Scilab Textbook Companion for Engineering Basics
by T. Thyagarajan[1]

Created by
Qureshi Mehtab Alam Niyaz Ahmed
B.E (EXTC)
Electronics Engineering
Mumbai
College Teacher
S. Chaya Ravindra
Cross-Checked by
Banda Nawaz

September 30, 2014

Book Description

Title: Engineering Basics

Author: T. Thyagarajan

Publisher: New Age International , New Delhi

Edition: 3

Year: 2000

ISBN: 81-224-1274-2

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

6

Chapter 1

concept of electric current and laws

Scilab code Exa 1.1 specific resistance

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

Scilab code Exa 1.2 resistance

```
1
2 //resistance at 40 degree
3 a0=0.0043
4 t1=27
5 t2=40
6 R1=1.5
```

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

Scilab code Exa 1.3 resistance and current

```
1
2  //find the total R.I.V
3  R1=5
4  R2=10
5  R3=15
6  V=120
7  R=R1+R2+R3
8  I=V/R
9  V1=I*R1
10 V2=I*R2
11 V3=I*R3
12 disp('Voltage V3='+string(V3)+'volts'  ,  'Voltage
       V2='+string(V2)+'volt' , 'Voltage V1='+string(V1)
       +'volts')
```

Scilab code Exa 1.4 resistance

```
1
2  //find the eqvivalent rasistance of series parallel
       combination
3  Rab=(2*4)/(2+4)
4  Rbc=(6*8)/(6+8)
5  Rac=Rab+Rbc
6  disp('rasistance across AC='+string(Rac)+'ohms')
```

Scilab code Exa 1.5 resistance

```
1
2 //find the eqvivalent resistance of series parallel
      combination
3 Rab =4
4 Rbc =(12*8) /(12+8)
5 Rcd =(3*6) /(3+6)
6 Rad = Rab + Rbc + Rcd
7 disp ( ' r e s i s t a n c e   a c r o s s  AC=' + string ( Rad ) + '       ohms '
      )
```

Scilab code Exa 1.6 resistance

```
1
2 //what resistance must be connected in parallel
3 R1 =8
4 R2 =48/2 //R1*R2/R1+R2
5 disp ( 'R2=' + string ( R2 ) + ' ohms ' )
```

Scilab code Exa 1.7 current

```
1
2 //calculate the current I1.I2
3 I =12
4 R1 =6
5 R2 =8
6 I1 = I * R2 /( R1 + R2 )
7 I2 = I * R1 /( R1 + R2 )
8 disp ( 'I1=' + string ( I1 ) + ' amps '   ,    ' I2  =' + string ( I2 ) +
      ' amps ' )
```

Scilab code Exa 1.9 current

```
1
2 //find how current divide in circuit
3 R1=0.02
4 R2=0.03
5 I1=(10*R2)/(R1+R2)
6 I2=(10*R1)/(R1+R2)
7 disp('I2='+string(I2)+  'amps'  ,  'I1= '+string(I1)
      +  'amps')
```

Scilab code Exa 1.10 resistance of coil

```
1
2 //what is the resistance of each coil
3 V=200
4 I=25
5 P1=1500
6 R1=(V*V)/P1
7 R=V/I          //total resistance
8 R2=R*R1/(R1-R)
9 disp('R2='+string(R2)+'  ohms'  )
```

Scilab code Exa 1.11 power

```
1
2 //what is the resistance of each coil
3 V=100
4 P=1500
```

```
5  R=(V^2/P)/2
6  Ra=R
7  Rb=R
8  Rc=R
9  R1=((Ra*Rc)/(Ra+Rc))+Rb
10 I=V/R1
11 I1=(I*Ra)/(Ra+Rc)
12 I2=(I*Ra)/(Ra+Rc)
13 Pa=I*I*Ra
14 Pb=I1*I1*Rb
15 Pc=I2*I2*Rc
16 disp( 'Pc='+string(Pc)+' watts' , 'Pb='+string(Pb)
       +' watts' , 'Pa='+string(Pa)+' watts')
```

Scilab code Exa 1.12 Bill amount

```
1
2  //determine the energy consume in a house in the
       month
3  L=3600//six lamp 1000 watt each for six days
4  H=3000//one haeter
5  M=735.5//single phase motor
6  F=2400//four fans 75W
7  T=L+H+M+F//total energy consumed in watt
8  TE=T*30/1000
9  C=0.9//cost of energy
10 B=TE*0.9//Bil amount
11 disp('B=  '+string(B)+'  ')
```

Scilab code Exa 1.18 resistance

```
1
2  //convert the delta circuit
```

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

Scilab code Exa 1.19 resistance

```
1
2  // convert  star  circuit
3  Rr =2
4  Ry =0 .67
5  Rb =1
6  Rry =( Rr * Ry ) +( Ry * Rb ) +( Rb * Rr ) / Rb
7  Ryb =( Rr * Ry ) +( Ry * Rb ) +( Rb * Rr ) / Rr
8  Rbr =( Rr * Ry ) +( Ry * Rb ) +( Rb * Rr ) / Ry
9  disp ( 'Rbr='+string (Rbr)+'ohms '   ,   'Ryb='+string (Ryb
          )+'ohms '   ,   'Rry='+string (Rry)+   'ohms ')
```

Chapter 2

Magnetic Current

Scilab code Exa 2.1 flux density

```
1
2 //determine the fukux density
3 F=0.5e-3;//webers
4 A=4*10^-4;//meter^2
5 B=F/A;
6 disp('flux density is = '+string(B)+' Wb/m^2');
```

Scilab code Exa 2.2 Magnetic field strength

```
1
2 //determine the magnetic field strenght at the
      centre of solinoid
3 I=2;//amp
4 L=50e-2;//meter
5 N=100;//turns
6 H=(N*I)/L;
7 disp('magnetic field strenght='+string(H)+'AT/m');
```

Scilab code Exa 2.3 reluctance current and

```
1
2  //calculate the reluctance and current
3  A=5e-4
4  N=250
5  l=50e-2
6  F=700e-6
7  u=380
8  S=l/(4*%pi*10^-7*A*u)
9  I=F*S/N
10 disp('current='+string(I)+'amps'  , 'reluctance ='+
       string(S)+'AT/Wb')
```

Scilab code Exa 2.4 relative permeability

```
1
2  //determine the value of relative permeability of
       iron
3  D=15e-2
4  l=%pi*15e-2
5  N=450
6  I=2
7  B=1.2
8  u=B/(4*%pi*10^-7*N*I*l)
9  disp('value of relative permeability='+string(u)+'
       ')
```

Scilab code Exa 2.5 mmf

14

```
1
2  // calculate the mmf
3  l=1.5
4  u=1600
5  B=1.2
6  H1=B*l/(4*%pi*10^-7*u)
7  la=1e-3
8  ua=1
9  H2=B*la/(4*%pi*10^-7*ua)
10 H=H1+H2
11 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

```
1
2  // calculate the magnetising force relative
      permeability
3  A=5e-4
4  l=25e-2
5  N=100
6  I=2
7  F=0.3e-3
8  H=(N*I)/l
9  u=(F*l)/(N*I*A*4*3.14*10^-7)
10 B=(u*H*4*3.14*10^-7)
11 I1=5
12 F1=0.58e-3
13 H1=(N*I1)/l
14 u1=(F1*l)/(N*I*A*4*3.14*10^-7)
15 B1=(u1*H*4*3.14*10^-7)
16 disp('flux density B1='  +string(B1)+   'Wb/m^2'   ,'
       flux density  B ='  +string(B)+   'Wb/m^2' )
```

Scilab code Exa 2.7 Magnetising Current

```
1
2  //calculate the magnitising current
3  A=0.01
4  l=2e-3
5  u=1
6  F=800e-6
7  B=F/A//flux
8  H=B/(4*3.14*10^-7*u)
9  N=(H*l)
10 L=150e-2
11 v=600
12 f=9.6e-4
13 N1=(f*L)/(v*A*4*%pi*10^-7)
14 N2=N1+N
15 n=200
16 M=N2/n
17 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

```
1
2  //find the number of amprs turns required
3  A=25e-4
4  F=1.2e-3
5  u=1  //air path
6  l=0.25e-2
```

```
7  N=(F*l/(4*%pi*10^-7*A*u))*2   // for two air gaps
8  v=2000   // iron path
9  L=50e-2
10 N1=(F*L)/(v*A*4*%pi*10^-7)
11 N2=N+N1
12 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

```
1
2  //calculate the circuit current
3  u=1//for air gap
4  F=1.5e-3//flux
5  A=9e-4 //area
6  B=F/A
7  H=B/(4*3.14*10^-7*u)
8  l=4e-3//air gap
9  S=H*l//amps turns in air gap
10 l=4e-3//air gap
11 u1=800// for iron gap
12 A1=750e-6
13 B1=F/A1
14 H1=B1/(4*3.14*10^-7*u1)
15 l1=270e-3
16 S1=H1*l1
17 u2=1000//for P,Q,R
18 H2=B/(4*3.14*10^-7*u2)
19 Ip=135e-3
20 Iq=270e-3
21 Ir=135e-3
22 S2=H2*(Ip+Iq+Ir)//amps turns
23 TNn=S+S1+S2
24 TN=4000
```

```
25  EI = TNn / TN
26  disp ( ' exciting  current =    ' + string ( EI ) + '  amps ' )
```

Scilab code Exa 2.10 exciting current

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

Scilab code Exa 2.11 hysteris loop

```
1
2  // calculate  the  hysteris  loss
3  A =50 // area  of  hysterisis
4  H =200
```

18

```
 5  B =0.2
 6  f =50
 7  D =10// density
 8  M =1000// mass
 9  V =M/D// velocity is mass /density
10  HL =A*H*B// ..... j/m^2/cycle
11  HL1 =A*H*B*10^-4// .... j/cycle
12  HL2 =A*H*B*50*1e-4// .... j/s
13
14  disp('Hysteresis loop = '+string(HL2)+'    j/s')
```

Chapter 3

Electromagnetism

Scilab code Exa 3.1 emf induced

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

Scilab code Exa 3.2 emf induced

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

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

Scilab code Exa 3.3 inductance of the coil

```
1
2 //find the inductance of the  coil
3 N=1500;// number of turns
4 I=10;//amp... current in coil
5 F=.5*10^-3;//weber... flux
6 L=N*F/I;
7 disp('inductance of coil='+string(L)+'henry');
```

Scilab code Exa 3.4 self inductance

```
1
2 //P3.4    calculate its self induction
3
4 Ur=1;
5 N=400;
6 l=30e-2;
7 A=5e-4;
8 U0=4e-7*%pi;
9 S=l/(U0*Ur*A);
10 L=N^2/S;
11 disp('Self inductance is = '+string(L)+' henry','S =
       '+string(S));
```

Scilab code Exa 3.5 inductance and emf induced

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

Scilab code Exa 3.6 inductance and emf induced

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

Scilab code Exa 3.7 inductance and emf induced

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

Scilab code Exa 3.8 mutual inductance and emf induced

```
1
2  ////calculate  the  mutual  inductance  between  the  two
       coil
3  N1 =50
4  N2 =400
5  A=150e-4
6  l=200e-2
7  u=2500
8  s=l/(4*3.14*10^-7*A*u)
9  M=(N1*N2)/s
10 dI1 =24
11 dt =0.03
12 eM2=M*dI1/dt
13 disp('induced emf=    '+string(eM2)+'  volts'  ,  '
       Mutual  inductance=   '+string(M)+'  henry'  ,  's=
       '+string(s)+'  AT/Wb')
```

Scilab code Exa 3.9 energy stored

```
1
2 //find the energy stored in it
3 L=0.5
4 I=2
5 E=0.5*L*I*I
6 disp('Energy stored=  '+string(E)+'  joule')
```

Scilab code Exa 3.10 force

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

Chapter 4

Ac circuit

Scilab code Exa 4.1 voltage and current factors

```
1
2  //
3  // i =40 sin 314 t
4  // i=Imsin wt
5  Im =40
6  w =314
7  Iav = Im /1.414
8  Irms = Im *2/3.14
9  f = w /(2*3.14)
10 Ff = Irms / Iav
11 Pf = Im / Irms
12 disp ( 'peak factor='+string (Pf)+ ' ' , 'form
       factor='+string (Ff)+ ' ' , 'frequency ='+string
       (f)+ ' ')
```

Scilab code Exa 4.2 voltage equation

```
1
```

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

Scilab code Exa 4.3 volatage and time

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

Scilab code Exa 4.12 power dissipated

```
1
2  //determine  the  power  dissipiated  in  resistance
3  //v=200  sind  314t
4  Vm =200;
5  o =314;   //@=omega
6  //i=50  sind  314t
```

26

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

Scilab code Exa 4.13 inductive reactance

```
1
2  // determine the inductive reactance of the coil
3  L =0.25; // henry .... inductance
4  f =50; // hertz ... frequency
5  X =2*3.14* f * L
6  disp ('value of inductive reactance='+string (X)+'ohms
       ');
```

Scilab code Exa 4.15 current

```
1
2  // calculate the current flowing through the coil
3  L =0.05
4  V =230
5  f =60
6  X =(2* %pi * f * L )
7  I = V / X
8  disp (' the current flowing through the coil='+string
       (I)+'amps ')
```

Scilab code Exa 4.16 inductance and current

```
1
2 //detrmine the value of inductance
3 I=5;//amp
4 V=200;//volt
5 f=50;//hertz
6 X=V/I;
7 L=40/(2*%pi*50);
8 disp('the value of inductive.reactance='+string (X)+
      'ohms' ,    'value of inductors='+string(L)+'
      henry');
```

Scilab code Exa 4.17 voltage and current

```
1
2 //write the time equation for voltage and current
3 Vrms=150
4 Vm=2*1.414*Vrms
5 f=50
6 L=0.2
7 X=2*3.14*f*L
8 Im=Vm/X
9 disp('current equation    i=212.132 sin(314)t' ,  '
      voltage equation v=3.376 sin(314t-90)' , ' Im= '+
      string(Im)+ ' ')
```

Scilab code Exa 4.18 current

```
1
2 //calculate the current
3 C=25e-6;
4 V=200
```

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

Scilab code Exa 4.19 capacitance current

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

Scilab code Exa 4.20 frequency

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

Scilab code Exa 4.21 phase angle

```
1
2  //calculate the value of current
3  R=10;//ohms
4  L=0.02;//henry
5  V=250;//volt
6  f=50;//hertz
7  X=(2*%pi*f*L)
8  Z=sqrt(R^2+X^2)
9  I=V/Z
10 coso=R/Z
11 o=acosd(coso)
12 disp('phase angle='+string(o)+'degree',  'current
       flowing through coil='+string(I)+'amp')
```

Scilab code Exa 4.22 voltage and current

```
1
2  //find the inductance impd,curent,power factr,
       voltage.power
3  R=50;//ohms
4  L=0.5;//henry
5  V=200;//volt
6  f=50;//hertz
7  X=(2*%pi*f*L)
8  Z=sqrt(R^2+X^2)
9  I=V/Z
10 coso=R/Z
11 sino=R/Z
12 o=acosd(coso)
13 o1=asind(sino)
14 Vr=I*R
15 Vl=I*X
16 AP=V*I*coso
```

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

Scilab code Exa 4.23 voltage

```
1
2  //determine the supply voltage
3  R=15;//ohms
4  L=0.15;//henry
5  I=20;//ampss
6  f=50;//hertz
7  X=2*%pi*50*0.15
8  Z=sqrt(R^2+X^2)
9  V=I*Z
10 disp('supply voltage = '+string(V)+'volts');
```

Scilab code Exa 4.24 resistance

```
1
2  //determine the supply voltage
3  V=200;//ohms
4  L=0.4;//henry
5  I=0.5;//ampss
6  f=50;//hertz
7  Z=V/I
8  X=2*%pi*f*L
9  R=sqrt(Z^2+X^2)
10 disp('Resistance = '+string(R)+'ohms')
```

Scilab code Exa 4.25 inductance

```
1
2  //determine the inductance of the coil
3  R=6
4  V=250;//volts
5  I=1.5;//amps
6  Z=V/I;//impedance
7  f=60;//hetrz
8  X=sqrt(Z^2-R^2)
9  L=X/(2*%pi*f)
10 disp('inductance of coil='+string(L)+  'henry')
```

Scilab code Exa 4.27 voltage across choking coil

```
1
2  //determine the inductance of the coil and voltage
        across each element
3  I=7
4  V=200
5  f=50
6  R=10
7  r=1.5   //rasistance choke coil
8  V1=I*R
9  V3=I*r
10 V2=sqrt(V^2-(V1+V3)^2)
11 X=V2/I   //inductive reactance
12 L=X/(2*%pi*f)
13 V4=sqrt(V2^2+V3^2)   ///voltage across choking coil
14 disp('voltage across choking coil='+string(V4)+'
        volts'  , 'inductor='+string(L)+'henry')
```

Scilab code Exa 4.28 time equation for v and i

```
1
2  4.28//voltage across R$C
3  C=15e-6;//farad..
4  R=100;//ohms
5  V=100;//volts
6  f=50;//hertz
7  Xc=1/(2*%pi*f*C);
8  Z=sqrt(R^2+(Xc^2));
9  I=V/Z;
10 coso=R/Z;
11 sino=R/Z
12 o=acosd(coso);
13 o=asind(sino)
14 Vr=I*R;
15 Vc=I*Xc;
16 AP=V*I*coso
17 RP=V*I*sino
18 APP=V*I;
19 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

```
1
2  //determine the frequency
3  R=30;//ohms
4  L=0.5;//henry
5  f=50;//hertz
```

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

Scilab code Exa 4.30 voltage across R and C

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

Scilab code Exa 4.31 resistance and capacitance

```
1
2  //calculate the value of RESISTANCE AND CAPACITANCE
3  I=2.5;//amps
4  V=150;//volts
5  f=50;//hetz
6  Z=V/I;
```

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

Scilab code Exa 4.32 capacitance

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

Scilab code Exa 4.33 voltage across RLC

```
 1
 2  // determine the ind . reactance nd capacitance nd
        voltage across R L C
 3  R =25
 4  C =20e -6
 5  L =0.15
 6  V =250
 7  f =50
 8  X =2*% pi * f * L
```

35

```
9  Xc=1/(2*%pi*f*C)
10 Z=sqrt(R^2+(X-Xc)^2)
11 I=V/Z
12 coso=R/Z
13 o=acosd(coso)
14 Vr=I*R
15 Vl=I*X
16 Vc=I*Xc
17 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

```
1
2  //determine the current also V1 nd V2
3  V=250
4  f=50
5  R1=10
6  L1=0.15
7  C1=10e-6
8  X1=2*%pi*f*L1
9  Xc1=1/(2*%pi*f*C1)
10 R2=8
11 L2=0.25
12 X2=2*%pi*f*L2
13 Z=sqrt((R1+R2)^2+[(X1+X2)-Xc1]^2)
14 I=V/Z
15 Z1=sqrt(R1^2+(X1-Xc1)^2)
16 V1=I*Z1
17 Z2=sqrt(R2^2+X2^2)
18 V2=I*Z2
```

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

Scilab code Exa 4.35 maximum current

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

Scilab code Exa 4.36 frequency response

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

Scilab code Exa 4.37 current voltage and power

```
1
```

```
2  //determine the current also power nd power factor
3  V=200+%i*0
4  f=50
5  R1=30
6  L1=0.2
7  C1=10e-6
8  X1=2*%pi*f*L1
9  Z1=R1+%i*X1
10 R2=40
11 L2=0.12
12 X2=2*%pi*f*L2
13 Z2=R2+%i*X2
14 Z=(Z1*Z2)/(Z1+Z2)
15 I=V/Z
16 R=18.858//calculatimg Z and I we get R and Z,I
17 Z=31.06
18 coso=R/Z
19 I=6.44
20 P=I^2*R
21 I1=(I*Z1)/(Z1+Z2)
22 I2=(I*Z1)/(Z1+Z2)
23 coso1=R1/Z1
24 P1=I1^2*R1
25 coso2=R2/Z2
26 P2=(I2)^2*R2
27 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

```
1
2  //determine the current also power nd power factor
```

```
 3  V=200+%i*0
 4  f=50
 5  R1=10
 6  X1=12
 7  Z1=R1+%i*X1
 8  R2=15
 9  Xc2=20
10  Z2=R2-%i*Xc2
11  Z=(Z1*Z2)/(Z1+Z2)
12  I=V/Z//calculatimg Z and I we get R and Z,I
13  R=14.36
14  I=13.46
15  coso=R/Z
16  P=I*I*R
17  I1=(I*Z2)/(Z1+Z2)
18  I2=(I*Z1)/(Z1+Z2)
19  coso1=R1/Z1
20  P1=I1*I1*R1
21  coso2=R2/Z2
22  P2=I2*I2*R2
23  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

```
1
2  //calculate the line currnt nd voltage
3  R=200
4  Vl=440
5  f=50
6  V=Vl/1.732//star connection
7  I=V/R
```

```
8  Il=I
9  coso=1
10  P=3*V*I*coso
11  Vp=440//delta connection
12  Vl=440
13  I1=1.732*I
14  P1=3*Vp*I*coso
15  disp('active power='+string(P)+'watt' , 'active
      power='+string(P1)+'watt' )
```

Scilab code Exa 4.41 power absorbed

```
1
2  //calculate total power absrbed
3  R=15
4  L=0.25
5  f=50
6  X=2*%pi*f*L
7  Z=sqrt(R^2+X^2)
8  Vl=400
9  V=Vl/1.732  //in star connection
10  I=V/Z
11  Il=I
12  coso=R/Z
13  P=3*V*Il*coso
14  disp('total power absorbed='+string(P)+'watt')
```

Scilab code Exa 4.42 power absorbed

```
1
2  //calculate resistance nd reactance of circuit
3  P=15000;  //power
4  Vl=400;//line voltage
```

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

Scilab code Exa 4.43 power factor

```
1
2  //calculate power factor
3  W1=5000//W1=V*L*cos(30+o)
4  W2=3000//W2=V*L*cos(30-o)
5  o=atand (1.732*(W1-W2)/(W1+W2))
6  disp('power factor='+string(o)+'  ')
```

Chapter 5

Electrical Machine

Scilab code Exa 5.1 determine the emf induced in the coil

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

Scilab code Exa 5.2 emf induced in coil

```
1
2  //P5.2    determine the induced emf in the armature
3  P=4; // poles
4  A=4; // wave wound
```

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

Scilab code Exa 5.3 speed

```
 1
 2  //determine the speed
 3  P=6;//poles
 4  A=2;//wave wound
 5  Z=780;//armature conductors
 6  F=12*10^-3;//webers..flux/poles
 7  E=400;//volt
 8  N=(E*60*2)/(F*Z*P);
 9  N2=(E*60*6)/(F*Z*P);
10  disp('determine the speed='+string(N)+'rpm',      '
        determine the speed (A=P=6)='+string(N2)+'rpm');
```

Scilab code Exa 5.4 induced emf

```
 1
 2  //determine the emf induced
 3  R=0.05;
 4  Rs=100;
 5  V=250;
 6  P=10000;
 7  I=P/V;
 8  Is=V/Rs;
 9  Ia=I+Is;
```

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

Scilab code Exa 5.5 emf induced

```
1
2  //calculate the emf induced in the armature
3  Il=200
4  Vl=500
5  Ra=0.03
6  Rs=0.015
7  R=150
8  BCD=2   //one volt per brush
9  I=Vl/R
10  Ia=Il+I
11  Eg=Vl+(Ia*Ra)+(Ia*Rs)+BCD
12  disp('emf induced=      '+string(Eg)+'     volts');
```

Scilab code Exa 5.6 emf induced

```
1
2  //calculate the emf induced in the armature
3  Il=200
4  Vl=500
5  Ra=0.03
6  Rs=0.015
7  Is=200   //for a short shunt generator   Il=Ise
8  R=150
9  BCD=2   //one volt per brush
10  I=(Vl+(Is*Rs))/R
11  Ia=Il+I
12  Eg=Vl+(Ia*Ra)+(Ia*Rs)+BCD
13  disp('emf induced=      '+string(Eg)+'     volts' );
```

Scilab code Exa 5.7 back emf

```
1
2  //calculate the back emf induced on full load
3  Ra=0.5   //armature resistance
4  Rs=250 //shunt resistance
5  Vl=250   //line volt
6  Il=40
7  Is=Vl/Rs
8  Ia=Il-Is
9  Eb=Vl-(Ia*Ra)
10 disp('emf induced=        '+string(Eb)+'    volts'  );
```

Scilab code Exa 5.8 power

```
1
2  //find the power developed in circiut
3  Pl=20e3
4  Vl=200
5  Ra=0.05
6  R=150
7  I=Vl/R
8  Il=Pl/Vl
9  Ia=Il+I
10 Eg=Vl+(Ia*Ra)
11 P=Eg*Ia
12 disp('power developed='+string(P)+'watt')
```

Scilab code Exa 5.9 speed

```
1
2 //calculate the speed of the machine when running
3 N1=1000  //speed of generator
4 E1=205.06  //emf generator
5 E2=195.06  //emf of motor
6 N2=(E2*N1)/E1  //speed of generator
7 disp('speed of motor='+string(N2)+'rpm')
```

Scilab code Exa 5.10 speed of rotor

```
1
2 //dtermine its speed when its take crnt 25 amps
3 Vl=250
4 Ra=0.05
5 R=0.02
6 Ia=30
7 I1=30 //Il=Ia
8 N1=400
9 E1=Vl-(Ia*Ra)-(Ia*R)
10 //E1=E2
11 I2=25
12 N2=(N1*E1*I1)/(E1*I2)
13 disp('speed of motor='+string(N2)+'rpm')
```

Scilab code Exa 5.11 torque

```
1
2 //find the torque whn its take scurnt 60amprs
3 Vl=200
4 Il=60 //amprs
5 R=50
6 I=Vl/R  // amprs
7 Ia=Il-I  //amprs
```

```
 8  f =0.03    //  flux
 9  Z =700
10  P =4
11  A =2
12  T =(0.159* f * Z * Ia * P )/ A
13  disp ( 'Torque= '+ string (T )+ 'N–m ')
```

Scilab code Exa 5.12 number of turns and current

```
 1
 2  // calcute  the  num  of  prim  turns  and  prim  $sec
         current
 3  KVA =50
 4  E1 =6000
 5  E2 =250
 6  N2 =52
 7  N1 = N2 * E1 / E2
 8  I2 = KVA *1000/ E2
 9  I1 = KVA *1000/ E1
10  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

```
 1
 2  // determine  the  emf  induced  in  the  secondry  max
         value  of  flux  density
 3  f =50
 4  N1 =350
 5  N2 =800
 6  E1 =400
```

47

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

Scilab code Exa 5.14 current

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

Scilab code Exa 5.15 efficiency

```
1
2  //calculate teh efficiency at loads
3  KVA=20
4  Il=350
5  Cl=400
6  x=1
7  pf=0.8//at full load
8  pf1=0.4  //at half load
9  x1=0.5
10 op=KVA*1000*x
11 op1=KVA*1000*x1*pf1
```

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

Scilab code Exa 5.16 speed and emf

```
1
2  // calculate  the  synchronous  speed  , slip , frequncy
       induced  emf
3  f =50
4  p =4
5  Ns =120* f / p
6  N =1460
7  s =( Ns - N )/ Ns
8  f1 =( s * f )
9  disp (  ' f1 = '+ string ( f1 )+ ' hz '   ,     ' s = '+ string ( s )+ '  '
       , ' Ns = '+ string ( Ns )+ ' rpm '   )
```

Scilab code Exa 5.17 speed

```
1
2  // determine  the  value  of  slip  nd  speed  of  motor
3  P =6
4  f =50
5  Ns =120* f / P
6  f1 =1.5
7  s = f1 / f
```

49

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

Scilab code Exa 5.18 poles speed frequency

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

Scilab code Exa 5.19 induced emf

```
1
2 //calculate the induced emf per phase
3 f=50
4 P=16
5 N=160
6 S=6
7 n=N*S
8 Z=n/3
9 F=0.025
10 e=2.22*F*f*Z
11 disp('e='+string(e)+'volts')
```