Scilab Textbook Companion for Engineering Basics by T. Thyagarajan[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

concept of electric current and laws

Scilab code Exa 1.1 `specific resistance`

```
    //find the specific resistance of the material
L =12  //meter
A=0.01*10^-4   //m^2
R=0.2  //ohm
p=R*A/L   //specific resistance
disp('value of specific resistance='+string(p)+'
   ohm -meter')
```

Scilab code Exa 1.2 `resistance`

```

//resistance at 40 degree
a0=0.0043
t1=27
t2=40
R1=1.5
```

```
R2=R1*(1+a0*t2)/(1+a0*t1)
disp('value of resistance='+string(R2)+ '   ohm')
```

Scilab code Exa 1.3 resistance and current

```

//find the total R.I.V
R1=5
R2=10
R3=15
V=120
R=R1+R2+R3
I=V/R
V1=I*R1
V2=I*R2
V3=I*R3
disp('Voltage V3='+string(V3)+'volts'  ,  'Voltage
   V2='+string(V2)+'volt' , 'Voltage V1='+string(V1)
   +'volts')
```

Scilab code Exa 1.4 resistance

```

//find the eqvivalent rasistance of series parallel
   combination
Rab=(2*4)/(2+4)
Rbc=(6*8)/(6+8)
Rac=Rab+Rbc
disp('rasistance across AC='+string(Rac)+'ohms')
```

Scilab code Exa 1.5 resistance

```
//find the eqvivalent resistance of series parallel
   combination
Rab=4
Rbc=(12*8)/(12+8)
Rcd=(3*6)/(3+6)
Rad=Rab+Rbc+Rcd
disp('resistance across AC='+string(Rad)+'      ohms'
   )
```

Scilab code Exa 1.6 resistance

```
//what resistance must be connected in parallel
R1=8
R2=48/2//R1*R2/R1+R2
disp('R2='+string(R2)+'ohms')
```

Scilab code Exa 1.7 current

```
//calculate the current I1.I2
I=12
R1=6
R2=8
I1=I*R2/(R1+R2)
I2=I*R1/(R1+R2)
disp('I1='+string(I1)+'amps'   ,    'I2 ='+string(I2)+
   'amps')
```

Scilab code Exa 1.9 current

```
//find how current divide in circuit
R1=0.02
R2=0.03
I1=(10*R2)/(R1+R2)
I2=(10*R1)/(R1+R2)
disp('I2='+string(I2)+ 'amps' , 'I1= '+string(I1)
    + 'amps')
```

Scilab code Exa 1.10 resistance of coil

```
//what is the resistance of each coil
V=200
I=25
P1=1500
R1=(V*V)/P1
R=V/I          //total resistance
R2=R*R1/(R1-R)
disp('R2='+string(R2)+' ohms' )
```

Scilab code Exa 1.11 power

```
//what is the resistance of each coil
V=100
P=1500
```

```
R=(V^2/P)/2
Ra=R
Rb=R
Rc=R
R1=((Ra*Rc)/(Ra+Rc))+Rb
I=V/R1
I1=(I*Ra)/(Ra+Rc)
I2=(I*Ra)/(Ra+Rc)
Pa=I*I*Ra
Pb=I1*I1*Rb
Pc=I2*I2*Rc
disp( 'Pc='+string(Pc)+'  watts' ,  'Pb='+string(Pb)
   +'  watts'  ,  'Pa='+string(Pa)+'  watts')
```

Scilab code Exa 1.12 Bill amount

```

//determine the energy consume in a house in the
   month
L=3600//six lamp 1000 watt each for six days
H=3000//one haeter
M=735.5//single phase motor
F=2400//four fans 75W
T=L+H+M+F//total energy consumed in watt
TE=T*30/1000
C=0.9//cost of energy
B=TE*0.9//Bil amount
disp('B=  '+string(B)+'  ')
```

Scilab code Exa 1.18 resistance

```

//convert the delta circuit
```

```
Rry=4
Ryb=1
Rbr=5
Rr=(Rbr*Rry)/(Rry+Rbr+Ryb)
Ry=(Rry*Ryb)/(Rry+Rbr+Ryb)
Rb=(Rbr*Ryb)/(Rry+Rbr+Ryb)
disp('Rb='+string(Rb)+  'ohms' , 'Ry='+string(Ry)+' ohms' , 'Rr='+string(Rr)+' ohms')
```

Scilab code Exa 1.19 `resistance`

```

//convert star circuit
Rr=2
Ry=0.67
Rb=1
Rry=(Rr*Ry)+(Ry*Rb)+(Rb*Rr)/Rb
Ryb=(Rr*Ry)+(Ry*Rb)+(Rb*Rr)/Rr
Rbr=(Rr*Ry)+(Ry*Rb)+(Rb*Rr)/Ry
disp('Rbr='+string(Rbr)+'ohms' , 'Ryb='+string(Ryb)+'ohms' , 'Rry='+string(Rry)+  'ohms')
```

Chapter 2

Magnetic Current

Scilab code Exa 2.1 flux density

```

//determine the fukux density
F=0.5e-3;//webers
A=4*10^-4;//meter^2
B=F/A;
disp('flux density is = '+string(B)+' Wb/m^2');
```

Scilab code Exa 2.2 Magnetic field strength

```

//determine the magnetic field strenght at the
    centre of solinoid
I=2;//amp
L=50e-2;//meter
N=100;//turns
H=(N*I)/L;
disp('magnetic field strenght='+string(H)+'AT/m');
```

Scilab code Exa 2.3 reluctance current and

```
//calculate the reluctance and current
A=5e-4
N=250
l=50e-2
F=700e-6
u=380
S=l/(4*%pi*10^-7*A*u)
I=F*S/N
disp('current='+string(I)+'amps' , 'reluctance ='+
    string(S)+'AT/Wb')
```

Scilab code Exa 2.4 relative permeability

```
//determine the value of relative permeability of
    iron
D=15e-2
l=%pi*15e-2
N=450
I=2
B=1.2
u=B/(4*%pi*10^-7*N*I*l)
disp('value of relative permeability='+string(u)+'
    ')
```

Scilab code Exa 2.5 mmf

```
//calculate the mmf
l=1.5
u=1600
B=1.2
H1=B*l/(4*%pi*10^-7*u)
la=1e-3
ua=1
H2=B*la/(4*%pi*10^-7*ua)
H=H1+H2
disp('total amprs turns ='+string(H)+' AT' ,  'amprs
    turns='+string(H2)+' AT', 'amprs turns='+string(
   H1)+' AT')
```

Scilab code Exa 2.6 `magnetising force relative permeability magnetic flux density`

```
//calculate the magnetising force relative
   permeability
A=5e-4
l=25e-2
N=100
I=2
F=0.3e-3
H=(N*I)/l
u=(F*l)/(N*I*A*4*3.14*10^-7)
B=(u*H*4*3.14*10^-7)
I1=5
F1=0.58e-3
H1=(N*I1)/l
u1=(F1*l)/(N*I*A*4*3.14*10^-7)
B1=(u1*H*4*3.14*10^-7)
disp('flux density B1='  +string(B1)+  'Wb/m^2'  ,'
   flux density  B ='  +string(B)+  'Wb/m^2' )
```

Scilab code Exa 2.7 Magnetising Current

```
//calculate the magnitising current
A=0.01
l=2e-3
u=1
F=800e-6
B=F/A//flux
H=B/(4*3.14*10^-7*u)
N=(H*l)
L=150e-2
v=600
f=9.6e-4
N1=(f*L)/(v*A*4*%pi*10^-7)
N2=N1+N
n=200
M=N2/n
disp('Magnetising current = '+string(M)+' A' , '
    Total amps turns= '+string(N2)+' AT' , 'amps
    turn iron= '+string(N1)+' AT' , 'amps turn for
    air= '+string(N)+' AT' )
```

Scilab code Exa 2.8 number of amperes turns

```
//find the number of amprs turns required
A=25e-4
F=1.2e-3
u=1 //air path
l=0.25e-2
N=(F*l/(4*%pi*10^-7*A*u))*2 // for two air gaps
```

```
v=2000  // iron path
L=50e-2
N1=(F*L)/(v*A*4*%pi*10^-7)
N2=N+N1
disp( 'total amps turns  =    '+string(N2)+'    AT'
    ,  'amps turn for air=    '+string(N1)+'    AT'
    , 'amps turn for air=   '+string(N)+'   AT'  )
```

Scilab code Exa 2.9 ampere turns

```

//calculate the circuit current
u=1//for air gap
F=1.5e-3//flux
A=9e-4 //area
B=F/A
H=B/(4*3.14*10^-7*u)
l=4e-3//air gap
S=H*l//amps turns in air gap
l=4e-3//air gap
u1=800// for iron gap
A1=750e-6
B1=F/A1
H1=B1/(4*3.14*10^-7*u1)
l1=270e-3
S1=H1*l1
u2=1000//for P,Q,R
H2=B/(4*3.14*10^-7*u2)
Ip=135e-3
Iq=270e-3
Ir=135e-3
S2=H2*(Ip+Iq+Ir)//amps turns
TNn=S+S1+S2
TN=4000
EI=TNn/TN
```

```
disp('exciting current=   '+string(EI)+'  amps')
```

Scilab code Exa 2.10 `exciting current`

```

//calculate the total amprers turns
u=1//for air gap
F=1.2e-3//flux
A=10e-4 //area
B=F/A
H=B/(4*3.14*10^-7*u)
l=0.2e-3//air gap
S=H*l//amps turns in air gap
l1=15e-2//air gap
A1=8e-4
H1=450
S1=H1*l1
F1=0.6e-3
B1=F1/A1
H2=140
S2=H2*30e-2
TN=500
TAN=S+S1+S2
EI=TAN/TN
disp('exciting current =' +string(EI)+'amps'  )
```

Scilab code Exa 2.11 `hysteris loop`

```

//calculate the hysteris loss
A=50//area of hysterisis
H=200
B=0.2
```

```
f=50
D=10// density
M=1000// mass
V=M/D// velocity is mass /density
HL=A*H*B//.....j/m^2/cycle
HL1=A*H*B*10^-4//....j/cycle
HL2=A*H*B*50*1e-4//....j/s

disp('Hysteresis loop = '+string(HL2)+'   j/s')
```

Chapter 3

Electromagnetism

Scilab code Exa 3.1 emf induced

```

//calculate the emf induced in the coil
N=200
F1=1e-3
F2=3e-3
F3=F2-F1
t=0.1
e=N*F3/t  //neglecting negative sign
disp('induced emf=   ' +string(e)+'  volts')
```

Scilab code Exa 3.2 emf induced

```

//calculate the emf inducedin a long wire
B=1.2;//weber/meter^2...flux density
V=4;//meter/second..velocity of conductor
l=2;//meter...lenght of
e=(B*V*l*1)//sin90=1
```

```
disp('emf induced in the conductor='+string(e)+'volt
    ');
```

Scilab code Exa 3.3 inductance of the coil

```

//find the inductance of the  coil
N=1500;// number of turns
I=10;//amp...current in coil
F=.5*10^-3;//weber...flux
L=N*F/I;
disp('inductance of coil='+string(L)+'henry');
```

Scilab code Exa 3.4 self inductance

```

//P3.4   calculate its self induction

Ur=1;
N=400;
l=30e-2;
A=5e-4;
U0=4e-7*%pi;
S=l/(U0*Ur*A);
L=N^2/S;
disp('Self inductance is = '+string(L)+' henry','S =
    '+string(S));
```

Scilab code Exa 3.5 inductance and emf induced

```

//calculat the inductance and emf induced in the
   coil
u=1  //air core torroidal ring
D=25e-2
l=3.14*D
N=500
d=4e-2  //cross sectional diameter
A=(3.14*d*d)/4 //cross sectional area
s=l/(4*3.14*10^-7*u*A)
L=N^2/s  // self inductance
dI=10
dt=50e-3
e=(L*dI)/dt
disp('Induced emf='  +string(e)+'   volts'  ,  '
   Inductance =   '+string(L)+'    henry')
```

Scilab code Exa 3.6 inductance and emf induced

```

//calculate the induced emf in the coil
A=4e-4 //cross sectional is a squar side
u=1  //air core torroidal ring
D=25e-2
l=3.14*D
N=500
d=4e-2  //cross sectional diameter
s=l/(4*3.14*10^-7*u*A)
L=N^2/s  // self inductance
dI=10
dt=50e-3
e=(L*dI)/dt
disp('Induced emf='  +string(e)+'   volts'  ,  '
   Inductance =   '+string(L)+'    henry')
```

Scilab code Exa 3.7 inductance and emf induced

```

//calculate the induced emf in coil
di=5
dt=0.05
L=5.029e-4
di1=400
dt1=1
e=L*di/dt
e1=L*di1/dt1
disp('Induced emf=    ' +string(e1)+'   volts' , '
    Induced emf=    ' +string(e)+'   volts')
```

Scilab code Exa 3.8 mutual inductance and emf induced

```

////calculate the mutual inductance between the two
    coil
N1=50
N2=400
A=150e-4
l=200e-2
u=2500
s=l/(4*3.14*10^-7*A*u)
M=(N1*N2)/s
dI1=24
dt=0.03
eM2=M*dI1/dt
disp('induced emf=   '+string(eM2)+'  volts' , '
    Mutual inductance=  '+string(M)+'  henry' , 's=
    '+string(s)+'  AT/Wb')
```

Scilab code Exa 3.9 energy stored

```
//find the energy stored in it
L=0.5
I=2
E=0.5*L*I*I
disp('Energy stored=  '+string(E)+'  joule')
```

Scilab code Exa 3.10 force

```
//determine the pull between poles and keeper
A=15e-4
B=1.2
U=1
F=2*B*B*A/(2*4*3.14*10^-7)
disp('Total force='+string(F)+'  N')
```

Chapter 4

Ac circuit

Scilab code Exa 4.1 `voltage and current factors`

```
//
//i=40sin 314t
//i=Imsin wt
Im=40
w=314
Iav=Im/1.414
Irms=Im*2/3.14
f=w/(2*3.14)
Ff=Irms/Iav
Pf=Im/Irms
disp('peak factor='+string(Pf)+ '  ' , 'form
    factor='+string(Ff)+ '  ' , 'frequency ='+string
    (f)+ '  ')
```

Scilab code Exa 4.2 `voltage equation`

```

```

```
//determine the voltage sin wave
f=50
V=50
Vm=V*1.414
w=2*3.14*f
t=(0:0.1:5*%pi)';
plot2d1('onn',t,[5*sin(t)])
disp('voltage equation v=70.7sin(314)t')
```

Scilab code Exa 4.3 volatage and time

```

//determine the time taken to reach the intantaneous
    of 150
f=50
Vr=200
Vm=Vr*1.414
t=2.5e-3
w=2*3.14*f*t
v=Vm*sind(w*180/%pi)
v1=150   //v1=Vmsimwt
t=1/18000*asind(150/282.8)
disp( 'voltage equation='+string(v)+' volts   '   ,   '
   time='+string(t)+' seconds   ')
```

Scilab code Exa 4.12 power dissipated

```

//determine the power dissipiated in resistance
//v=200 sind 314t
Vm=200;
o=314;   //@=omega
//i=50 sind 314t
```

```
Im=50
o=314
R=Vm/Im
I=Im/1.414
P=(I*I*R)
disp( 'power dissipiated in resistance='+string(P)+'
     watts')
```

Scilab code Exa 4.13 inductive reactance

```

//determine the inductive reactance of the coil
L=0.25;//henry....inductance
f=50;//hertz...frequency
X=2*3.14*f*L
disp('value of inductive reactance='+string(X)+'ohms
   ');
```

Scilab code Exa 4.15 current

```

//calculate the current flowing through the coil
L=0.05
V=230
f=60
X=(2*%pi*f*L)
I=V/X
disp(' the current flowing through the coil='+string
   (I)+'amps')
```

Scilab code Exa 4.16 inductance and current

```

//detrmine the value of inductance
I=5;//amp
V=200;//volt
f=50;//hertz
X=V/I;
L=40/(2*%pi*50);
disp('the value of inductive.reactance='+string (X)+
    'ohms' , 'value of inductors='+string(L)+'
    henry');
```

Scilab code Exa 4.17 voltage and current

```

//write the time equation for voltage and current
Vrms=150
Vm=2*1.414*Vrms
f=50
L=0.2
X=2*3.14*f*L
Im=Vm/X
disp('current equation  i=212.132sin(314)t' , '
    voltage equation v=3.376sin(314t-90)' , ' Im= '+
    string(Im)+ ' ')
```

Scilab code Exa 4.18 current

```

//calculate the current
C=25e-6;
V=200
```

```
f=60  //frequency half
f2=120  //frequency doubled
Xc=1/(2*%pi*f*C)
Xc=1/(2*%pi*f2*C)
I=V/Xc
disp('frequency half='+string(f)+'hz' ,  'frequency
   douled='+string(f2)+'hz')
```

Scilab code Exa 4.19 capacitance current

```

//determine the value of capacitance nd current
Xc=25
V=200
f=50
C=1/(2*%pi*f*Xc)
I=V/Xc
disp('the value of capacitance ='+string(C)+'farad',
    'the value of current='+string(I)+'amps')
```

Scilab code Exa 4.20 frequency

```

//find the frquency
Vrms=110
c=15e-6
I=0.518
Xc=Vrms/I
f=1/(2*%pi*Xc*c)
disp('value of frequency='+string(f)+'hz')
```

Scilab code Exa 4.21 phase angle

```
//calculate the value of current
R=10;//ohms
L=0.02;//henry
V=250;//volt
f=50;//hertz
X=(2*%pi*f*L)
Z=sqrt(R^2+X^2)
I=V/Z
coso=R/Z
o=acosd(coso)
disp('phase angle='+string(o)+'degree',  'current
    flowing through coil='+string(I)+'amp')
```

Scilab code Exa 4.22 voltage and current

```
//find the inductance impd,curent,power factr,
    voltage.power
R=50;//ohms
L=0.5;//henry
V=200;//volt
f=50;//hertz
X=(2*%pi*f*L)
Z=sqrt(R^2+X^2)
I=V/Z
coso=R/Z
sino=R/Z
o=acosd(coso)
o1=asind(sino)
Vr=I*R
Vl=I*X
AP=V*I*coso
```

```
RP=V*I*sino
APP=V*I;
//disp('Apprent power='+string(AP)+'degree''phase angle='+string(o)+'degree', 'crnt flowing through coil='+string(I)+'amp')
disp('The time equation of current = 1.711sin(314t-72.34)')
```

Scilab code Exa 4.23 `voltage`

```

//determine the supply voltage
R=15;//ohms
L=0.15;//henry
I=20;//ampss
f=50;//hertz
X=2*%pi*50*0.15
Z=sqrt(R^2+X^2)
V=I*Z
disp('supply voltage = '+string(V)+'volts');
```

Scilab code Exa 4.24 `resistance`

```

//determine the supply voltage
V=200;//ohms
L=0.4;//henry
I=0.5;//ampss
f=50;//hertz
Z=V/I
X=2*%pi*f*L
R=sqrt(Z^2+X^2)
disp('Resistance = '+string(R)+'ohms')
```

Scilab code Exa 4.25 inductance

```
//determine the inductance of the coil
R=6
V=250;//volts
I=1.5;//amps
Z=V/I;//impedance
f=60;//hetrz
X=sqrt(Z^2-R^2)
L=X/(2*%pi*f)
disp('inductance of coil='+string(L)+  'henry')
```

Scilab code Exa 4.27 voltage across choking coil

```
//determine the inductance of the coil and voltage
   across each element
I=7
V=200
f=50
R=10
r=1.5  //rasistance choke coil
V1=I*R
V3=I*r
V2=sqrt(V^2-(V1+V3)^2)
X=V2/I  //inductive reactance
L=X/(2*%pi*f)
V4=sqrt(V2^2+V3^2)  ///voltage across choking coil
disp('voltage across choking coil='+string(V4)+'
   volts'  , 'inductor='+string(L)+'henry')
```

Scilab code Exa 4.28 time equation for v and i

```
4.28//voltage across R$C
C=15e-6;//farad..
R=100;//ohms
V=100;//volts
f=50;//hertz
Xc=1/(2*%pi*f*C);
Z=sqrt(R^2+(Xc^2));
I=V/Z;
coso=R/Z;
sino=R/Z
o=acosd(coso);
o=asind(sino)
Vr=I*R;
Vc=I*Xc;
AP=V*I*coso
RP=V*I*sino
APP=V*I;
disp('The time equation of current i = (0.426)1.414
    sin(314t-64.34)' , 'Apparent power ='+string(APP
    )+'vars ' , 'ACTIVE POWER ='+string(AP)+ '
    watts' )
```

Scilab code Exa 4.29 current and voltage

```
//determine the frequency
R=30;//ohms
L=0.5;//henry
f=50;//hertz
```

```
X=(2*%pi*f*L)
Z=R+%i*X
V=86.6+%i*50
I=V/Z
disp('current  = '+string(I)+ 'A')
```

Scilab code Exa 4.30 `voltage across R and C`

```

//find the equation of voltage and current
C=10e-6;//farad..
R=300;//ohms
//i=2 sin 314t
V=100;//volts
f=50;//hertz
Xc=1/(2*%pi*f*C);
Z=sqrt(R^2+(Xc^2));
Im=2
Vm=2*Z
coso=R/Z;
o=acosd(coso);
disp('The time equation of voltage Vr  = 600sin(314t
    )' ,  'The time equation of voltage Vc  = 636sin(
    wt-90)')
```

Scilab code Exa 4.31 `resistance and capacitance`

```

//calculate the value of RESISTANCE AND CAPACITANCE
I=2.5;//amps
V=150;//volts
f=50;//hetz
Z=V/I;
```

```
P=100; //watt..power
R=P/(I*I)
Xc=sqrt(Z^2-R^2)
C=1/(2*3.14*f*Xc); // capacitance
disp('find tha value of capacitance='+string(C)+'
   farad');
```

Scilab code Exa 4.32 capacitance

```

//determine the value of capacitance
V1=100; //volts
V=250; //volts
f=50; //hertz
P=500; //watt
I=P/V;
V2=sqrt(V^2-V1^2); //volts
Xc=V2/I;
C=1/(2*%pi*f*Xc);
disp('determine the value of capacitance='+string(C)
   +'farad');
```

Scilab code Exa 4.33 voltage across RLC

```

//determine the ind.reactance nd capacitance nd
   voltage across R L C
R=25
C=20e-6
L=0.15
V=250
f=50
X=2*%pi*f*L
```

```
Xc=1/(2*%pi*f*C)
Z=sqrt(R^2+(X-Xc)^2)
I=V/Z
coso=R/Z
o=acosd(coso)
Vr=I*R
Vl=I*X
Vc=I*Xc
disp('Vr='+string(Vr)+'volts' , 'Vl='+string(Vl)+'volts' , 'Vc='+string(Vc)+'volts' , 'phase angle='+string(o)+'degree' , 'current='+string(I)+'amps' , 'impedence='+string(Z)+'ohms' , 'ind.reactance='+string(X)+'ohms' , 'ind capacitance='+string(Xc)+'ohms')
```

Scilab code Exa 4.34 `current and voltage`

```

//determine the current also V1 nd V2
V=250
f=50
R1=10
L1=0.15
C1=10e-6
X1=2*%pi*f*L1
Xc1=1/(2*%pi*f*C1)
R2=8
L2=0.25
X2=2*%pi*f*L2
Z=sqrt((R1+R2)^2+[(X1+X2)-Xc1]^2)
I=V/Z
Z1=sqrt(R1^2+(X1-Xc1)^2)
V1=I*Z1
Z2=sqrt(R2^2+X2^2)
V2=I*Z2
```

```
disp('value of current='+string(I)+'amps' , 'v1='+
    string(V1)+'volts', 'V2='+string(V2)+'volts')
```

Scilab code Exa 4.35 maximum current

```

//determine the value of max. current
C=30e-6;//farad
R=12;//ohms
L=0.2;//henry
V=200;//volt
I=V/R
f=1/(2*%pi*sqrt (L*C))
disp('frequency='+string(f)+'hertz','maximum crnt='+
    string(I)+'amp')
```

Scilab code Exa 4.36 frequency response

```

//calculate freq at resonance
C=30*10^-6
L=0.2
R=12
F= sqrt(1/(L*C)-R^2/(L*L))
f=1/(2*3.14)*F
disp(('freq at resonance='+string(f)+'hz'))
```

Scilab code Exa 4.37 current voltage and power

```

```

```
//determine the current also power nd power factor
V=200+%i*0
f=50
R1=30
L1=0.2
C1=10e-6
X1=2*%pi*f*L1
Z1=R1+%i*X1
R2=40
L2=0.12
X2=2*%pi*f*L2
Z2=R2+%i*X2
Z=(Z1*Z2)/(Z1+Z2)
I=V/Z
R=18.858//calculatimg Z and I we get R and Z,I
Z=31.06
coso=R/Z
I=6.44
P=I^2*R
I1=(I*Z1)/(Z1+Z2)
I2=(I*Z1)/(Z1+Z2)
coso1=R1/Z1
P1=I1^2*R1
coso2=R2/Z2
P2=(I2)^2*R2
disp('P2 ='+string(P2)+  'watt' ,'P1 ='+string(P1)+
    'watt  ' ,  'Total power factr='+string(coso)+''
     ,  'Total power='+string(P)+'watt' ,  'total
   current  ='+string(I)+'amps'   , 'total impedance
   ='+string(Z)+'ohms' )
```

Scilab code Exa 4.38 current and power

```

//determine the current also power nd power factor
```

```
V=200+%i*0
f=50
R1=10
X1=12
Z1=R1+%i*X1
R2=15
Xc2=20
Z2=R2-%i*Xc2
Z=(Z1*Z2)/(Z1+Z2)
I=V/Z//calculatimg Z and I we get R and Z,I
R=14.36
I=13.46
coso=R/Z
P=I*I*R
I1=(I*Z2)/(Z1+Z2)
I2=(I*Z1)/(Z1+Z2)
coso1=R1/Z1
P1=I1*I1*R1
coso2=R2/Z2
P2=I2*I2*R2
disp('P2 ='+string(P2)+ 'watt' ,'P1 ='+string(P1)+
    'watt ' , 'Total power factr='+string(coso)+''
    , 'Total power='+string(P)+'watt' , 'total
    current ='+string(I)+'amps' , 'total impedance
    Z ='+string(Z)+'ohms' )
```

Scilab code Exa 4.40 voltage and current

```

//calculate the line currnt nd voltage
R=200
Vl=440
f=50
V=Vl/1.732//star connection
I=V/R
```

```
Il=I
coso=1
P=3*V*I*coso
Vp=440//delta connection
Vl=440
I1=1.732*I
P1=3*Vp*I*coso
disp('active power='+string(P)+'watt' , 'active
   power='+string(P1)+'watt' )
```

Scilab code Exa 4.41 `power absorbed`

```

//calculate total power absrbed
R=15
L=0.25
f=50
X=2*%pi*f*L
Z=sqrt(R^2+X^2)
Vl=400
V=Vl/1.732  //in star connection
I=V/Z
Il=I
coso=R/Z
P=3*V*Il*coso
disp('total power absorbed='+string(P)+'watt')
```

Scilab code Exa 4.42 `power absorbed`

```

//calculate resistance nd reactance of circuit
P=15000;  //power
Vl=400;//line voltage
```

```
V=Vl/1.732
I=35;//line current equal to phase current
Z=V/I
coso=15e3/(1.732*400*35)
R=Z*coso
X=sqrt(Z^2-R^2)
disp('reactance='+string(X)+'ohms'  ,'resistance='+
   string(R)+'ohms')
```

Scilab code Exa 4.43 power factor

```

//calculate power factor
W1=5000//W1=V*L*cos(30+o)
W2=3000//W2=V*L*cos(30-o)
o=atand (1.732*(W1-W2)/(W1+W2))
disp('power factor='+string(o)+'  ')
```

Chapter 5

Electrical Machine

Scilab code Exa 5.1 determine the emf induced in the coil

```

//P5.1    determine the induced emf in the armature
P=4;//poles
A=2;//wave wound
N=50;//number of slots
SperCondctr=24;//slots/conductor
Z=SperCondctr*N;//total conductor
N=600;//rpm....speed of armature
F=10e-3;//webers....flux/poles
E=F*Z*N*P/(60*A);//emf induced
disp('e.m.f induced is = '+string(E)+' volts');
```

Scilab code Exa 5.2 emf induced in coil

```

//P5.2    determine the induced emf in the armature
P=4;//poles
A=4;//wave wound
```

```
N=50;//number of slots
SperCondctr=24;//slots/conductor
Z=SperCondctr*N;//total conductor
N=600;//rpm....speed of armature
F=10e-3;//webers....flux/poles
E=F*Z*N*P/(60*A);//emf induced
disp('e.m.f induced is = '+string(E)+' volts');
```

Scilab code Exa 5.3 speed

```

//determine the speed
P=6;//poles
A=2;//wave wound
Z=780;//armature conductors
F=12*10^-3;//webers..flux/poles
E=400;//volt
N=(E*60*2)/(F*Z*P);
N2=(E*60*6)/(F*Z*P);
disp('determine the speed='+string(N)+'rpm',     '
   determine the speed (A=P=6)='+string(N2)+'rpm');
```

Scilab code Exa 5.4 induced emf

```

//determine the emf induced
R=0.05;
Rs=100;
V=250;
P=10000;
I=P/V;
Is=V/Rs;
Ia=I+Is;
```

```
Eg=V+(R*Ia);
disp('emf induced='+string(Eg)+'volts');
```

Scilab code Exa 5.5 emf induced

```

//calculate the emf induced in the armature
Il=200
Vl=500
Ra=0.03
Rs=0.015
R=150
BCD=2  //one volt per brush
I=Vl/R
Ia=Il+I
Eg=Vl+(Ia*Ra)+(Ia*Rs)+BCD
disp('emf induced=     '+string(Eg)+'     volts');
```

Scilab code Exa 5.6 emf induced

```

//calculate the emf induced in the armature
Il=200
Vl=500
Ra=0.03
Rs=0.015
Is=200  //for a short shunt generator   Il=Ise
R=150
BCD=2  //one volt per brush
I=(Vl+(Is*Rs))/R
Ia=Il+I
Eg=Vl+(Ia*Ra)+(Ia*Rs)+BCD
disp('emf induced=     '+string(Eg)+'    volts'  );
```

Scilab code Exa 5.7 back emf

```
//calculate the back emf induced on full load
Ra=0.5  //armature resistance
Rs=250 //shunt resistance
Vl=250  //line volt
Il=40
Is=Vl/Rs
Ia=Il-Is
Eb=Vl-(Ia*Ra)
disp('emf induced=     '+string(Eb)+'    volts'  );
```

Scilab code Exa 5.8 power

```
//find the power developed in circiut
Pl=20e3
Vl=200
Ra=0.05
R=150
I=Vl/R
Il=Pl/Vl
Ia=Il+I
Eg=Vl+(Ia*Ra)
P=Eg*Ia
disp('power developed='+string(P)+'watt')
```

Scilab code Exa 5.9 speed

```

//calculate the speed of the machine when running
N1=1000  //speed of generator
E1=205.06  //emf generator
E2=195.06  //emf of motor
N2=(E2*N1)/E1  //speed of generator
disp('speed of motor='+string(N2)+'rpm')
```

Scilab code Exa 5.10 speed of rotor

```

//dtermine its speed when its take crnt 25 amps
Vl=250
Ra=0.05
R=0.02
Ia=30
I1=30 //Il=Ia
N1=400
E1=Vl-(Ia*Ra)-(Ia*R)
//E1=E2
I2=25
N2=(N1*E1*I1)/(E1*I2)
disp('speed of motor='+string(N2)+'rpm')
```

Scilab code Exa 5.11 torque

```

//find the torque whn its take scurnt 60amprs
Vl=200
Il=60 //amprs
R=50
I=Vl/R  // amprs
Ia=Il-I  //amprs
```

```
f=0.03  // flux
Z=700
P=4
A=2
T=(0.159*f*Z*Ia*P)/A
disp('Torque='+string(T)+'N-m')
```

Scilab code Exa 5.12 `number of turns and current`

```

//calcute the num of prim turns and prim $sec
    current
KVA=50
E1=6000
E2=250
N2=52
N1=N2*E1/E2
I2=KVA*1000/E2
I1=KVA*1000/E1
disp('prim current  I1 =  '+string(I1)+'   amps'  ,
    'sec current  I2 =  '+string(I2)+'   amps'  ,  '
    prim num of turns  N1 =  '+string(N1)+'   turns'
    )
```

Scilab code Exa 5.13 `flux density`

```

//determine the emf induced in the secondry max
    value of flux density
f=50
N1=350
N2=800
E1=400
```

```
E2=(N2*E1)/N1
A=75e-4
Bm=E1/(4.44*f*A*N1)
disp('flux density='+string(Bm)+'wb/m^2')
```

Scilab code Exa 5.14 current

```

//find the magnetic nd iron loss component of
   current
E1=440
E2=200
I=0.2
coso=0.18
sino=sqrt(1-coso^2)
Iw=I*coso
Iu=I*sino
disp('Iw='+string(Iw)+'amps' , 'Iu='+string(Iu)+'
   amprs')
```

Scilab code Exa 5.15 efficiency

```

//calculate teh efficiency at loads
KVA=20
Il=350
Cl=400
x=1
pf=0.8//at full load
pf1=0.4 //at half load
x1=0.5
op=KVA*1000*x
op1=KVA*1000*x1*pf1
```

```
Tl=Il+(Cl*x*x)
Tl1=Il+(Cl*x1*x1)
ip=op+Tl
ip1=op1+Tl1
%n=op/ip*100
%n1=op1/ip1*100
disp('efficiency at half load n = '+string(%n1)+' ' , 'efficiency at full load n1 = '+string(%n)+' ' )
```

Scilab code Exa 5.16 speed and emf

```

//calculate the synchronous speed ,slip ,frequncy induced emf
f=50
p=4
Ns=120*f/p
N=1460
s=(Ns-N)/Ns
f1=(s*f)
disp( 'f1='+string(f1)+'hz' , 's='+string(s)+' ' , 'Ns='+string(Ns)+'rpm' )
```

Scilab code Exa 5.17 speed

```

//determine the value of slip nd speed of motor
P=6
f=50
Ns=120*f/P
f1=1.5
s=f1/f
```

```
N=Ns*(1-s)
disp('speed of motor='+string(N)+'RPM')
```

Scilab code Exa 5.18 poles speed frequency

```

//calculate the numbers of poles ,slip at full load ,
   frequncy rotor ,speed of motor
Ns=1000
N=960
f=50
P=120*f/Ns// synchronous speed
s=(Ns-N)/Ns
f1=s*f
N=Ns*(1-0.08)//speed of motor at 8% slip
disp('speed of rotor='+string(N)+'RPM')
```

Scilab code Exa 5.19 induced emf

```

//calculate the induced emf per phase
f=50
P=16
N=160
S=6
n=N*S
Z=n/3
F=0.025
e=2.22*F*f*Z
disp('e='+string(e)+'volts')
```