance in
      ohms
12 Z=R-((%i)*Xc);//impedance in ohms
13 disp(Z);
14 z1=sqrt((R)^2+(Xc)^2);
15 theta=atan(Xc/R);
16 pf=cos(theta);//powerfactor
17 I=V/z1;//current in A
18 P=V*I*pf;//power in Watts
19 mprintf("Thus current,power factor,power are % 1.2 f
      A ,%1.3 f ,%d W respectively",I,pf,P);
20 //==================================END OF PROGRAM
   ================================================

21
22 ;
```

Scilab code Exa 5.13 INDUCTANCE

```
1  //Chapter −5, Example 5.13, Page 170
2  //
   ================================================

3  clc
4  clear
5  //INPUT DATA
6  C=0.05;//capacitance in uf
7  F=500;//freq in hz
```

```
 8  //CALCULATIONS
 9  Xl=1/(2*%pi*F*C*10^-6);//capacitive reactance in
       ohms
10  //at resonance Xl=Xc
11  L=(Xl/(2*%pi*F));//inductance in H
12  mprintf("Thus value of L is %1.2f H",L);
13  //===================================END OF PROGRAM
       =================================================

14
15  ;
```

_____

Scilab code Exa 5.14 CURRENT

```
 1  //Chapter −5, Example  5.14 , Page  171
 2  //
       =================================================

 3  clc
 4  clear
 5  //INPUT DATA
 6  V=200;//voltage in V
 7  R=50;//resistance in ohms
 8  L=0.5;//inductance in Henry
 9  F=50;//freq in hz
10  //CALCULATIONS
11  Xl=2*%pi*F*L;//inductive reactance
12  Z=(R)+((%i)*Xl)//impedance
13  disp(Z);
14  z1=sqrt((R)^2+(Xl)^2);//magnitude
15  theta=atan(Xl/R);//angle in radians
16  I=V/z1;//current in A
17  P=V*I*cos(theta);//power supplied in W
18  //here capacitive reactance equals inductive
       reactance
```

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```
19  //hence Xc=Xl
20  C=1/(2*%pi*F*Xl);//capacitance in uf
21  r=(V/I)-(R);//additional resistance to be added in
        series
22  mprintf("Thus current and power required are % 1.2f
        A and %2.2f W respectively\n",I,P);
23  mprintf("Thus additional resistance that neede to be
        connected in series with R and C to have same
        current at unity power factor is %1.1f ohms",r);
24  //=================================END OF PROGRAM

25
26  ;
```

Scilab code Exa 5.15 CAPACITANCE

```
1  //Chapter −5, Example  5.15 , Page  171
2  //=====================================

3  clc
4  clear
5  //INPUT DATA
6  R=50;//resistance in ohms
7  L=9;//inductance in Henry
8  I0=1;//current in A
9  f=75;//ferquency in Hz
10  //at resonance Xl=Xc
11  //CALCULATIONS
12  Xl=2*%pi*f*L;//inductive reactance
13  Xc=Xl;//capacitive reactance
14  C=1/(2*%pi*f*Xc);//capacitance in uf
15  mprintf("Thus capacitance is %g F",C);
16  //=================================END OF PROGRAM
```

```
17
18  ;
```

───

Scilab code Exa 5.16 INDUCTIVE REACTANCE

```scilab
1  //Chapter-5, Example 5.16, Page 175
2  //
```

═══

```scilab
3  clc
4  clear
5  //INPUT DATA
6  R=10;//resistance in ohms
7  L=0.1;//inductance in Henry
8  C=150;//capacitor in uf
9  V=200;//voltage in V
10 f=50;//frequency in hz
11 //CALCULATIONS
12 Xc=1/(2*%pi*f*C*10^-6);//Capacitive reactance in
       ohms
13 Xl=(2*%pi*f*L);//inductive reactance in ohms
14 Z=R+((%i)*(Xl-Xc));//impedance in ohms
15 z1=sqrt((R)^2+(Xl-Xc)^2);//magnitude of Z
16 I=V/z1;//current in A
17 pf=R/z1;//power factor ———>cos(phi)
18 //As Xl-Xc is inductive,pf is lagging
19 z2=sqrt((R^2)+(Xl)^2);//impedance of coil in ohms
20 Vl=I*(z2);//voltage across coil in volts
21 Vc=I*(Xc);//voltage across capacitor in volts
22 mprintf("Thus inductive reactance,capacitive
       reactance,impedance,current,powerfactor are %2.2f
        ohms,%2.2f ohms,%2.2f ohms,%d A,%1.1f
       respectively ,",Xl,Xc,z1,I,pf);
```

```
23  //==================================END OF PROGRAM
    ===================================================


24
25  ;
```

Scilab code Exa 5.17 RESISTANCE

```
1   //Chapter −5, Example 5.17, Page 176
2   //
        ===================================================

3   clc
4   clear
5   //INPUT DATA
6   L=10;//inductance in milliHenry
7   C=5;//capacitor in uf
8   phi=50;//phase in degrees−−−−−−>lagging
9   f=500;//frequency in hz
10  V=200;//supply voltage in volts
11  //CALCULATIONS
12  Xc=1/(2*%pi*f*C*10^-6);//Capacitive reactance in
        ohms
13  Xl=(2*%pi*f*L*10^-3);//inductive reactance in ohms
14  R=(Xc-Xl)/(tan(phi*%pi/180));//resistance in ohms
15  Z=sqrt((R)^2+(Xc-Xl)^2);//impedance in ohms
16  I=V/Z;//current in A
17  Vr=(I)*(R);//voltage across resistance
18  Vl=(I)*(Xl);//voltage across inductance
19  Vc=(I)*(Xc);//voltage across capacitance
20  mprintf("Thus voltages across resistance,inductance,
        capacitance are %3.2f volts,%3.2f volts,%3.2f
        volts respectively,",Vr,Vl,Vc);
21  //==================================END OF PROGRAM
    ===================================================
```

```
22
23  ;
```

Scilab code Exa 5.18 CAPACITANCE

```
 1  //Chapter −5, Example  5.18 ,  Page  176
 2  //
 3  clc
 4  clear
 5  //INPUT DATA
 6  L=5;//inductance  in  Henry
 7  f=50;//frequency  in  hz
 8  V=230;//supply  voltage  in  volts
 9  R=2;//resitance  in  ohms
10  V1=250;//voltage  across  coil  in  V
11  //CALCULATIONS
12  Xl=(2*%pi*f*L);//inductive  reactance  in  ohms
13  Z1=sqrt((R)^2+(Xl)^2);//impedance  of  coil  in  ohms
14  I=V1/Z1;//current  in  A
15  Z=V/I;//total  impedance  in  ohms
16  //Z=sqrt((R)^2+(Xl−Xc)^2)  and  solving  for  Xc
17  Xc=poly(0,"Xc");
18  p=(Xc^2)-3141.58*(Xc)+378004
19  roots2 = roots (p);
20  r2 = roots2 (2);
21  //Xc cannot  be  greater  than  Z
22  C=1/(2*%pi*f*r2);//capacitance  in  F
23  mprintf("Thus value  of  C  that  must  be  present  suct
        that  voltage  across  coil  is  250  volts  is  %g  F
        respectively ,",C);
24  //==================================END  OF  PROGRAM
```

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```
25
26  ;
```
_____

Scilab code Exa 5.19 RESISTANCE AND CAPACITANCE

```
1  //Chapter −5, Example 5.19 , Page 178
2  //
        ===============================================================
3  clc
4  clear
5  //v=350*cos(3000*t−20)
6  //i=15*cos(3000*t−60)
7  //INPUT DATA
8  L=0.5;//inductance in Henry
9  phi=-40;//phase difference between applied voltage
        and current
10 //Xl>Xc(P.f is lagging)
11 w=3000;//freq in hz
12 Vm=350;//peak voltage in volts
13 Im=15;//peak current in amps
14 //CALCULATIONS
15 Z=Vm/Im;//total impedance in ohms
16 //Xl−Xc=0.839*R=X
17 //Z=sqrt((R)^2+(X)^2)
18 //Z=1.305*R
19 R=Z/1.305;//resistance in ohms
20 X=0.839*R;//
21 //X=Xl−Xc
22 Xl=w*L;//reactive inductance in ohms
23 Xc=Xl-X;//capacitive reactance in ohms
24 C=1/(w*Xc);//capacitance in uf
25 mprintf("Thus resistance and capacitance are %2.2 f
        ohms and %g F respectively ,",R,C);
```

Scilab code Exa 5.20 ADMITTANCE

```
1  //Chapter −5, Example 5.20, Page 182
2  //
3  clc
4  clear
5  //INPUT DATA
6  R=10;// resistance in ohms
7  L=0.1;// inductance in henry
8  f=50;// frequency in hz
9  //CALCULATIONS
10 Xl=(2*%pi*f*L);// inductive reactance in ohms
11 Z=R+((%i)*(Xl));// impedance in ohms
12 Y=inv(Z);// admittance in mho
13 disp(Y);
14 y=abs(Y);// admittance in mho
15 mprintf("admittance is %1.5f mho",y);
16 //═══════════════════════════════════════════END OF PROGRAM
```

Scilab code Exa 5.21 ADMITTANCE

```
1  //Chapter −5, Example 5.21, Page 182
2  //
```

```
3  clc
4  clear
5  //INPUT DATA
6  //CALCULATIONS
7  Z=10+((%i)*(5));//impedance in ohms
8  Y=inv(Z);//Admittance in mho
9  disp(Y);
10 //===================================END OF PROGRAM
```

Scilab code Exa 5.22 ADMITTANCE

```
1  //Chapter −5, Example 5.22 , Page 182
2  //
```

```
3  clc
4  clear
5  //INPUT DATA
6  Z1=7+((%i)*5);//impedance of branch1 in ohms
7  Z2=10-((%i)*8);//impedance  of branch2 in ohms
8  V=230;//supply voltage in volts
9  f=50;//frequency in hz
10 //CALCULATIONS
11 Y1=1/(Z1);//admittance of branch1 in mho
12 Y2=1/(Z2);//admittance of branch2 in mho
13 Y=Y1+Y2;//admittance of combined circuit
14 disp(Y);
15 g=abs(Y);//conductance in mho;
16 B=atan(imag(Y)/real(Y));//susceptance in mho
17 I=V*(Y);//current
18 disp(I);//total current taken from mains in A
19 z=atan(imag(I)/real(I));
20 pf=cos(z);//power factor
```

```
21  mprintf("thus conductance and susceptance of the
        circuit is %1.3f mho and %1.3f mho respectively\n
        ",g,B);
22  mprintf("power factor is %1.3f lagging",pf)
23  //========================================END OF PROGRAM
    ============================================
```

Scilab code Exa 5.23 FREQUENCY

```
1   //Chapter−5, Example 5.23, Page 183
2   //
    ===========================================
3   clc
4   clear
5   //INPUT DATA
6   V=240;//voltage in volts
7   f=50;//frequency in Hz
8   R=15;//resisitance in ohms
9   I=22.1;//current in A
10  //CALCULATIONS
11  G=1/R;//conductance in mho
12  //susceptance of the circuit ,B=1/(Xl)=0.00318/L
13  //admittance of the circuit ,(G−jB)=(0.067−j(0.00318/
        L))
14  Y=I/V;//admittance in mho;
15  //Y=sqrt((0.067)^2+(0.00318/L)^2)=0.092−−−−−eqn(1)
16  //solving eqn(1) for L we have it as
17  L=sqrt((0.00318)^2/((Y)^2-(G)^2));//inductance in
        henry
18  //when current is 34A
19  I1=34;//current in A
20  Y1=I1/V;//admittance in mho
21  //for Y1 we need to find f
```

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```
22  f1=sqrt ((3.183)^2/((Y1)^2-(G)^2)); //frequency in hz
23  mprintf("Thus value of frequency when current is 34A
        is %2.1 f Hz",f1);
24  //══════════════════════════════════════END OF PROGRAM
        ══════════════════════════════════════════════════════
```

Scilab code Exa 5.24 CURRENT

```
1  //Chapter −5, Example 5.24 , Page 184
2  //
       ══════════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  L=0.05; //inductance in henry
7  R2=20; //resistance in ohms
8  R1=15; //resistance in ohms
9  V=200; //supply voltage in volts
10  f=50; //frequency in hz
11  //CALCULATIONS
12  //for branch 1
13  Z1=(R1)+((%i)*(2*%pi*f*L)); //impedance in ohms
14  Y1=inv(Z1); //admittance in branch
15  I1=V*(Y1); //current in branch
16  disp(I1);
17  i1=abs(I1); //magnitude of current
18  //for branch 2
19  Y2=1/R2; //admittance in branch
20  I2=V*Y2; //current in branch
21  i2=abs(I2); //magnitude of current
22  I=I1+I2; //total current in A
23  i=abs(I); //magnitude of total current
24  theta=atan(imag(I)/real(I)); //angle in radians
```

```
25  theta=theta*(180)/(%pi);//angle in degrees
26  mprintf("Thus current in branch1,branch2 abd total
        currents are %1.2f A,%d A,%2.2f A respectively\n"
        ,i1,i2,i);
27  mprintf("phase angle of the combination is %2.1f
        degrees",theta);
28  //===================================END OF PROGRAM
    ================================================================
```

Scilab code Exa 5.25 TOTAL CURRENT

```
1  //Chapter−5, Example 5.25, Page 185
2  //
    ================================================================

3  clc
4  clear
5  //INPUT DATA
6  L=6;//inductance in millihenry
7  R2=50;//resistance in ohms
8  R1=40;//resistance in ohms
9  C=4;//capacitance in uf
10 V=100;//voltage in volts
11 f=800;//frequency in hz
12 //CALCULATIONS
13 Xl=(2*%pi*f*L*10^-3);//inductive reactance in ohms
14 Xc=1/(2*%pi*f*C*10^-6);//capacitive reactance in
       ohms
15 Y1=inv((R1)+(%i*Xl));//admittance of branch1 in mho
16 Y2=inv((R2)-(%i*Xc));//admittance of branch2 in mho
17 I1=V*(Y1);//current in branch 1
18 I2=V*(Y2);//current in branch 2
19 I=I1+I2;//total curremt in A
20 theta=(atan(imag(I1)/real(I1))-atan(imag(I2)/real(I2
```

```
      )));
21  theta=theta*180/%pi;//angle in degrees
22  mprintf("Thus total current taken from supply is %2
        .2f\n",abs(I));
23  mprintf("phase angle between currents of coil and
        capacitor is %2.2f degrees",theta);
24  //==================================END OF PROGRAM
        ===================================================
```

Scilab code Exa 5.26 POWER

```
1  //Chapter−5, Example 5.26, Page 186
2  //
        ===================================================

3  clc
4  clear
5  //INPUT DATA
6  Z1=10+(%i*15);//impedance in ohms
7  Z2=6-(%i*8);//impedance in ohms
8  I=15;//current in A
9  //CALCULATIONS
10 I1=((Z2)/(Z1+Z2))*(I);//using current division rule
11 I2=((Z1)/(Z1+Z2))*(I);//using current division rule
12 i1=abs(I1);//magnitude of current 1
13 i2=abs(I2);//magnitdude of current 2
14 P1=((i1)^2)*(Z1(1));//power consumed by branch 1
15 P2=((i2)^2)*(Z2(1));//power consumed by branch 2
16 mprintf("Thus power consumed by branches 1 and 2 are
        %3.2f W and %4.1f W respectively",P1,P2);
17 //==================================END OF PROGRAM
        ===================================================
```

Scilab code Exa 5.27 CURRENT

```scilab
1  //Chapter-5, Example 5.27, Page 187
2  //
     _____
3  clc
4  clear
5  //INPUT DATA
6  V=200;//voltage in volts
7  f=50;//frequency in hz
8  R1=10;//resistance in ohms
9  L1=0.0023;//inductance in henry
10 R2=5;//resistance in ohms
11 L2=0.035;//inductance in henry
12 //CALCULATIONS
13 Xl1=(2*%pi*f*L1);//inductive reactance in branch 1
      in ohm
14 Xl2=(2*%pi*f*L2);//inductive reactance in branch 2
      in ohm
15 Y1=inv(10+(%i*7.23));//admittance of branch 1 in mho
16 Y2=inv(5+(%i*10.99));//admittance of branch 2 in mho
17 Y=Y1+Y2;//total admittance in mho
18 I1=V*(Y1);//current through branch1
19 I2=V*(Y2);//current through branch2
20 I=I1+I2;//total current in A
21 theta=atan(imag(I)/real(I));//angle in radians
22 pf_of_combination=cos(theta);//powerfactor----->
      lagging
23 mprintf("Thus currents in branch1,branch2 and total
      current are %2.1f A,%2.1f A and %2.2f A
      respectively\n",abs(I1),abs(I2),abs(I));
24 mprintf("pf of combination is %1.3f",
      pf_of_combination);
```

_____

Scilab code Exa 5.28 CURRENT

```
1  //Chapter −5, Example  5.28 ,  Page  189
2  //
   ═══════════════════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  f =50;//freq  in  hz
7  V =100;//volatge  in  V
8  L1 =0.015;//inductance  in  branch  1  in  henry
9  L2 =0.08;//inductance  in  branch  2  in  henry
10 R1 =2;//resistance  of  branch  1  in  ohms
11 x1 =4.71;//reactance  of  branch  1  in  ohms
12 R2 =1;//resistance  of  branch  2  in  ohms
13 x2 =25.13;//reactance  of  branch  2  in  ohms
14 Z1 =( R1 )+(%i*x1);//impedance  of  branch1  in  ohms
15 Z2 =( R2 )+(%i*x2);//impedance  of  branch1  in  ohms
16 I1=V/Z1;//current  in  branch  1  in  A
17 printf (" current  in  branch  1  in  A")
18 disp ( I1 ) ;
19 I2=V/Z2;//current  in  branch  2  in  A
20 printf (" current  in  branch  2  in  A")
21 disp ( I2 ) ;
22 I3=I1+I2;//total  current  in  A
23 printf (" total  current  in  A")
24 disp ( I3 ) ;
25 //note:Answer  for  real  part  of  total  current  given
      in  textbook  is  wrong.Please  check  the
      calculations
```

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```
26  //                                         END  OF  PROGRAM
```

Scilab code Exa 5.29 ADMITTANCE

```
1  //Chapter −5, Example  5.29 , Page  189
2  //
3  clc
4  clear
5  //CALCULATIONS
6  R=8;//resistance  in  ohms
7  Xc=-(%i)*12;//capacitive  reactance  in  ohms
8  Y=(inv(R)+inv(Xc));//admittance  in  mho
9  disp(Y);
10  //                                        END  OF  PROGRAM
```

Scilab code Exa 5.30 ADMITTANCE

```
1  //Chapter −5, Example  5.30 , Page  189
2  //
3  clc
4  clear
5  //CALCULATIONS
6  R=3;//resistance  in  ohms
7  Xl=(%i)*4;//inductive  reactance  in  ohms
8  Y=(inv(R)+inv(Xl));//admittance  in  mho
```

```
9  disp(Y);
10 //═══════════════════════════════════════END OF PROGRAM
   ═══════════════════════════════════════════════════════
```

_____

Scilab code Exa 5.31 RESONANT FREQUENCY

```
1  //Chapter −5, Example 5.31, Page 196
2  //════════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  R=10;//resistance in ohms
7  L=10;//inductance in milli henry
8  C=1;//capacitance in uF
9  V=200;//applied voltage in volts
10 //CALCULATIONS
11 fr=1/(2*%pi*(sqrt(L*C*10^-3*10^-6)));//resonant
       frequency in hz
12 I0=V/(R);//current at resonance in A
13 Vr=I0*R;//voltage across resistance in volts
14 Xl=2*%pi*fr*L*10^-3;//inductance in ohms
15 Vl=I0*Xl;//voltage across inductor in volts
16 Xc=inv(2*%pi*fr*C*10^-6);//capacitance in ohms
17 Vc=I0*Xc;//voltage across capacitor in volts
18 wr=2*%pi*fr//angular resonant frewuency in rad/sec
19 Q=(wr*L*10^-3)/(R);//quality factor
20 Bw=(fr/Q);//bandwidth in hz
21 mprintf("Thus resonant frequency and current are %4
       .2 f hz and %d A respectively\n",fr,I0);
22 mprintf("voltages across resistance ,inductance and
       capacitance are %d V,%d V and %d V respectively\n
       ",Vr,Vl,Vc);
```

```
23  mprintf("bandwidth and quality factor are %3.2f hz
        and %d respectively",Bw,Q);
24  //===================================END OF PROGRAM
        ====================================
```

Scilab code Exa 5.32 CIRCUIT CONSTANTS

```
1  //Chapter −5, Example 5.32, Page 196
2  //
        =====================================
3  clc
4  clear
5  //INPUT DATA
6  V=220;//applied voltage in volts
7  f=50;//frequency in hz
8  Imax=0.4;//maximum current in A
9  Vc=330;//voltage across capacitance in volts
10 //at resonance condition I0=0.4 A
11 I0=0.4//current in A
12 //CALCULATIONS
13 Xc=(Vc)/(I0);//capacitive reactance in ohms
14 C=inv(2*%pi*f*Xc);//capacitance in F
15 //at resonance condition Xc=Xl, hence
16 L=Xc/(2*%pi*f);//inductance in henry
17 R=V/(Imax);//resistance in ohms
18 mprintf("Thus resistance ,inductance and capacitance
        are %d ohms,%1.2f H and %g F respectively\n",R,L,
        C);
19 //===================================END OF PROGRAM
        ====================================
```

Scilab code Exa 5.33 RESONANT FREQUENCY

```scilab
1  //Chapter -5, Example  5.33 , Page  197
2  //
                 _____
3  clc
4  clear
5  //INPUT DATA
6  R1=5;// resistance  of  branch1  in  ohms
7  R2=2;// resistance  of  branch2  in  ohms
8  L=10;// inductance  in  mH
9  C=40;// capacitance  in  uF
10  //CALCULATIONS
11  fr=(1/(2*%pi*(sqrt(L*C*10^-9))))*(sqrt(((C*10^-6*(R1
       )^2)-L*10^-3)/((C*10^-6*(R2)^2)-L*10^-3)));//
       resonant  frequency  in  hz
12  mprintf("Thus  resonant  frequency  is  %f  hz",fr);
13  //========================================END OF PROGRAM
                 _____
```

Scilab code Exa 5.34 FREQUENCY

```scilab
1  //Chapter -5, Example  5.34 , Page  197
2  //
                 _____
3  clc
4  clear
5  //INPUT DATA
6  R=20;// resistance  in  ohms
```

```
7  L=0.2;//inductance in H
8  C=100;//capacitance in uF
9  //resistance will be non-inductive only at reosnant
       frequency
10 //CALCULATIONS
11 fr=(1/(2*%pi*(sqrt(L*C*10^-6))))*(sqrt((L-(C*10^-6*(
       R)^2))/(L)));//resonant frequency in hz
12 mprintf("Thus resonant frequency is %2.2f hz\n",fr);
13 Rf=(L)/(C*R*10^-6);//non-inductive resistance
14 mprintf("Thus value of non-inductive resistance is
       %d ohms",Rf);
15 //═══════════════════════════════════END OF PROGRAM
   ═══════════════════════════════════════════════════
```

Scilab code Exa 5.35 BANDWIDTH

```
1  //Chapter-5, Example 5.35, Page 198
2  //
   ═══════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  Q=250;//quality factor
7  fr=1.5*10^6;//resonant freq in hertz
8  //CALCULATIONS
9  Bw=(fr)/(Q);//bandwidth in Hz
10 hf1=fr+Bw;//half power freq 1
11 hf2=fr-Bw;//half power freq 2
12 mprintf("Thus bandwidth is %d hz\n",Bw);
13 mprintf("Thus value of half-power frequencies are %g
       hz and %g hz",hf1,hf2);
14 //═══════════════════════════════════END OF PROGRAM
   ═══════════════════════════════════════════════════
```

Scilab code Exa 5.36 RESONANT FREQUENCY

```
1  //Chapter −5, Example 5.36, Page 198
2  //_____

3  clc
4  clear
5  //INPUT DATA
6  L=40*10^-3;//inductance in henry
7  C=0.01*10^-6;//capacitance in uf
8  //CALCULATIONS
9  fr=1/(2*%pi*sqrt(L*C));//resonant frequency
10 mprintf("Thus resonant frequency is %d hz\n",fr);
11 //==============================END OF PROGRAM
   _____
```

Scilab code Exa 5.37 RESONANT FREQUENCY

```
1  //Chapter −5, Example 5.37, Page 198
2  //_____

3  clc
4  clear
5  //INPUT DATA
6  V=120;//source voltage in volts
7  R=50;//resistance in ohms
8  L=0.5;//inductance in Henry
9  C=50;//capacitance in uF
```

```
10 //CALCULATIONS
11 //at Resonance
12 fr=(1/(2*%pi*(sqrt(L*C*10^-6))));//resonant
      frequency in hz
13 I0=V/R;//current at resonance in A
14 Vl=(%i)*(I0*L);//voltage developed across inductor
      in volts
15 Vc=(-%i)*(I0*L);//voltage developed across capacitor
       in volts
16 Q=(inv(R))*(sqrt(L/(C*10^-6)));//quality factor
17 Bw=(fr)/(Q);//Bandwidth in Hz
18 //given resonance is to occur at 300 rad/sec,then
19 wr=300;//wr=(2*%pi*f*r)--------->measured in Hz
20 //wr=inv(sqrt(L*Cn))
21 Cr=inv(L*(wr)^2);//capacitance required in uF
22 mprintf("Thus resonant frequency,current,quality
      factor and bandwidth are %2.1f Hz,%1.1f A,%d and
      %2.1f hz respectively\n",fr,I0,Q,Bw);
23 mprintf("New value of capacitance at 300 rad/sec is
      %g F",Cr)
24 //================================END OF PROGRAM
```

Scilab code Exa 5.38 Q FACTOR

```
1 //Chapter-5, Example 5.38, Page 199
2 //================================

3 clc
4 clear
5 //INPUT DATA
6 Q=45;//quality factor
7 f1=600*10^3;//freq in Hz
```

```
8  f2=1000*10^3;//freq in Hz
9  //given new resistance is 50% greater than former.
       let us consider two reistances as R1=1 ohm and R2
       =1.5 ohm for ease of calculation.Then
10 R1=1;//resistance in ohm
11 R2=1.5;//resistance in ohm
12 //CALCULATIONS
13 W1=2*%pi*f1;//angular freq 1 in rad/sec
14 W2=2*%pi*f2;//angular freq 2 in rad/sec
15 Q=45;//quality factor
16 L=(Q*R1)/(W1);//inductance in henry
17 Q1=(W2*L)/(R2);//new quality factor
18 mprintf("Thus new quality factor is %d",Q1);
19 //==================================END OF PROGRAM
   ==================================================
```

Scilab code Exa 5.39 SINGLE PHASE AC CIRCUITS

```
1  //Chapter-5, Example 5.39, Page 199
2  //
   ==================================================
3  clc
4  clear
5  //INPUT DATA
6  R=4;//resistance in ohm
7  L=100*10^-6;//inductance in henry
8  C=250*10^-12;//capacitance in Farads
9  //CALCULATIONS
10 fr=inv(2*%pi*sqrt(L*C));//resonant frequency in Hz
11 Q=(inv(R))*(sqrt(L/C));//Q-factor
12 Bw=fr/Q;//bandwidth in Hz
13 hf1=fr+Bw;//halfpower freq1 in Hz
14 hf2=fr-Bw;//halfpower freq2 in Hz
```

```
15  mprintf (" Thus resonant freq ,Q−factor and new
        halfpower frequencies are %dhz ,%d,%g hz ,%g hz
        respectively ",fr ,Q ,hf1 ,hf2 ) ;
16  // note : given answers are wrong in textbook . Please
        check the answers
17  //═══════════════════════════════════END OF PROGRAM
    ═══════════════════════════════════════════════════
```

_____

Scilab code Exa 5.40 RESONANT FREQUENCY

```
 1  // Chapter −5, Example 5.40 , Page 200
 2  //
    ═══════════════════════════════════════════════════

 3  clc
 4  clear
 5  //INPUT DATA
 6  R=10; // resistance in ohm
 7  L=10^-3; // inductance in henry
 8  C=1000*10^-12; // capacitance in Farads
 9  V=20; // voltage in volts
10  //CALCULATIONS
11  fr=inv (2*%pi*sqrt (L*C) ) ; // resonant frequency in Hz
12  Q=(inv (R) ) *(sqrt (L/C) ) ; //Q−factor
13  Bw=fr/Q; // bandwidth in Hz
14  hf1=fr+Bw; // halfpower freq1 in Hz
15  hf2=fr-Bw; // halfpower freq2 in Hz
16  mprintf (" Thus resonant freq ,Q−factor and new
        halfpower frequencies are %d hz ,%d ,%g hz ,%g hz
        respectively ",fr ,Q ,hf1 ,hf2 ) ;
17  //═══════════════════════════════════END OF PROGRAM
    ═══════════════════════════════════════════════════
```

_____

Scilab code Exa 5.41 POWER

```scilab
1  //Chapter-5, Example 5.41, Page 208
2  //
      _____

3  clc
4  clear
5  //INPUT DATA
6  P1=1000;//power1 in watts
7  P2=1000;//power2 in watts
8  //CALCULATIONS
9  //for case(1)
10 Pt=P1+P2;//total power in watts
11 phi=atan(sqrt(3)*((P2-P1)/(P2+P1))*(180/%pi));//
      since tan(phi)=sqrt(3)*((P2-P1)/(P2+P1)))
12 pf=cos(phi);
13 mprintf("Thus power and powerfactor are %d W ,%d
      respectively\n",Pt,pf);
14 //for case(2)
15 P3=1000;//power3 in watts
16 P4=-1000;//power4 in watts
17 Pt1=P3+P4;//total power in watts
18 pf1=0;//since we cannot perform division by zero in
      scilab,it doesn't consider it as infinite
      quantity to yield 90 degree angle and hence
      powerfactor 0
19 mprintf("Thus power and powerfactor are %d W ,%d
      respectively",Pt1,pf1);
20 //=============================END OF PROGRAM
      _____
```

Scilab code Exa 5.42 REAL POWER

```
1  //Chapter -5, Example 5.42, Page 209
2  //
       _____

3  clc
4  clear
5  //INPUT DATA
6  V1=400;//voltage in volts
7  Z1=(3+((%i)*4));//impedance in ohms
8  //CALCULATIONS
9  //in star connected system,phase voltage=(line
       voltage)
10 Ep=V1/(sqrt(3));//voltage in volts
11 Ip=Ep/Z1;//current in A
12 ip1=abs(Ip);//line current in A
13 theta=atan((imag(Ip)/real(Ip)));
14 Pt=sqrt(3)*V1*ip1*cos(theta);//total power consumed
       in load in W
15 mprintf("Thus total power consumed in load is %f W",
       Pt);
16 //note:for line current the answer given is 46.02A
       instead of 46.2 A and hence total power consumed
       changes
17 //===================================END OF PROGRAM
       _____
```

Scilab code Exa 5.43 LINE TO NEUTRAL VOLTAGE

```
1  //Chapter -5, Example 5.43, Page 209
```

```
 2  //
    ================================================================

 3  clc
 4  clear
 5  //INPUT DATA
 6  V1=400;//voltage in volts
 7  Il=10;//current in A
 8  //CALCULATIONS
 9  //in star connected system, phase current=(line
       current)=I1
10  phase_voltage=(V1)/(sqrt(3));//voltage in Volts
11  mprintf("Thus phase voltage is %1.0f V",
       phase_voltage);
12  //==============================END OF PROGRAM
    ================================================================
```

_____

Scilab code Exa 5.44 CURRENT

```
 1  //Chapter −5, Example 5.44 , Page 209
 2  //
    ================================================================

 3  clc
 4  clear
 5  //INPUT DATA
 6  Z1=(6-((%i)*8));//impedance1 in ohms
 7  Z2=(16+((%i)*12));//impedance2 in ohms
 8  I1=(12+((%i)*16));//current in A
 9  //CALCULATIONS
10  V=I1*Z1;//applied voltage in volts
11  I2=V/(Z2);//current in other branch in A
12  mprintf("current in other branch in Amps")
13  disp(I2);
```

```
14  I=I1+I2;//total current in A
15  mprintf("total current in Amps");
16  disp(I);
17  i1=abs(I);//magnitude in A
18  i2=atan((imag(I)/real(I)));
19  P=V*i1*cos(i2);//power consumed in circuit
20  mprintf("Thus voltage applied and power consumed are
        %d V and %d W respectively",V,P);
21  //================================END OF PROGRAM
    ================================================
```

_____

Scilab code Exa 5.45 THREE PHASE POWER

```
1  //Chapter −5, Example 5.45, Page 210
2  //
    ================================================

3  clc
4  clear
5  //INPUT DATA
6  Vl=415;//voltage in volts
7  Z=(4+((%i)*6));//impedance in each phase in ohm
8  //CALCULATIONS
9  Ip=Vl/Z;//current in each phase in A
10 ip1=abs(Ip);//magnitude of Ip
11 Il=(sqrt(3))*(ip1);//line current in A
12 phi=atan((imag(Ip)/real(Ip)))
13 P=(sqrt(3))*Vl*Il*cos(phi);//power supplied in W
14 mprintf("Thus power supplied is %d W",P);
15 //note:the cosfunction of scilab and calculator will
        differ slightly
16 //================================END OF PROGRAM
    ================================================
```

Scilab code Exa 5.46 IMPEDANCE

```
1  //Chapter −5, Example 5.46, Page 210
2  //
   _____

3  clc
4  clear
5  //INPUT DATA
6  Vl=400;//voltage in volts
7  Il=20;//current in A
8  f=50;//freq in hz
9  pf=0.3//power factor
10 //CALCULATIONS
11 Ip=Il/sqrt(3);//phase current in A
12 Z=Vl/Ip;//impedance in each phase in ohms
13 phi=acos(0.3);//angle in radians
14 Zb=Z*(cos(phi)+(%i)*sin(phi));//impedance connected
      in each phase
15 mprintf("Thus impedance connected in each phase in
      ohms");
16 disp(Zb);
17 //===============================END OF PROGRAM
   _____
```

Scilab code Exa 5.47 POWER

```
1  //Chapter −5, Example 5.47, Page 210
2  //
   _____
```

```
3  clc
4  clear
5  //INPUT DATA
6  P1=6*10^3;//power in Kw
7  P2=-1*10^3;//power in Kw
8  //CALCULATIONS
9  P=P1+P2;//total power in Kw
10 a=atan(sqrt(3)*((P2-P1)/(P2+P1)));
11 pf=cos(a);//power factor
12 mprintf("Thus power and power factor are %d W and %1
      .2f respectively",P,pf);
13 //========================================END OF PROGRAM
      ===============================================
```

Scilab code Exa 5.48 POWER FACTOR

```
1  //Chapter-5, Example 5.48, Page 211
2  //
      =======================================================
3  clc
4  clear
5  //INPUT DATA
6  Z=3-((%i)*4);//impedance in ohms
7  Vl=400;//line voltage in volts
8  //CALCULATIONS
9  Vp=Vl/(sqrt(3));//phase voltage in volts
10 Ip=Vp/abs(Z);//phase current in Amps
11 //line current(Il)=phase current(Ip)
12 Il=Ip;//line current in A
13 power_factor=cos(atan(imag(Z)/real(Z)));
14 power_consumed=sqrt(3)*Vl*Il*power_factor;
15 mprintf("Thus power consumed and power factor are %f
      W and %1.1f respectively",power_consumed,
```

```
     power_factor );
16 //note:answer  computed  for  power  consumed  in
       textbook  is  wrong.Please  check  the  calculations
17 //═══════════════════════════════════END OF PROGRAM
   ═══════════════════════════════════════════════════
```

_____

Scilab code Exa 5.49 LINE TO NEUTRAL VOLTAGE

```
1 //Chapter −5,  Example  5.49 ,  Page  211
2 //
   ═══════════════════════════════════════════════════

3 clc
4 clear
5 //INPUT DATA
6 Il=10;//current  in  Amps
7 Vl=400;//line  voltage  in  volts
8 //CALCULATIONS
9 Vp=Vl/(sqrt(3));//line  to  neutral  voltage
10 Ip=Il;//phase  current  in  Amps
11 mprintf("Thus  line  to  neutral  voltage   and  phase
       current  are  %1.0f V and  %d A respectively",Vp,Ip)
       ;
12 //═══════════════════════════════════END OF PROGRAM
   ═══════════════════════════════════════════════════
```

_____

Scilab code Exa 5.50 POWER

```
1 //Chapter −5,  Example  5.50 ,  Page  211
```

```
 2 //
   ═══════════════════════════════════════════════════════════

 3 clc
 4 clear
 5 //INPUT DATA
 6 P1=2000;//power in watts
 7 P2=1000;//power in watts
 8 Vl=400;//line voltage in volts
 9 //CALCULATIONS
10 P=P1+P2;//power in Watts
11 a=sqrt(3*(P1-P2)/(P1+P2));
12 b=atan(sqrt(a));
13 power_factor=cos(b);
14 kVA=P/power_factor;
15 mprintf("Thus power,power factor and kVA are %d W ,
      %1.3f and %1.2f respectively",P,power_factor,kVA)
      ;
16 //note:computed value for powerfactor and kVA in
      textbook are wrong.Please check the calculations
17 //══════════════════════════════════════END OF PROGRAM
   ═══════════════════════════════════════════════════════════
```

Chapter 12

JUNCTION DIODE AND ITS APPLICATIONS

Scilab code Exa 12.1 PEAK RMS AND AVERAGE CURRENT

```scilab
1 //Chapter-12, Example 12.1, Page 341
2 //
   _____

3 clc
4 clear
5 //INPUT DATA
6 Vm=325;//voltage in volts
7 Rl=1000;//resistive load in ohms
8 rf=100;//forward resistance in ohms
9 //CALCULATIONS
10 //for subdivision (a)
11 Im=Vm/(rf+Rl);//peak value of current in A
12 Idc=Im/(%pi);//average current in A
13 Irms=Im/2;//rms value of current in A
14 mprintf("Thus peak value of current ,average current
       and rms value of current are %g A ,%g A and %g A
       respectively\n",Im,Idc,Irms);
15 //for subdivision (b)
```

```
16  Pdc =(Idc)^2*(Rl);//DC power output
17  mprintf("Thus DC power is %1.3f W\n",Pdc);
18  //for subdivision (c)
19  Pac =(Irms)^2*(rf+Rl);//AC input power
20  mprintf("Thus AC power is %d W\n",Pac);
21  //for subdivision (d)
22  n=(Pdc/Pac);//efficiency of rectification
23  n=n*100;//efficiency in percentage
24  mprintf("Thus efficiency in percentage is %2.2f
        percentage",n);
25  //================================END OF PROGRAM
```

Scilab code Exa 12.2 AC VOLTAGE

```
 1  //Chapter −12, Example 12.2, Page 341
 2  //
        ================================
 3  clc
 4  clear
 5  //INPUT DATA
 6  Vdc =24;//supply voltage in volts
 7  Rl=500;//resistance in ohms
 8  rf =50;//forward resistance in ohms
 9  //CALCULATIONS
10  Idc =(Vdc)/(Rl);//average value of load current in A
11  Im =(%pi)*(Idc);//maximum value of load current in A
12  Vm =(Im)*(rf+Rl);//Maximum voltage required at input
        in volts
13  mprintf("Thus average current ,maximum current and
        maximum voltage required are %g A,%g A and %2.2f
        V respectively",Idc,Im,Vm);
14  //================================END OF PROGRAM
```

Scilab code Exa 12.3 DC VOLTAGE

```
1  //Chapter-12, Example 12.3, Page 342
2  //
3  clc
4  clear
5  //INPUT DATA
6  Vac=230;//AC supply voltage
7  turnsratio=5;//turns ratio
8  Rl=300;//resistance in ohms
9  //CALCULATIONS
10 Vs=(Vac)/(turnsratio);//transformer sceondary
      voltage in V
11 Vm=sqrt(2)*(Vs);//maximum value of secondary voltage
       in V
12 Vdc=Vm/(%pi);//DC output voltage in V
13 PIV=Vm;//PIV of a diode in V
14 Im=(Vm/Rl);//maximum value of load current in A
15 Pm=(Im)^2*(Rl);//Maximum value of power delivered
16 Idc=Vdc/(Rl);//average value of load current in A
17 Pdc=(Idc)^2*(Rl);//average value of power delivered
      to load
18 mprintf("Thus DC output voltage,PIV,Maximum value of
       power delivered ,average value of power delivered
       to load are %2.1f V,%d V,%2.1f W,%1.2f W
      respectively",Vdc,PIV,Pm,Pdc);
19 //================================END OF PROGRAM
```

Scilab code Exa 12.4 DC VOLTAGE

```scilab
1  //Chapter-12, Example 12.4, Page 344
2  //
      ================================================================
3  clc
4  clear
5  //INPUT DATA
6  Vac=230;//AC supply voltage
7  f=60;//frequency in Hz
8  Rl=900;//load resistance in ohms
9  noofturns=5;//no of turns
10 Rl=900;//resistance of load in ohms
11 rs=100;//secondary coil resistance in ohms
12 //CALCULATIONS
13 Vs=(Vac)/(noofturns);//voltage across two ends of
      secondary in V
14 Vrms=(Vs)/2;//voltage from center tapping to one end
15 Vm=Vrms*sqrt(2);//mean voltage in V
16 Vdc=(2*Vm)/(%pi);//voltage across load in V
17 Idc=(Vdc)/(rs+Rl);//DC current flowing through to
      load in A
18 Pdc=(Idc)^2*(Rl);//DC power delivered to the load in
      W
19 PIV=2*Vm;//PIV across each diode in V
20 Vr=sqrt((Vrms)^2-(Vdc)^2);//Ripple voltage in V
21 fr=2*f;//frequency of ripple voltage in Hz
22 mprintf("Thus voltage across load ,DC current flowing
       through to load ,DC power delivered to the load ,
      PIV across each diode ,Ripple voltage are %2.1 f V,
      %g A,%1.3 f W,%d V,%2.2 f V and %d Hz respectively"
      ,Vdc,Idc,Pdc,PIV,Vr,fr);
23 //=================================END OF PROGRAM
```

Scilab code Exa 12.5 RESISTANCE

```
1  //Chapter-12, Example 12.5, Page 344
2  //
                ==================================================
3  clc
4  clear
5  //INPUT DATA
6  Imax=400*10^-3;//maximum value of current in mA
7  Iav=150*10^-3;//average value of current in mA
8  Vs=100;//maximum value of secondary voltage in V
9  //CALCULATIONS
10 //we know that maximum value of current does not
        exceed 80 percentage
11 Imax1=0.8*Imax;//maximum value of current in mA
12 Vm=sqrt(2)*(Vs);//maximum value of secondary voltage
        in V
13 Rl=(Vm)/(Imax1);//value of load resistor in ohms
14 Vdc=(2*Vm)/(%pi);//DC(load) voltage
15 Idc=Vdc/(Rl);//DC load current in A
16 PIV=2*Vm;//PIV of each diode
17 mprintf("Thus value of load resistor ,voltage ,current
        and PIV of each diode are %1.0f ohms,%d V,%1.3f
      A and %3.1f V respectively",Rl,Vdc,Idc,PIV);
18 //=================================END OF PROGRAM
                ==================================================
```

Scilab code Exa 12.6 RIPPLE VOLTAGE

159

```
1  //Chapter −12, Example 12.6, Page 345
2  //
   ============================================================
3  clc
4  clear
5  //INPUT DATA
6  Pdc=50;//power in W
7  Rl=200;//resistance in ohms
8  ripplefactor=0.01
9  //CALCULATIONS
10 Vdc=sqrt(Pdc*Rl);//DC voltage
11 Vac=ripplefactor*Vdc;//AC voltage
12 mprintf("Thus AC ripple voltage across the load is
       %d V",Vac);
13 //===============================END OF PROGRAM
   ============================================================
```

Scilab code Exa 12.7 DC VOLTAGE

```
1  //Chapter −12, Example 12.7, Page 346
2  //
   ============================================================
3  clc
4  clear
5  //INPUT DATA
6  V=230;//AC supply voltage
7  f=50;//frequency in Hz
8  noofturns=4;//noofturns ratio
9  Rl=600;//load resistance in ohms
10 //CALCULATIONS
11 Vrms=(V/4);//rms value of secondary voltage in V
12 Vm=sqrt(2)*(Vrms);//max value of secondary voltage
```

```
13  Vdc =(2*Vm)/(%pi);//DC output voltage
14  Pdc =(Vdc)^2/(Rl);//DC power in W
15  PIV=Vm;//PIV across each diode in V
16  f0 =2*f;//output frequency in Hz
17  mprintf("Thus DC output voltage,DC power,PIV and
        output frequency are %1.0f V,%1.3f W,%2.1f V and
        %d hz respectively",Vdc,Pdc,PIV,f0);
18  //note:in given problem,Rl is 600 ohms,but in
        textbook calculations Rl taken is 1000 ohms,I
        took Rl as 600 ohms
19  //========================================END OF PROGRAM
    ======================================================
```

Scilab code Exa 12.8 INDUCTANCE

```
1  //Chapter −12, Example 12.8, Page 349
2  //
    ======================================================

3  clc
4  clear
5  //INPUT DATA
6  Rl =100;//resistance of load in ohms
7  f =60;//frequency in hz
8  ripplefactor =0.04;
9  //CALCULATIONS
10 L=Rl/(3*sqrt(2)*(2*%pi*f*ripplefactor));//inductance
11 mprintf("inductance is %1.4f H",L);
12 //========================================END OF PROGRAM
    ======================================================
```

Scilab code Exa 12.9 CAPACITANCE

```
1  //Chapter −12, Example 12.9, Page 351
2  //
   ═══════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  Rl=500;// resistance of load in ohms
7  f=400;// frequency in hz
8  ripplefactor=0.1;
9  //CALCULATIONS
10 C=inv(4*sqrt(3)*f*Rl*ripplefactor);// capacitance in
      uF
11 mprintf("thus capacitance is %g F",C);
12 //note:ripple factor is 0.1 not 0.01 as mentioned by
       problem in text book
13 //════════════════════════════════END OF PROGRAM
   ═══════════════════════════════════════════
```

Scilab code Exa 12.10 FILTER DESIGN

```
1  //Chapter −12, Example 12.10, Page 352
2  //
   ═══════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  V=10;// output voltage in V
7  Il=200*10^-3;// load current in A
8  //CALCULATIONS
9  Rl=V/(Il);// effective load resistance in ohms
```

```
10  ripplefactor =0.02;
11  // critical  value  occurs  at  f=50  hz
12  f =50; // freq  in  hz
13  L=Rl /(3*2*%pi*f ); // inductance  in  H
14  // but  taking  L=60mh( about  20  percentage  higher )we
        have
15  L1 =60*10^-3; // inductance  in  henry
16  C=1.194/( ripplefactor *L1 );
17  mprintf (" the  values  of  L  and  C  for  LC  filter  are  %g
        H  and  %g  F  respectively ",L1 ,C)
18  // note :C  value  calculated  is  wrong  in  textbook
19  //═══════════════════════════════════════════END  OF  PROGRAM
        ═══════════════════════════════════════════════════════════
```

_____

Scilab code Exa 12.11 CLC

```
1  // Chapter −12,  Example  12.11 ,  Page  353
2  //
        ═══════════════════════════════════════════════════════════

3  clc
4  clear
5  // INPUT DATA
6  V =10; // output  voltage  in  V
7  Il =200*10^-3; // load  current  in  A
8  ripplefactor =0.02;
9  // CALCULATIONS
10  Rl=V /( Il ); // resistance  in  ohms
11  // if  we  assume  L=10H  and  C1=C2=C
12  L =10; // indcutance  in  henry
13  C=sqrt (5700/(L*50* ripplefactor ));
14  mprintf (" the  values  of  L  and  C  for  CLC  section  are
        %d  H  and  %1.0 f  uF  respectively ",L,C)
15  //═══════════════════════════════════════════END  OF  PROGRAM
```

Scilab code Exa 12.16 VOLTAGE

```
1  //Chapter −12, Example 12.16, Page 363
2  //
   ===============================================
3  clc
4  clear
5  //The frequency of given input signal is 2000 hz.
      Hence, the period of the signal is 0.5ms.During
      the negative half of the signal, the diode is
      forward biased and it acts like a short circuit
      and the capacitor charges to 20 V.THis can be
      found out by applying Kirchoff's law in the input
       side.
6  //15+Vc−5=0;
7  //and
8  //Vc=20 V
9  //The voltage across the resistor will be equal to
      Dc voltage 5V
10 //During the positive half of input signal, the diode
       is reverse biased and it acts like an open
      circuit.Hence, the 5V battery has no effect on V0.
      Applying Kirchhoff's voltage law around the
      outside loop, we get
11 //15+20−Vo=0
12 //Vo=35V
13 mprintf("Vc=20V\n")
14 mprintf("the voltage across resistor will be equal
      to 5V")
15 //===============================END OF PROGRAM
   ===============================================
```

Scilab code Exa 12.17 VOLTAGE

```
1  //Chapter −12, Example  12.17 , Page  364
2  //
       =====================================================
3  clc
4  clear
5  //During the negative half of the input signal ,the
       diode conducts ,and acts like a short circuit.Now,
       the output voltage ,V0=0V.The capacitor is charged
        to 10V with polarities and it behaves like a
       battery.
6  //During the positive half of the input signal ,the
       diode does not conduct ,and acts like an open
       circuit.Hence ,the output voltage ,V0=20V.This
       gives positively clamped voltage.
7  mprintf("V0=10+10=20 V")
8  //=============================END OF PROGRAM
       =====================================================
```

Scilab code Exa 12.18 VOLTAGE

```
1  //Chapter −12, Example  12.18 , Page  365
2  //
       =====================================================
3  clc
4  clear
```

```
5  //During the positive half of the input signal, the
       diode conducts and acts like a short circuit.Now,
       the output voltage,V0=0V.The capacitor is charged
        to 12V with polarities and it behaves like a
       battery.
6  //during the negative half of the input signal, the
       diode does not conduct and acts like an open
       circuit.Hence the output voltage ,V0=−24V.This
       gives negatively clamped voltage.
7  mprintf(”V0=0V\n”)
8  mprintf(”output voltage V0=−24V”)
9  //════════════════════════════════END OF PROGRAM
   ═════════════════════════════════════════════════════
```

Scilab code Exa 12.19 ELECTRON MOBILITY

```
1  //Chapter−12, Example 12.19, Page 367
2  //
   ═════════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  Rh=200;//Hall−coefficient in cubiccentimeter/C
7  a=10;//conductivity in s/m
8  //CALCULATIONS
9  un=a*Rh;//electron mobility in cm^2/V−s
10 mprintf(”electron mobility is %d cm^2/V−s”,un)
11 //note:answer given is wrong in textbook
12 //════════════════════════════════END OF PROGRAM
   ═════════════════════════════════════════════════════
```

Scilab code Exa 12.20 ELECTRON CONCENTRATION

```
1  //Chapter -12, Example 12.20, Page 367
2  //
      ================================================================
3  clc
4  clear
5  //INPUT DATA
6  a=10;//conductivity in s/m
7  un=50*10^-4;//electron mobility in m^2/V-s
8  q=1.6*10^-19;//charge in coulombs
9  //CALCULATIONS
10 n=(a/(un*q));//electron concentration in m^-3
11 mprintf("electron concentration is %g m^-3 ",n)
12 //==================================END OF PROGRAM
      ================================================================
```

Scilab code Exa 12.21 ELECTRON DENSITY

```
1  //Chapter -12, Example 12.21, Page 368
2  //
      ================================================================
3  clc
4  clear
5  //INPUT DATA
6  I=20;//current in A
7  B=1.2//magnetic flux density in Wb/m^2
8  Vh=60;//hall voltage in V
9  w=0.5;//thickness of strip in mm
```

```
10  q=1.6*10^-19;//charge in coulombs
11  //CALCULATIONS
12  n=(B*I)/(Vh*q*w*10^-3);//electron concentration in m
        ^-3
13  mprintf("electron density is %g m^3 ",n)
14  //===================================END OF PROGRAM
        =========================================
```

Chapter 13

TRANSISTOR AND OTHER DEVICES

Scilab code Exa 13.1 BASE CURRENT

```
1  //Chapter-13, Example 13.1, Page 388
2  //
   ================================================================
3  clc
4  clear
5  //INPUT DATA
6  Ie=10;//emitter current in mA
7  Ic=9.8;//collector current in mA
8  //CALCULATIONS
9  Ib=Ie-Ic;//base current in mA
10 mprintf("base current is %1.1f mA ",Ib)
11 //==============================END OF PROGRAM
   ================================================================
```

Scilab code Exa 13.2 CURRENT GAIN

```scilab
1  //Chapter-13, Example 13.2, Page 389
2  //=====================================================
3  clc
4  clear
5  //INPUT DATA
6  Ie=6.28;//emitter current in mA
7  Ic=6.20;//collector current in mA
8  //CALCULATIONS
9  a=(Ic/Ie);//current gain
10 mprintf("current gain is %1.3f",a)
11 //==================================END OF PROGRAM
   ======================================================
```

Scilab code Exa 13.3 BASE CURRENT

```scilab
1  //Chapter-13, Example 13.3, Page 389
2  //=====================================================
3  clc
4  clear
5  //INPUT DATA
6  a=0.967//common-base DC current gain
7  Ie=10;//emitter current in mA
8  //CALCULATIONS
9  Ic=Ie*a;//collector current in mA
10 Ib=Ie-Ic;//base current in mA
11 mprintf("base current is %1.2f mA",Ib)
12 //==================================END OF PROGRAM
   ======================================================
```

Scilab code Exa 13.4 COLLECTOR CURRENT

```
1  //Chapter -13, Example 13.4, Page 389
2  //
   //=================================================
3  clc
4  clear
5  //INPUT DATA
6  a=0.98//common-base DC current gain
7  Ie=10;//emitter current in mA
8  //CALCULATIONS
9  Ic=Ie*a;//collector current in mA
10 Ib=Ie-Ic;//base current in mA
11 mprintf("base current is %1.1f mA",Ib)
12 //================================END OF PROGRAM
   //=================================================
```

Scilab code Exa 13.5 CURRENT GAIN

```
1  //Chapter -13, Example 13.5, Page 389
2  //
   //=================================================
3  clc
4  clear
5  //INPUT DATA
6  a=0.97//common-base DC current gain
7  b=200;//common-emitter DC current gain
8  //CALCULATIONS
```

```
9  b1=a/(1-a);//common−emitter DC current gain when a
      =0.97
10 a1=b/(b+1);//common−base DC current gain when b=200
11 mprintf("Thus common−emitter DC current gain when a
      =0.97 and common−base DC current gain when b=200
      are %2.2f and %1.3f respectively ",b1,a1)
12 //═══════════════════════════════════════END OF PROGRAM
   ════════════════════════════════════════════════════════
```

Scilab code Exa 13.6 EMITTER CURRENT

```
1  //Chapter −13, Example 13.6 , Page 389
2  //
   ════════════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  Ic=40;//collector current in mA
7  b=100;//common−emitter DC current gain
8  //CALCULATIONS
9  Ib=Ic/b;//base current in mA
10 Ie=Ib+Ic;//emitter current in mA
11 mprintf("Thus emitter current is %2.1f mA",Ie);
12 //═══════════════════════════════════════END OF PROGRAM
   ════════════════════════════════════════════════════════
```

Scilab code Exa 13.7 COLLECTOR CURRENT

```
1  //Chapter −13, Example 13.7 , Page 390
```

```
2  //
   ════════════════════════════════════════════════════════════
```

```
 3  clc
 4  clear
 5  //INPUT DATA
 6  Ie =10; // emitter current in mA
 7  b =150; // common−emitter DC current gain
 8  //CALCULATIONS
 9  a=b/(b+1) ; // common−base DC current gain
10  Ic=a*Ie ; // collector current in mA
11  Ib=Ie-Ic ; // base current in mA
12  mprintf ("Thus collector and base currents are %1.2 f
        mA and %1.2 f mA respectively",Ic,Ib);
13  //════════════════════════════════════════END OF PROGRAM
    ════════════════════════════════════════════════════════════
```

───

Scilab code Exa 13.8 BASE CURRENT

```
 1  //Chapter −13, Example 13.8 , Page 390
 2  //
    ════════════════════════════════════════════════════════════
```

```
 3  clc
 4  clear
 5  //INPUT DATA
 6  Ic =80; // collector current in mA
 7  b =170; // common−emitter DC current gain
 8  //CALCULATIONS
 9  Ib=Ic/b; // base current in mA
10  Ie=Ib+Ic ; // emitter current in mA
11  mprintf ("Thus emitter and base currents are %2.2 f mA
          and %1.2 f mA respectively",Ie,Ib);
12  //════════════════════════════════════════END OF PROGRAM
```

Scilab code Exa 13.9 COLLECTOR CURRENT

```
1  //Chapter−13, Example 13.9, Page 390
2  //========================================
3  clc
4  clear
5  //INPUT DATA
6  Ib=0.125;//base current in mA
7  b=200;//common−emitter DC current gain
8  //CALCULATIONS
9  Ic=b*Ib;//collector current in mA
10 Ie=Ib+Ic;//emitter current in mA
11 mprintf("Thus emitter and collector currents are %2
      .3f mA and %d mA respectively",Ie,Ic);
12 //=======================================END OF PROGRAM
   ========================================
```

Scilab code Exa 13.10 COLLECTOR CURRENT

```
1  //Chapter−13, Example 13.10, Page 391
2  //========================================
3  clc
4  clear
5  //INPUT DATA
6  Ie=12;//emitter current in mA
```

```
7  b=100;//common−emitter DC current gain
8  //CALCULATIONS
9  Ib=Ie/(1+b);//base current in mA
10 Ic=Ie-Ib;//collector current in mA
11 mprintf("Thus base and collector currents are %1.4f
     mA and %2.4f mA respectively",Ib,Ic);
12 //==================================END OF PROGRAM
   ================================================
```

Scilab code Exa 13.11 COMMON EMITTER CURRENT GAIN

```
1  //Chapter−13, Example 13.11, Page 391
2  //
   ================================================

3  clc
4  clear
5  //INPUT DATA
6  Ib=100*10^-6;//base current in A
7  Ic=2*10^-3;//collector current in A
8  Ib1=125*10^-6;//base current in A when change in Ib
     is 25 A
9  Ic1=2.6*10^-3;//collector current in A when change
     in Ic is 0.6 A
10 //CALCULATIONS
11 b=Ic/Ib;//common−emitter DC current gain
12 a=(b)/(b+1);//common−base DC current gain
13 Ie=Ib+Ic;//emitter current in A
14 b1=Ic1/Ib1;//new common−emitter DC current gain
15 mprintf("Thus b  a and Ie of transistor are %d ,%1.3
     f and %g A respectively\n",b,a,Ie);
16 mprintf("new value of b is %2.1f",b1)
17 //==================================END OF PROGRAM
   ================================================
```

Scilab code Exa 13.12 COLLECTOR CURRENT

```
1  //Chapter −13, Example 13.12, Page 391
2  //
       ════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  a=0.98//common−base DC current gain
7  Icbo=5*10^-6;//current in A
8  Ib=100*10^-6;//base current in A
9  //CALCULATIONS
10 Ic=((a*Ib)/(1-a))+(Icbo/(1-a));//collector current
       in mA
11 Ie=Ib+Ic;//emitter current in mA
12 mprintf("Thus collector and emitter currents are %g
        A and %g A respectively",Ic,Ie);
13 //══════════════════════════════════════END OF PROGRAM
       ════════════════════════════════════════════════
```

Scilab code Exa 13.13 COLLECTOR CURRENT

```
1  //Chapter −13, Example 13.13, Page 391
2  //
       ════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
```

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```
 6  Icbo =10*10^-6;//current in A
 7  hfe =50;//common−emitter DC current gain
 8  Ib =0.25*10^-3;//base current in A
 9  T2 =50;//temperature in degree centigrade
10  T1 =27;//temperature in degree centigrade
11  //CALCULATIONS
12  Ic1 =(hfe*Ib)+((1+hfe)*(Icbo));//collector current in
        A when base current is Ib=0.25*10^−3
13  I1cbo=Icbo*(2*(T2-T1)/10);//new value of Icbo when
        temperature changes from 27 degree centigrade to
        50 degree centigrade
14  Ic2 =(hfe*Ib)+((1+hfe)*(I1cbo));//collector current
        in A
15  mprintf("Thus collector currents in case 1 and 2 are
        %g A ,%g A respectively",Ic1,Ic2);
16  //================================END OF PROGRAM
    ================================
```

Scilab code Exa 13.14 CURRENT GAIN

```
 1  //Chapter −13, Example 13.14 , Page 391
 2  //
    ================================
 3  clc
 4  clear
 5  //INPUT DATA
 6  deltaIe =1*10^-3;//change in emitter current in A
 7  deltaIc =0.99*10^-3;//change in collector current in
      A
 8  //CALCULATIONS
 9  a=(deltaIc/deltaIe);//current gain of the transistor
10  mprintf("Thus current gain of the transistor is %1.2
      f",a);
```

```
11  //═══════════════════════════════════END OF PROGRAM
    ════════════════════════════════════════════════════
```

Scilab code Exa 13.15 CURRENT GAIN

```
1  //Chapter −13, Example 13.15, Page 391
2  //
      ══════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  b=100;//common−emitter DC current gain
7  //CALCULATIONS
8  a=(b/(1+b));//common−base DC current gain
9  mprintf("Thus common−base DC current gain is %1.2f",
      a);
10 //═══════════════════════════════════END OF PROGRAM
    ════════════════════════════════════════════════════
```

Scilab code Exa 13.16 CURRENT GAIN

```
1  //Chapter −13, Example 13.16, Page 391
2  //
      ══════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  deltaIe=1*10^-3;//change in emitter current in A
```

```
7  deltaIc=0.995*10^-3;//change in collector current in
       A
8  //CALCULATIONS
9  a=deltaIc/deltaIe;//common−base DC current gain
10 b=a/(1-a);//common−emitter DC current gain
11 mprintf("Thus common−base DC current gain and common
       −emitter DC current gain are %1.3f and %1.0f
       respectively",a,b);
12 //══════════════════════════════════════END OF PROGRAM
   ════════════════════════════════════════════════════
```

Scilab code Exa 13.17 BASE CURRENT

```
1  //Chapter −13, Example 13.17, Page 391
2  //
   ════════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  b=49;//common−emitter DC current gain
7  Ie=3*10^-3;//emitter current in A
8  //CALCULATIONS
9  a=b/(1+b);//common−base DC current gain
10 Ic=a*Ie;//collector current in A
11 mprintf("Thus common−base DC current gain and
       ccollector current are %1.2f and %g A
       respectively",a,Ic);
12 //══════════════════════════════════════END OF PROGRAM
   ════════════════════════════════════════════════════
```

Scilab code Exa 13.18 COLLECTOR CURRENT

```
1  //Chapter -13, Example 13.18, Page 393
2  //=================================================
3  clc
4  clear
5  //INPUT DATA
6  Ib=15*10^-3;//base current in A
7  b=150;//common-emitter DC current gain
8  //CALCULATIONS
9  Ic=b*Ib;//collector current in A
10 Ie=Ic+Ib;//emitter current in A
11 a=b/(1+b);//common-base DC current gain
12 mprintf("Thus collector current ,emitter current and
      common-base DC current gain are %g A, %g A  and
      %1.4f  respectively",Ic,Ie,a);
13 //================================END OF PROGRAM
   =================================================
```

Scilab code Exa 13.19 BASE CURRENT

```
1  //Chapter -13, Example 13.19, Page 393
2  //=================================================
3  clc
4  clear
5  //INPUT DATA
6  Vcc=10;//collector to collector voltage in volts
7  Vbb=4;//base to base voltage in volts
8  Rb=200*10^3;//base resistance in ohms
9  Rc=2*10^3;//collector resistance in ohms
```

```
10  Vbe=0.7;//base to emitter voltage in volts
11  b=200;//common-emitter DC current gain
12  //CALCULATIONS
13  Ib=(Vbb-Vbe)/(Rb);//base current in A
14  Ic=b*Ib;//collector current in A
15  Ie=Ic+Ib;//emitter current in A
16  Vce=Vcc-(Ic*Rc);//collector to emitter voltage in
        volts
17  mprintf("Thus collector current,emitter current and
        base currents are %g A,%g A and %g A respectively
        \n",Ib,Ic,Ie);
18  mprintf("collector to emitter voltage is %1.1f V",
        Vce)
19  //===================================END OF PROGRAM
    ===================================================
```

_____

Scilab code Exa 13.20 COLLECTOR CURRENT

```
1  //Chapter-13, Example 13.20, Page 394
2  //
    ===================================================

3  clc
4  clear
5  //INPUT DATA
6  a=0.99;//common-base DC current gain
7  Icbo=5*10^-6;//current in A
8  Ib=20*10^-6;//current in A
9  //CALCULATIONS
10  Ic=((a*Ib)/(1-a))+(Icbo/(1-a));//collector current
        in A
11  Ie=Ib+Ic;//emitter current in A
12  mprintf("collector and  emitter currents are %g A
        and %g A respectively",Ic,Ie)
```

```
13  //════════════════════════════════════════END OF PROGRAM
     ════════════════════════════════════════════════════════
```

_____

Scilab code Exa 13.21 CURRENT GAIN

```
1  //Chapter −13, Example  13.21 , Page  394
2  //
         ════════════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  Icbo=0.2*10^-6;//current  in  A
7  Iceo=18*10^-6;//current  in  A
8  Ib=30*10^-6;//current  in  A
9  //CALCULATIONS
10  a=1-(Icbo/Iceo);//common−base DC current  gain
11  b=(Iceo/Icbo)-1;//common−emitter DC current  gain
12  Ic=(b*Ib)+((1+b)*(Icbo));//collector  current  in  A
13  mprintf(”Thus common−base DC current  gain  and  common
      −emitter DC current  gain  are  %1.3 f  and  %d
      respectively”,a,b)
14  //════════════════════════════════════════END OF PROGRAM
     ════════════════════════════════════════════════════════
```

_____

Scilab code Exa 13.22 EMITTER CURRENT

```
1  //Chapter −13, Example  13.22 , Page  394
2  //
         ════════════════════════════════════════════════════════
```

```
 3  clc
 4  clear
 5  //INPUT DATA
 6  a=0.99;//common−base DC current gain
 7  Icbo=50*10^-6;//current in A
 8  Ib=1*10^-3;//current in A
 9  //CALCULATIONS
10  Ic=((a*Ib)/(1-a))+(Icbo/(1-a));//collector current
       in A
11  Ie=Ic+Ib;//emitter current in A
12  mprintf("Thus emitter current is %g A",Ie)
13  //==============================END OF PROGRAM
    ===========================================
```

Chapter 14

INTEGRATED CIRCUITS

Scilab code Exa 14.1 COMMONMODE GAIN

```
1 //Chapter−14, Example 14.1, Page 456
2 //
   ================================================================
3 clc
4 clear
5 //INPUT DATA
6 CMRR=10^5;//common−mode rejection ratio
7 Ad=10^5;//differential gain
8 //CALCULATIONS
9 Acm=Ad/(CMRR);//common mode gain
10 mprintf("common−mode gain is %d",Acm);
11 //================================END OF PROGRAM
   ================================================================
```

Scilab code Exa 14.2 SLEWRATE

```
1  //Chapter −14, Example 14.2 , Page 458
2  //
   ═══════════════════════════════════════════════════════════════════
3  clc
4  clear
5  //INPUT DATA
6  V0 =20;// voltage in volts
7  t =4;// time in microsec
8  //SLEW RATE
9  SR =( V0 )/t;// slewrate in V/us
10 mprintf ("slewrate is %d V/us",SR);
11 //══════════════════════════════════END OF PROGRAM
   ═══════════════════════════════════════════════════════════════════
```

_____

Scilab code Exa 14.3 FREQUENCY

```
1  //Chapter −14, Example 14.3 , Page 458
2  //
   ═══════════════════════════════════════════════════════════════════
3  clc
4  clear
5  //INPUT DATA
6  A =50;// gain of inverting amplifier
7  Vid =20*10^ -3;// voltage in V
8  SR =0.5;// slewrate in V/us———>SR=(2*%pi*f*Vm)
        /(10^6)
9  //CALCULATIONS
10 Vm =A *( Vid );// maximum output voltage in V
11 fmax =( SR *10^6)/(2*%pi*Vm);// frequency in hz
12 mprintf ("thus maximum frequency of the input for
        which undistorted output is obtained is %g hz",
        fmax);
```

```
13  //═══════════════════════════════════END  OF  PROGRAM
    ═══════════════════════════════════════════════════
```

Scilab code Exa 14.4 PEAK TO PEAK VOLTAGE

```
1  //Chapter −14,  Example  14.4 ,  Page  458
2  //
       ═══════════════════════════════════════════════════
3  clc
4  clear
5  //INPUT DATA
6  A=10;//gain  of  inverting  amplifier
7  f=40*10^3;//frequency  in  hz
8  SR=0.5;//slewrate  in  V/us−−−−−>SR=(2*%pi*f*Vm)
       /(10^6)
9  //CALCULATIONS
10  Vm=(SR*10^6)/(2*%pi*f);//maximum  output  voltage  in  V
        peak
11  Vm=2*Vm;//maximum  output  voltage  in  V peak  to  peak
12  Vid=Vm/A;//maximum  peak−to−peak  input  voltage  for
       undistorted  output
13  mprintf("Thus maximum  peak−to−peak  input  voltage  for
        undistorted  output  is  %1.3f  V peak−to−peak",Vid)
       ;
14  //═══════════════════════════════════END  OF  PROGRAM
     ═══════════════════════════════════════════════════
```

Scilab code Exa 14.5 VOLTAGE GAIN

```
1  //Chapter −14,  Example  14.5 ,  Page  465
```

```
2  //
```
═══

```
 3  clc
 4  clear
 5  //INPUT DATA
 6  Rf=10*10^3;//feedback resistance in ohms
 7  R1=1*10^3;//resistance in ohms
 8  //CALCULATIONS
 9  Af=-(Rf/R1);//closed-loop voltage gain for inverting
        amplifier
10  mprintf("Thus closed-loop voltage gain is %d",Af);
11  //════════════════════════════════════════END OF PROGRAM
```
═══

_____

Scilab code Exa 14.6 VOLTAGE GAIN

```
 1  //Chapter-14, Example 14.6, Page 466
 2  //
```
═══

```
 3  clc
 4  clear
 5  //INPUT DATA
 6  Rf=10*10^3;//forward resistance in ohms
 7  R1=1*10^3;//resistance in ohms
 8  //CALCULATIONS
 9  Af=1+(Rf/R1);//closed-loop voltage gain in non-
        inverting amplifier
10  b=(R1/(R1+Rf));//feedback factor
11  mprintf("Thus closed-loop voltage gain and feedback
        factor are %d and %1.3f respectively",Af,b);
12  //════════════════════════════════════════END OF PROGRAM
```
═══

Scilab code Exa 14.7 OUTPUT VOLTAGE

```scilab
1  //Chapter-14, Example 14.7, Page 473
2  //
3  clc
4  clear
5  //INPUT DATA
6  V1=2;//input voltage 1 of summing amplifier in V
7  V2=3;//input voltage 2 of summing amplifier in V
8  V3=4;//input voltage 3 of summing amplifier in V
9  R1=1;//resistance 1 of summing amplifier in kilo
        ohms
10 R2=1;//resistance 2 of summing amplifier in kilo
        ohms
11 R3=1;//resistance 3 of summing amplifier in kilo
        ohms
12 Rf=1;//feedback resistance in kilo ohms
13 R=1;//resistance in kilo ohms
14 //CALCULATIONS
15 V0=(-Rf/R)*(V1+V2+V3);//output voltage in volts
16 mprintf("Thus output voltage is %d V",V0);
17 //============================END OF PROGRAM
```

Chapter 15

DIGITAL ELECTRONICS

Scilab code Exa 15.1 DEC TO OCT

```
1  //Chapter −15, Example  15.1 , Page  492
2  //
     ═══════════════════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  x=12;//in  decimal  form
7  //CALCULATIONS
8  y=dec2oct(x);//converting  to  octal  form
9  mprintf("Thus  octal  number  is");
10 disp(y);
11 //════════════════════════════════════END  OF  PROGRAM
     ═══════════════════════════════════════════════════════════
```

Scilab code Exa 15.2 OCT TO DEC

```
1  //Chapter −15, Example 15.2, Page 492
2  //
      ════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  x1=444;//in  octal  form
7  x2=237;//in  octal  form
8  x3=120;//in  octal  form
9  //CALCULATIONS
10 x1=base2dec(['444','237','120'],8)//converting  octal
      to  decimal
11 disp(x1);
12 //════════════════════════════════END  OF  PROGRAM
      ════════════════════════════════════════════
```

───

Scilab code Exa 15.3 DEC TO HEX

```
1  //Chapter −15, Example 15.3, Page 493
2  //
      ════════════════════════════════════════════

3  clc
4  clear
5  //INPUT DATA
6  x1=112;//in  decimal  form
7  x2=253;//in  decimal  form
8  //CALCULATIONS
9  y1=dec2base(x1,16)//converting  decimal  to
      hexadecimal
10 y2=dec2base(x2,16)//converting  decimal  to
      hexadecimal
11 disp(y1);
```

```
12  disp(y2);
13  //══════════════════════════════════════════END OF PROGRAM
    ══════════════════════════════════════════════
```

_____

Scilab code Exa 15.4 HEX TO DEC

```
1  //Chapter −15, Example 15.4, Page 494
2  //
    ══════════════════════════════════════════════

3  clc
4  clear
5  //CALCULATIONS
6  x1=base2dec(['4AB','23F'],16)//converting
       hexadecimal to decimal
7  disp(x1);
8  //══════════════════════════════════════════END OF PROGRAM
    ══════════════════════════════════════════════
```

_____

Scilab code Exa 15.5 MULTIPLICATION OF BINARY NUMBERS

```
1  //Chapter −15, Example 15.5, Page 496
2  //
    ══════════════════════════════════════════════

3  clc
4  clear
5  //CALCULATIONS
6  x1=base2dec(['1101','1100'],2)//converting binary to
       decimal
```

```
7  x2=base2dec(['1000','101'],2)//converting binary to
       decimal
8  x3=base2dec(['1111','1001'],2)//converting binary to
        decimal
9  y1=(x1(1))*(x1(2));//multiplying
10 y2=(x2(1))*(x2(2));//multiplying
11 y3=(x3(1))*(x3(2));//multiplying
12 z1=dec2base(y1,2)//converting decimal to hexadecimal
13 z2=dec2base(y2,2)//converting decimal to hexadecimal
14 z3=dec2base(y3,2)//converting decimal to hexadecimal
15 disp(z1)
16 disp(z2)
17 disp(z3)
18 //==================================END OF PROGRAM
   ===============================================
```

Scilab code Exa 15.6 DIVISION OF BINARY

```
1  //Chapter −15, Example 15.6, Page 497
2  //
    ===============================================

3  clc
4  clear
5  //CALCULATIONS
6  x1=base2dec(['110','10'],2)//converting binary to
      decimal
7  x2=base2dec(['1111','110'],2)//converting binary to
      decimal
8  y1=(x1(1))/(x1(2));//dividing
9  y2=(x2(1))/(x2(2));//dividing
10 z1=dec2base(y1,2);//converting decimal to binary
11 [f,e]=frexp(y2);//separating exponent and mantissa
12 disp(f)//mantissa
```

```
13  disp(e)//exponent
14  f=f*2;
15  g=floor(f);//rounding to nearest integer
16  disp(g);
17  z2=dec2base(e,2);//converting decimal to binary
          ————————>before point part of resultant binary
       number
18  disp(z2)
19  g1=dec2base(g,2);//converting decimal to binary
          ————————>after point part of  resultant binary
       number
20  disp(g1)
21  //NOTE:here floating point decimal cannot be
       directly converted to binary for second case.
       Hence computed to binary
22  //══════════════════════════════════════END OF PROGRAM
    ════════════════════════════════════════════════════
```

Scilab code Exa 15.7 SUBTRACTION OF BINARY NUMBERS

```
1  //Chapter −15, Example 15.7, Page 497
2  //
     ════════════════════════════════════════════════════

3  clc
4  clear
5  //CALCULATIONS
6  //using 1's complement method
7  x1=base2dec(['1111'],2)//converting binary to
       decimal
8  x=bin2dec('1010')
9  x2=dec2bin(bitcmp(x,4))//1's complement of a number
10  disp(x2)
11  x3=base2dec([x2],2)
```

```
12  x4=x1+x3;
13  x5=dec2base(x4,2)//converting decimal to hexadecimal
14  disp(x5)
15  y=15;
16  z=bitand(x4,y);//eliminating carry
17  z1=bitset(z,1);//setting 1st bit t0 1
18  z2=dec2base(z1,2)//converting decimal to binary
19  disp(z2)
20  //using normal method
21  a=base2dec(['1111','1010'],2);//converting binary to
        decimal
22  b=a(1)-a(2);//subtraction
23  c=dec2base(b,2)//converting decimal to binary
24  disp(c)
25  //════════════════════════════════END OF PROGRAM
    ═══════════════════════════════════════════════
```

Scilab code Exa 15.8 SUBTRACTION OF BINARY NUMBERS

```
1  //Chapter −15, Example 15.8, Page 498
2  //
    ═══════════════════════════════════════════════

3  clc
4  clear
5  //CALCULATIONS
6  //using 1's complement method
7  x1=base2dec(['1000'],2)//converting binary to
      decimal
8  x=bin2dec('1010')
9  x2=dec2bin(bitcmp(x,4))//1's complement of a number
10  disp(x2)
11  x3=base2dec([x2],2)
12  x4=x1+x3;
```

```
13  x5=dec2base(x4,2)//converting decimal to hexadecimal
14  disp(x5)
15  y=15;
16  z=bitand(x4,y);//eliminating carry
17  z2=dec2base(z,2)//converting decimal to binary
18  disp(z2)
19  //using normal method
20  a=base2dec(['1000','1010'],2);//converting binary to
        decimal
21  b=a(2)-a(1);//subtraction
22  c=dec2base(b,2)//converting decimal to binary
23  disp(c);//since we cannot use dec2base for negative
      integers,we cannot do (a(1)-a(2)) but we can do (
      a(2)-a(1)),with '-' sign added before the result.
      hence 'c' here is actually -'c'
24  //=================================END OF PROGRAM
```

Scilab code Exa 15.9 SUBTRACTION OF BINARY NUMBERS

```
1  //Chapter -15, Example 15.9, Page 497
2  //
      ================================================

3  clc
4  clear
5  //CALCULATIONS
6  //using 1's complement method
7  x1=base2dec(['1111'],2)//converting binary to
      decimal
8  x=bin2dec('1010')
9  x2=dec2bin(bitcmp(x,4))//1's complement of a number
10  disp(x2)
11  x3=base2dec([x2],2)
```

```
12  x4=x1+x3+1;
13  x5=dec2base(x4,2)//converting decimal to hexadecimal
14  disp(x5)
15  y=15;
16  z=bitand(x4,y);//eliminating carry
17  z2=dec2base(z,2)//converting decimal to binary
18  disp(z2)
19  //using normal method
20  a=base2dec(['1111','1010'],2);//converting binary to
        decimal
21  b=a(1)-a(2);//subtraction
22  c=dec2base(b,2)//converting decimal to binary
23  disp(c)
24  //===================================END OF PROGRAM
    ==============================================
```

Scilab code Exa 15.10 SUBTRACTION OF BINARY NUMBERS

```
1  //Chapter −15, Example 15.10, Page 497
2  //
    ==============================================

3  clc
4  clear
5  //CALCULATIONS
6  //using 1's complement method
7  x1=base2dec(['1000'],2)//converting binary to
      decimal
8  x=bin2dec('1010')
9  x2=dec2bin(bitcmp(x,4))//1's complement of a number
10  disp(x2)
11  x3=base2dec([x2],2)
12  x4=x1+x3+1;
13  x5=dec2base(x4,2)//converting decimal to hexadecimal
```

```
14  disp(x5)
15  //using normal method
16  a=base2dec(['1000','1010'],2);//converting binary to
        decimal
17  b=a(2)-a(1);//subtraction
18  c=dec2base(b,2)//converting decimal to binary
19  disp(c)
20  //since we cannot use dec2base for negative integers
        ,we cannot do (a(1)-a(2)) but we can do (a(2)-a
        (1)),with '-' sign added before the result.hence
        'c' here is actually -'c'
21  //===============================END OF PROGRAM
    ==============================================
```

Scilab code Exa 15.11 ADD BCD NUMBERS

```
1  //Chapter-15, Example 15.11, Page 500
2  //
    ==============================================

3  clc
4  clear
5  //CALCULATIONS
6  x1=base2dec(['1001'],2)//converting binary to
        decimal
7  x2=base2dec(['0100'],2)//converting binary to
        decimal
8  x3=x1+x2;
9  if(x3>9)
10     x3=x3+6;
11     z1=dec2base(x3,2)//converting decimal to binary
12  else
13     z1=dec2base(x3,2)//converting decimal to binary
14  end
```

```
15  disp(z1)
16  //note:last 4 bits represent 3 and 5th bit prefixed
        with 3 bits will look as 1.hence the combined
        result will be 13
17  //═══════════════════════════════════════END OF PROGRAM
    ═══════════════════════════════════════════════════
```

Scilab code Exa 15.12 LAWS OF BOOLEAN ALGEBRA

```
1  //Chapter−15, Example 15.12 , Page 502
2  //
    ═══════════════════════════════════════════════════
3  clc
4  clear
5  //CALCULATIONS
6  disp('given=> Y=(A+AB)')
7  //given in the question//
8  disp('Y=A(1+B)')//by distributive law
9  disp('A.1')//by law 2
10 disp('A')//by law 4
11 disp('given=> Y=(A+A''B)')
12 disp('(A+A'').(A+B)')//by distributive law
13 disp('1.(A+B)')//by law 6
14 disp('A+B')//by law 4
15 disp('given=>(AB+A''C+BC)')
16 disp('AB+A''C+BC(A+A'')')
17 disp('AB+A''C+ABC+A''BC')
18 disp('AB(1+C)+A''C(1+B)')//by consensus theorem
19 disp('AB+A''C')
20 //═══════════════════════════════════════END OF PROGRAM
    ═══════════════════════════════════════════════════
```

Scilab code Exa 15.13 SIMPLIFICATION

```
1  //Chapter-15, Example 15.13, Page 503
2  //
   ===================================================
3  clc
4  clear
5  //CALCULATIONS
6  //for (a)
7  disp('given=> Y=(A+AB+AB''C)')
8  disp('Y=A+AB''C')//by (A+AB=A)-------->step 1
9  disp('A(A+B''C)')//by distributive law------------>step
      2
10 disp('A(1.(1+B''C))')//by talking A as common
      ----------->step 3
11 disp('A.1=A')//by 1+B''C=1----------->step 4
12 //for (b)
13 disp('given=> Y=(A''+B)C+ABC')
14 disp('A''C+BC+ABC')//by distributive law---------->
      step 1
15 disp('A''C+BC(1+A)')//by taking BC as common
      ----------->step 2
16 disp('A''C+BC')//by rule 2 ----------->step 3
17 disp('C(A''+B)')//taking C as common term---------->
      step 4
18 //for (c)
19 disp('given=> Y=(AB''BCD+AB''CDE+AC'')')
20 disp('AB''CDE+AC''')//applying rules 8 and 7 to
      first and second terms,respectively ------->step
       1
21 disp('A(B''CDE+C'')')//taking A as common term
      ----------->step 2
22 disp('A(B''DE+C'')')//by applying B''CDE+C'=B'DE+C
```

199

```
    '−−−−−−−−−>s t e p  3
23  //═══════════════════════════════════END  OF  PROGRAM
    ═══════════════════════════════════════════════
```

Scilab code Exa 15.17 LOGIC CIRCUIT SIMPLIFICATION

```
1  //Chapter −15, Example  15.17 ,  Page  513
2  //
   ═══════════════════════════════════════════════

3  clc
4  clear
5  //CALCULATIONS
6  disp ( ' ( ( ( (A+C ' ' ) ) ' ' (BD ' ' ) ) ' ' . ( (A+C ' ' ) . (BD ' ' ) ) ' ' ) ' ' ' )
      //−−−−−−>s t e p  1
7  disp ( ' ( (A+C ' ' ) +((BD ' ' ) ' ' ) . ( (A+C) ' ' +(BD ' ' ) ' ' ) ) ' ' ' ) //
      −−−−−−>s t e p  2
8  disp ( ' ( (A+C ' ' ) +(BD ' ' ) ' ' ) . ( (A+C ' ' ) ' ' +(BD ' ' ) ' ' ) ' ' ' ) //
      −−−−−−>s t e p  3
9  disp ( ' ( (BD ' ' ) ' ' +((A+C ' ' ) ( (A+C ' ' ) ) ' ' ) ' ' ' ) //−−−−−−>
      s t e p  4
10 disp ( ' (BD ' ' ) ' ' ) ' ' ' ) //−−−−−−>s t e p  5
11 disp ( 'BD ' ' ' ) //−−−−−−>s t e p  6
12 //═══════════════════════════════════END  OF  PROGRAM
   ═══════════════════════════════════════════════
```

Scilab code Exa 15.19 SIMPLIFICATION OF K MAP

```
1  //Chapter −15, Example  15.19 ,  Page  519
```

```
2  //
```
═══

```
3  clc
4  clear
5  //CALCULATIONS
6  //The adjacent cells that can be combined together
       are the cells 000 and 100 and the cell 011 and
       111
7  //By combining the adjacent cells ,we get
8  disp('((A''+A)B''C'')+(A''+A)BC) ')//------->step 1
9  disp('(B''C'')+(BC) ')//------->step 2
10 //══════════════════════════════════════════END OF PROGRAM
```
═══

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Scilab code Exa 15.20 SIMPLIFICATION OF K MAP

```
1  //Chapter −15, Example 15.20 , Page 519
2  //
```
═══

```
3  clc
4  clear
5  //CALCULATIONS
6  disp('(B''C''D'')+(BC''D) ')
7  //══════════════════════════════════════END OF PROGRAM
```
═══

───