

Scilab Textbook Companion for
Engineering Basics
by T. Thyagarajan¹

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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.

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List of Scilab Codes

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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 equivalent resistance of series parallel
  combination
3 Rab=(2*4)/(2+4)
4 Rbc=(6*8)/(6+8)
5 Rac=Rab+Rbc
6 disp('resistance across AC='+string(Rac)+' ohms')
```

Scilab code Exa 1.5 resistance

```
1
2 //find the equivalent 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('resistance across 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*I)/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 flux 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 strength 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 strength='+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=1/(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

```

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 magnetising 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*1/(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=1.2e-3//flux
5 A=10e-4 //area
6 B=F/A
7 H=B/(4*3.14*10^-7*u)
8 l=0.2e-3//air gap
9 S=H*l//amps turns in air gap
10 l1=15e-2//air gap
11 A1=8e-4
12 H1=450
13 S1=H1*l1
14 F1=0.6e-3
15 B1=F1/A1
16 H2=140
17 S2=H2*30e-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
```

```
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 induced in a long wire
3 B=1.2; //weber/meter ^2... flux density
4 V=4; //meter/second.. velocity of conductor
5 l=2; //meter... length 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*I/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=1/(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=1/(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=1/(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=1/(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=40sin 314t
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=70.7 sin(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 dissipated in resistance
3 //v=200 sind 314t
4 Vm=200;
5 o=314; //@=omega
6 //i=50 sind 314t

```

```
7 Im=50
8 o=314
9 R=Vm/Im
10 I=Im/1.414
11 P=(I*I*R)
12 disp('power dissipated 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=15e-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 = 600sin(314t
      )' , 'The time equation of voltage Vc = 636sin(
      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 the 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

```

```

 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' , 'impedance='+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 and 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 //calculating 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//calculating 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 V1=440
5 f=50
6 V=V1/1.732//star connection
7 I=V/R

```



```

8 I1=I
9 coso=1
10 P=3*V*I*coso
11 Vp=440//delta connection
12 V1=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 V1=400
9 V=V1/1.732 //in star connection
10 I=V/Z
11 I1=I
12 coso=R/Z
13 P=3*V*I1*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 V1=400; //line voltage

```

```

5 V=V1/1.732
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; //voltage
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 I1=200
4 V1=500
5 Ra=0.03
6 Rs=0.015
7 R=150
8 BCD=2 //one volt per brush
9 I=V1/R
10 Ia=I1+I
11 Eg=V1+(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 I1=200
4 V1=500
5 Ra=0.03
6 Rs=0.015
7 Is=200 //for a short shunt generator I1=Ise
8 R=150
9 BCD=2 //one volt per brush
10 I=(V1+(Is*Rs))/R
11 Ia=I1+I
12 Eg=V1+(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 V1=250 //line volt
6 I1=40
7 Is=V1/Rs
8 Ia=I1-Is
9 Eb=V1-(Ia*Ra)
10 disp('emf induced= '+string(Eb)+' volts ');
```

Scilab code Exa 5.8 power

```
1
2 //find the power developed in circiut
3 P1=20e3
4 V1=200
5 Ra=0.05
6 R=150
7 I=V1/R
8 I1=P1/V1
9 Ia=I1+I
10 Eg=V1+(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 V1=250
4 Ra=0.05
5 R=0.02
6 Ia=30
7 I1=30 // I1=Ia
8 N1=400
9 E1=V1-(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 V1=200
4 I1=60 //amprs
5 R=50
6 I=V1/R // amprs
7 Ia=I1-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

```



```

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 I1=350
5 C1=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 T1=I1+(C1*x*x)
13 T11=I1+(C1*x1*x1)
14 ip=op+T1
15 ip1=op1+T11
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 ,frequency
   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 and speed of motor
3 P=6
4 f=50
5 Ns=120*f/P
6 f1=1.5
7 s=f1/f

```

```
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 ,
   frequency 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')
```
