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

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Book Description

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

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

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

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

Contents

List of Scilab Codes

Chapter 1

FUNDAMENTALS OF ELECTRICITY AND DC CIRCUITS

Scilab code Exa 1.1 RESISTANCE

```
//Chapter-1, Example 1.1, Page 18
//=============================================================================
clc;
clear;
//INPUT DATA
// details for the first wire
l1=1;//length in m
R1=2;//resistance in ohms
x=R1;//say
d=1;//say
p=1;//say
d1=d;//say diameter in m
p1=p;//say specific resistance of  wire
//details for the second wire
l2=3;//length in m
```

```
d=1;//say
p=1;//say
d2=2*d;//say diameter in m
p2=2*p;//say specific resistance of  wire
//CALCULATIONS
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
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
//dividing equation 1 by equation 2
z=R1/R2;
R2=x/z;
//OUTPUT
mprintf("Thus the resistance of second wire is %1.0f ohm \n",R2);

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

Scilab code Exa 1.2 RESISTANCE

```
//Chapter-1, Example 1.2, Page 18
//=============================================================================
clc;
clear;
//INPUT DATA
l1=20;//length in cm for first case
l2=0.4;//length in cm for second case
w=0.1;//width in cm
t=0.4;//thickness in cm
```

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

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

Scilab code Exa 1.3 DIAMETER

```
//Chapter-1, Example 1.3, Page 19
//=============================================================================

clc;
clear;
//INPUT DATA
la=1000;//length  of aluminium wire in cm
da=0.2;//diameter in cm
pa=2.6*10^-6;//specific resistance of aluminium in ohm cm
pc=1.6*10^-6;//specific resistance of copper in ohm cm
lc=600;//length  of copper wire in cm
i=2;//current in A passing through combination
ia=1.25;//current in A passing through aluminium wire
//CALCULATIONS
ic=i-ia;//current in A passing through copper wire
//resistance of aluminium wire in ohms
```

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

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

Scilab code Exa 1.4 RESISTANCE

```
//Chapter-1, Example 1.4, Page 20
//==============================================================================
clc;
clear;
//INPUT DATA
l=10000;//length drawn from 10cc of copper in cm
p=1.7*10^-6;//Resistivity of copper in ohm cm
v=10;//volume of copper in cc
s1=10;//square sheet side in second case in cm
//CALCULATIONS
a=v/l;//area of cross-section in cm^2 in first case
R1=p*l/a;//resistance of wire in first case in ohm
a1=s1*s1;//area of cross-section in cm^2 in second case
l1=v/a1;//thickness in case 2 in cm
R2=p*l1/a1;//resistance of wire in second case in ohm
```

```
//OUTPUT
mprintf("Thus the resistance in first and second cases are %g ohms and %g ohms\n",R1,R2);

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

Scilab code Exa 1.5 TEMPERATURE COEFFICIENT

```
//Chapter-1, Example 1.5, Page 21
//==========================================================================================

clc;
clear;
//INPUT DATA
t1=40;//temperature in degree centigrade
t2=100;//temperature in degree centigrade
R1=3.146;//resistance of platinum coli at t1
R2=3.767;//resistance of platinum coli at t2
//CALCULATIONS
x=R1/R2;
a0=((R1-R2)/(R2*t1-R1*t2));//temperature coefficient at 0 degree centigrade
R0=R1/(1+(a0*t1));//resistance at zero degree centigrade
a40=a0/(1+(a0*t1));//temperature coefficient at 40 degree centigrade
//OUTPUT
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);

```

```

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

Scilab code Exa 1.6 RESISTANCE

```
//Chapter-1, Example 1.6, Page 21
//
    ====================================================================================

clc;
clear;
//INPUT DATA
t1=12;//temperature in degree centigrade
t2=50;//temperature in degree centigrade
R1=0.4;//copper coil resistance in ohms
a0=0.004;//temperature coefficient of copper at zero
     degree centigrade
//CALCULATIONS
a12=1/((1/a0)+t1);//temperature coefficient at 12
   degree centigrade
R2=R1*[1+(a12*(t2-t1))];//resistance of copper wire
     in ohm at 52 degree centigrade
//OUTPUT
mprintf("Thus the resistance copper wire at 52
   degree centigrade is %1.2f  ohm \n",R2);

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

Scilab code Exa 1.7 TEMPERATURE

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

```
//==================================================================================
clc;
clear;
//INPUT DATA
t1=20;//temperature in degree centigrade
R1=45;//shunt motor resistance at t1
R2=48.5;//new shunt resistance at t2
a0=0.004;//temperature coefficient of resistance at
   0 degree centigrade
//CALCULATIONS
x=R1/R2;
t2=((1+(a0*t1)-x)/(a0*x));
//OUTPUT
mprintf("Thus the temperature for new resistance is
   %d degree centigrade \n",t2);

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

Scilab code Exa 1.8 TEMPERATURE RISE

```
//Chapter-1, Example 1.8, Page 22
//==================================================================================
clc;
clear;
//INPUT DATA
V=180;//supply voltage in volts
I1=4;//initial current of coil in A
t1=20;//initial temperature
I2=3.4;//new decreased current of coil in A at
   temperature t2
```

```
a0=0.0043;//temperature coefficient in per degree centigrade
//CALCULATIONS
R1=V/I1;//initial resistance of coil in ohms
R2=V/I2;//resistance of coil after some time in ohms
x=R1/R2;
t2=(1+(a0*t1)-x)/(a0*x);
t=t2-t1;//temperature rise
//OUTPUT
mprintf("Thus the temperature rise is %2.2f degree centigrade \n",t);

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

Scilab code Exa 1.9 CURRENT

```
//Chapter-1, Example 1.9, Page 23
//=============================================================================================================

clc;
clear;
//INPUT DATA
t2=2750;//temperature in degree centigrade for tungsten lamp
P=150;//power in watts
V=230;//voltage in volts
t1=16;//temperature in degree centigrade
a0=0.0047;//temperature coefficient of tungsten in per degree centigrade
//CALCULATIONS
R2=(V*V)/P;
a1=1/((1/a0)+t1);//temperature coefficient of resistant at 16 degree centigrade
```

```
R2=(V*V)/P;//Resistance of the filament of the lamp under normal working condition
R1=R2/[1+(a1*(t2-t1))];//resistance of copper wire in ohm at 52 degree centigrade
I2=V/R2;//normal current taken by lamb
I1=V/R1;//current taken at the moment of switching on
//OUTPUT
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);

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

Scilab code Exa 1.10 EFFICIENCY

```
//Chapter-1, Example 1.10, Page 23
//=============================================================================

clc;
clear;
//INPUT DATA
m1=2;//mass of water in kg
theta1=20;//temperature 20 degree centigrade
theta2=100;//temperature 100 degree centigrade(boiling point of water)
t=1/10;//time taken to boil water in hr
x=40;//cost of energy of 1kwh in paise for one unit
y=12;//cost of energy consumed
S=1;//specific heat of water
//CALCULATIONS
H=m1*S*(theta2-theta1);//heat energy required to raise temperature from theta1 to theta2 in kcals
```

```
H=H/860;//heat energy in Kwh
E=(12/40);//electrical energy or input energy to kettle in Kwh
n=H/E*100;//efficiency of kettle in percentage;
P=E/t;//power rating of kettle
//OUTPUT
mprintf("Thus the efficiency of kettle in percentage and power rating of kettle is %d and %1.0f Kw",n,P);


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

Scilab code Exa 1.11 RESISTANCE

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

```
n=n/100;
E=H/n;//electrical energy or input energy to kettle
    in Kwh
P=E/t;//power rating of kettle in Kw
P=P*1000;//power rating of kettle in w
R=(V*V)/P;//resistance of heating element in ohms
//OUTPUT
mprintf("Thus the resistance of heating element is
    %2.2f ohms",R);


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

Scilab code Exa 1.12 TIME

```
//Chapter-1, Example 1.12, Page 24
//
    ====================================================================================================

clc;
clear;
//INPUT DATA
m=20;//mass of aluminium in kg
S=0.896;//specific heat of aluminium in KJ/Kg degree
     centigrade
L=402;//latent heat of fusion of aluminium in KJ/Kg
theta2=657;//final temperature
theta1=20;//initial temperature(assumed)
P=25;//power of furnace in Kw
n=80;//efficiency of kettle in percentage
//CALCULATIONS
H=m*S*(theta2-theta1)+(m*L);//heat energy required
    to melt aluminium or energy output from the
    furnace in Kj
```

```
H=H/4.186;//heat energy required to melt aluminium or energy output from the furnace in Kcal
H=H/860;//heat energy required to melt aluminium or energy output from the furnace in KWh
n=n/100;
E=H/n;//electrical energy or input energy to kettle in Kwh
t=E/P;//time taken to melt the aluminium in hr
t=t*60;// time taken to melt the aluminium in min
//OUTPUT
mprintf("Thus the time taken to melt the aluminium is %2.2f min",t);


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

Scilab code Exa 1.13 ENERGY

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

```
//CALCULATIONS
P=m*g*h;//potential energy possessed by water per minute or workdone by motor pump/minute measured in joules
P=P/60;//potential energy possessed by water per minute or workdone by motor pump/minute  measured in joules/sec or watts.
O=P/1000;//output power of motor in Kw
n=n/100;
E=O/n;//input power of motor in Kw
Et=E*T;//total energy supplied or energy consumption in Kwh
C=C/100;//cost of energy in Rs/Kwh
Ct=C*Et;//Total cost of energy
//OUTPUT
mprintf("Thus the total cost of energy is  Rs %4.0f",Ct);


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

Scilab code Exa 1.14 VOLUME

```
//Chapter-1, Example 1.14, Page 26
//=============================================================================

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

```
t=10;//operation time of power station
//CALCULATIONS
E1=P*t;// energy output from the station in 10 hours
    measured in MWh
n=n/100;
E2=P*t/n;//energy input to the station in 10 hours
    measured in MWh
E2=E2*10^6*60*60;//energy input to the station in 10
    hours measured in Wsec or joules
//energy input to the station is equal to potential
    energy supplied by water to station
m=E2/(g*h);//mass in kg of water used
d=1000;//density of water in kg/m^3
V=m/d;//volume of water used in 10 hours
//OUTPUT
mprintf("Thus the volume of water used in 10 hours
    is %e cubic metre",V);


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

Scilab code Exa 1.15 VELOCITY

```
//Chapter-1, Example 1.15, Page 26
//
    ==========================================================================================
clc;
clear;
//INPUT DATA
I=20;//current in A
V=8;//supply voltage in V
t=3600;//1hr=3600sec
m=1000;//mass in kg(1 tonne= 1000 kg)
```

```
//kinetic energy = energy dissipated in the
   resistance-----eqn(1)
//CALCULATIONS
E=V*I*t;// energy dissipated in resistance in joules
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
//OUTPUT
mprintf("Thus the velocity is %2.2f m/sec",v);


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

Scilab code Exa 1.16 RESISTIVITY

```
//Chapter-1, Example 1.16, Page 27
//
   ==================================================================

clc;
clear;
//INPUT DATA
I=7.9;//current in A
V=240;//supply voltage in V
t=55;//temperature in degree centigrade
a0=0.00029;//temperature coefficient in ohm/ohm/
   degree centigrade
l=15.6;//length of wire in m
a=12;//cross-sectional area in mm^2
//CALCULATIONS
R=V/I;//resistance of wire in ohm
p=R*a/l;//resistivity of wire in ohm metre
Rt=R*(1+(a0*t));//resistance at 55 degree centigrade
    in ohm
```

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


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

Scilab code Exa 1.17 RESISTANCE

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

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

```

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

Scilab code Exa 1.18 RESISTANCE

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

```
    centigrade is %g ohms",R50);


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

Scilab code Exa 1.19 RESISTIVITY

```
//Chapter-1, Example 1.19, Page 28
//
    ====================================================================================

clc;
clear;
//INPUT DATA
l1=0.5;//length of copper rod in m
a=0.00426;//temperature coefficient of copper measured in per degree centigrade
R1=4.25*10^-4;//resistance of wire at 15 degree centigrade in ohm
d1=5*10^-3;//diameter of copper rod in m in case 1
r1=0.5*d1;//radius of copper rod in m in case 1
a1=%pi*((r1)^2);//area of cross-section in m^2 in case 1
t1=15;//temperature in degree centigrade
t2=50;//temperature in degree centigrade
//CALCULATIONS
p=R1*a1/l1;//resistivity in ohm-m
d2=1*10^-3;//diameter of copper rod in m in case 2
r2=d2/2;//radius of copper rod in m in case 2
a2=%pi*(r2)^2;//area of cross-section in m^2 in case 2
R15=(a1/a2)^2*R1;//resistance at 15 degree centigrade
R50=R15*((1+(a*t2))/(1+(a*t1)));
```

```
//OUTPUT
mprintf("Thus the resistance of wire at 50 degree centigrade is %1.4f ohm",R50);


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

Scilab code Exa 1.20 DIAMETER

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

```
d2=sqrt(4*a2/%pi);//diameter of copper wire in m
//OUTPUT
mprintf("Thus the diameter of copper wire is %g m",d2);

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

Scilab code Exa 1.22 TEMPERATURE RISE

```
//Chapter-1, Example 1.22, Page 29
//==========================================================================================
clc;
clear;
//INPUT DATA
R20=100;//resistance of coil at 20 degree centigrade in ohms
R45=110;//resistance of coil at 45 degree centigrade in ohms
Rt=124;//resistance of coil at t degree centigrade in ohms
t1=20;//temperature in degree centigrade
t2=15;//temperature in degree centigrade
a=R45/R20;
//CALCULATIONS
a0=(a-1)/(45-(20*a));//temperature coefficient of coil at 0 degree centigrade
x=(Rt/R20);
t=(x)*(1+(a0*t1));
t=t-1;
t=(t)*(1/a0);////temperature of coil when Rt=124 ohms measured in degree centigrade
deltat=t-t2;//mean temperature rise
```

```
//OUTPUT
mprintf("Thus the mean temperature rise is %2.0f degree centigrade",deltat);


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

Scilab code Exa 1.23 TEMPERATURE RISE

```
//Chapter-1, Example 1.23, Page 30
//=============================================================================

clc;
clear;
//INPUT DATA
R20=18;//resistance of coil at 20 degree centigrade in ohms
R50=20;//resistance of coil at 50 degree centigrade in ohms
Rt=21;//resistance of coil at t degree centigrade in ohms
t1=20;//temperature in degree centigrade
t2=50;//temperature in degree centigrade
t3=15;//temperature in degree centigrade
a=R50/R20;
//CALCULATIONS
a0=(a-1)/(50-(20*a));//temperature coefficient of coil at 0 degree centigrade
x=(Rt/R50);
t=(x)*(1+(a0*t2));
t=t-1;
t=(t)*(1/a0);////temperature of coil when Rt=21 ohms measured in degree centigrade
```

```
deltat=t-t3;//mean temperature rise
//OUTPUT
mprintf("Thus the mean temperature rise is %2.0f
   degree centigrade",deltat);


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

Scilab code Exa 1.24 CURRENT

```
//Chapter-1, Example 1.24, Page 40
//
   ==========================================================================================

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

Scilab code Exa 1.25 POWER

```
//Chapter-1, Example 1.25, Page 41
//=============================================================================
clc;
clear;
//INPUT DATA
R1=2;//resistance1 in ohms
R2=3;//resistance2 in ohms
R3=4;//resistance3 in ohms
R4=5;//resistance4 in ohms
P=100;//total power absorbed in watts
//CALCULATIONS
RT=((R2*R3*R4)+(R1*R3*R4)+(R1*R2*R4)+(R1*R2*R3))/(R1
    *R2*R3*R4);
RT=1/RT;//equivalent resistance of parallel
    combination of R1,R2,R3,R4 Resistors
V=sqrt(P*RT);//voltage in volts that has to be
    applied to absorb 100w of power
//OUTPUT
mprintf("Thus the voltage in volts that has to be
    applied to absorb 100w of power is %1.3f V ",V);
 //=================================END OF PROGRAM
    ==============================
```

Scilab code Exa 1.26 RESISTANCE

```
//Chapter-1, Example 1.26, Page 41
//=============================================================================
clc;
clear;
//INPUT DATA
V=230;//supply voltage in volts
```

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

Scilab code Exa 1.27 CURRENT

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

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

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

Scilab code Exa 1.28 RESISTANCE

```
//Chapter-1, Example 1.28, Page 42
//
============================================================================================================
clc;
clear;
//INPUT DATA
R1=3.6;//resistance in ohm
R2=4.56;//resistance in ohm
RT=6;//resistance in ohm
//CALCULATIONS
X=RT-(R2);
R3=(X*R1)/(R1-X);
//OUTPUT
mprintf("Thus the value of third resistance placed
    is %1.1f ohm ",R3);
//==========================================================END OF PROGRAM
=================================================
```

Scilab code Exa 1.29 RESISTANCE

```
//Chapter-1, Example 1.29, Page 42
//
============================================================================================================
clc;
clear;
//INPUT DATA
```

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

Scilab code Exa 1.30 EMF

```
//Chapter-1, Example 1.30, Page 43
//=============================================================================
clc;
clear;
//INPUT DATA
P=70;//total power dissipated in circuit in watts
V1=6;//since applied voltage  E is 6V,as per the characteristics of parallel circuit P.D across R1 is
V2=6;//V1=V2,in volts
R1=12;//resistance1 in parallel combination in ohms
R2=6;//resistance2 in parallel combination in ohms
R3=6.25//resistance3 in series with parallel
```

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

Scilab code Exa 1.31 CURRENT

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

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

Scilab code Exa 1.32 CURRENT

```
//Chapter-1, Example 1.32, Page 45
//
    ================================================================

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

```
RT=Rae+Raf;//total equivalent circuit resistance in
    ohms
Iaf=V/RT;//current through resistance Raf in A
Vae=V-(Iaf*Raf);//P.D across AE in volts
Iae=Vae/Rx;//current in AE in A
Iab=Iaf-Iae;//current in AB in A
Vab=Rab*Iab;//P.D across AB in volts
Vbe=Vae-Vab;//Voltage across branch BE in volts
Pbe=((Vbe)^2)/(Ry);//power absorbed in branch Be in
    watts
Ibe=Vbe/Ry;//current in BE in A
Ibc=Iab-Ibe;//current in BC in A
Icde=(Ibc)/(2);//current in CDE in A
Vcd=Icde*(Rcd);//P.D across CD
//OUTPUT
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);
//=================================END OF PROGRAM
    ==============================
```

Scilab code Exa 1.33 CURRENT

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

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

```
//let I1 be the current in loop1 and I2 current be
   in loop2
//CALCULATIONS
//V1=((R1+R3)*(I1)-(R3*I2));//applying KVL in loop1
   ---------------eqn(1)
//V2=((R3)*(I1)-(R2+R3)*(I2));//applying KVL in
   loop2 ---------------eqn(2)
//solving both eqn(1) and eqn(2)
[a]=[(R1+R3),-R3;(R3),-(R2+R3)]
[b]=[V1;-V2]
[c]=inv(a)*(b)//ax=b
c1=c(1);//c1 is current in branch FABC measured in A
c2=c(2);//c2 is current in branch CDEF measured in A
c3=c1-c2;//current in branch CF in A
//OUTPUT
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);
 //==================================END OF PROGRAM
   ================================
```

Scilab code Exa 1.34 CURRENT

```
//Chapter-1, Example 1.34, Page 46
//
   ==========================================================================

clc;
clear;
//INPUT DATA
V=4.5;//supply voltage of battery in volts
RAB=1000;//resistance between A and B points in ohms
RBC=100;//resistance between B and C points in ohms
RAD=5000;//resistance between A and D points in ohms
RCD=450;//resistance between C and D points in ohms
```

```
Rg=500;//resistance of galvanometer in ohms
//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
//where I=I1+I2
//CALCULATIONS
//(-(RAB*I1)-(Rg*Ig)+(RAD*I2))=0;//applying KVL to loop ABDA --------------eqn(1)
//(-(RBC*I1)+((Rg+RCD+RBC)*(Ig))+(RCD*I2))=0;//applying KVL to loop BCDB --------------eqn(2)
//((RAD+RCD)*I2)+(RCD*Ig))=V;//applying KVL to loop EADCFE--------------eqn(3)
//solving  eqn(1),eqn(2) and eqn(3)
[a]=[-RAB,-Rg,RAD;-RBC,(Rg+RCD+RBC),RCD;0,RCD,(RAD+RCD)];
[b]=[0;0;V];
[c]=inv(a)*(b)//ax=b
I1=c(1);//c1 is current in branch FABC measured in A
Ig=c(2);//c2 is current in branch CDEF measured in A
I2=c(3);//current in branch CF in A
//OUTPUT
mprintf("Current through galvanometer is %g A \n since the answer is positive our assumed direction is correct ",Ig);
//=================================================END OF PROGRAM=================================================
```

Scilab code Exa 1.35 CURRENT

```
//Chapter-1, Example 1.35, Page 47
//=============================================================================================================
clc;
clear;
```

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

Scilab code Exa 1.36 RESISTANCE

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

```
Rs=25;//total resistance when two resistances are connected in series in ohms
Rp=6;//total resistance when two resistances are connected in parallel in ohms
//let individual resistances be R1 and R2 ohms
//CALCULATIONS
//Rs=(R1+R2)---eqn(1)
//Rp=((R1*R2)/(R1+R2))---eqn(2)
//let (R1*R2)=x
//let(R1-R2)=y
//solving eqn(1)and eqn(2)
x=Rs*Rp;//in ohms
y=sqrt((Rs)^2-(4*x));//eqn---(3)
//solving eqn(1) and eqn(3)
z=Rs+y;
R1=z/2;//resistance1 in ohms
R2=Rs-R1;//resistance2 in ohms
//OUTPUT
mprintf("Thus the individual resistances are R1=%d ohms and R2=%d ohms ",R1,R2);
//==================================END OF PROGRAM==================================
```

Scilab code Exa 1.37 CURRENT

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

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

Scilab code Exa 1.38 CURRENT

```
//Chapter-1, Example 1.38, Page 49
//=============================================================================

clc;
clear;
//INPUT DATA
R1=2;//resistance R1 in Ohms
R2=12;//resistance R2 in parallel circuit measured in ohms
R3=20;//resistance R3 in parallel circuit measured in ohms
R4=30;//resistance R4 in parallel circuit measured in ohms
```

```
R5=2;//resistance R5 in ohms
V=100;//supply voltage in volts
//CALCULATIONS
Reff=(R1)+((1)/((1/R2)+(1/R3)+(1/R4)))+(R5);//total effective resistance of circuit in ohms
I=V/Reff;//total current in A
// let individual currents in 3 parallel resistance network be I1,I2,I3 respectively
//Then I1+I2+I3=I----eqn(1)
//where I2=(I1*R1/R2) and I3=(I1*R1/R3)
//solving for I1 in eqn(1)
I1=I/2;//in A
I2=(I1*R2/R3);//in A
I3=(I1*R2/R4);//in A
mprintf("I1=%d A \n I2=%1.0f A \n I3=%1.0f A",I1,I2,I3);
//=================================END OF PROGRAM==============================
```

Scilab code Exa 1.39 RESISTANCE

```
//Chapter-1, Example 1.39, Page 49
//=============================================================================
clc;
clear;
//INPUT DATA
V=100;//supply voltage in volts
I=10;//total current in A
P1=600;//power dissipated in coil in Watts
//CALCULATIONS
//Reff=((R1*R2)/(R1+R2)) is total effective resistance of circuit in ohms----eqn(1)
Reff=V/I;;//total effective resistance of circuit in
```

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

Scilab code Exa 1.40 CURRENT

```
//Chapter-1, Example 1.40, Page 50
//
    ====================================================================================

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

Scilab code Exa 1.41 RESISTANCE

```
//Chapter-1, Example 1.41, Page 50
//
    ====================================================================================
```

```
clc;
clear;
//INPUT DATA
I1=2;//current through R1 in A
I3=1.5;//current through R3 in A
I5=0.5;//current through R5 in A
P2=75;//power dissipated in R2 in W
P4=30;//power dissipated in R4 in W
V=200;//supply voltage in volts
//let the current through R2 and R4 be I2 and I4 respectively
//CALCULATIONS
I2=I1-I3;//current through R2 in A
I4=I3-I5;//current through R4 in A
R2=P2/(I2)^2;//resistance R2 in Ohms
R4=P4/(I4)^2;//resistance R4 in Ohms
R5=(R4*I4)/(I5);//resistance R5 in Ohms
//(R1*I1)+(R2*I2)=200
//(R3*I3)+(R4*I4)=(R2*I2)
R1=((V-(R2*I2))/I1);//resistance R1 in Ohms
R3=((R2*I2)-(R4*I4))/(I3);//resistance R3 in Ohms
//OUTPUT
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);
//==========================================END OF PROGRAM==========================================
```

Scilab code Exa 1.42 CURRENT

```
//Chapter-1, Example 1.42, Page 50
//=============================================================================
clc;
clear;
```

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

Scilab code Exa 1.43 RESISTANCE

```
//Chapter-1, Example 1.43, Page 51
//
   ================================================================

clc;
clear;
//INPUT DATA
R1=10;//resistance R1 in ohms
R2=20;//resistance R2 in ohms
R3=40;//resistance R3 in ohms
//after certain manipulations the resultant network
   can be evaluated as parallel combinaton of R1,R2,
   R3
//CALCULATIONS
RAD=1/((1/R1)+(1/R2)+(1/R3));//resultant resistance
   in Ohms
//OUTPUT
mprintf("Resultant resitance RAD is %1.3f ohms",RAD)
```

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

Scilab code Exa 1.44 RESISTANCE

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

Scilab code Exa 1.45 RESISTANCE

```
//Chapter-1, Example 1.45, Page 52
//==================================================================================================
clc;
```

```
clear;
//INPUT DATA
V=15;//supply voltage in volts
VAB=5;//voltage across AB in volts
R1=5;//resitance in ohms
R2=10;//resitance in ohms
R3=10;//resitance in ohms
//CALCULATIONS
VAC=((R1)/(R1+R3))*V;//Volatge across AC terminals in Volts
//VBC=(((R)/(R+2))*V)---------------eqn(1) by ohm's law
//VAB=(VAC-((VBC)*(R2-(((R1+R2)*R)/(R+2)))---------------eqn(2) by ohm's law
//solving equation 2 with Vab=5V
R=10/10;//resistance R in ohms
//OUTPUT
mprintf("R=%d ohms",R);
//==================================END OF PROGRAM==============================
```

Scilab code Exa 1.46 CURRENT

```
//Chapter-1, Example 1.46, Page 52
//=============================================================================
clc;
clear;
//INPUT DATA
Ra=4;//Resistance in ohms
Rb=9;//Resistance in ohms
Rc=18;//Resistance in ohms
Rd=2;//Resistance in ohms
Re=7;//Resistance in ohms
```

```
Rf=15;//Resistance in ohms
V=125;//voltage in volts
//CALCULATIONS
R1=((Ra)+((Rb*Rc)/(Rc+Rb)));//resistance in branch1 in ohms
R2=((Rd)+(Re));//resistance in branch2 in ohms
Reff=((R1*R2)/(R1+R2))+Rf;//effective resistance in ohms
I=V/Reff;//current in Rf resistor in Amps
I1=(I)*(Rb)/(Rb+R1);//current in resistor Ra in Amps
Ix=(I1)*(Rb/(Rb+Rc)) ;//current in resistor Rc in Amps
V2=(Ix)*(Rc);//voltage across Rc in volts
I2=I-I1;//current across Re in Amps
P4=(I2)^2*Re;//power dissipated across Re in W
//OUTPUT
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);
//==============================================END OF PROGRAM==========================================
```

Scilab code Exa 1.47 CURRENT

```
//Chapter-1, Example 1.47, Page 53
//=============================================================================
clc;
clear;
//INPUT DATA
R1=20;//Resistance in ohms
R2=50;//Resistance in ohms
R3=30;//Resistance in ohms
```

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

Scilab code Exa 1.48 CURRENT

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

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

Scilab code Exa 1.49 CURRENT

```
//Chapter-1, Example 1.49, Page 54
//
    ==========================================================================
clc;
clear;
//INPUT DATA
R1=5;//Resistance in ohms
R2=15;//Resistance in ohms
R3=10;//Resistance in ohms
R4=8;//resistance in ohms
R5=12;//resistance in ohms
```

```
V1=4;// supply voltage in volts
V2=6;//supply voltage in volts
//let currents in mesh I,II and III is I1,I2,I3
    respectively
//applying KVL to meshes I,II and III
//(R1+R2)*(I1)-R2*(I2)=V1---------eqn(1)
//R2*(I1)-(R2+R3+R4)*(I2)+(R4)*(I3)=0-----------eqn(2)
//R4*(I2)-(R4+R5)=V2---------eqn(3)
//solving eqn(1) we get it as (I2=I1) and applying
    it in eqn(2) we get R as 6 ohms
R=6;//Resistance ROC
//solving eqn(1),(2)and (3)
//CALCULATIONS
[a]=[R1+R2,-R2,0;R2,-(R2+R3+R4),R4;0,R4,-(R4+R5)];
[b]=[V1;0;V2];
[c]=inv(a)*(b);
I1=c(1);//current in mesh1 in A
I2=c(2);//current in mesh2 in A
I3=c(3);//current in mesh3 in A
I=(I2-I3);//current flowing through R4 in Amps
//OUTPUT
mprintf("current across 8 ohm resistor is %1.3f amps
    ",I);
//=================================END OF PROGRAM
    ====================================
```

Scilab code Exa 1.50 CURRENT

```
//Chapter-1, Example 1.50, Page 55
//
    =============================================================================

clc;
clear;
//INPUT DATA
```

```
RAB=25;//Resistance in ohms
RBC=10;//Resistance in ohms
RAD=20;//Resistance in ohms
RCD=15;//resistance in ohms
RG=50;//resistance of galvanometer in ohms
REF=2;//internal resistance in ohms
V=25;// supply voltage in volts
//let currents in mesh I,II and III is I1,I2,I3 respectively
//applying KVL to meshes I,II and III
//(RAB+RG+RAD)*(I1)-(RG)*(I2)-(RAD)*(I3)=0---------eqn(1)
//-(RG)*(I1)-(RG+RCD+RBC)*(I2)-(RCD)*(I3)=0----------eqn(2)
//-(RAD)*(I1)-(RCD)*(I2)+(RAD+RCD+REF)=-V----eqn(3)
//solving eqn(1),(2)and (3)
//CALCULATIONS
[a]=[RAB+RG+RAD,-RG,-RAD;-RG,(RG+RCD+RBC),-RCD;-RAD,-RCD,(RAD+RCD+REF)];
[b]=[0;0;-V];
[c]=inv(a)*(b);
I1=c(1);//current in mesh1 in A
I2=c(2);//current in mesh2 in A
I3=c(3);//current in mesh3 in A
I=(I1-I2);//currentthrough galvanometer in Amps
//OUTPUT
mprintf("current across galavanometer is %1.5f amps",I);
//=================================================END OF PROGRAM=================================================
```

Scilab code Exa 1.51 CURRENT

```
//Chapter-1, Example 1.51, Page 56
//
```

```
    ============================================================
clc;
clear;
//INPUT DATA
V1=100;//source1 voltage in volts
V2=50;//source2 voltage in volts
R1=10;//Resistance in ohms
R2=20;//resistance in ohms
R3=30;//resistance in ohms
R4=40;//resistance in ohms
//let currents in mesh I,II is I1,I2 respectively
//applying KVL to meshes I,II
//(R1+R3+R4)*(I1)-(R3)*(I2)=V1--------eqn(1)
//(R3)*(I1)-(R2+R3)*(I2)=-V2----------eqn(2)
//solving eqn(1),(2)
//CALCULATIONS
[a]=[(R1+R3+R4),-R3;R3,-(R2+R3)];
[b]=[V1;-V2];
[c]=inv(a)*(b);
I1=c(1);//current in mesh1 in A
I2=c(2);//current in mesh2 in A
I=(I2-I1);//current through R3 in Amps
//OUTPUT
mprintf("current across 30 ohm resistor is %1.3f
   amps",I);
 //======================================END OF PROGRAM
    ====================================
```

Scilab code Exa 1.52 POWER

```
//Chapter-1, Example 1.52, Page 57
//
    ============================================================
```

```
clc;
clear;
//INPUT DATA
V1=10;//source1 voltage in volts
V2=5;//source2 voltage in volts
V3=5;//source3 voltage in volts
RAH=2;//Resistance in ohms
RAB=3;//resistance in ohms
RBE=5;//resistance in ohms
REG=5;//resistance in ohms
RED=5;//resistance in ohms
RBC=7;//resistance in ohms
RCD=3;//resistance in ohms
RDF=5;//resistance in ohms
RHG=5;//resistance in ohms
//let currents in mesh I,II,III is I1,I2,I3 respectively
//applying KVL to meshes I,II
//(RAH+RHG+RAB+RBE+REG)*(I1)-(RBE)*(I2)-(REG)*(I3)=V1----------eqn(1)
//-(RBE)*(I1)+(RBC+RCD+RBE+RED)*(I2)-(RDF)*(I3)=-V2-----------eqn(2)
//-(REG)*(I1)-(RED)*(I2)+(REG+RED+RDF)*(I3)=-V3----------eqn(3)
//solving eqn(1),(2) and (3)
//CALCULATIONS
[a]=[(RAH+RHG+RAB+RBE+REG),-RBE,-REG;-REG,(RBC+RCD+RBE+RED),-(RDF);-REG,-RED,(REG+RED+RDF)];
[b]=[V1;-V2;-V3];
[c]=inv(a)*(b);
I1=c(1);//current in mesh1 in A
I2=c(2);//current in mesh2 in A
I3=c(3);//current in mesh3 in A
P1=V1*I1;//power output from V1 in W
P2=V2*I2;//power output from V2 in W
P3=V3*I3;//power output from V3 in W
//OUTPUT
mprintf("power output from 10V is %1.1f W\n from 5V
```

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

Scilab code Exa 1.54 RESISTANCE

```
//Chapter-1, Example 1.54, Page 61
//
    ======================================================================================

clc;
clear;
//INPUT DATA
RAC=10;//Resistance in ohms
RCD=10;//resistance in ohms
RCF=50;//resistance in ohms
RDH=50;//resistance in ohms
RDF=30;//resistance in ohms
RHF=10;//resistance in ohms
//using star to delta conversion ,the star point D is
    eliminated
//CALCULATIONS
RCF1=((RCD*RDF)+(RDF*RDH)+(RDH*RCD))/(RDH);//by
    using star to delta conversion technique
RFH=((RCD*RDF)+(RDF*RDH)+(RDH*RCD))/(RCD);//by using
    star to delta conversion technique
RHC=((RCD*RDF)+(RDF*RDH)+(RDH*RCD))/(RDF);//by using
    star to delta conversion technique
RCF2=(RCF*RCF1)/(RCF+RCF1);
RCF=RCF2;//equivalent resistance of RCF in ohms
RHF1=(RHF*RFH)/(RHF+RFH);
RHF=RHF1;//equivalent resistance of RHF in ohms
RAB=(RAC)+(RHC*(RCF+RHF))/(RHC+RCF+RHF);//equivalent
    resistance of AB in ohms
//OUTPUT
```

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

Scilab code Exa 1.55 RESISTANCE

```
//Chapter-1, Example 1.55, Page 62
//
   ================================================================================

clc;
clear;
//INPUT DATA
RAB=1;//Resistance in ohms
RBE=2;//resistance in ohms
RED=3;//resistance in ohms
REF=3;//resistance in ohms
RDF=3;//resistance in ohms
RAD=2;//resistance in ohms
RAC=1;//resistance in ohms
RBC=1;//resistance in ohms
RFC=2;//resistance in ohms
//CALCULATIONS
//Delta DEF is converted into equivalent star where
   RDN=REN=RFN=1 ohm
//series branches of inner star network are added
//Star ABCN is converted to equivalent delta
RDN=1;
REN=RDN;
RFN=REN;
RAN=RAD+RDN;RBN=RBE+REN;RCN=RFC+RFN
RAB1=((RAN*RBN)+(RBN*RCN)+(RCN*RAN))/(RCN);//by
```

```
using star to delta conversion technique
RBC1=((RAN*RBN)+(RBN*RCN)+(RCN*RAN))/(RAN);//by using star to delta conversion technique
RCA1=((RAN*RBN)+(RBN*RCN)+(RCN*RAN))/(RBN);//by using star to delta conversion technique
//parallel resistances in each branch are converted to single resistance
RAB2=(RAB*RAB1)/(RAB+RAB1);
RAB=RAB2;//equivalent resistance of RAB in ohms
RBC2=(RBC*RBC1)/(RBC+RBC1);
RBC=RBC2;//equivalent resistance of RBC in ohms
RCA2=(RAC*RCA1)/(RAC+RCA1);
RCA3=((RCA2)*(RAB+RBC))/(RBC+RAB+RCA2);
RCA=RCA3;
//OUTPUT
mprintf("Thus equivalent resistance of CA is %1.1f ohms",RCA);
//TO FIND EQUIVALENT RESISTANCE BETWEEN DF
//

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

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

Scilab code Exa 1.56 CURRENT

```
//Chapter-1, Example 1.56, Page 66
//
   ====================================================================================================

clc;
clear;
//INPUT DATA
RAB=6;//Resistance in ohms
RBC=3;//resistance in ohms
RBD=4;//resistance in ohms
V1=25;//source voltage in volts
V2=45;//source voltage in volts
//CALCULATIONS
//applying kirchoff's current law at node B
//-I1-I2+I3=0
//I1=(V1-VB)/RAB
//I2=(V3-VB)/RBC
//I3=VB/RBD
VB=((V1/RAB)+(V2/RBC))/((1/RAB)+(1/RBC)+(1/RBD));
I1=(V1-VB)/(RAB);//current across AB
I2=(V2-VB)/(RBC);//current across BC
I3=(VB)/(RBD);//current across BD
```

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

Scilab code Exa 1.57 VOLTAGE

```
//Chapter-1, Example 1.57, Page 67
//=============================================================================
clc;
clear;
//INPUT DATA
I1=25;//current source in A
I2=6;//current source in A
I3=5;//current source in A
RAB=5;//Resistance in ohms
RAC=10;//Resistance in ohms
RBC=2;//Resistance in ohms
//let currents across AC and BC and AB are Ix,Iy and Iz respectively
//applying kirchoff's current law at node A
//-I1+Ix+I3+Iz=0-------eqn(1)
//applying kirchoff's current law at node B
//-Iz-I3+Iy+I2=0-------eqn(2)
//CALCULATIONS
[a]=[((1/RAC)+(1/RAB)),(-1/RAB);(-1/RAB),((1/RAB)+(1/RBC))];
[b]=[20;-1];
[c]=inv(a)*(b)
VA=c(1);//voltage at node A
VB=c(2);//voltage at node B
//OUTPUT
```

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

Scilab code Exa 1.58 RESISTANCE

```
//Chapter-1, Example 1.58, Page 68
//=============================================================================
clc;
clear;
//INPUT DATA
RAB=1;//Resistance in ohms
RAD=1;//Resistance in ohms
RDC=2;//Resistance in ohms
RCB=1;//Resistance in ohms
RAC=1;//Resistance in ohms
//delta DAC has been converted to star DAC where RDN=0.5 ohms,RNA=0.25 ohms,RNC=0.5 ohms
//CALCULATIONS
RDN=0.5;
RNA=0.25;
RNC=0.5
RBD=((RDN)+(((RNA+RAB)*(RNC+RCB))/(RNA+RAB+RNC+RCB)));//equivalent resistance across BD
//OUTPUT
mprintf("Thus equivalent resistance across BD is %1.2f ohms",RBD);
//==============================END OF PROGRAM==============================
```

Scilab code Exa 1.59 RESISTANCE

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

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

Chapter 2

MAGNETIC CIRCUITS

Scilab code Exa 2.1 MMF

```
//Chapter-2, Example 2.1, Page 89
//=============================================================================
clc;
clear;
//INPUT DATA
N=2000;//no of turns
I=10;//current in A
Rm=25;//mean radius in cm
d=6;//diameter of each turn in cm
//CALCULATIONS
MMF=N*I;//magneto motive force in A
l=2*%pi*(Rm/100);//circumference of coli in m
u=(4*%pi*10^-7);//permeability (U=Ur*U0)
a=(%pi*d*d*10^-4)/4;
reluctance=(l/(a*u));//reluctance in At/Wb
flux=(MMF)/(reluctance);//flux in Wb
fluxdensity=(flux/a);//flux density in Wb/m^2 or tesla
//OUTPUT
```

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

Scilab code Exa 2.2 FLUX DENSITY

```
//Chapter-2, Example 2.2, Page 90
//
    =====================================================================================

clc;
clear;
//INPUT DATA
phi=5*10^-2;//flux in wb
a=0.2;//area of cross-section in m^2
lg=1.2*10^-2;//length of air gap in m
ur=1;//permeability
u=ur*4*%pi*10^-7;//permeability
//CALCULATIONS
B=(phi/a);//flux density in wb/sq.m
H=(B/(4*%pi*10^-7*ur));//magnetic flux density in A/
    m
S=lg/(a*u);//reluctance of air gap in A/wb
permeance=1/S;//permenace in A/wb
mmf_in_airgap=phi*S;//mmf in A
//OUTPUT
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);
//==========================================END OF PROGRAM
    ======================================
```

Scilab code Exa 2.3 PERMEABILITY

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

Scilab code Exa 2.4 CURRENT

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

Scilab code Exa 2.5 CURRENT

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

```
//
clc;
clear;
//INPUT DATA
r=0.01;//radius in m
lg=10^-3;//length of air gap in m
Rm=(30/2)*10^-2;//mean radius in m
ur=800;//relative permeability of iron
ur2=1;//relative permeability of air gap
N=250;//no of turns
phi=20000*10^-8;//flux in Wb
u0=4*%pi*10^-7;//permeability in free space
a=%pi*(r)^2;//area of cross-section in m
leakage_factor=1.1
//CALCULATIONS
Reluctance_of_air_gap=(lg/(u0*ur2*a));//reluctance of air gap in A/wb
li=(%pi*(2*r)-(lg));//length of iron path in m
Reluctance_of_iron_path=((%pi*0.3)-(lg))/(4*%pi*10^-7*800*a);//in A/wb
total_reluctance=Reluctance_of_air_gap+Reluctance_of_iron_path;//in A/wb
MMF=phi*total_reluctance;//in Ampere turns
current_required=(MMF)/(N);//in A
//OUTPUT
mprintf("Thus current required is %1.2f A \n",current_required);
 //Including leakage
 //CALCULATIONS
 MMF_of_airgap=phi*Reluctance_of_air_gap;//in A/wb
 Total_flux_in_ironpath=leakage_factor*phi;//in Wb
 MMF_of_ironpath=Total_flux_in_ironpath*Reluctance_of_iron_path;//in A
 Total_MMF=MMF_of_ironpath+MMF_of_airgap;//in A/wb
 current_required2=Total_MMF/(N);//in A
//OUTPUT
```

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

Scilab code Exa 2.6 CURRENT

```
//Chapter-2, Example 2.6, Page 93
//

clc;
clear;
//INPUT DATA
l1=0.1;//length in m
l2=0.18;//length in m
l3=0.18;//length in m
lg=1*10^-3;//airgap length in mm
a1=6.25*10^-4;//area in m^2
a2=3*10^-4;//area in m^2
ur=800;//relative permeability of iron path
ur2=1;//relative permeability in free space
u0=4*%pi*10^-7
N=600;
phi=10^-4;//airgap flux in Wb
//CALCULATIONS
//for the airgap
Bg=(phi/(a1));//fluxdensity in Tesla
Hg=(Bg/(u0*ur2));//magnetising force in A/m
MMF1=Hg*lg;//in A
//for path I1
B1=0.16;// flux density in tesla
H1=(B1/(ur*u0));//magnetising force in A/m
MMF2=H1*l1;//in A
//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
```

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

Scilab code Exa 2.7 CURRENT

```
//Chapter-2, Example 2.7, Page 95
//
=====================================================================================

clc;
clear;
//INPUT DATA
Dm=0.1//diameter in m
a=10^-3;//area of cross-section im m^2
N=150;//no of turns
ur=800;//permeability of iron ring
B=0.1;//in Wb/m^2
u0=4*%pi*10^-7;//permeability of free space
//CALCULATIONS
S=(%pi*Dm)/(a*ur*u0);//reluctance
I=(B*a*S)/(N);//current in A
//OUTPUT
mprintf("Thus current is %f A",I);
//==================================================END OF PROGRAM
==============================================
```

Scilab code Exa 2.8 RELUCTANCE

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

Scilab code Exa 2.9 MMF

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

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

Scilab code Exa 2.10 FLUX DENSITY

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

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

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

Chapter 3

ELECTROMAGNETIC INDUCTION

Scilab code Exa 3.1 VOLTAGE

```
//Chapter-3, Example 3.1, Page 109
//

clc;
clear;
//INPUT DATA
P=4;//no of poles
N1=500;//no of turns per pole
phi=0.02;//magnetic flux in wb/pole
t=0.02;//time in sec
rphi=0.002;//residual flux in wb/pole

//CALCULATIONS
N=P*N1;//total no of turns
di=P*phi;//total initial flux in wb
dR=P*rphi;//total residual flux in wb
dphi=di-dR;//change in flux in wb
dt=0.02;//time of opening the circuit in sec
```

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

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

Scilab code Exa 3.2 AVERAGE EMF

```
//Chapter-3, Example 3.2, Page 109
//
    ====================================================================================

clc
clear

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

```
//OUTPUT
mprintf('Average induced emf and current are %1.0f V and %1.4f A',E,I);

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

Scilab code Exa 3.3 FORCE

```
//Chapter-3, Example 3.3, Page 110
//=============================================================================

clc
clear

//INPUT DATA
l=0.1;//conductor length (10 cm)=(0.1 m)
I=60;//current in amperes (A)
H=1000;//magnetic field strength in ampere/metre (A/m)
v=1;//conductor speed in metre/second(m/s)
u0=4*%pi*10^-7;//permeability in free space in henry/m
//CALCULATIONS
B=u0*1000;//magnetic flux density in (wb/m^2)
F=B*I*l;//force in Newtons(N)
P=F*v;//power in watt
E=B*l*v;//emf induced in conductor
//OUTPUT
mprintf("The force acting on conductor %1.4f N \n",F);
mprintf("The mechanical power to move this conductor is %1.4f watt \n",P);
```

```
mprintf("The induced emf in conductor is %1.5f V \n",E);

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

Scilab code Exa 3.4 INDUCTANCE

```
//Chapter-3, Example 3.4, Page 110
//=============================================================================

clc
clear

//INPUT DATA
l=0.3;//mean length of toroidal coil in meters (30cm=0.3m)
N=480;//no of turns of coil
a=5*10^-4;//cross sectional area in metres (1 cm^2=10^-4 m^2)
I=4;//current in amps
dt=60*10^-3;//time in sec
u0=4*%pi*10^-7;//permeability in free space in henry/m
ur=1;//relative permeability for air
//CALCULATIONS
L=(u0*ur*a*N*N)/(l);//inductance of coli in henry
di=I-(-I);//change in current in amps
E=L*(di/dt);//average induced emf
//OUTPUT
mprintf('The inductance of the coil is %1.6f H \n',L)
mprintf('average induced emf is %1.3f V \n',E)

```

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

Scilab code Exa 3.5 MUTUAL INDUCTANCE

```
//Chapter-3, Example 3.5, Page 111

//
    ====================================================================================================

clc
clear
//INPUT DATA
L1=0.25;//self inductance of coil in henry(H)
N1=500;//no of turns of coil 1
N2=10500;//no of turns of coil 2
phi2=0.6*L1;//60 % of flux of first coil(m1) is
    linked with second coil(m2)
z=100;//rate of change of current(dii/dt) in A/sec

//CALCULATIONS
x=L1/N1;//flux/ampere in first coil(phi1/I1)
y=0.6*(x);//flux linking the second coil(phi2/I1)
M=N2*(y);//mutual inductance between the two coils
    in H
E=M*(z);//induced emf in V
//OUTPUT
mprintf("Thus the mutual inductance between two
    coils is %1.2f H \n",M);
mprintf("The induced emf in second coil when current
     changes in first coil is %3.0f V \n",E);

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

Scilab code Exa 3.6 INDUCTANCE

```
//Chapter-3, Example 3.6, Page 111
//=============================================================================
clc
clear
//INPUT DATA
N1=250;//no of turns in a coil
I1=2;//current in coil in A
phi1=0.3;//flux in coil in wb
dt=2//time in  millisec
Em2=63.75//induced voltage in V
K=0.75
//CALCULATIONS
L1=N1*(phi1/I1);//self inductance of first coil in H
M=Em2*(dt/I1);//mutual inductance of two coils in H
L2=((Em2/K)^2)/(L1);//self inductance of second coil in H
phi2=K*phi1;//flux in second coil in wb
N2=(Em2*dt)/phi2;//no of turns in second coil
//OUTPUT
mprintf("Thus the self inductance of first coil is %2.1f mH \n",L1);
mprintf("mutual inductance of two coils %2.2f mH \n",M);
mprintf("self inductance of second coil %4.0f mH \n",L2);
mprintf("no of turns in second coil %3.0f turns \n",N2);
//note:the answer given  for N2 in textbook is wrong.please check the calculations

```

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

Scilab code Exa 3.7 EMF

```
//Chapter-3, Example 3.7, Page 112
//=============================================================================
clc
clear
//INPUT DATA
l=1;//length of wire in m
v=50;//velocity in m/sec
B=1;//magnetic flux density in wb/m^2
theta1=90;//the angle of conductor in degrees to the field in case 1
theta2=30;//the angle of conductor in degrees to the field in case 2
//CALCULATIONS
E1=B*l*v*sin (theta1*%pi/180);//emf induced in conductor in case 1(1degree =3.14/180 radians)
E2=B*l*v*sin ((360+theta2)*%pi/180);//emf induced in conductor in case 2(1degree =3.14/180 radians)
//OUTPUT
mprintf("Thus the emf induced in case 1 is %2.0f volts \n",E1);
mprintf("Thus the emf induced in case 2 is %2.0f volts \n",E2);
//note:convert angle in degrees to radians and compute it.
//==============================END OF PROGRAM==============================
```

Scilab code Exa 3.8 AVERAGE INDUCTANCE

```
//Chapter-3, Example 3.8, Page 112
//=============================================================================
clc
clear
//INPUT DATA
N=1000;//no of turns in a coil
a=10*10^-4;//crossectional area in m^2
i1=4.2;//current in A in case 1
i2=9.2;//current in A in case 2
B1=1;//flux density in wb/m^2 when current is i1
B2=1.42;//flux density in wb/m^2 when current is
dt=0.05;//time in sec where current reduces from 9.2 A to 4.2A
//CALCULATIONS
db=(B2-B1)//difference in flux densities
di=(i2-i1);//difference in currents
di1=(i1-i2);//difference in currents
L=N*a*(db)/di;//average inductance between the limits in H
E=-(L*di1/dt);//emf induced
//OUTPUT
mprintf("Thus the average inductance between the limits is %1.3f H \n",L);
mprintf("emf induced is %1.1f volts\n",E);

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

Scilab code Exa 3.9 MUTUAL INDUCTANCE

```
//Chapter-3, Example 3.9, Page 113
//=============================================================================
clc
clear
//INPUT DATA
N1=1600;//no of turns of solenoid
l=0.5;//length of wire of solenoid in m
N2=600;//no of turns of second coil
a=18*10^-4;//area of second coil in m^2
u0=4*%pi*10^-7;//permeability in free space
z=300;//rate of change of current(di1/dt) in A/sec
//CALCULATIONS
B=(u0*N1)/(l);//flux density in solenoid
M=(B*a*N2);//mutual inductance in mH
E=M*(z);//voltage induced
//OUTPUT
mprintf("Thus the mutual inductance is %f H \n",M);
mprintf("Thus the voltage induced is %f V \n",E);
//note:answer given for voltage in text book is wrong.please check the calculations
//=================================END OF PROGRAM==============================
```

Scilab code Exa 3.10 MUTUAL INDUCTANCE

```
//Chapter-3, Example 3.10, Page 113
//=============================================================================
clc
clear
```

```
//INPUT DATA
NA=15000;//no of turns in coil A
IA=6;//current in coil A in Amp(A)
phiA=0.05*10^-3;//flux in coil A in wb
NB=12000;//no of turns in coil B
IB=6;//current in coil B in Amp(A)
phiB=0.08*10^-3;//flux in coil B in wb
phiAB=0.55*0.05*10^-3;//mutual flux in wb
//CALCULATIONS
LA=phiA*NA/IA;//self inductance of coil A in H
LB=phiB*NB/IB;//self inductance of coil B in H
LAB=phiAB*NB/IB;//mutual inductance of coils in H
K=LAB/sqrt(LA*LB);//coefficient of coupling
//OUTPUT
mprintf("Thus the self inductance of coil A  is %1.3
   f H\n",LA);
mprintf("Thus the self inductance of coil B is %1.2f
    H \n",LB);
mprintf("Thus the mutual inductance of coils is %1.3
   f H \n",LAB);
mprintf("Thus the coefficient of coupling is %1.3f \
   n",K)

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

Chapter 4

AC FUNDAMENTALS

Scilab code Exa 4.1 FORM FACTOR

```
//Chapter-4, Example 4.1, Page 126
//============================================================================
clc
clear
//CALCULATIONS
//for WAVEFORM 1
//Average Value
b1=2;
h1=5;
area1=0.5*b1*h1;//area under one complete cycle(area
    of a triangle)
av0=area1/2;//average value
//rms value
area2=0.33*(h1)^2*b1;
rms=sqrt(area2/b1);//rms value
//form factor
ff=rms/av0;//form factor
//peak factor
Kp=h1/rms;//peak factor
```

```
mprintf("WAVEFORM 1\n");
mprintf("average value=%1.1f amps,rms value=%1.3f
   amps,formfactor=%1.3f ,peak factor=%1.3f\n",av0,
   rms,ff,Kp);
//for WAVEFORM 2
//Average Value
T=1;//assuming time period is 1
h2=100;
h3=-50;
area3=(h2+h3)*(T/2);//area under one complete cycle(
   area of a rectangle)
av=area3/T;//average value
//rms value
area_under_squared_curve=((h2)^2+(h3)^2)*(T/2);
rms1=sqrt(area_under_squared_curve/T);//rms value
//form factor
ff1=rms1/av;//form factor
//peak factor
Kp1=h2/rms1;//peak factor
mprintf("WAVEFORM 2\n");
mprintf("average value=%d volts,rms value=%2.3f volt
   ,formfactor=%1.2f ,peak factor=%1.2f\n",av,rms1,
   ff1,Kp1);
//for WAVEFORM 3
//Average Value
Vm=1;//assuming mean voltage is 1
a1=0.5*Vm*(%pi/3);//area of the triangle from 0 to (
   pi/3)
a2=Vm*(%pi/3);//area of the rectangle for period (pi
   /3) to (2*pi/3)
a3=0.5*Vm*(%pi/3);//area of the triangle from (2*pi
   /3) to pi
a=a1+a2+a3;
av2=(a/%pi);//average value
//rms value
area_under_squared_curv2=((Vm)^2*(%pi/3)*(5/3))
rms2=sqrt(area_under_squared_curv2/(%pi));//rms
   value
```

```
//form factor
ff2=rms2/av2;//form factor
//peak factor
Kp2=Vm/rms2;//peak factor
mprintf("WAVEFORM 3\n");
mprintf("average value=%1.3f volts,rms value=%1.3f volt,formfactor=%1.2f ,peak factor=%1.3f\n",av2,rms2,ff2,Kp2);
//for WAVEFORM 4
//Average Value
T2=1;//let timeperiod=1
av3=(100*(T2/2))/(T2/2);//average
//rms value
area_under_squared_curv3=((100)^2*(T2/2));
rms3=sqrt((area_under_squared_curv3)/(T2/2));//rms value
//form factor
ff3=rms3/av3;//form factor
//peak factor
Kp3=100/rms3;//peak factor
mprintf("WAVEFORM 4\n");
mprintf("average value=%d volts,rms value=%d volt,formfactor=%d ,peak factor=%d\n",av3,rms3,ff3,Kp3);
//==========================================END OF PROGRAM==============================================
```

Scilab code Exa 4.2 FORM FACTOR

```
//Chapter-4, Example 4.2, Page 130
//==========================================================================================
clc
clear
```

```
//CALCULATIONS
//for halfwave rectifier
Im=1;//assume peak value is 1
//for (0 to pi) value is (Im*sin(theta)) for (pi to 2*pi) value is 0
function y1=f1(x),y1=(Im^2)*(sin(x))^2,endfunction
a1=(intg(0,%pi,f1));
a=(a1)/(2*%pi);//mean square value
rms=sqrt(a);//rms value
function y3=f3(x),y3=(Im)*(sin(x)),endfunction
a3=(intg(0,%pi,f3));
av=a3/(2*(%pi));//average value
ff=rms/av;//form factor
pf=Im/rms;//peak factor
mprintf("for half wave rectifier\n");
mprintf("form factor=%1.2f,peak factor=%d\n",ff,pf);
//for fullwave rectifier
function y4=f4(x),y4=(Im^2)*(sin(x))^2,endfunction
a4=(intg(0,%pi,f4));
a4=a4/(%pi);
rms2=sqrt(a4);//rms value
function y5=f5(x),y5=(Im)*(sin(x)),endfunction
av2=(intg(0,%pi,f5))/(%pi);//average value
ff2=rms2/av2;//form factor
pf2=Im/rms2;//peak factor
mprintf("for full wave rectifier\n");
mprintf("form factor=%1.2f,peak factor=%1.2f",ff2,pf2);
//==========================================END OF PROGRAM==========================================
```

Scilab code Exa 4.3 RMS

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

```
==================================================================
clc
clear
//CALCULATIONS
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;
Vm=60;
V=((v1^2)+(v2^2)+(v3^2)+(v4^2)+(v5^2)+(v6^2)+(v7^2)
   +(v8^2)+(v9^2)+(v10^2))
V=sqrt(V/10);
Vav=(v1+v2+v3+v4+v5+v6+v7+v8+v9+v10)/10;//average
   value
Kf=V/Vav;//form factor
Kp=Vm/V;//peak factor
rms2=Vm/(sqrt(2));//rms voltage value with the same
   peak value
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);
//==================================END OF PROGRAM
   ==============================
```

Scilab code Exa 4.4 TIME

```
//Chapter-4, Example 4.4, Page 133
//
   ==================================================================
clc
clear
//CALCULATIONS
f=60;
Im=120;
i=96;
```

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

Scilab code Exa 4.5 RATE OF CHANGE OF CURRENT

```
//Chapter-4, Example 4.5, Page 133
//=============================================================================
clc
clear
funcprot(0)
//CALCULATIONS
Im=100;//current in amps
f=50;//freq in hz
w=2*%pi*50;//angular freq in rad/sec
//at t=0.0025
function f=myfun(t)
  f=Im*sin(w*t(1));
endfunction
t=[0.0025];
g=numdiff(myfun,t)//by using numdiff function the
    calculated value will defer to observed value by
    15
//at t= 0.005
function f1=myfun(t1)
  f1=Im*sin(w*t1(1));
endfunction
t1=[0.005];
g1=numdiff(myfun,t1);
//at t= 0.01
function f2=myfun(t2);
  f2=Im*sin(w*t2(1));
```

```
endfunction
t2=[0.01];
g2=numdiff(myfun,t2);
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);
//==========================================END OF PROGRAM==========================================
```

Scilab code Exa 4.6 EMF

```
//Chapter-4, Example 4.6, Page 134
//=============================================================================
clc
clear
//INPUT DATA
N=200;//no of turns
a=250;//area of cross-section in sq.cm
Bm=0.5;//magnetic field strength in Tesla
speed=1200;//in r.p.m
//CALCULATIONS
w=2*%pi*(speed/60);//angular freq in rad/sec
phi=Bm*a*10^-4;//area taken in sq.m
Em=N*w*phi;//maximum value of induced Emf
mprintf("maximum value of induced Emf is %d volts\n",Em);
//equation for instantaneous induced emf is e=Em*sin(w*t)
//when  plane of coil is parallel to field ,theta is 90 degrees
e1=Em*sin(%pi/2);//converted degrees to radians
mprintf("when  plane of coil is parallel to field , induced Emf is %d volts\n",e1);
```

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

Scilab code Exa 4.7 RMS

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

Scilab code Exa 4.8 RELATIVE HEATING EFFECTS

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

Scilab code Exa 4.9 RMS CURRENT

```
//Chapter-4, Example 4.9, Page 137
//=============================================================================
clc
clear
//CALCULATIONS
//for subdivision a
funcprot(0);
```

```
max=40;
rms=max/sqrt(2);
mprintf("max and rms values are %d  units and %2.2f
    units respectively\n",max,rms);
//for subdivision b
//max=A+B
//rms=(A+B)/sqrt(2)
//for subdivision c
max1=sqrt(((10)^2)+((17.3)^2));
rms1=max1/sqrt(2);
mprintf("max and rms values are %2.2f units and %2.2
    f units respectively",max1,rms1);
//note:in textbook for sub div (c) square root has
    not taken for maximum value computed
//==========================================END OF PROGRAM
    ======================================
```

Scilab code Exa 4.10 TIME

```
//Chapter-4, Example 4.10, Page 137
//
    ==========================================================================

clc
clear
//INPUT DATA
f=50;//freq in c/s
I=20;//current in A
Im=I/sqrt(2);
t=0.0025;//time in sec
//equation for instantaneous emf
i=(20*sqrt(2))*sin(2*%pi*f*t);
t1=0.0125;
i1=(20*sqrt(2))*sin(2*%pi*f*t1);
i2=14.14;
```

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

Scilab code Exa 4.11 RMS CURRENT

```
//Chapter-4, Example 4.11, Page 137
//
    ================================================================================

clc
clear
//INPUT DATA
I1=5;//current in A
I=10;//current in A
I2=I/sqrt(2);
//CALCULATIONS
i3=sqrt(((2*I1)^2)+(I2^2));
mprintf("rms value of current is %1.2f A
    respectively\n",i3);
//==========================================END OF PROGRAM
    ========================================
```

Scilab code Exa 4.12 CURRENT

```
//Chapter-4, Example 4.12, Page 138
//=============================================================================
clc
clear
//CALCULATIONS
Im=141.4;//instantaneous current
f=50;//freq in hz
w=2*%pi*f;//angular freq in rad/sec
//instantaneous current equation is i=141.4*sin(w*t);
function f=myfun(t)
  f=Im*sin(w*t(1));
endfunction
t=[0.0025];
g=numdiff(myfun,t)
mprintf("rate of change of current is %d A/sec \n",g);
function f1=myfun(t1)
  f1=Im*sin(w*t1(1));
endfunction
t1=[0.005];
g1=numdiff(myfun,t1)
mprintf("rate of change of current is %d A/sec \n",g1);
function f2=myfun(t2)
  f2=Im*sin(w*t2(1));
endfunction
t2=[0.01];
g2=numdiff(myfun,t2)
mprintf("rate of change of current is %d A/sec \n",g2);
//note:answer given in textbook for section c is wrong
//=========================================END OF PROGRAM=========================================
```

Scilab code Exa 4.13 CURRENT

```
//Chapter-4, Example 4.13, Page 138
//
clc
clear
//INPUT DATA
R=60;//resistance in ohms
Rf=50;//resistance in ohms
Rr=500;//resistance in ohms
V=120;//supply voltage in volts
f=50;//freq in hz
//CALCULATIONS
peak=V*sqrt(2);//peak value of applied voltage
peak1=peak/(R+Rf);//peak value of current in forward direction
peak2=peak/(R+Rr);//peak value of current in reverse direction
i=((2*peak1)-(2*peak2))/(2*%pi);//current in moving coil ammeter over the period 0 to 2*(%pi)
i1=((%pi/2)*((peak1)^2+(peak2)^2))/(2*(%pi));//mean current over the period 0 to 2*(%pi)
rms=sqrt(i1);//rms value in hot wire ammeter
mprintf("rms value in hot wire ammeter is %1.3f A\n",rms);
If=(peak1)/(sqrt(2));//rms value in forward direction
mprintf("rms value in forward direction is %1.2f A\n",If);
Ir=(peak2)/(sqrt(2));//rms value in reverse direction
mprintf("rms value in reverse direction is %1.2f A\n
```

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

Scilab code Exa 4.14 CURRENT

```
//Chapter-4, Example 4.14, Page 144
//
    ==============================================================================================

clc
clear
//given voltage applied is 100*sin(w*t)
//CALCULATIONS
R=10;//resisitance in ohms
//i=(100)*sin(w*t)/10=10*sin(w*t)
//instantaneous power=1000*(sin(w*t))^2
E=(100)/sqrt(2);//average value of voltage in volts
I=(10)/sqrt(2);//average value of current in amps
P=E*I;//average power in Watts
mprintf("thus average power is %1.0f W",P);
//===========================================END OF PROGRAM
    ========================================
```

Scilab code Exa 4.15 POWER

```
//Chapter-4, Example 4.15, Page 144
```

```
//
    ==========================================================================================

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

Scilab code Exa 4.16 INSTANTANEOUS CURRENT

```
//Chapter-4, Example 4.16, Page 145
//
    ==========================================================================================

clc
clear
//given voltage applied is e=100*sin(314*t)
//CALCULATIONS
E=100/sqrt(2);
w=314;
L=0.2;//inductannce in henry
// indefinitely integrating e and later dividing by
    L we get it as
//i=-1.592*cos(314*t);//instantaneous current
//instantaneous power=e*i=-79.6*sin(628t)
P=0;//average power=0
Xl=w*L;//inductance in ohms
```

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

Scilab code Exa 4.17 INDUCTIVE REACTANCE

```
//Chapter-4, Example 4.17, Page 145
//=============================================================================
clc
clear
//CALCULATIONS
L=0.225;//inductance in henry
e=120;//voltage in volts
f=50;//frequency in c/s
Xl=(2*%pi*f*L);//inductive reactance in ohms
mprintf("Inductive reactance in ohms is %2.2f ohms\n",Xl);
L=0.2;//inductance in henry
Im=2.4;//peak value of current in A
//instantaneous voltage equation is e=(sqrt(2)*120*sin(314*t))
// indefinitely integrating e and later dividing by L we get it as
//i=-2.4*cos(314t);//instantaneous current in A
I=Im/(sqrt(2));//in A
mprintf("Current is %1.3f A\n",I);
m=(e*sqrt(2)*Im)/2;//maximum power delivered in watts
```

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

Scilab code Exa 4.18 INDUCTIVE REACTANCE

```
//Chapter−4, Example 4.18, Page 146
//=============================================================================
clc
clear
//CALCULATIONS
L=0.01;//inductance in henry
//equation of current is 10*cos(1500*t)
w=1500;//angular freq in rad/sec
Xl=(w*L);//inductive reactance in ohms
mprintf("inductive reactance is %1.1f ohms\n",Xl);
function f=myfun(t)
  f=10*cos(w*t);
q=derivative(f);
endfunction//derivation yields e=−150*sin(1500*t)
mprintf("equation for voltage across is e=−150*sin(1500*t)")
X2=40;//given new inductance in ohms
f2=X2/(2*%pi*L);//freq in hz
mprintf("thus at freq %d hz inductance will be 40
```

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

Scilab code Exa 4.19 CAPACITIVE REACTANCE

```
//Chapter-4, Example 4.19, Page 146
//
    ====================================================================================================

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

Scilab code Exa 4.20 IMPEDANCE

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

Scilab code Exa 4.21 CURRENT AND PHASE

```
//Chapter-4, Example 4.21, Page 147
//=============================================================
clc
clear
 function [polar] = r2p(x,y)//function to convert rectangular to polar
 polar = ones(1,2)
 polar(1) = sqrt ((x ^2) +(y^2))
 polar(2) = atan (y/x)
 polar(2) =(polar (2)*180)/%pi
 endfunction
 function [ rect ] = p2r(r,theta)//function to convert polar to rectangular
 rect = ones(1 ,2)
 theta =( theta *%pi) /180
 rect (1)=r* cos(theta)
 rect (2)=r* sin(theta)
 endfunction
//CALCULATIONS
I1=p2r(300,0);
disp(I1);
I2=p2r(350,30);
disp(I2);
I=I1+I2;
disp(I);
i3=r2p(I(1),I(2))
disp(i3);
mprintf("Thus resultant current is 627.9 A and it leads 300 A by 16 degrees")
//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
//=================================END OF PROGRAM=============================
```

Scilab code Exa 4.22 POWER

```
//Chapter-4, Example 4.22, Page 147
//
clc
clear
funcprot(0)
function [polar] = r2p(x,y)//function to convert rectangular to polar
 polar = ones(1,2)
 polar(1) = sqrt ((x ^2) +(y^2))
 polar(2) = atan (y/x)
 polar(2) =(polar (2)*180)/%pi
 endfunction
 function [ rect ] = p2r(r,theta)//function to convert polar to rectangular
 rect = ones(1 ,2)
 theta =( theta *%pi) /180
 rect (1)=r* cos(theta)
 rect (2)=r* sin(theta)
 endfunction
//v=230*sin(100*%pi*t)
//CALCULATIONS
R=100;//resistance in ohms
L=319;//inductance in mH
Xl=(100*%pi*L*10^-3);//inductive reactance in ohms
Z=R+((%i)*(Xl));//impedance in ohms
Z=r2p(R,Xl);//impedance in polar form
disp(Z);
Z1=p2r(Z(1),Z(2));
disp(Z1);
//i=230/1.414*sin(100*%3.14*t-45)=1.626*sin(100*%3
```

```
.14*t-45)
i=(1.626/(sqrt(2)));//rms current in A
P=(i)^2*R;//power taken by the coil in W
mprintf("power taken by the coil is %3.1f W",P);
//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
//==================================END OF PROGRAM==================================================================
```

Scilab code Exa 4.23 RMS CURRENT

```
//Chapter-4, Example 4.23, Page 148
//==================================================================================
clc
clear
function [polar] = r2p(x,y)//function to convert rectangular to polar
 polar = ones(1,2)
 polar(1) = sqrt ((x ^2) +(y^2))
 polar(2) = atan (y/x)
 polar(2) =(polar (2)*180)/%pi
 endfunction
 function [ rect ] = p2r(r,theta)//function to convert polar to rectangular
 rect = ones(1 ,2)
 theta =( theta *%pi) /180
 rect (1)=r* cos(theta)
 rect (2)=r* sin(theta)
 endfunction
//e1=230*sin(w*t)
```

```
//e2=230*sin(w*t*%pi/6)
//CALCULATIONS
E1=p2r(230,0);//impedance in rectangular form
disp(E1);
E2=p2r(230,30);
disp(E2);
E=E1+E2;
E=E/sqrt(2);
E=r2p(E(1),E(2));
disp(E)
Z=r2p(8,6);
disp(Z);
I1=E(1)/Z(1);
disp(I1)
theta=E(2)-Z(2);
disp(theta);
phi=cos(theta*%pi/180)
disp(phi)
P1=(E(1))*(I1)*(phi);//power supplied in Watts
mprintf("Thus Rms current and power supplied are %2
    .1f A and %f W respectively",I1,P1);
//note here power calculated my vary as we took many
     decimal values for calculation.Please check the
    calculations
//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
//===================================END OF PROGRAM
    ==================================================================
```

Scilab code Exa 4.24 CURRENT

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

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

Scilab code Exa 4.25 RMS CURRENT

```
//Chapter-4, Example 4.25, Page 149
//=====================================================================
clc
clear
funcprot(0)
function [polar] = r2p(x,y) //function to convert rectangular to polar
 polar = ones(1,2)
 polar(1) = sqrt ((x ^2) +(y^2))
 polar(2) = atan (y/x)
```

```
polar(2) =(polar (2)*180)/%pi
endfunction
function [ rect ] = p2r(r,theta)//function to
   convert polar to rectangular
rect = ones(1 ,2)
theta =( theta *%pi) /180
rect (1)=r* cos(theta)
rect (2)=r* sin(theta)
endfunction
//CALCULATIONS
//v=230*sin(314*t)+60*sin(942*t)
V=230;//voltage in volts
V1=60;//voltage of harmonic in volts
R=10;//resistance in ohms
L=0.3;//inductance in henry
C=100*10^-6;//capacitance in F
//Branch with Resistor (R)
I1m=V/R;//current in A
I1m=I1m/(sqrt(2));//rms current in A
I3m=V1/R;//current in A
I3m=I3m/(sqrt(2));//rms current in A
I=sqrt((I1m)^2+(I3m)^2);//rms current in A
Pr=((I)^2)*(R);//power in Watts
//Branch with inductor(L)
Z1=(10+((%i)*(314*0.03)));//impedance to fundamental
   component
M=sqrt((10)^2+(9.42)^2);//magnitude of Z1 in polar
  form
theta=atan(9.42/10)*(180/%pi);//angle of Z1 in polar
   form
I2m=V/M;//fundamental current in A
I2m=I2m/(sqrt(2));//rms current in A
I4m=V1/M;//third harmonic component of current
I4m=I4m/(sqrt(2));//rms current in A
I1=((I2m)^2+(I4m)^2);//total rms current in A
Pr1=(I1)*(R);//Power in Watts
//branch with capacitor
X1=1/(314*10^-4);//reactance to fundamental
```

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

Chapter 5

SINGLE PHASE AC CIRCUITS

Scilab code Exa 5.1 POLAR

```
//Chapter-5, Example 5.1, Page 157
//=============================================================================
clc
clear
 function [polar] = r2p(x,y)//function to convert rectangular to polar
 polar = ones(1,2)
 polar(1) = sqrt ((x ^2) +(y^2))
 polar(2) = atan (y/x)
 polar(2) =(polar (2)*180)/%pi
 endfunction
 function [ rect ] = p2r(r,theta)//function to convert polar to rectangular
 rect = ones(1 ,2)
 theta =( theta *%pi) /180
 rect (1)=r* cos(theta)
 rect (2)=r* sin(theta)
```

```
 endfunction
//CALCULATIONS
I1=r2p(7,-5);
disp(I1);
I2=r2p(-9,6);
I2(2)=I2(2)+(180);//this belongs to quadrant 2 and hence 180 degrees should be added
disp(I2);
I3=r2p(-8,-8);
I3(2)=I3(2)+(180);//this belongs to quadrant 3 and hence 180 degrees should be added
disp(I3);
I4=r2p(6,6);
disp(I4);
//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
//=================================END OF PROGRAM==================================================
```

Scilab code Exa 5.2 POLAR

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

```
polar(2) =(polar (2)*180)/%pi
endfunction
function [ rect ] = p2r(r,theta)//function to
    convert polar to rectangular
rect = ones(1,2)
theta =( theta *%pi) /180
rect (1)=r* cos(theta)
rect (2)=r* sin(theta)
endfunction
//CALCULATIONS
//for subdivision 1
I1=p2r(10,60);
I2=p2r(8,-45);
I3=I1+I2;
disp(I3);
I4=r2p(I3(1),I3(2));
disp(I4)
//for subdivision 2
I5=r2p(5,4);
I6=r2p(-4,-6);
I7(1)=(I5(1))*(I6(1));
I7(2)=(I5(2)+I6(2));
I7(2)=I7(2)-180;
disp(I7);
//for subdivision 3
I8=r2p(-2,-5);
I9=r2p(5,7);
I10(1)=I8(1)/I9(1);
I10(2)=I8(2)-I9(2);
I10(2)=I10(2)-180
disp(I10);
//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
//=========================================END OF PROGRAM
   ==========================================================================
```

Scilab code Exa 5.3 IMPEDANCE

```
//Chapter-5, Example 5.3, Page 160
//=============================================================================
clc
clear
//given i(t)=5*sin(314*t+(2*%pi/3))&& v(t)=20*sin
    (314*t+(5*%pi/6))
//CALCULATIONS
P1=2*(%pi/3);//phase angle of current in radians
P1=P1*(180/%pi);//phase angle of current in degrees
P2=5*(%pi/6);//phase angle of voltage in radians
P2=P2*(180/%pi);//phase angle of voltage in degrees
P3=P2-P1;//current lags voltage by P3 degrees
P4=P3*%pi/180;
pf=cos(P4);//lagging pf
Vm=20;//peak voltage
Im=5;//peak current
Z=Vm/Im;//impedance in ohms
R=(Z)*cos(P4);//resistance in ohms
Xl=sqrt((Z)^2-(R)^2);//reactance
W=314;
L=Xl/W;//inductance in henry
V=Vm/sqrt(2);//average value of voltage
I=Im/sqrt(2);//average value of current
av=(V*I)*cos(P4);//average power in watts
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);
//=================================END OF PROGRAM
=============================================================================
```

Scilab code Exa 5.4 IMPEDANCE

```
//Chapter-5, Example 5.4, Page 161
//=============================================================================
clc
clear
//INPUT DATA
I=10;//given current in A
P=1000;//power in Watts
V=250;//voltage in volts
f=25;//frequency in Hz
//CALCULATIONS
R=P/((I)^2);//resistance in ohms
Z=V/I;//impedance in ohms
Xl=sqrt((Z)^2-(R)^2);//reactance in ohms
L=Xl/(2*%pi*f);//inductance in Henry
Pf=R/Z;//power factor,lagging,pf=cos(phi)
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);
//=================================END OF PROGRAM=============================================================================
```

Scilab code Exa 5.5 IMPEDANCE

```
//Chapter-5, Example 5.5, Page 162
```

```
//
=====================================================================
clc
clear
//INPUT DATA
V=250;//supply voltage in volts
f=50;//frequency in hz
Vr=125;//voltage across resistance in volts
Vc=200;//voltage across coil in volts
I=5;//current in A
//CALCULATIONS
R=Vr/I;//resistance in ohms
Z1=Vc/I;//impedance of coil in ohms
//Z1=sqrt((R1)^2+(Xl)^2)-------eqn(1)
Z=V/I;//total impedance in ohms
//Z=sqrt((R+R1)^2+(Xl)^2)------eqn(2)
//solving eqn(1)and eqn(2) we get R1 as follows
R1=(((Z)^2-(Z1)^2)-(R)^2)/(2*R);//in ohms
Xl=sqrt((Z1)^2-(R1)^2);//reactance of coil in ohms
P=((I)^2*R1);//power absorbed by the coil in Watts
Pt=((I)^2)*(R+R1);//total power in Watts
mprintf("thus impedance,resistance,reactance are %d
    ohms,%d ohms,%2.2f ohms respectively\n",Z1,R,Xl);
mprintf("power absorbed and total power are %3.1f W
    and %3.1f W respectively",P,Pt)

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

Scilab code Exa 5.6 RESISTANCE

```
//Chapter-5, Example 5.6, Page 163
//
```

```
clc
clear
//INPUT DATA
V=240;//supply voltage in volts
Vl=171;//voltage across inductor in volts
I=3;//current in A
phi=37;//power factor laggging in degrees
//CALCULATIONS
Zl=Vl/I;//impedance of coil in ohms
//Zl=sqrt((R1)^2+(Xl)^2)-------eqn(1)
Z=V/I;//total impedance in ohms
//Z=sqrt((R+R1)^2+(Xl)^2)------eqn(2)
pf=cos(phi*%pi/180);//powerfactor
Rt=pf*Z;//total resistance in ohms//Rt=(R+R1)
//substituting Rt value in eqn(2) we find Xl as follows
Xl=sqrt((Z)^2-(Rt)^2);//reactance of inductor in ohms
//ubstituting Xl value in eqn(1) we find R1 as follows
R1=sqrt((Zl)^2-(Xl)^2);//resistance of inductor in ohms
R=Rt-R1;//resistance of resistor in ohms
mprintf("Thus resistance of resistor  is %2.2f ohms\n",R);
mprintf("Thus resisitance and reactance of inductor are %2.2f ohms and %2.2f ohms respectively",R1,Xl)

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

Scilab code Exa 5.7 CURRENT

```
//Chapter-5, Example 5.7, Page 164
//=============================================================================
clc
clear
//INPUT DATA
V=100;//supply voltage in volts
//for COIL A
f=50;//frequency in Hz
I1=8;//current in A
P1=120;//power in Watts
//for COIL B
I2=10;//current in A
P2=500;//power in Watts
//CALCULATIONS
//FOR COIL A
Z1=V/I1;//impedance of coil A in ohms
R1=P1/(I1)^2;//resistance of coil A in ohms
X1=sqrt(((Z1)^2-(R1)^2));//reactance of coil A in
    ohms
//FOR COIL B
Z2=V/I2;//impedance of coil B in ohms
R2=P2/(I2)^2;//resistance of coil B in ohms
X2=sqrt(((Z2)^2-(R2)^2));//reactance of coil B in
    ohms
//When both COILS A and B are in series
Rt=R1+R2;//total resistance in ohms
Xt=X1+X2;//total reactance in ohms
Zt=sqrt((Rt)^2+(Xt)^2);//total impedance in ohms
It=V/Zt;//current drawn in A
P=((It)^2)*(Rt);//power taken in watts
mprintf("Thus current drawn and power taken in watts
    are %2.2f A and %3.2f W respectively",It,P);
//=================================END OF PROGRAM
=============================================================================
```

Scilab code Exa 5.8 IMPEDANCE

```
//Chapter-5, Example 5.8, Page 167
//=============================================================================
clc
clear
//INPUT DATA
R=100;//resistance in ohms
C=50*10^-6;//capacitance in F
V=200;//voltage in Volts
f=50;//frequency in Hz
//Z=R-(%i)*(Xc)------->impedance
Xc=1/(2*%pi*f*C);//capacitive reactance in ohms
Z=sqrt((R)^2+(Xc)^2);//impedance in ohms
I=V/Z;//current in A
pf=R/Z;//power factor ------>cos(phi)---->leading
phi=acos(0.844);//phase angle in radians
phi=phi*180/%pi;//phase angle in degrees
Vr=(I)*(R);//voltage across resistor
Vc=(I)*(Xc);//votage across capacitor
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);
mprintf("voltage across resistor and capacitor are %d V and %3.2f V respectively",Vr,Vc)

//=================================END OF PROGRAM=============================================

;
```

Scilab code Exa 5.9 POWER FACTOR

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

;
```

Scilab code Exa 5.10 IMPEDANCE

```
//Chapter-5, Example 5.10, Page 169
```

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

;
```

Scilab code Exa 5.11 RESISTANCE

```
//Chapter-5, Example 5.11, Page 169
//==================================================================
clc
clear
//INPUT DATA
```

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

;
```

Scilab code Exa 5.12 IMPEDANCE

```
//Chapter-5, Example 5.12, Page 170
//====================================================================================
clc
```

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

;
```

Scilab code Exa 5.13 INDUCTANCE

```
//Chapter-5, Example 5.13, Page 170
//==========================================================================

clc
clear
//INPUT DATA
C=0.05;//capacitance in uf
F=500;//freq in hz
```

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

;
```

Scilab code Exa 5.14 CURRENT

```
//Chapter-5, Example 5.14, Page 171
//
   =========================================================================

clc
clear
//INPUT DATA
V=200;//voltage in V
R=50;//resistance in ohms
L=0.5;//inductance in Henry
F=50;//freq in hz
//CALCULATIONS
Xl=2*%pi*F*L;//inductive reactance
Z=(R)+((%i)*Xl)//impedance
disp(Z);
z1=sqrt((R)^2+(Xl)^2);//magnitude
theta=atan(Xl/R);//angle in radians
I=V/z1;//current in A
P=V*I*cos(theta);//power supplied in W
//here capacitive reactance equals inductive
   reactance
```

```
//hence Xc=Xl
C=1/(2*%pi*F*Xl);//capacitance in uf
r=(V/I)-(R);//additional resistance to be added in
    series
mprintf("Thus current and power required are % 1.2f
   A and %2.2f W respectively\n",I,P);
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);
//==============================================END OF PROGRAM
   ====================================================================================

;
```

Scilab code Exa 5.15 CAPACITANCE

```
//Chapter-5, Example 5.15, Page 171
//
   ====================================================================================

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

```
;
```

Scilab code Exa 5.16 INDUCTIVE REACTANCE

```
//Chapter-5, Example 5.16, Page 175
//

clc
clear
//INPUT DATA
R=10;//resistance in ohms
L=0.1;//inductance in Henry
C=150;//capacitor in uf
V=200;//voltage in V
f=50;//frequency in hz
//CALCULATIONS
Xc=1/(2*%pi*f*C*10^-6);//Capacitive reactance in
    ohms
Xl=(2*%pi*f*L);//inductive reactance in ohms
Z=R+((%i)*(Xl-Xc));//impedance in ohms
z1=sqrt((R)^2+(Xl-Xc)^2);//magnitude of Z
I=V/z1;//current in A
pf=R/z1;//power factor---->cos(phi)
//As Xl-Xc is inductive,pf is lagging
z2=sqrt((R^2)+(Xl)^2);//impedance of coil in ohms
Vl=I*(z2);//voltage across coil in volts
Vc=I*(Xc);//voltage across capacitor in volts
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);
```

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

;
```

Scilab code Exa 5.17 RESISTANCE

```
//Chapter-5, Example 5.17, Page 176
//
==============================================================================

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

```
;
```

Scilab code Exa 5.18 CAPACITANCE

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

```
;
```

Scilab code Exa 5.19 RESISTANCE AND CAPACITANCE

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

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

Scilab code Exa 5.20 ADMITTANCE

```
//Chapter-5, Example 5.20, Page 182
//
===================================================================================

clc
clear
//INPUT DATA
R=10;//resistance in ohms
L=0.1;//inductance in henry
f=50;//frequency in hz
//CALCULATIONS
Xl=(2*%pi*f*L);//inductive reactance in ohms
Z=R+((%i)*(Xl));//impedance in ohms
Y=inv(Z);//admittance in mho
disp(Y);
y=abs(Y);//admittance in mho
mprintf("admittance is %1.5f mho",y);
//==========================================END OF PROGRAM
===================================================================================
```

Scilab code Exa 5.21 ADMITTANCE

```
//Chapter-5, Example 5.21, Page 182
//
===================================================================================
```

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

Scilab code Exa 5.22 ADMITTANCE

```
//Chapter-5, Example 5.22, Page 182
//
    ==================================================================
clc
clear
//INPUT DATA
Z1=7+((%i)*5);//impedance of branch1 in ohms
Z2=10-((%i)*8);//impedance  of branch2 in ohms
V=230;//supply voltage in volts
f=50;//frequency in hz
//CALCULATIONS
Y1=1/(Z1);//admittance of branch1 in mho
Y2=1/(Z2);//admittance of branch2 in mho
Y=Y1+Y2;//admittance of combined circuit
disp(Y);
g=abs(Y);//conductance in mho;
B=atan(imag(Y)/real(Y));//susceptance in mho
I=V*(Y);//current
disp(I);//total current taken from mains in A
z=atan(imag(I)/real(I));
pf=cos(z);//power factor
```

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

Scilab code Exa 5.23 FREQUENCY

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

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

Scilab code Exa 5.24 CURRENT

```
//Chapter-5, Example 5.24, Page 184
//
    ==========================================
clc
clear
//INPUT DATA
L=0.05;//inductance in henry
R2=20;//resistance in ohms
R1=15;//resistance in ohms
V=200;//supply voltage in volts
f=50;//frequency in hz
//CALCULATIONS
//for branch 1
Z1=(R1)+((%i)*(2*%pi*f*L));//impedance in ohms
Y1=inv(Z1);//admittance in branch
I1=V*(Y1);//current in branch
disp(I1);
i1=abs(I1);//magnitude of current
//for branch 2
Y2=1/R2;//admittance in branch
I2=V*Y2;//current in branch
i2=abs(I2);//magnitude of current
I=I1+I2;//total current in A
i=abs(I);//magnitude of total current
theta=atan(imag(I)/real(I));//angle in radians
```

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

Scilab code Exa 5.25 TOTAL CURRENT

```
//Chapter-5, Example 5.25, Page 185
//
    ==================================================================
clc
clear
//INPUT DATA
L=6;//inductance in millihenry
R2=50;//resistance in ohms
R1=40;//resistance in ohms
C=4;//capacitance in uf
V=100;//voltage in volts
f=800;//frequency in hz
//CALCULATIONS
Xl=(2*%pi*f*L*10^-3);//inductive reactance in ohms
Xc=1/(2*%pi*f*C*10^-6);//capacitive reactance in
    ohms
Y1=inv((R1)+(%i*Xl));//admittance of branch1 in mho
Y2=inv((R2)-(%i*Xc));//admittance of branch2 in mho
I1=V*(Y1);//current in branch 1
I2=V*(Y2);//current in branch 2
I=I1+I2;//total curremt in A
theta=(atan(imag(I1)/real(I1))-atan(imag(I2)/real(I2
```

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

Scilab code Exa 5.26 POWER

```
//Chapter-5, Example 5.26, Page 186
//
   ==================================================================================

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

Scilab code Exa 5.27 CURRENT

```
//Chapter-5, Example 5.27, Page 187
//=============================================================================
clc
clear
//INPUT DATA
V=200;//voltage in volts
f=50;//frequency in hz
R1=10;//resistance in ohms
L1=0.0023;//inductance in henry
R2=5;//resistance in ohms
L2=0.035;//inductance in henry
//CALCULATIONS
Xl1=(2*%pi*f*L1);//inductive reactance in branch 1
    in ohm
Xl2=(2*%pi*f*L2);//inductive reactance in branch 2
    in ohm
Y1=inv(10+(%i*7.23));//admittance of branch 1 in mho
Y2=inv(5+(%i*10.99));//admittance of branch 2 in mho
Y=Y1+Y2;//total admittance in mho
I1=V*(Y1);//current through branch1
I2=V*(Y2);//current through branch2
I=I1+I2;//total current in A
theta=atan(imag(I)/real(I));//angle in radians
pf_of_combination=cos(theta);//powerfactor---->
    lagging
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));
mprintf("pf of combination is %1.3f",
    pf_of_combination);
```

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

Scilab code Exa 5.28 CURRENT

```
//Chapter-5, Example 5.28, Page 189
//
    ==================================================
clc
clear
//INPUT DATA
f=50;//freq in hz
V=100;//volatge in V
L1=0.015;//inductance in branch 1 in henry
L2=0.08;//inductance in branch 2 in henry
R1=2;//resistance of branch 1 in ohms
x1=4.71;//reactance of branch 1 in ohms
R2=1;//resistance of branch 2 in ohms
x2=25.13;//reactance of branch 2 in ohms
Z1=(R1)+(%i*x1);//impedance of branch1 in ohms
Z2=(R2)+(%i*x2);//impedance of branch1 in ohms
I1=V/Z1;//current in branch 1 in A
printf("current in branch 1 in A")
disp(I1);
I2=V/Z2;//current in branch 2 in A
printf("current in branch 2 in A")
disp(I2);
I3=I1+I2;//total current in A
printf("total current in A")
disp(I3);
//note:Answer for real part of total current given
    in textbook is wrong.Please check the
    calculations
```

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

Scilab code Exa 5.29 ADMITTANCE

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

Scilab code Exa 5.30 ADMITTANCE

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

```
disp(Y);
//==========================================END OF PROGRAM==========================================
```

Scilab code Exa 5.31 RESONANT FREQUENCY

```
//Chapter-5, Example 5.31, Page 196
//==================================================================
clc
clear
//INPUT DATA
R=10;//resistance in ohms
L=10;//inductance in milli henry
C=1;//capacitance in uF
V=200;//applied voltage in volts
//CALCULATIONS
fr=1/(2*%pi*(sqrt(L*C*10^-3*10^-6)));//resonant frequency in hz
I0=V/(R);//current at resonance in A
Vr=I0*R;//voltage across resistance in volts
Xl=2*%pi*fr*L*10^-3;//inductance in ohms
Vl=I0*Xl;//voltage across inductor in volts
Xc=inv(2*%pi*fr*C*10^-6);//capacitance in ohms
Vc=I0*Xc;//voltage across capacitor in volts
wr=2*%pi*fr//angular resonant frewuency in rad/sec
Q=(wr*L*10^-3)/(R);//quality factor
Bw=(fr/Q);//bandwidth in hz
mprintf("Thus resonant frequency and current are %4.2f hz and %d A respectively\n",fr,I0);
mprintf("voltages across resistance,inductance and capacitance are %d V,%d V and %d V respectively\n",Vr,Vl,Vc);
```

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

Scilab code Exa 5.32 CIRCUIT CONSTANTS

```
//Chapter-5, Example 5.32, Page 196
//==================================================================================================

clc
clear
//INPUT DATA
V=220;//applied voltage in volts
f=50;//frequency in hz
Imax=0.4;//maximum current in A
Vc=330;//voltage across capacitance in volts
//at resonance condition I0=0.4 A
I0=0.4//current in A
//CALCULATIONS
Xc=(Vc)/(I0);//capacitive reactance in ohms
C=inv(2*%pi*f*Xc);//capacitance in F
//at resonance condition Xc=Xl, hence
L=Xc/(2*%pi*f);//inductance in henry
R=V/(Imax);//resistance in ohms
mprintf("Thus resistance,inductance and capacitance are %d ohms,%1.2f H and %g F respectively\n",R,L,C);
//==========================================END OF PROGRAM==========================================
```

Scilab code Exa 5.33 RESONANT FREQUENCY

```
//Chapter-5, Example 5.33, Page 197
//
    ====================================================================

clc
clear
//INPUT DATA
R1=5;//resistance of branch1 in ohms
R2=2;//resistance of branch2 in ohms
L=10;//inductance in mH
C=40;//capacitance in uF
//CALCULATIONS
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
mprintf("Thus resonant frequency is %f hz",fr);
//=================================END OF PROGRAM
    ====================================================================
```

Scilab code Exa 5.34 FREQUENCY

```
//Chapter-5, Example 5.34, Page 197
//
    ====================================================================

clc
clear
//INPUT DATA
R=20;//resistance in ohms
```

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

Scilab code Exa 5.35 BANDWIDTH

```
//Chapter-5, Example 5.35, Page 198
//=================================================================================
clc
clear
//INPUT DATA
Q=250;//quality factor
fr=1.5*10^6;//resonant freq in hertz
//CALCULATIONS
Bw=(fr)/(Q);//bandwidth in Hz
hf1=fr+Bw;//half power freq 1
hf2=fr-Bw;//half power freq 2
mprintf("Thus bandwidth is %d hz\n",Bw);
mprintf("Thus value of half-power frequencies are %g hz and %g hz",hf1,hf2);
//==========================================END OF PROGRAM ==================================================
```

Scilab code Exa 5.36 RESONANT FREQUENCY

```
//Chapter-5, Example 5.36, Page 198
//=============================================================================
clc
clear
//INPUT DATA
L=40*10^-3;//inductance in henry
C=0.01*10^-6;//capacitance in uf
//CALCULATIONS
fr=1/(2*%pi*sqrt(L*C));//resonant frequency
mprintf("Thus resonant frequency is %d hz\n",fr);
//=================================END OF PROGRAM==============================
```

Scilab code Exa 5.37 RESONANT FREQUENCY

```
//Chapter-5, Example 5.37, Page 198
//=============================================================================
clc
clear
//INPUT DATA
V=120;//source voltage in volts
R=50;//resistance in ohms
L=0.5;//inductance in Henry
C=50;//capacitance in uF
```

```
//CALCULATIONS
//at Resonance
fr=(1/(2*%pi*(sqrt(L*C*10^-6))));//resonant frequency in hz
I0=V/R;//current at resonance in A
Vl=(%i)*(I0*L);//voltage developed across inductor in volts
Vc=(-%i)*(I0*L);//voltage developed across capacitor in volts
Q=(inv(R))*(sqrt(L/(C*10^-6)));//quality factor
Bw=(fr)/(Q);//Bandwidth in Hz
//given resonance is to occur at 300 rad/sec,then
wr=300;//wr=(2*%pi*f*r)-------->measured in Hz
//wr=inv(sqrt(L*Cn))
Cr=inv(L*(wr)^2);//capacitance required in uF
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);
mprintf("New value of capacitance at 300 rad/sec is %g F",Cr)
//===========================================END OF PROGRAM==============================================================================
```

Scilab code Exa 5.38 Q FACTOR

```
//Chapter-5, Example 5.38, Page 199
//==============================================================================
clc
clear
//INPUT DATA
Q=45;//quality factor
f1=600*10^3;//freq in Hz
```

```
f2=1000*10^3;//freq in Hz
//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
R1=1;//resistance in ohm
R2=1.5;//resistance in ohm
//CALCULATIONS
W1=2*%pi*f1;//angular freq 1 in rad/sec
W2=2*%pi*f2;//angular freq 2 in rad/sec
Q=45;//quality factor
L=(Q*R1)/(W1);//inductance in henry
Q1=(W2*L)/(R2);//new quality factor
mprintf("Thus new quality factor is %d",Q1);
//==========================================END OF PROGRAM==========================================================
```

Scilab code Exa 5.39 SINGLE PHASE AC CIRCUITS

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

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

Scilab code Exa 5.40 RESONANT FREQUENCY

```
//Chapter-5, Example 5.40 , Page 200
//
clc
clear
//INPUT DATA
R=10;//resistance in ohm
L=10^-3;//inductance in henry
C=1000*10^-12;//capacitance in Farads
V=20;//voltage in volts
//CALCULATIONS
fr=inv(2*%pi*sqrt(L*C));//resonant frequency in Hz
Q=(inv(R))*(sqrt(L/C));//Q-factor
Bw=fr/Q;//bandwidth in Hz
hf1=fr+Bw;//halfpower freq1 in Hz
hf2=fr-Bw;//halfpower freq2 in Hz
mprintf("Thus resonant freq ,Q-factor and new halfpower frequencies are %d hz ,%d ,%g hz ,%g hz respectively",fr,Q,hf1,hf2);
//END OF PROGRAM
```

Scilab code Exa 5.41 POWER

```
//Chapter-5, Example 5.41, Page 208
//=============================================================================
clc
clear
//INPUT DATA
P1=1000;//power1 in watts
P2=1000;//power2 in watts
//CALCULATIONS
//for case(1)
Pt=P1+P2;//total power in watts
phi=atan(sqrt(3)*((P2-P1)/(P2+P1))*(180/%pi));//
    since tan(phi)=sqrt(3)*((P2-P1)/(P2+P1)))
pf=cos(phi);
mprintf("Thus power and powerfactor are %d W ,%d
    respectively\n",Pt,pf);
//for case(2)
P3=1000;//power3 in watts
P4=-1000;//power4 in watts
Pt1=P3+P4;//total power in watts
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
mprintf("Thus power and powerfactor are %d W ,%d
    respectively",Pt1,pf1);
//==================================END OF PROGRAM
    =============================================================================
```

Scilab code Exa 5.42 REAL POWER

```
//Chapter-5, Example 5.42, Page 209
//=============================================================================
clc
clear
//INPUT DATA
V1=400;//voltage in volts
Z1=(3+((%i)*4));//impedance in ohms
//CALCULATIONS
//in star connected system,phase voltage=(line
   voltage)
Ep=V1/(sqrt(3));//voltage in volts
Ip=Ep/Z1;//current in A
ip1=abs(Ip);//line current in A
theta=atan((imag(Ip)/real(Ip)));
Pt=sqrt(3)*V1*ip1*cos(theta);//total power consumed
   in load in W
mprintf("Thus total power consumed in load is %f W",
   Pt);
//note:for line current the answer given is 46.02A
   instead of 46.2 A and hence total power consumed
   changes
//=================================END OF PROGRAM
   ==============================================================================
```

Scilab code Exa 5.43 LINE TO NEUTRAL VOLTAGE

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

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

Scilab code Exa 5.44 CURRENT

```
//Chapter-5, Example 5.44, Page 209
//==================================================================
clc
clear
//INPUT DATA
Z1=(6-((%i)*8));//impedance1 in ohms
Z2=(16+((%i)*12));//impedance2 in ohms
I1=(12+((%i)*16));//current in A
//CALCULATIONS
V=I1*Z1;//applied voltage in volts
I2=V/(Z2);//current in other branch in A
mprintf("current in other branch in Amps")
disp(I2);
```

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

Scilab code Exa 5.45 THREE PHASE POWER

```
//Chapter-5, Example 5.45, Page 210
//==================================================================================
clc
clear
//INPUT DATA
Vl=415;//voltage in volts
Z=(4+((%i)*6));//impedance in each phase in ohm
//CALCULATIONS
Ip=Vl/Z;//current in each phase in A
ip1=abs(Ip);//magnitude of Ip
Il=(sqrt(3))*(ip1);//line current in A
phi=atan((imag(Ip)/real(Ip)))
P=(sqrt(3))*Vl*Il*cos(phi);//power supplied in W
mprintf("Thus power supplied is %d W",P);
//note:the cosfunction of scilab and calculator will differ slightly
//==========================================END OF PROGRAM==========================================
```

Scilab code Exa 5.46 IMPEDANCE

```
//Chapter-5, Example 5.46, Page 210
//=============================================================================
clc
clear
//INPUT DATA
Vl=400;//voltage in volts
Il=20;//current in A
f=50;//freq in hz
pf=0.3//power factor
//CALCULATIONS
Ip=Il/sqrt(3);//phase current in A
Z=Vl/Ip;//impedance in each phase in ohms
phi=acos(0.3);//angle in radians
Zb=Z*(cos(phi)+(%i)*sin(phi));//impedance connected in each phase
mprintf("Thus impedance connected in each phase in ohms");
disp(Zb);
//=================================END OF PROGRAM==============================
```

Scilab code Exa 5.47 POWER

```
//Chapter-5, Example 5.47, Page 210
//=============================================================================
```

```
clc
clear
//INPUT DATA
P1=6*10^3;//power in Kw
P2=-1*10^3;//power in Kw
//CALCULATIONS
P=P1+P2;//total power in Kw
a=atan(sqrt(3)*((P2-P1)/(P2+P1)));
pf=cos(a);//power factor
mprintf("Thus power and power factor are %d W and %1.2f respectively",P,pf);
//==================================END OF PROGRAM==================================
```

Scilab code Exa 5.48 POWER FACTOR

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

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

Scilab code Exa 5.49 LINE TO NEUTRAL VOLTAGE

```
//Chapter-5, Example 5.49, Page 211
//
   ====================================================================================
clc
clear
//INPUT DATA
Il=10;//current in Amps
Vl=400;//line voltage in volts
//CALCULATIONS
Vp=Vl/(sqrt(3));//line to neutral voltage
Ip=Il;//phase current in Amps
mprintf("Thus line to neutral voltage  and phase
   current are %1.0f V and %d A respectively",Vp,Ip)
   ;
//==========================================END OF PROGRAM
   ====================================================================================
```

Scilab code Exa 5.50 POWER

```
//Chapter-5, Example 5.50, Page 211
```

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

Chapter 12

JUNCTION DIODE AND ITS APPLICATIONS

Scilab code Exa 12.1 PEAK RMS AND AVERAGE CURRENT

```
//Chapter-12, Example 12.1, Page 341
//
clc
clear
//INPUT DATA
Vm=325;//voltage in volts
Rl=1000;//resistive load in ohms
rf=100;//forward resistance in ohms
//CALCULATIONS
//for subdivision (a)
Im=Vm/(rf+Rl);//peak value of current in A
Idc=Im/(%pi);//average current in A
Irms=Im/2;//rms value of current in A
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);
//for subdivision (b)
```

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

Scilab code Exa 12.2 AC VOLTAGE

```
//Chapter-12, Example 12.2, Page 341
//
    =================================================================

clc
clear
//INPUT DATA
Vdc=24;//supply voltage in volts
Rl=500;//resistance in ohms
rf=50;//forward resistance in ohms
//CALCULATIONS
Idc=(Vdc)/(Rl);//average value of load current in A
Im=(%pi)*(Idc);//maximum value of load current in A
Vm=(Im)*(rf+Rl);//Maximum voltage required at input
    in volts
mprintf("Thus average current,maximum current and
    maximum voltage required are %g A,%g A and %2.2f
    V respectively",Idc,Im,Vm);
//==========================================END OF PROGRAM
```

Scilab code Exa 12.3 DC VOLTAGE

```
//Chapter-12, Example 12.3, Page 342
//=============================================================================
clc
clear
//INPUT DATA
Vac=230;//AC supply voltage
turnsratio=5;//turns ratio
Rl=300;//resistance in ohms
//CALCULATIONS
Vs=(Vac)/(turnsratio);//transformer sceondary
   voltage in V
Vm=sqrt(2)*(Vs);//maximum value of secondary voltage
    in V
Vdc=Vm/(%pi);//DC output voltage in V
PIV=Vm;//PIV of a diode in V
Im=(Vm/Rl);//maximum value of load current in A
Pm=(Im)^2*(Rl);//Maximum value of power delivered
Idc=Vdc/(Rl);//average value of load current in A
Pdc=(Idc)^2*(Rl);//average value of power delivered
   to load
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);
//=================================END OF PROGRAM
```

Scilab code Exa 12.4 DC VOLTAGE

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

Scilab code Exa 12.5 RESISTANCE

```
//Chapter-12, Example 12.5, Page 344
//=============================================================================
clc
clear
//INPUT DATA
Imax=400*10^-3;//maximum value of current in mA
Iav=150*10^-3;//average value of current in mA
Vs=100;//maximum value of secondary voltage in V
//CALCULATIONS
//we know that maximum value of current does not
   exceed 80 percentage
Imax1=0.8*Imax;//maximum value of current in mA
Vm=sqrt(2)*(Vs);//maximum value of secondary voltage
    in V
Rl=(Vm)/(Imax1);//value of load resistor in ohms
Vdc=(2*Vm)/(%pi);//DC(load) voltage
Idc=Vdc/(Rl);//DC load current in A
PIV=2*Vm;//PIV of each diode
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);
//=================================END OF PROGRAM
=============================================================================
```

Scilab code Exa 12.6 RIPPLE VOLTAGE

```
//Chapter-12, Example 12.6, Page 345
//=============================================================================
clc
clear
//INPUT DATA
Pdc=50;//power in W
Rl=200;//resistance in ohms
ripplefactor=0.01
//CALCULATIONS
Vdc=sqrt(Pdc*Rl);//DC voltage
Vac=ripplefactor*Vdc;//AC voltage
mprintf("Thus AC ripple voltage across the load is %d V",Vac);
//=================================END OF PROGRAM==============================
```

Scilab code Exa 12.7 DC VOLTAGE

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

```
Vdc=(2*Vm)/(%pi);//DC output voltage
Pdc=(Vdc)^2/(Rl);//DC power in W
PIV=Vm;//PIV across each diode in V
f0=2*f;//output frequency in Hz
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);
//note:in given problem,Rl is 600 ohms,but in textbook calculations Rl taken is 1000 ohms,I took Rl as 600 ohms
//==================================END OF PROGRAM==================================================================
```

Scilab code Exa 12.8 INDUCTANCE

```
//Chapter-12, Example 12.8, Page 349
//==================================================================================================================

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

Scilab code Exa 12.9 CAPACITANCE

```
//Chapter-12, Example 12.9, Page 351
//=============================================================================
clc
clear
//INPUT DATA
Rl=500;//resistance of load in ohms
f=400;//frequency in hz
ripplefactor=0.1;
//CALCULATIONS
C=inv(4*sqrt(3)*f*Rl*ripplefactor);//capacitance in
   uF
mprintf("thus capacitance is %g F",C);
//note:ripple factor is 0.1 not 0.01 as mentioned by
    problem in text book
//=================================END OF PROGRAM
=============================================================================
```

Scilab code Exa 12.10 FILTER DESIGN

```
//Chapter-12, Example 12.10, Page 352
//=============================================================================
clc
clear
//INPUT DATA
V=10;//output voltage in V
Il=200*10^-3;//load current in A
//CALCULATIONS
Rl=V/(Il);//effective load resistance in ohms
```

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

Scilab code Exa 12.11 CLC

```
//Chapter-12, Example 12.11, Page 353
//==================================================================================================
clc
clear
//INPUT DATA
V=10;//output voltage in V
Il=200*10^-3;//load current in A
ripplefactor=0.02;
//CALCULATIONS
Rl=V/(Il);//resistance in ohms
//if we assume L=10H and C1=C2=C
L=10;//indcutance in henry
C=sqrt(5700/(L*50*ripplefactor));
mprintf("the values of L and C for CLC section are %d H and %1.0f uF respectively",L,C)
//=====================================END OF PROGRAM
```

Scilab code Exa 12.16 VOLTAGE

```
//Chapter-12, Example 12.16, Page 363
//=============================================================================
clc
clear
//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.
//15+Vc-5=0;
//and
//Vc=20 V
//The voltage across the resistor will be equal to Dc voltage 5V
//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
//15+20-Vo=0
//Vo=35V
mprintf("Vc=20V\n")
mprintf("the voltage across resistor will be equal to 5V")
//=================================END OF PROGRAM
```

Scilab code Exa 12.17 VOLTAGE

```
//Chapter-12, Example 12.17, Page 364
//=============================================================================
clc
clear
//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.
//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.
mprintf("V0=10+10=20 V")
//=================================END OF PROGRAM=============================================
```

Scilab code Exa 12.18 VOLTAGE

```
//Chapter-12, Example 12.18, Page 365
//=============================================================================
clc
clear
```

```
//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.
//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.
mprintf("V0=0V\n")
mprintf("output voltage V0=-24V")
//==========================================END OF PROGRAM
   ================================================================================
```

Scilab code Exa 12.19 ELECTRON MOBILITY

```
//Chapter-12, Example 12.19, Page 367
//
   ================================================================================

clc
clear
//INPUT DATA
Rh=200;//Hall-coefficient in cubiccentimeter/C
a=10;//conductivity in s/m
//CALCULATIONS
un=a*Rh;//electron mobility in cm^2/V-s
mprintf("electron mobility is %d cm^2/V-s",un)
//note:answer given is wrong in textbook
//==========================================END OF PROGRAM
   ================================================================================
```

Scilab code Exa 12.20 ELECTRON CONCENTRATION

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

Scilab code Exa 12.21 ELECTRON DENSITY

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

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

Chapter 13

TRANSISTOR AND OTHER DEVICES

Scilab code Exa 13.1 BASE CURRENT

```
//Chapter-13, Example 13.1, Page 388
//=============================================================================
clc
clear
//INPUT DATA
Ie=10;//emitter current in mA
Ic=9.8;//collector current in mA
//CALCULATIONS
Ib=Ie-Ic;//base current in mA
mprintf("base current is %1.1f mA ",Ib)
//=================================END OF PROGRAM==============================
```

Scilab code Exa 13.2 CURRENT GAIN

```
//Chapter-13, Example 13.2, Page 389
//=============================================================================
clc
clear
//INPUT DATA
Ie=6.28;//emitter current in mA
Ic=6.20;//collector current in mA
//CALCULATIONS
a=(Ic/Ie);//current gain
mprintf("current gain is %1.3f",a)
//=================================END OF PROGRAM
==============================================================================
```

Scilab code Exa 13.3 BASE CURRENT

```
//Chapter-13, Example 13.3, Page 389
//=============================================================================
clc
clear
//INPUT DATA
a=0.967//common-base DC current gain
Ie=10;//emitter current in mA
//CALCULATIONS
Ic=Ie*a;//collector current in mA
Ib=Ie-Ic;//base current in mA
mprintf("base current is %1.2f mA",Ib)
//=================================END OF PROGRAM
==============================================================================
```

Scilab code Exa 13.4 COLLECTOR CURRENT

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

Scilab code Exa 13.5 CURRENT GAIN

```
//Chapter-13, Example 13.5, Page 389
//=============================================================================
clc
clear
//INPUT DATA
a=0.97//common-base DC current gain
b=200;//common-emitter DC current gain
//CALCULATIONS
```

```
b1=a/(1-a);//common-emitter DC current gain when a
    =0.97
a1=b/(b+1);//common-base DC current gain when b=200
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)
//=================================END OF PROGRAM
    ==============================================
```

Scilab code Exa 13.6 EMITTER CURRENT

```
//Chapter-13, Example 13.6, Page 389
//
    ==============================================

clc
clear
//INPUT DATA
Ic=40;//collector current in mA
b=100;//common-emitter DC current gain
//CALCULATIONS
Ib=Ic/b;//base current in mA
Ie=Ib+Ic;//emitter current in mA
mprintf("Thus emitter current is %2.1f mA",Ie);
//=================================END OF PROGRAM
    ==============================================
```

Scilab code Exa 13.7 COLLECTOR CURRENT

```
//Chapter-13, Example 13.7, Page 390
```

```
//
    ================================================================

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

Scilab code Exa 13.8 BASE CURRENT

```
//Chapter−13, Example 13.8, Page 390
//
    ================================================================

clc
clear
//INPUT DATA
Ic=80;//collector current in mA
b=170;//common−emitter DC current gain
//CALCULATIONS
Ib=Ic/b;//base current in mA
Ie=Ib+Ic;//emitter current in mA
mprintf("Thus emitter and base currents are %2.2f mA
     and %1.2f mA respectively",Ie,Ib);
//=================================END OF PROGRAM
```

Scilab code Exa 13.9 COLLECTOR CURRENT

```
//Chapter-13, Example 13.9, Page 390
//=============================================================================
clc
clear
//INPUT DATA
Ib=0.125;//base current in mA
b=200;//common-emitter DC current gain
//CALCULATIONS
Ic=b*Ib;//collector current in mA
Ie=Ib+Ic;//emitter current in mA
mprintf("Thus emitter and collector currents are %2.3f mA and %d mA respectively",Ie,Ic);
//=================================END OF PROGRAM=============================
```

Scilab code Exa 13.10 COLLECTOR CURRENT

```
//Chapter-13, Example 13.10, Page 391
//=============================================================================
clc
clear
//INPUT DATA
Ie=12;//emitter current in mA
```

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

Scilab code Exa 13.11 COMMON EMITTER CURRENT GAIN

```
//Chapter-13, Example 13.11, Page 391
//
   ==================================================================

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

Scilab code Exa 13.12 COLLECTOR CURRENT

```
//Chapter-13, Example 13.12, Page 391
//=============================================================================
clc
clear
//INPUT DATA
a=0.98//common-base DC current gain
Icbo=5*10^-6;//current in A
Ib=100*10^-6;//base current in A
//CALCULATIONS
Ic=((a*Ib)/(1-a))+(Icbo/(1-a));//collector current
    in mA
Ie=Ib+Ic;//emitter current in mA
mprintf("Thus collector and emitter currents are %g
    A and %g A respectively",Ic,Ie);
//=================================END OF PROGRAM
    ==============================================================================
```

Scilab code Exa 13.13 COLLECTOR CURRENT

```
//Chapter-13, Example 13.13, Page 391
//=============================================================================
clc
clear
//INPUT DATA
```

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

Scilab code Exa 13.14 CURRENT GAIN

```
//Chapter-13, Example 13.14, Page 391
//
    ==================================================

clc
clear
//INPUT DATA
deltaIe=1*10^-3;//change in emitter current in A
deltaIc=0.99*10^-3;//change in collector current in
    A
//CALCULATIONS
a=(deltaIc/deltaIe);//current gain of the transistor
mprintf("Thus current gain of the transistor is %1.2
    f",a);
```

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

Scilab code Exa 13.15 CURRENT GAIN

```
//Chapter-13, Example 13.15, Page 391
//
    ==================================================================

clc
clear
//INPUT DATA
b=100;//common-emitter DC current gain
//CALCULATIONS
a=(b/(1+b));//common-base DC current gain
mprintf("Thus common-base DC current gain is %1.2f",
    a);
//==================================END OF PROGRAM
    ==================================================================
```

Scilab code Exa 13.16 CURRENT GAIN

```
//Chapter-13, Example 13.16, Page 391
//
    ==================================================================

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

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

Scilab code Exa 13.17 BASE CURRENT

```
//Chapter−13, Example 13.17, Page 391
//=============================================================================================
clc
clear
//INPUT DATA
b=49;//common−emitter DC current gain
Ie=3*10^-3;//emitter current in A
//CALCULATIONS
a=b/(1+b);//common−base DC current gain
Ic=a*Ie;//collector current in A
mprintf("Thus common−base DC current gain and ccollector current are %1.2f and %g A respectively",a,Ic);
//==================================END OF PROGRAM======================================================================
```

Scilab code Exa 13.18 COLLECTOR CURRENT

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

Scilab code Exa 13.19 BASE CURRENT

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

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

Scilab code Exa 13.20 COLLECTOR CURRENT

```
//Chapter-13, Example 13.20, Page 394
//=================================================================================================
clc
clear
//INPUT DATA
a=0.99;//common-base DC current gain
Icbo=5*10^-6;//current in A
Ib=20*10^-6;//current in A
//CALCULATIONS
Ic=((a*Ib)/(1-a))+(Icbo/(1-a));//collector current in A
Ie=Ib+Ic;//emitter current in A
mprintf("collector and emitter currents are %g A and %g A respectively",Ic,Ie)
```

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

Scilab code Exa 13.21 CURRENT GAIN

```
//Chapter-13, Example 13.21, Page 394
//==================================================================================================
clc
clear
//INPUT DATA
Icbo=0.2*10^-6;//current in A
Iceo=18*10^-6;//current in A
Ib=30*10^-6;//current in A
//CALCULATIONS
a=1-(Icbo/Iceo);//common-base DC current gain
b=(Iceo/Icbo)-1;//common-emitter DC current gain
Ic=(b*Ib)+((1+b)*(Icbo));//collector current in A
mprintf("Thus common-base DC current gain and common
   -emitter DC current gain are %1.3f and %d
   respectively",a,b)
//==========================================END OF PROGRAM==========================================
```

Scilab code Exa 13.22 EMITTER CURRENT

```
//Chapter-13, Example 13.22, Page 394
//==================================================================================================
```

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

Chapter 14

INTEGRATED CIRCUITS

Scilab code Exa 14.1 COMMONMODE GAIN

```
//Chapter-14, Example 14.1, Page 456
//=============================================================================
clc
clear
//INPUT DATA
CMRR=10^5;//common-mode rejection ratio
Ad=10^5;//differential gain
//CALCULATIONS
Acm=Ad/(CMRR);//common mode gain
mprintf("common-mode gain is %d",Acm);
//=================================END OF PROGRAM==============================
```

Scilab code Exa 14.2 SLEWRATE

```
//Chapter-14, Example 14.2, Page 458
//=============================================================================
clc
clear
//INPUT DATA
V0=20;//voltage in volts
t=4;//time in microsec
//SLEW RATE
SR=(V0)/t;//slewrate in V/us
mprintf("slewrate is %d V/us",SR);
//=================================END OF PROGRAM=============================================
```

Scilab code Exa 14.3 FREQUENCY

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

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

Scilab code Exa 14.4 PEAK TO PEAK VOLTAGE

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

Scilab code Exa 14.5 VOLTAGE GAIN

```
//Chapter-14, Example 14.5, Page 465
```

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

Scilab code Exa 14.6 VOLTAGE GAIN

```
//Chapter-14, Example 14.6, Page 466
//
    ================================================================
clc
clear
//INPUT DATA
Rf=10*10^3;//forward resistance in ohms
R1=1*10^3;//resistance in ohms
//CALCULATIONS
Af=1+(Rf/R1);//closed-loop voltage gain in non-
   inverting amplifier
b=(R1/(R1+Rf));//feedback factor
mprintf("Thus closed-loop voltage gain and feedback
   factor are %d and %1.3f respectively",Af,b);
//==================================END OF PROGRAM
    ================================================================
```

Scilab code Exa 14.7 OUTPUT VOLTAGE

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

Chapter 15

DIGITAL ELECTRONICS

Scilab code Exa 15.1 DEC TO OCT

```
//Chapter-15, Example 15.1, Page 492
//=============================================================================
clc
clear
//INPUT DATA
x=12;//in decimal form
//CALCULATIONS
y=dec2oct(x);//converting to octal form
mprintf("Thus octal number is");
disp(y);
//=================================END OF PROGRAM==============================
```

Scilab code Exa 15.2 OCT TO DEC

```
//Chapter-15, Example 15.2, Page 492
//=============================================================================
clc
clear
//INPUT DATA
x1=444;//in octal form
x2=237;//in octal form
x3=120;//in octal form
//CALCULATIONS
x1=base2dec(['444','237','120'],8)//converting octal to decimal
disp(x1);
//=================================END OF PROGRAM=================================
```

Scilab code Exa 15.3 DEC TO HEX

```
//Chapter-15, Example 15.3, Page 493
//=============================================================================
clc
clear
//INPUT DATA
x1=112;//in decimal form
x2=253;//in decimal form
//CALCULATIONS
y1=dec2base(x1,16)//converting decimal to hexadecimal
y2=dec2base(x2,16)//converting decimal to hexadecimal
disp(y1);
```

```
disp(y2);
//==============================================END OF PROGRAM
   ===================================================================
```

Scilab code Exa 15.4 HEX TO DEC

```
//Chapter-15, Example 15.4, Page 494
//
   ===================================================================
clc
clear
//CALCULATIONS
x1=base2dec(['4AB','23F'],16)//converting
    hexadecimal to decimal
disp(x1);
//==============================================END OF PROGRAM
   ===================================================================
```

Scilab code Exa 15.5 MULTIPLICATION OF BINARY NUMBERS

```
//Chapter-15, Example 15.5, Page 496
//
   ===================================================================
clc
clear
//CALCULATIONS
x1=base2dec(['1101','1100'],2)//converting binary to
     decimal
```

```
x2=base2dec(['1000','101'],2)//converting binary to
    decimal
x3=base2dec(['1111','1001'],2)//converting binary to
     decimal
y1=(x1(1))*(x1(2));//multiplying
y2=(x2(1))*(x2(2));//multiplying
y3=(x3(1))*(x3(2));//multiplying
z1=dec2base(y1,2)//converting decimal to hexadecimal
z2=dec2base(y2,2)//converting decimal to hexadecimal
z3=dec2base(y3,2)//converting decimal to hexadecimal
disp(z1)
disp(z2)
disp(z3)
//=================================END OF PROGRAM
    ==================================================================
```

Scilab code Exa 15.6 DIVISION OF BINARY

```
//Chapter-15, Example 15.6, Page 497
//
    ==================================================================

clc
clear
//CALCULATIONS
x1=base2dec(['110','10'],2)//converting binary to
    decimal
x2=base2dec(['1111','110'],2)//converting binary to
    decimal
y1=(x1(1))/(x1(2));//dividing
y2=(x2(1))/(x2(2));//dividing
z1=dec2base(y1,2);//converting decimal to binary
[f,e]=frexp(y2);//separting exponent and mantissa
disp(f)//mantissa
```

```
disp(e)//exponent
f=f*2;
g=floor(f);//rounding to nearest integer
disp(g);
z2=dec2base(e,2);//converting decimal to binary ---------->before point part of resultant binary number
disp(z2)
g1=dec2base(g,2);//converting decimal to binary ---------->after point part of  resultant binary number
disp(g1)
//NOTE:here floating point decimal cannot be directly converted to binary for second case. Hence computed to binary
//==========================================END OF PROGRAM==========================================
```

Scilab code Exa 15.7 SUBTRACTION OF BINARY NUMBERS

```
//Chapter-15, Example 15.7, Page 497
//==================================================================================

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

```
x4=x1+x3;
x5=dec2base(x4,2)//converting decimal to hexadecimal
disp(x5)
y=15;
z=bitand(x4,y);//eliminating carry
z1=bitset(z,1);//setting 1st bit t0 1
z2=dec2base(z1,2)//converting decimal to binary
disp(z2)
//using normal method
a=base2dec(['1111','1010'],2);//converting binary to
    decimal
b=a(1)-a(2);//subtraction
c=dec2base(b,2)//converting decimal to binary
disp(c)
//==================================END OF PROGRAM
    ==================================================================
```

Scilab code Exa 15.8 SUBTRACTION OF BINARY NUMBERS

```
//Chapter-15, Example 15.8, Page 498
//
    ==================================================================
clc
clear
//CALCULATIONS
//using 1's complement method
x1=base2dec(['1000'],2)//converting binary to
    decimal
x=bin2dec('1010')
x2=dec2bin(bitcmp(x,4))//1's complement of a number
disp(x2)
x3=base2dec([x2],2)
x4=x1+x3;
```

```
x5=dec2base(x4,2)//converting decimal to hexadecimal
disp(x5)
y=15;
z=bitand(x4,y);//eliminating carry
z2=dec2base(z,2)//converting decimal to binary
disp(z2)
//using normal method
a=base2dec(['1000','1010'],2);//converting binary to decimal
b=a(2)-a(1);//subtraction
c=dec2base(b,2)//converting decimal to binary
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'
//==================================END OF PROGRAM==================================
```

Scilab code Exa 15.9 SUBTRACTION OF BINARY NUMBERS

```
//Chapter-15, Example 15.9, Page 497
//==================================================================================
clc
clear
//CALCULATIONS
//using 1's complement method
x1=base2dec(['1111'],2)//converting binary to decimal
x=bin2dec('1010')
x2=dec2bin(bitcmp(x,4))//1's complement of a number
disp(x2)
x3=base2dec([x2],2)
```

```
x4=x1+x3+1;
x5=dec2base(x4,2)//converting decimal to hexadecimal
disp(x5)
y=15;
z=bitand(x4,y);//eliminating carry
z2=dec2base(z,2)//converting decimal to binary
disp(z2)
//using normal method
a=base2dec(['1111','1010'],2);//converting binary to
    decimal
b=a(1)-a(2);//subtraction
c=dec2base(b,2)//converting decimal to binary
disp(c)
//==================================END OF PROGRAM
    ================================================================
```

Scilab code Exa 15.10 SUBTRACTION OF BINARY NUMBERS

```
//Chapter-15, Example 15.10, Page 497
//
    ================================================================
clc
clear
//CALCULATIONS
//using 1's complement method
x1=base2dec(['1000'],2)//converting binary to
    decimal
x=bin2dec('1010')
x2=dec2bin(bitcmp(x,4))//1's complement of a number
disp(x2)
x3=base2dec([x2],2)
x4=x1+x3+1;
x5=dec2base(x4,2)//converting decimal to hexadecimal
```

```
disp(x5)
//using normal method
a=base2dec(['1000','1010'],2);//converting binary to decimal
b=a(2)-a(1);//subtraction
c=dec2base(b,2)//converting decimal to binary
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'
//=================================END OF PROGRAM=================================
```

Scilab code Exa 15.11 ADD BCD NUMBERS

```
//Chapter-15, Example 15.11, Page 500
//=================================================================================
clc
clear
//CALCULATIONS
x1=base2dec(['1001'],2)//converting binary to decimal
x2=base2dec(['0100'],2)//converting binary to decimal
x3=x1+x2;
if(x3>9)
    x3=x3+6;
    z1=dec2base(x3,2)//converting decimal to binary
else
    z1=dec2base(x3,2)//converting decimal to binary
end
```

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

Scilab code Exa 15.12 LAWS OF BOOLEAN ALGEBRA

```
//Chapter-15, Example 15.12, Page 502
//
   ================================================

clc
clear
//CALCULATIONS
disp('given=> Y=(A+AB)')
//given in the question//
disp('Y=A(1+B)')//by distributive law
disp('A.1')//by law 2
disp('A')//by law 4
disp('given=> Y=(A+A''B)')
disp('(A+A'').(A+B)')//by distributive law
disp('1.(A+B)')//by law 6
disp('A+B')//by law 4
disp('given=>(AB+A''C+BC)')
disp('AB+A''C+BC(A+A'')')
disp('AB+A''C+ABC+A''BC')
disp('AB(1+C)+A''C(1+B)')//by consensus theorem
disp('AB+A''C')
//==========================================END OF PROGRAM
   ================================================
```

Scilab code Exa 15.13 SIMPLIFICATION

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

```
'----------->step 3
//==========================================END OF PROGRAM
==========================================================================
```

Scilab code Exa 15.17 LOGIC CIRCUIT SIMPLIFICATION

```
//Chapter-15, Example 15.17, Page 513
//
==========================================================================

clc
clear
//CALCULATIONS
disp('((((A+C''))''(BD''))''.((A+C'').(BD''))'')''')
//------->step 1
disp('((A+C'')+((BD'')'').((A+C)''+(BD'')''))''')//
------->step 2
disp('((A+C'')+(BD'')'').((A+C'')''+(BD'')'')''')//
------->step 3
disp('((BD'')''+((A+C'')((A+C''))'')''')//------->
step 4
disp('(BD'')'')''')//------->step 5
disp('BD''')//------->step 6
//==========================================END OF PROGRAM
==========================================================================
```

Scilab code Exa 15.19 SIMPLIFICATION OF K MAP

```
//Chapter-15, Example 15.19, Page 519
```

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

Scilab code Exa 15.20 SIMPLIFICATION OF K MAP

```
//Chapter-15, Example 15.20, Page 519
//
   ==================================================================
clc
clear
//CALCULATIONS
disp('(B''C''D'')+(BC''D)')
//================================END OF PROGRAM
   ==================================================================
```