# Scilab Textbook Companion for Basic Electrical And Electronics Engineering by R. R. Singh[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

# Basic Circuit Concepts

**Scilab code Exa 1.2** Find Resistance

```
//Chapter 1,Example 1.2,Pg 1.10
clc;
l=2000*10^3 //length of the cable in metres
d=0.7*10^-2 //diameter of the cable in metres
p=(1/58)*10^-6 //ohms per m for 1sq mm cross
    sectional area
A=(%pi*d^2)/4
R=(p*l)/A
printf("\n Resistance = %.2f ohms \n",R)
```

**Scilab code Exa 1.3** Resistance

```
//Chapter1,Example1.3,Pg1.10
printf("\n Diameter of wire=d\n")
printf("\n Length of wire=l\n")
printf("\n Resistance of wire = 4pl/A\n")
printf("\n For another wire diameter =2d\n")
printf("\n length =4l\n")
```

```
printf("\n Hence Resistance = 4pl/A")
printf("\n Hence Resistance = R\n")
```

**Scilab code Exa 1.4** Resistance

```
//Chapter1,Example1.4,Pg1.10
clc;
l1=100 //length of the wire in metres
A1=0.1*10^-6 //area of the wire in metres
p=50*10^-8 //resistivity of the wire in ohm metre
R1=p*l1/A1
printf("\n Resistance before drawing out the wire =
    %1f ohms\n",R1)
printf("\n Volume of the wire before drawing out=
    Volume of the wire after drawing out \n")
A2=A1/3
l2=3*l1
R2=p*l2/A2
printf("\n Resistance after drawing out = %1f ohms \
    n",R2)
a=R2/R1
printf("\n The Ratio of the resistances is = %1f \n"
    ,a)
```

**Scilab code Exa 1.5** Resistance

```
clc;
//Chapter 1,Example 1.5,Pg 1.11
printf("\n For silver wire R1 = (p1 X l1)/A1 \n")
printf("\n For Manganin wire R2= (p1 X l2)/A2 \n")
printf("R2/R1 = (p2 X l2 X A1)/(p1 X l1 X A2)\n")
R1=2 //resistance of silver wire in ohms
```

```
d1=1 //assuming the diameter of the silver wire to be 1 unit
d2=d1/3
l1=1 //assuming the length of the silver wire to be 1 unit
l2=l1/3
p1=1 //assuming the resistivity of silver wire is 1 unit
p2=30*p1
A1=%pi*d1^2/4
A2=%pi*d2^2/4
R2=p2*l2/A2
Rone=p1*l1/A1
R=R2/Rone
R2=R1*R
printf("\n Resistance of manganin wire = %.0f ohms\n",R2)
```

**Scilab code Exa 1.6** Resistance

```
//Chapter 1,Example 1.6,Pg 1.11
clc;
R10=80 //Resistance at 10 degrees Celsius
R60=96.6 //Resistance at 60 degrees Celsius
disp("R10=R0(1 + 10a0)")
disp("R60=R0(1 + 60a0)")
disp("Divide both the equations")
disp("96.6/80 = (1 +60a0)/(1+10a0)")
a0=(96.6-80)/(4800-966)
at=a0/(1+a0*60)
printf("\n Temp coeff at 60 degrees= %1f  per degree C\n",at)
```

**Scilab code Exa 1.7** Resistance

```
//Chapter1,Example 1.7,Pg1.12
function[at]=a0toat(a0)
    t=temp;
    at=a0/(1+a0*t)
endfunction
function[a0]=attoa0(at)
    t=temp;
    a0=at/(1-at*t)
endfunction
clc;
at=1/254.5 //given
temp=20 //temperature
a00=attoa0(at) //storing the returned temperature
   coefficient in variable a00
printf("\n Temp coeff = %.6f per degree C \n",a00)
temp=60
at1=a0toat(a00)
printf("\n Temp coeff at 60 degress = %8f per degree
    C \n",at1)
```

**Scilab code Exa 1.8** Resistance

```
//Chapter 1,Example 1.8,Pg 1.12
clc;
disp("We know that R1 = R0(1+a0t)")
disp("At t1=20 degree C, R1=45 ohms")
R0=45/(1+0.004*20)
disp("At t2, R2=48.5 ohms")
disp("Therefore, we can calculate t2 as follows")
disp("45/48.5 = (1+0.004*20)/(1+0.004t2)")
t2=(48.5-R0)/(0.004*R0)
printf("\n Therefore t2= %.0f degree C \n",t2)
```

**Scilab code Exa 1.9** Resistance

```
//Chapter 1, Example 1.9,Pg 1.13
clc;
disp("We know that Rt = R0(1+a0*t)")
disp("At t1=20 degree C, R1=18 ohms")
disp("18=R0(1+20*a0)")
disp("At t2=50 degree C R2=20 ohms")
disp("20=R0(1+50a0)")
a0=20-18/(900-400) //Divide both the equations
printf("\n a0=%.3f per degree c \n",a0)
t=(21+1.68-18)/0.072
printf("\n Therefore temp t = %.0f degrees C \n",t)
```

**Scilab code Exa 1.10** Resistance

```
//Chapter 1,Example 1.10,Pg1.13
clc;
Ra0=120
Rb0=180
Aa=0.0035
Ab=0.008
A=(Ra0*Aa+Rb0*Ab)/(Ra0+Rb0)
printf("\n The series combination of the two = %.4f
   per degree C\n",A)
```

**Scilab code Exa 1.11** Resistance

```
//Chapter1,Example1.11,Pg1.14
```

```
function [R2] = myfunction(R1)
    temp1=t1
    temp2=t2
    a=a0
    R2=R1*(1+a0*(temp2-temp1))
endfunction
function[alpha]=coefficient(a1)
    temp1=t1
    temp2=t2
    alpha=a1/(1+a1*(temp2-temp1))
    endfunction
clc;
t1=30
t2=50
a0=0.003
A1=coefficient(a0)
r1=myfunction(150)
a0=0.002
A2=coefficient(a0)
r2=myfunction(350)
printf("\n Series combination=%.0f ohms \n",r1+r2)
printf("\n Parallel combination=%.2f ohms \n",r1*r2/(r1+r2))
printf("\n For first coil a50=%.4f per degree C \n",A1)
printf("\n For second coil a50=%.5f per degree C \n",A2)
```

**Scilab code Exa 1.12** Resistance

```
//Chapter1,Example1.12,Pg1.17
clc;
disp("When a wire is bent in the form of a circle, its resistance gets divided between any two points on its diameter as the resistance is
```

```
directly proportional to its length. The two
    parts can be considered as two resistors of 6ohms
     in parallel")
R=6*6/(6+6)
printf("\n Hence equivalent resistance R=%.0f ohms \
    n",R)
```

**Scilab code Exa 1.14** Resistance

```
//Chapter1,Example 1.14,Pg1.18
clc;
disp("Refer to the figure shown in the problem")
R=1/((1/25)+(1/50)+(1/50))+2+8
printf("\n Equivalent resistance between A and B = %
    .1f ohms \n",R)
```

**Scilab code Exa 1.15** Resistance

```
//Chapter1,Example1.15,Pg1.19
clc;
disp("Refer to the figure shown in the problem")
R1=4*4/(4+4) //Equivalent resistance of the upper
    triangular network
R2=3*3/(3+3) //Equivalent resistance of the
    triangular network on right
R3=2*(R1+R2)/(2+R1+R2)
R=2*(R3+1)/(2+R3+1)
printf("\n Equivalent resistance =%.2f ohms \n",R)
I=30/R
printf("\n Current=%.1f A \n",I)
```

**Scilab code Exa 1.16** Resistance

```
//Chapter1,Example 1.16,Pg1.20
clc;
disp("Refer to the figure given in the problem")
R1=4*4/(4+4) //Equivalent resistance of the upper
    triangle shown in the figure obtained by the
    reduction of the upper left and right triangular
    resistance networks
R2=3*3/(3+3)
R3=(2*(R1+R2))/(2+R1+R2)
R=1/((1/5)+(1/2)+(1/(R3+1)))
printf("\n Equivalent resistance =%.2f ohms \n",R)
I=50/R
printf("\n Current = %.2f A \n",I)
```

**Scilab code Exa 1.18** Resistance

```
//Chapter1,Example 1.18,Pg 1.23
clc;
I=30/15
disp("Refer to the diagram given in the question")
printf("\n Current through the 15 ohm resistor is
    given by I= 30/15 = %.0f A \n",I)
printf("Current through the 5 ohm resistance = 5+2=
    %.0f A",5+2)
disp("Applying KVL to the closed path and thus
    obtaining the result we can say")
disp("-5(7)-R(I)+100-30=0")
R=(100-30-35)/2
printf("\n R= %.1f ohms \n",R)
```

**Scilab code Exa 1.19** Resistance

```
//Chapter 1,Example 1.19,Pg 1.24
clc;
disp("Refer to the figure shown in the diagram")
disp("Assign branch currents as shown in the figure"
  )
disp("I2-I3=13")
disp("-20I1+8I2=0")
disp("-12I1-16I2=0")
disp("By solving the equations we can obtain the
  result as follows")
A=[0 1 -1;-20 8 0;-12 0 -16]
B=[13;0;0]
I=A\B
printf("\n I1= %.0f A \n",I(1,:))
printf("\n I2= %.0f A \n",I(2,:))
printf("\n I3= %.0f A \n",I(3,:))
```

**Scilab code Exa 1.21** Resistance

```
//Chapter 1,Example 1.21,Pg1.26
clc;
disp("Refer to the figure shown in the question")
disp("Let the branch current be as follows")
disp("IOA=x")
disp("IOB=1-x")
disp("IAB=y")
disp("IBC=1-x-y")
disp("IAC=x+y")
A=[3 -3;9 12]
B=[2;4]
XY= A\B
x=XY(1,1)
y=XY(2,1)
IOA=x
IOB=1-x
```

```
IAB=y
IBC=1-x-y
IAC=x+y
printf("\n IOA=%.2f A \n",IOA)
printf("\n IOB=%.2f A \n",IOB)
printf("\n IAB=%.3f A \n",IAB)
printf("\n IBC=%.3f A \n",IBC)
printf("\n IAC=%.3f A \n",IAC)
```

**Scilab code Exa 1.22** Resistance

```
//Chapter 1,Example1.26,Pg1.22
clc;
disp("Refer to the figure shown in the question")
I1=2/5
I2=4/8
printf("\n I1= %.1f A \n",I1)
printf("\n I2=%.1f A \n",I2)
Vxy=3*I2-3*I1-4
printf("\n Vxy=%.1f V",Vxy)
```

**Scilab code Exa 1.23** Resistance

```
//Chapter 1,Example 1.23,Pg1.27
clc;
disp("Refer to the figure shown in the diagram")
I1=20/15 //Voltage in the loop divided by the sum of resistances
I2=15/10 //Voltage in the loop divided by the sum of resistances
printf("\n I1=%.2f A \n",I1)
printf("\n I2=%.1f A \n",I2)
Vab=5*I1-6*I2+5+15 //By applying KVL to the loop
```

```
printf("\n Vab=%.2f V",Vab)
```

**Scilab code Exa 1.24** Resistance

```
//Chapter 1,Example1.24,Pg1.27
clc;
disp("Refer to the figure shown in the problem")
I1=5/2 //The 3ohms resistance gets shorted hence
    current flows only through the 2 ohms resistor
I2=2
printf("\n I1=%.1f A \n",I1)
printf("\n I2=%.0f A \n",I2)
Vab=2*I1-8+5*I2
printf("\n Vab=%.0f V \n",Vab)
```

**Scilab code Exa 1.25** Resistance

```
//Chapter 1,Example1.25,Pg1.28
clc;
disp("Refer to the figure shown in the problem")
I1=10/8 //Voltage divided by the sum of the
    resistances
I2=5 //Current in the second loop is indicated by a
    current source of 5A
printf("\n I1=%.2f A \n",I1)
printf("\n I2=%.0f A \n",I2)
//Apply KVL to the path from A to B
Vab=3*I1+8-3*I2
printf("\n Vab=%.2f V \n",Vab)
```

**Scilab code Exa 1.26** Resistance

```
//Chapter1,Ex1.26,Pg1.29
function [current1] = voltagetocurrent(voltage1)
    resistance1=R
    current1=voltage1/resistance1
endfunction
function[voltage2]=currenttovoltage(current2)
    resistance2=R
    voltage2=current2*resistance2
endfunction
clc;
disp("Refer to the figure shown in the question")
R=5 //Resistance in ohms
I1=voltagetocurrent(20) //Converting voltage source with series resistance to current source with parallel resistance
I=I1+3 //Total of the current sources in the circuit
R=1/((1/30)+(1/50)+(1/5)+(1/6)) //Equivalent resistance in the circuit
V1=currenttovoltage(I) //Converting current source with parallel resistance to voltage source with series resistance
printf("\n Equivalent resistance in network = %.2f ohms \n",R)
printf("\n Equivalent voltage source in network = %.2f V \n",V1)
```

**Scilab code Exa 1.27** Resistance

```
//Chapter1,Example1.27,Pg1.30
clc;
disp("Since the 5 ohms resistor is connected in parallel with 20V source,it becomes redundant")
I=20.00/6.00 //Converting 20V in series with 6 ohms
```

```
   to current source in parallel with 6 ohms
I=I+10
printf("\n Total current in circuit = %.2f A \n",I)
printf("Equivalent resistance = %.0f ohms \n",6)
```

**Scilab code Exa 1.28** Resistance

```
//Chapter1,Example1.28,Pg30
function [current1] = voltagetocurrent(voltage1)
    resistance1=R
    current1=voltage1/resistance1
endfunction
function[voltage2]=currenttovoltage(current2)
    resistance2=R
    voltage2=current2*resistance2
endfunction
clc;
disp("Refer to the figure shown in the diagram")
R=3 //Resistance in ohms
I1=voltagetocurrent(6) //Converting voltage source
   with series resistance to current source with
   parallel resistance
R=2
I2=voltagetocurrent(4)
R=1
I3=voltagetocurrent(3)
R1=2*2/(2+2) //Equivalent resistance of upper
   portion
R2=3*1/(3+1) //Equivalent resistance of lower
   portion
I11=1+I2 //Total current of upper portion
I12=-I1+I3 //Total current of lower portion
R=R1
V1=currenttovoltage(I11)
R=R2
```

```
V2=currenttovoltage(I12)
V=V1+V2
R=R1+R2
printf("\n Total voltage source = %.2f V \n",V)
printf("\n Total equivalent resistance = %.2f ohms \
    n",R)
```

**Scilab code Exa 1.29** Resistance

```
//Chapter1,Example1.29,Pg1.32
function [current1] = voltagetocurrent(voltage1)
    resistance1=R
    current1=voltage1/resistance1
endfunction
function[voltage2]=currenttovoltage(current2)
    resistance2=R
    voltage2=current2*resistance2
endfunction
clc;
disp("Refer to the diagram shown in the figure")
R=3 //Resistance in ohms
I=voltagetocurrent(10)
I=I+10 //Total current in the circuit
R=3*2/(3+2)
V=currenttovoltage(13.33)
I=(50-16)/(5+1.2) //Current in the circuit
P=50*I //Power delivered by the 50V source
printf("\n Power delivered by the 50V source=%.0f W
    \n",P)
```

**Scilab code Exa 1.30** Resistance

```
//Chapter1,Example1.30,Pg1.32
```

```
function [current1] = voltagetocurrent(voltage1)
    resistance1=R
    current1=voltage1/resistance1
endfunction
function[voltage2]=currenttovoltage(current2)
    resistance2=R
    voltage2=current2*resistance2
endfunction
clc;
disp("Refer to the figure shown in the problem")
R=2 //Resistance in ohms
V=currenttovoltage(5) //Converting current source
    with parallel resistance to voltage source with
    series resistance
V=V-6 //Equivalent resistance in the closed path
I=voltagetocurrent(V) //Converting voltage source
    with series resistance to current source with
    parallel resistance
I=I+2 //Total current provided by combination of
    current sources in circuit
I4=I*2/(2+4) //Current through the 4 ohm resistance
printf("\n Current through the 4 ohm resistance = %
    .2f A \n",I4)
```

**Scilab code Exa 1.31** Resistance

```
//Chapter1,Example1.31,Pg1.33
function [current1] = voltagetocurrent(voltage1)
    resistance1=R
    current1=voltage1/resistance1
endfunction
function[voltage2]=currenttovoltage(current2)
    resistance2=R
    voltage2=current2*resistance2
endfunction
```

```
clc;
disp("Refer to the figure shown in the diagram")
disp("Since nodes 1 and 2 are maintained at the same voltage by the sources, the connection between nodes 1 and nodes 2 is removed. Now the two voltage sources have resistors in series and source transformation can be applied")
R=4 //Resistance in ohms
I=voltagetocurrent(18) //Converting voltage source with series resistance to current source with parallel resistance
R=4*2/(4+2) //Since the 4 ohm and 2 ohm resistances are in parallel
V=currenttovoltage(I) //Converting current source with parallel resistance to voltage source with series resistance
Va=(6+(5.985/2.33))/((1/3)+(1/2.33)+(1/6))
printf("\n Voltage at node A = %.2f V \n",Va)
```

# Chapter 2

# DC CIRCUITS

**Scilab code Exa 2.1** Equivalent resistance

```
//Chapter 2,Ex 2.1,Pg 2.4
function [resistance_1] = deltatostar(R)
    resistance1=R1
    resistance2=R2
    resistance_1= (resistance1*resistance2)/R
endfunction
clc;
disp("Refer to the diagram shown in the figure")
R1=4.5 //Resistance in ohms
R2=7.5 //Resistance in ohms
R3=3 //Resistance in ohms
R=R1+R2+R3
Ra=deltatostar(R) //Converting the given delta
   network to star network
R2=3 //Resistance in ohms
Rb=deltatostar(R) //Converting delta network to star
    network
R1=7.5
Rc=deltatostar(R) //Converting delta network to star
    network
R_1= 1/((1/(Rb+Rb+4)) + (1/(Rc+Rc+3)))
```

```
R_eq=(2*Ra) + R_1 // Equivalent resistance of the entire network
printf("\n The equivalent resistance R = %.2f ohms \n",R_eq)
```

**Scilab code Exa 2.2** Equivalent resistance

```
//Chapter 2,Ex 2.2,Pg 2.5
function [resistance_1] = deltatostar(R)
resistance1=R1
resistance2=R2
resistance_1= (resistance1*resistance2)/R
endfunction
clc;
disp("Refer to the diagram shown in the problem")
R1=10 //Resistance in ohms
R2=10 //Resistance in ohms
R3=10 //Resistance in ohms
R=R1+R2+R3
Ra=deltatostar(R) //Converting the delta network to star network of resistances. All the resistances in the star network will be the same as the resistances in the delta network have the same value
R_1= 1/(1/(Ra+10) + 1/(Ra+10))
R_eq=Ra+R_1
printf("\n The equivalent resistance R= %.0f ohms\n",R_eq)
```

**Scilab code Exa 2.3** Equivalent resistance

```
//Chapter 2,Ex 2.3,Pg 2.7
function [resistance_1] = startodelta(R)
```

```
    resistance_1= (R1*R + R2*R + R1*R2)/R
endfunction
clc;
disp("Refer to the diagram shown in the figure")
R1=6 //One of the Resistances of the star network to be converted into delta
R2=4 //One of the Resistances of the star network to be converted into delta
R3=3
//To find out individual resistances of the star network
Ra=startodelta(R3)
R3=4
R2=3
Rb=startodelta(R3)
R3=6
R1=4
Rc=startodelta(R3)
R_1= 1/((1/Ra) + (1/9))
R_2= 1/((1/Rb)+(1/1.5))
R_eq= 1/((1/6) + (1/(R_2+0.9)))
printf("\n Equivalent resistance R= %.2f ohms\n", R_eq) //Equivalent resistance of the circuit
```

**Scilab code Exa 2.4** Equivalent resistance

```
//Chapter 2,Ex2.4,Pg 2.8
clc;
disp("Refer to the diagram shown in the figure")
R=6+6+6 //Total resistance of the delta network in the left part of the circuit
r1=6*6/(R) //Delta to star conversion
R=15+15+15 //Total resistance of the delta network in the right part of the circuit
r2=15*15/R
```

```
R_1=1/(1/(r1+41+r2) + 1/(r1+17+r2))
R_eq=R_1+r1+r2
printf("\n The equivalent resistance R = %.0f ohms\n
    ",R_eq)
```

**Scilab code Exa 2.6** Equivalent resistance

```
//Chapter2, Ex2.6,Pg 2.11
function [R] = deltatostar(R1,R2,R3,n)
    Rtotal=R1+R2+R3
    if(n==1)then
        R=R1*R2/Rtotal
    elseif(n==2)
        R=R2*R3/Rtotal
    else
        R=R1*R3/Rtotal
            end
endfunction
clc;
disp("Refer to the diagram shown in the figure")

r1=deltatostar(20,5,15,1) //Converting delta network
    to star network
r3=deltatostar(20,5,15,2)
r2=deltatostar(20,5,15,3)
r1'=r1
R1=r3+2
R2=r2+30
r1=deltatostar(R1,R2,30,1)
r2=deltatostar(R1,R2,30,2)
r3=deltatostar(R1,R2,30,3)
Req=1/(1/(r1'+r1+10) + 1/(15+r3)) + r2
printf("\n The equivalent resistance R= %.2f ohms\n"
    ,Req)
```

**Scilab code Exa 2.7** Equivalent resistance

```
//Chapter 2,Ex2.7,Pg2.13
function [r_1] = startodelta(r1,r2,r3) //Function that converts star network to equivalent delta network
    r_1=ones(1:3)
    Rtotal=(r1*r3 + r2*r3 + r1*r2)
    r_1(1)=Rtotal/r1
    r_1(2)=Rtotal/r2
    r_1(3)=Rtotal/r3
endfunction
function[r_2]=deltatostar(r1,r2,r3) //Function that converts delta network to equivalent star network
    Rtotal=r1+r2+r3
    r_2=ones(1:3)
    r_2(1)=r1*r2/Rtotal
    r_2(2)=r2*r3/Rtotal
    r_2(3)=r1*r3/Rtotal
    endfunction
clc;
disp("refer to the figure shown in the diagram")
R=startodelta(8,5,3)
R_1=R(2)*5/(R(2)+5) //Parallel combination of resistances
R_2=R(3)*4/(R(3)+4) //Parallel combination of resistances
R1=deltatostar(R_1,R(1),R_2)
Req=1/(1/(6+R1(1)) + 1/(4+R1(2))) +R1(3)
printf("\n The equivalent resistance R= %.2f ohms\n",Req)
```

**Scilab code Exa 2.9** Find current

```
//Chapter 2,Ex2.9,Pg 2.18
clc;
disp("Refer to the diagram shown in the figure")
A=[10 -3 -6;-3 10 0;-6 0 10]
B=[10; -5; 25]
I=A\B
printf("\n Current through the 5 ohms resistor=%.2f
    A\n",I(2))
```

**Scilab code Exa 2.10** Find current through 2ohm resistor

```
//Chapter 2,Ex2.10,Pg 2.19
clc;
disp("Refer to the diagram shown in the figure")
A=[7 -1 0 ;-1 6 -3; 0 -3 13]
B=[10; 0; -20]
I=A\B
printf("\n Current through the 2 ohms resistor=%.2f
    A\n",I(2))
```

**Scilab code Exa 2.11** Determine current through 5 ohm resistor

```
//Chapter 2,Ex2.11,Pg 2.20
clc;
disp("Refer to the diagram shown in the figure")
A=[3 -1 -2 ;-1 8 -3; -2 -3 10]
B=[8; 10; 12]
I=A\B
printf("\n Current through the 5 ohms resistor=%.2f
    A\n",I(3))
```

**Scilab code Exa 2.12** Find current supplied by the battery

```
//Chapter 2,Ex2.12,Pg 2.21
clc;
disp("Refer to the diagram shown in the figure")
A=[8 -1 -4 ;-1 8 -5; -4 -5 15]
B=[4; 0; 0]
I=A\B
printf("\n Current supplied by battery=%.2f A\n",I
    (1))
```

---

**Scilab code Exa 2.13** Determine voltage

```
//Chapter 2,Ex2.13,Pg 2.22
clc;
disp("Refer to the diagram shown in the figure")
A=[1 -2 -5 ;0 -6 1; 1 1 -10]
B=[20; 0; 0]
VI=A\B
printf("\n Current supplied by battery=%.1f A\n",VI
    (1))
```

---

**Scilab code Exa 2.14** Find current through 2ohm resistor

```
//Chapter 2,Ex2.14,Pg 2.22
clc;
disp("Refer to the diagram shown in the figure")
A=[1 0 0 ;0 18 -6; 0 6 -11]
B=[6; 108; 9]
```

```
I=A\B
printf("\n Current through 2 ohms resistor=%.0f A\n"
   ,I(3))
```

**Scilab code Exa 2.15** Find current through 10 ohm resistor

```
//Chapter 2,Ex2.15,Pg2.23
clc;
disp("Refer to the diagram shown in the figure")
a=[11 -10 0;0 -1 1;2 -3 -3]
b=[2;4;0]
i=a\b
printf("\n I1 = %.2f A\n",i(1))
printf("\n I2 = %.2f A\n",i(2))
printf("\ I3=%.2f A\n",i(3))
printf("\n Current through 10 ohms resistor = %.2f A
   \n",i(1)-i(2))
```

**Scilab code Exa 2.16** Find current in 3 ohm resistor

```
//Chapter 2,Ex2.16,Pg2.24
clc;
disp("Refer to the diagram shown in the figure")
a=[1 0 -1;-1 4 -4;1 -6 3]
b=[7;-7;0]
i=a\b
printf("\n I1 = %.1f A\n",i(1))
printf("\n I2 = %.1f A\n",i(2))
printf("\ I3=%.0f A\n",i(3))
printf("\n Current through 3 ohms resistor = %.1f A\
   n",i(2)-i(3))
```

**Scilab code Exa 2.17** Find current in 5 ohm resistor

```
//Chapter 2,Ex2.16,Pg2.24
clc;
disp("Refer to the diagram shown in the figure")
a=[15 -10 -5;0 1 -1;-15 12 6]
b=[50;2;0]
i=a\b
printf("\n I1 = %.0f A\n",i(1))
printf("\n I2 = %.2f A\n",i(2))
printf("\ I3=%.2f A\n",i(3))
printf("\n Current through 5 ohms resistor = %.1f A\
    n",i(1)-i(3))
```

---

**Scilab code Exa 2.19** Find voltage at nodes 1 and 2

```
//Chapter2,Ex2.20,Pg 2.26
clc;
disp("Refer to the diagram shown in the figure")
a=[2 -1;-1 3]
b=[2;4]
v=a\b
printf("\n V1=%.0f V\n",v(1))
printf("\n V2=%.0f V\n",v(2))
```

---

**Scilab code Exa 2.20** Find Va and Vb

```
//Chapter2,Ex2.20,Pg2.27
clc;
```

```
disp("Refer to the diagram shown in the figure")
a=[8 -2;-3 9]
b=[50;85]
v=a\b
printf("\n Va=%.2f V\n",v(1))
printf("\n Vb=%.2f V\n",v(2))
```

**Scilab code Exa 2.21** Calculate the current through the 5 ohm resistor

```
//Chapter2,Ex2.21,Pg2.27
clc;
disp("Refer to the diagram shown in the figure")
a=[5 -2 0;10 -31 6;0 -4 9]
b=[-24;300;160]
v=a\b
printf("\n V1=%.2f V\n",v(1))
printf("\n V2=%.2f V\n",v(2))
printf("\n V3=%.2f V\n",v(3))
printf("\n Current through 5 ohms resistor = %.2f A\
   n",(v(3)-v(2))/5)
```

**Scilab code Exa 2.23** Find Va and Vb

```
//Chapter 23,Ex 2.23,Pg2.29
clc;
disp("Refer to the diagram given in the question")
A=[4 -2;-2 3]
B=[5;4]
V=A\B
printf("\n Va=%.2f V\n",V(1))
printf("\n Vb=%.2f V\n",V(2))
```

**Scilab code Exa 2.24** Find voltage across 5 ohm resistor

```
//Chapter 2,Example 2.24,Pg 2.30
clc;
disp("Refer to the diagram shown in the figure")
A=[4 -2 -1;-50 71 -20;-5 -4 10]
B=[-24;0;180]
V=A\B
printf("\n Va=%.2f V\n",V(1))
printf("\n Vb=%.2f V\n",V(2))
printf("\n Vc=%.2f \n",V(3))
printf("\n Voltage across 5 ohms resistor=%.2f \n",V
    (3)-V(2))
```

**Scilab code Exa 2.25** Find currents I1 I2 and I3

```
//Chapter2,Ex2.25,Pg2.30
clc;
disp("Refer to the diagram shown in the figure")
A=[8 -1;-2 17]
B=[50;-500]
V=A\B
printf("\n V1=%.2f V \n",V(1))
printf("\n V2=%.2f V \n",V(2))
printf("\n I1=%.2f \n",-V(1)/2)
printf("\n I2=%.2f \n",(V(1)-V(2))/10)
printf("\n I3=%.2f \n",(V(2)+50)/2)
```

**Scilab code Exa 2.26** Find currents and voltages

```
//Chapter 2,Ex2.26,Pg 2.31
clc;
disp("Refer to the diagram shown in the figure")
A=[0.5 -0.2;0.1 -0.4]
B=[34.2;-32.4]
V=A\B
printf("\n Va=%.2f V \n",V(1))
printf("\n Vb=%.2f V \n",V(2))
printf("\n I1=%.0f A \n",(120-V(1))/0.2)
printf("\n I2=%.0f A \n",(V(1)-V(2))/0.3)
printf("\n I3=%.0f A \n",(110-V(2))/0.1)
```

**Scilab code Exa 2.27** Find current in the 10 ohm resistor

```
//Chapter 2,Ex2.27,Pg 2.33
clc;
disp("Refer to the diagram shown in the figure")
A=[1 0;-2 17]
B=[50;50]
V=A\B
printf("\n V1=%.0f V \n",V(1))
printf("\n V2=%.2f V \n",V(2))
printf("\n Current in the 10 ohms resistor = %.2f A\
   n",V(2)/10)
```

**Scilab code Exa 2.28** Find V1 and V2

```
//Chapter 2,Example 2.28,Pg 2.33
clc;
disp("Refer to diagram shown in the diagram")
A=[6 -5 0;-10 17 -5;0 0 1]
B=[-20;0;20]
V=A\B
```

```
printf("\n Va=%.2f V \n",V(1))
printf("\n Vb=%.2f V \n",V(2))
printf("\n Vc=%.0f V \n",V(3))
printf("\n V1=%.2f V \n",V(1)-V(2))
printf("\n V2=%.2f V \n",V(2)-V(3))
```

**Scilab code Exa 2.29** Find voltage across the 100 ohm resistor

```
//Chapter 2,Ex2.29,Pg 2.33
clc;
disp("Refer to the figure shown in the diagram")
A=[1 0 0;-1 3 -1;-2 -5 10]
B=[60;12;24]
V=A\B
printf("\n Voltage across the 100 ohms resistor=%.2f
    V\n",V(3))
```

**Scilab code Exa 2.30** Find current through the 4 ohm resistor

```
//Chapter 2,Ex2.30,Pg2.34
clc;
disp("Refer to the figure shown in the diagram")
A=[1 -1;2 1]
B=[6;28]
V=A\B
printf("\n V1=%.2f V\n",V(1))
printf("\n V2=%.2f V\n",V(2))
printf("\n Current through the 4 ohms resistor=%.2f\
   n",V(2)/4)
```

**Scilab code Exa 2.31** Find current through the 4 ohm resistor

```
//Chapter 2,Example 2.31,Pg2.35
clc;
disp("Refer to the figure shown question")
A=[1 0 -1;2 -2 1;-5 7 0]
B=[8; -12; 80]
V=A\B
printf("\n V1=%.0f V \n",V(1))
printf("\n V2=%.0f V \n",V(2))
printf("\n V3=%.0f V \n",V(3))
printf("\n Current through the 4 ohms resistor= %.0f A \n",V(3)/4)
```

**Scilab code Exa 2.42** Find the current between the 2 ohm resistor connected btw A and B

```
//Chapter 2,Ex2.42,Pg2.53
clc;
disp("Refer to the diagram shown in the question")
A=[14 -12;-12 16] //Apply KVL theorem to obtain the required result
B=[2;-4]
I=A\B
Vth=3*I(2)+4 //Thevenin voltage
printf("\n Vth=%.1f \n",Vth)
R1=((2*12)/(2+12))+1
Rth=R1*3/(R1+3)
Iload=Vth/(Rth+2)
printf("\n Il=%.2f \n",Iload)
```

**Scilab code Exa 2.43** Find the current through the 10 ohm resistor

```
//Chapter 2,Example2.43,Pg 2.54
clc;
disp("Refer to the diagram shown in the question")
A=[7 -1;1 -6]
B=[10;0]
I=A\B
Vth=(3*I(2))-20
printf("\n Vth=%.2f V \n",Vth)
R1=[((6*1)/(6+1))+2]
Rth=R1*3/(R1+3)
printf("\n Rth=%.2f A \n",Rth)
Il=Vth/(Rth+10)
printf("\n The value of load current = %.2f A \n",Il
    )
```

**Scilab code Exa 2.44** Find the current through the 10 ohm resistor

```
//Chapter 2,Example 2.44<pg2.55
clc;
disp("Refer to the diagram shown in the question")
//It can found out by looking at the figure that I1
    =10A
I2=100/50 //Applying KVL
Vth=(5*10)-(20*I2)
Rth=5+(20*30/(20+30))
Iload=10/(Rth+10)
printf("\n Rth=%.0f ohms\n",Rth)
printf("\n Il=%.2f A\n",Iload)
```

**Scilab code Exa 2.45** Find the current through the 40 ohm resistor

```
//Chapter 2,Ex45,Pg2.56
```

```
//Since the 20 ohms resistor is connected across the
    25V source ,the resistor becomes redundant
I=35/60
Vth=(10*I)-10
printf("\n Vth=%.1f V \n",Vth)
Rth=50*10/(50+10)
printf("\n Rth=%.2f ohms \n",Rth)
Il=Vth/(Rth+40)
printf("\n Iload=%.2f A \n",Il)
```

**Scilab code Exa 2.46** Find the current through the 10 ohm resistor

```
//Chapter 2,Ex2.46,Pg2.57
clc;
disp("Refer to the diagram shown in the question")
I1=50/10
I2=20/20
Vth=(4*I1)+2-(15*I2)
printf("\n Vth=%.0f V \n",Vth)
Rth=(6*4/(6+4))+(5*15/(5+15))
printf("\n Rth=%.2f ohms \n",Rth)
Il=7/(Rth+10)
printf("\n Iload=%.2f \n",Il)
```

**Scilab code Exa 2.47** Find current through the 24 ohm resistor

```
//Chapter2,Ex2.47,Pg2.58
clc;
disp("Refer to the diagram shown in the question")
I1=220/(30+50)
I2=220/(20+5)
printf("\n I1=%.2f A \n",I1)
printf("\n I2=%.2f A \n",I2)
```

```
Vth=(20*I2)-(30*I1)
printf("\n Vth=%.1f V \n",Vth)
Rth=(30*50/(30+50))+(20*5/(20+5))
printf("\n Rth=%.2f ohms \n",Rth)
Il=Vth/(Rth+24)
printf("\n Iload=%.0f A \n",Il)
```

**Scilab code Exa 2.49** Find the current through the 20 ohm resistor

```
//Chapter 2,Ex2.49,Pg2.61
clc;
disp("Refer to the diagram shown in the question")
A=[30 -15;-15 20]
B=[-75;20]
I=A\B
printf("\n I1=%.1f A \n",I(1))
printf("\n I2=%.1f A \n",I(2))
Vth=45-(10*(I(1)-I(2))) //Thevenin Voltage
printf("\n Vth =%.0f V \n",Vth)
//Converting the delta formed by the resistances
   into star network
R1=10*5/(10+5+5)
R2=10*5/(10+5+5)
R3=5*5/(10+5+5)
Rth=((R3+15)*2.5/(R3+15+2.5))+2.5
printf("\n Rth=%.2f ohms \n",Rth)
Il=Vth/(Rth+20)
printf("\n Iload=%.2f A \n",Il)
```

**Scilab code Exa 2.50** Find the current through the 3 ohm resistor

```
//Chapter 2.Ex2.50,Pg 2.63
clc;
```

```
disp("Refer to the diagram shown in the figure")
//Simultaneous equations have been found by applying Kirchoff's Laws to the meshes
A=[1 0;-12 18]
B=[6;42]
I=A\B
Vth=6*I(2)
printf("\n Vth=%.0f V \n ",Vth)
Rth=6*12/(6+12) //Thevenin resistance of the network
Il=Vth/(Rth+3)
printf("\n Iload= %.2f A \n",Il)
```

**Scilab code Exa 2.51** Find the current through the 30 ohm resistor

```
//Chapter2,Ex2.51,Pg2.64
clc;
disp("Refer to the diagram shown in the figure")
A=[-1 1;15 100]
B=[13;150]
I=A\B
printf("\n I1=%.0f A \n",I(1))
printf("\n I2=%.0f A \n",I(2))
Vth=(40*I(2))-50
printf("\n Vth=%.0f V \n",Vth)
Rth=75*40/(75+40)
printf("\n Rth=%.2f ohms \n",Rth)
Il=Vth/(Rth+30)
printf("\n Iload=%.2f A \n",Il)
```

**Scilab code Exa 2.53** Find the current through the 20 ohm resistor

```
//Chapter 2,Ex2.53,Pg2.66
clc;
```

```
disp("Refer to the diagram shown in the figure")
//Applying Kirchoff's laws to mesh 1 and mesh 2 we
    can state the following
I1=10/(10+4) //Current in amperes
I2=2 //Current in amperes
printf("\n I1=%.2f A \n",I1)
printf("\n I2=%.0f \n",I2)
vth=(4*I1)+(8*I2)
printf("Vth=%.2f V \n",vth)
//Calculation of Rth
//From the figure it can be seen that Rth can be
    easily calculated to be the following
Rth=(10*4/(10+4))+8
printf("\n Rth=%.2f ohms \n",Rth)
//Calculation of load current
Il=vth/(Rth+20)
printf("\n Iload=%.2f A \n",Il)
```

**Scilab code Exa 2.54** Find the current through the 5 ohm resistor

```
//Chapter 2,Ex2.54,Pg2.67
clc;
disp("Refer to the diagram shown in the figure")
//Remove the 5 ohms resistor from the network and
    apply Kirchoff's laws
A=[14 -2;-2 5]
B=[150;50]
I=A\B
printf("\n I1=%.2f A \n",I(1))
printf("\n I2=%.2f A \n",I(2))
//Calculation of Thevenin Voltage
Vth=100-(10*I(1))
printf("\n Vth=%.2f V \n",Vth)
//Calculation of Thevenin Current
Rth=10*3.2/(10+3.2)
```

```
printf("\n Rth=%.2f ohms \n",Rth)
//Calculation of load current
Il=Vth/(Rth+5)
printf("\n Iload =%.2f A \n",Il)
```

**Scilab code Exa 2.55** Find the current through the 10 ohm resistor

```
//Chapter 2,Ex2.55,Pg2.68
clc;
disp("Refer to the diagram shown in the figure")
//Calculation of Vth
//The network is divided into meshes and Kirchoff's
   laws are applied to the meshes to obtain
   simultaneous equations
A=[4 -2;-1 4]
B=[-25;10]
I=A\B
printf("\n I1=%.0f A \n",I(1))
printf("\n I2=%.0f A \n",I(2))
Vth=(2*I(1))+(2*I(2))
printf("\n Vth=%.0f V \n",Vth)
//Calculation of Rth
//Convert star resistances formed by 2 ohms, 2 ohms
   and 1 ohm into an equivalent delta network
R1=2*2/(2+2+1)
R2=R1 //R1=R2 since the resistances are of equal
   value
R3=2*1/(2+1+2)
Rth=8*(2*(4*1/(4+1)))/(8+(2*(4*1/(4+1))))
printf("\n Rth=%.2f ohms \n",Rth)
//Calculation of load current
Il=Vth/(Rth+10)
printf("\n Il=%.2f A \n",Il)
```

**Scilab code Exa 2.56** Find current through the 1 ohm resistor

```
//Chapter 2,Ex2.56,Pg2.71
clc;
disp("Refer to the diagram shown in the question")
//Remove the 1 ohm resistor from the meshes 1 and 2,
    then we can say the following about the current
I1=-3 //Current in amperes
I2=1 //Current in amperes
printf("\n I1=%.0f A \n",I1)
printf("\n I2=%.0f A \n",I2)
//Calculation of Vth
Vth=4-2*(I1-I2)
printf("\n Vth=%.2f V \n",Vth)
//Calculation of Rth
//It can be easily deduced by looking at the diagram
    that Rth=2 ohms
Rth=2
//Calculation of load current
Il=Vth/(Rth+1)
printf("\n Il=%.0f A \n",Il)
```

**Scilab code Exa 2.57** Find current in the 10 ohm resistor

```
//Chapter2,Ex2.57,Pg2.73
clc;
disp("Refer to the diagram shown in the question")
A=[1 0 0;0 -1 1;0 -5 -15]
B=[2;4;0]
I=A\B
printf("\n I1=%.0f A \n",I(1))
printf("\n I2=%.0f A \n",I(2))
```

```
printf("\n I3=%.0f A \n",I(3))
printf("\n In=%.0f A \n",(I(1)-I(2)))
//Calculation of Rn
//Replace the voltage sources by open circuit and current sources by short circuit
Rn=1*(5+15)/(1+5+15)
printf("\n Rn=%.2f ohms \n",Rn)
Il=(5*Rn)/(10+Rn) //Using current division formula
printf("\n Il = %.2f A \n",Il)
```

**Scilab code Exa 2.58** Find current in the 10 ohm resistor

```
//Chapter 2,Ex2.58,Pg 2.74
clc;
disp("Refer to the diagram shown in the figure")
A=[7 -2;-2 10]
B=[20;-12]
I=A\B
printf("\n I2= %.2f A \n",I(2))
printf("\n In=%.2f A \n",-I(2))
//Calculation of Rn
Rn=(5*2/(5+2))+8
printf("\n Rn=%.2f ohms \n",Rn)
//Calculation of Il
Il=0.67*(Rn/(Rn+10)) //Current is short circuit current calculated
printf("\n Il=%.2f A \n",Il)
```

**Scilab code Exa 2.59** Find the current through the 10 ohm resistor

```
//Chapter 2,Ex2.59,Pg2.75
clc;
disp("Refer to the diagram shown in the figure")
```

```
A=[70 -20;-20 20]
B=[40;0]
I=A\B
printf("\n I1=%.0f A \n",I(1))
printf("\n I2 =%.1f A \n",I(2))
printf("\n In = %.1f A \n",I(2))
//Calculation of Rn
Rn=(50*20/(50+20)) //Resistance of 40 ohms gets
    shorted because it is connected across a short
    circuit
printf("\n Rn=%.2f ohms \n",Rn)
//Calculation of Il
Il=(1.5*14.28/(14.28+10))
printf("\n Il=%.2f A \n",Il)
```

**Scilab code Exa 2.60** Find current through 10 ohm resistor

```
//Chapter 2,Ex2.60,Pg2.76
clc;
disp("Refer to diagram shown in the question")
A=[-7 1 0;-1 6 -3;0 3 -3]
B=[-10;0;20]
I=A\B
printf("\n I3=%.2f A \n",I(3))
printf("\n In= %.2f A \n",-I(3))
Rn=[(6*1/(6+1)+2)]*3/(3+[(6*1/(6+1)+2)])
printf("\n Rn=%.2f A \n",Rn)
//Calculation of Il
Il=13.17*(1.46/(1.46+10))
printf("\n Il=%.2f A \n",Il)
```

**Scilab code Exa 2.61** Find current in the 10 ohm resistor

```
//Chapter2 ,Ex2.61 ,Pg2.77
clc;
disp("Refer to the diagram shown in the figure")
A=[20 -20 0;-20 60 -20;0 -20 50]
B=[10;40;-100]
I=A\B
printf("\n I1=%.2f A \n",I(1))
printf("\n In=%.2f A \n",I(1))
//Calculation of Rn
Rn=[(20*30/(20+30))+20]*20/(20+[(20*30/(20+30))+20])
printf("\n Rn=%.1f ohms \n",Rn)
//Calculation of Il
Il=I(1)*Rn/(Rn+10)
printf("\n Il=%.2f A \n",Il)
```

**Scilab code Exa 2.62** Nortons equivalent

```
//Chapter 2,Ex2.62,Pg2.77
clc;
disp("Refer to the diagram shown in the figure")
A=[90 -60 0;-60 100 -30;0 30 -30]
B=[120;40;-10]
I=A\B
printf("\n I3=%.2f A \n",I(3))
printf("\n In=%.2f A \n",-I(3))
//Calculation of RN
Rn=[(30*60/(30+60))+10]*30/(30+[(30*60/(30+60))+10])
printf("\n Rn=%.0f ohms \n",Rn)
```

**Scilab code Exa 2.63** Find current through the 8 ohm resistor

```
//Chapter 2,Ex2.63,Pg2.79
clc;
```

```
disp("Refer to the diagram shown in the figure")
A=[-1 1;12 0]
B=[2;55]
I=A\B
printf("\n I1=%.2f A \n",I(1))
printf("\n I2=%.2f A \n",I(2))
printf("\n In=%.2f A \n",I(2))
//Calculation of Rn
Rn=12*4/(12+4)
printf("\n Rn=%.0f ohms \n",Rn)
//Calcuation of Il
Il=6.58*Rn/(Rn+8)
printf("\n Il=%.2f A \n",Il)
```

**Scilab code Exa 2.64** Find current through the 1 ohm resistor

```
//Chapter 2,Ex2.64,Pg2.80
clc;
disp("Refer to the diagram shown in the figure")
A=[0 -5 -2;0 4 -2;-2 -2 4]
B=[-2;-1;0]
I=A\B
printf("\n I1=%.2f A \n",I(1))
printf("\n I2=%.2f A \n",I(2))
printf("\n I3=%.2f A \n",I(3))
printf("\n In=%.2f A \n",I(3))
//Calculation of Rn
Rn=(2*3/(2+3))+(2*2/(2+2))
printf("\n Rn=%.1f ohms \n",Rn)
```

**Scilab code Exa 2.65** Find max power

```
//Chapter 2,Ex2.65,Pg2.82
```

```
clc;
disp("Refer to the diagram shown in the figure")
I=-3/4
printf("\n I=%.2f A \n",I)
Vth=6+2*I-10
printf("\n Vth=%.1f V \n",Vth)
//Calculations Rth
Rth=(2*2/(2+2))+2
printf("\n Rth=%.0f ohms \n",Rth)
//Value of Rl
Pmax=(Vth*Vth/(4*Rth))
printf("\n Pmax=%.2f W \n",Pmax)
```

**Scilab code Exa 2.66** Find max power

```
//Chapter 2,Ex2.66,Pg2.83
clc;
disp("Refer to the diagram shown in the question")
//Calculation og Vth
A=[-1 1;-6 -5]
B=[4;2]
I=A\B
printf("\n I1=%.0f A \n",I(1))
printf("\n I2=%.0f A \n",I(2))
Vth=8-I(1)
printf("\n Vth=%.0f V \n",Vth)
```

**Scilab code Exa 2.67** Find max power

```
//Chapter 2,Ex2.67,Pg2.84
clc;
disp("Refer to the diagram shown in the question")
A=[1 0;5 -10]
```

```
B=[50;0]
I=A\B
printf("\n I1=%.0f A \n",I(1))
printf("\n I2=%.0f A \n",I(2))
Vth=3*I(2)
printf("\n Vth=%.0f V \n",Vth)
//Calculation of Rth
Rth=(7*3/(7+3))
printf("\n Rth=%.1f \n",Rth)
//For maximum power transfer the value of the load
    resistance should be equal to the value of the
    Thevenin resistance
Pmax=(Vth*Vth)/(4*Rth)
printf("\n Pmax=%.2f W \n",Pmax)
```

---

**Scilab code Exa 2.68** Find Rl and calculate maximum power

```
//Chapter 2,Example2.68,Pg2.85
clc;
disp("Refer to the diagram shown in the figure")
A=[-1 1;5 2]
B=[6;10]
I=A\B
printf("\n I1=%.2f A \n",I(1))
printf("\n I2=%.2f A \n",I(2))
//Calculation of Vth
Vth=2*I(2)
printf("\n Vth=%.2f V \n",Vth)
//Calculation of Rth
Rth=(5*2/(5+2))+3+4
printf("\n Rth=%.2f ohms \n",Rth)
//For maximum power transfer the load resistance
    should be equal to the Thevenin resistance
Pmax=(Vth*Vth/(4*Rth))
printf("\n Pmax=%.2f W \n",Pmax)
```

**Scilab code Exa 2.69** Find Rl and calculate max power

```
//Chapter 2, Example2.69,Pg2.85
clc;
disp("Refer to the diagram shown in the figure")
A=[15 -5;0 1]
B=[120;-6]
I=A\B
printf("\n I1=%.0f A \n",I(1))
printf("\n I2=%.0f A \n",I(2))
Vth=120-10*I(1)  //Thevenin Voltage
printf("\n Vth =%.0f V \n",Vth)
//Calculation of Rth
Rth=(10*5/(10+5))
printf("\n Rth=%.2f ohms \n",Rth)
//For maximum power transfer load resistance should
   be equal to thevenin resistance
Pmax=(Vth*Vth/(4*Rth))
printf("\n Pmax=%.2f W \n",Pmax)
```

**Scilab code Exa 2.70** Find Rl and max power

```
//Chapter 2,Ex2.70,Pg2.87
clc;
disp("Refer to the diagram shown in the question")
A=[1 0;-25 41]
B=[3;0]
I=A\B
printf("\n I1= %.0f A \n",I(1))
printf("\n I2= %.0f A \n",I(2))
Vth=-20+10*I(2)+6*I(2)
```

```
printf("\n Vth=%.2f V \n",Vth)
//Calculation of Rth
Rth=(25*16/(25+16))
printf("\n Rth= %.2f ohms \n",Rth)
//For maximum power transfer the load resistance should be equal to the Thevenin resistance
Pmax=(Vth*Vth/(4*Rth))
printf("\n Pmax=%.2f W \n",Pmax)
```

**Scilab code Exa 2.71** Max power

```
//Chapter 2,Ex2.71,Pg2.88
clc;
disp("Refer to the diagram shown in the question")
A=[-1 1 0;1 10 -10;0 -10 15]
B=[1;5;0]
I=A\B
printf("\n I1=%.2f A \n",I(1))
printf("\n I2=%.2f A \n",I(2))
printf("\n I3=%.2f A \n",I(3))
//Calculation of Vth
Vth=3*I(3)
printf("\n Vth=%.2f V \n",Vth)
//Calculation of Rth
Rth=[(10*1/(10+1))+2]*3/(3+[(10*1/(10+1))+2]) + 5
printf("\n Rth=%.2f ohms \n",Rth)
//Calculation of Pmax
Pmax=(Vth*Vth/(4*Rth))
printf("\n Pmax=%.2f W \n",Pmax)
```

# Chapter 3

# AC Fundamentals

**Scilab code Exa 3.1** Mean value of current

```
//Chapter 3,Ex3.1,Pg3.4
clc;
Im=15/(sin(2*%pi*3.375*0.001*40))
printf("\n Im=%.0f A \n",Im)
```

**Scilab code Exa 3.2** Time at which current attain a particular value

```
//Chapter 3,Ex3.2,Pg3.4
clc;
//(a)
//Given that f=50c/s and Im=100A
i=100*sin(2*%pi*50*(1/600))
printf("\n Instantaneous value of current i=%.0f A \
   n",i)
//(b)
t=(asin(60*%pi)/180)/(100*180)
printf("\n t=%.4f sec \n",t)
```

**Scilab code Exa 3.3** Time at which current attain a particular value

```
clc;
f=50 //Frequence in hertz
Irms=20 //Rms current in amperes
Im=Irms*sqrt(2)
disp("(i)")
printf("\n Im=%02f A \n",Im)
t=0.0025 //Time in seconds
i=Im*sin(2*%pi*f*t)
disp("(ii)")
printf("\n i=%.0f \n",i)
t=0.0125
i=Im*sin(2*%pi*f*t)
disp("(iii)")
printf("\n i=%.0f \n",i)
i1=14.14/Im
disp(i1)
i2=asin(i1)
i2=i2*180/%pi
disp(i2)
i=i2/(2*180*f)
printf("\n i=%.2f \n ms",i*10^3)
```

**Scilab code Exa 3.4** Time at which current attain a particular value

```
clc;
f=60
Im=110
disp("(i)")
t1=90/Im
t2=asin(t1)
```

```
disp(t2)
t2=t1*180/%pi
disp(t2)
t=t1/21600
printf("\n t=%.2f ms \n",t*10^3)
```

**Scilab code Exa 3.5** Time at which current attain a particular value

```
//Example 5,Chapter 3
clc;
f=50 //Frequency in hertz
Im=9.2 //Current in amperes
//(i)
t=0.002
i=Im*sin(2*%pi*f*t)
printf("\n Instantaneous value of current=%.2f A \n"
    ,i)
//(ii)
t=0.0045
t=(1/(4*f))+0.0045
i=Im*sin(2*%pi*f*t)
printf("\n Instantaneous Value=%.2f A \n",i)
```

**Scilab code Exa 3.6** Time at which current attain a particular value

```
//Example6, Chapter 3
clc;
f=50
Irms=20
//(i)
Im=Irms*sqrt(2)
i=10*sqrt(2)
ans=asin(i/Im)
```

```
ans=ans*180/%pi
t= ans/(2*180*f)
printf("\n t=%.0f ms \n",t*10^3)
//(ii)
t=(1/(4*f))+t
printf("\n t=%.2f ms \n",t)
```

**Scilab code Exa 3.8** Time at which current attain a particular value

```
//Example 8,Chapter 3
clc;
f=50
Irms=10 //Current in amperes
//(i)
Im=Irms*sqrt(2)
disp('14.14sin(18000t)')
//(ii)
t=0.0025
t=(1/(4*f)) + t
printf("\n t=%.1f ms \n",t*10^3)
i=14.14*sin(18000*7.5*10^-3)
printf("\n i=%.0f A \n",i)
//(ii)
t=0.0075
t=(1/(2*f))+t
printf("\n t=%.1f ms \n",t*10^3)
i=14.14*sin(18000*t*10^-3)
printf("\n i=%.0f A \n",i)
```

**Scilab code Exa 3.10** Time at which current attain a particular value

```
//Example 10,Chapter 3
//(i)
```

```
clc;
Ieff=7.071/sqrt(2)
Irms=Ieff
Im=5*sqrt(2)
//(ii)
f=(157.08)/(2*%pi)
T=(1/f)
printf("\n T=%.2f s \n",T)
//(iii)
t=(asin((7.071/7.071))+0.785)/157.08
printf("\n t=%.3f s \n",t)
```

**Scilab code Exa 3.15** Form factor Frequence and Crest Factor

```
//Example 15,Chapter 3
clc;
f=(314/(2*%pi))
printf("\n f=%.0f Hz \n",f)
disp('For a sinusoidal waveform')
disp('Vavg=2Vm/pi')
disp('Vrms=Vm/sqrt(2)')
//(ii)
disp('kf=Vrms/Vavg')
kf=%pi/(2*sqrt(2))
printf("\n kf=%.2f \n",kf)
//(iii)
disp('kp=Vm/Vrms')
kp=sqrt(2)
printf("\n kp=%.3f \n",kp)
```

**Scilab code Exa 3.16** RMS value and maximum value

```
//Example 16,Chapter 3
```

```
kf=1.2 //Form factor
kp=1.5 //Peak factor
Vavg=10
//(i)
Vrms=kf*Vavg
printf("\n Vrms=%.0f V \n",Vrms)
//(ii)
Vm=kp*Vrms
printf("\n Vm=%.0f V \n",Vm)
```

**Scilab code Exa 3.17** Average value and RMS value of voltage

```
//Example 17,Chapter 3
kf=1.15
kp=1.5
Vm=4500
//(i)
Vrms=Vm/kp
printf("\n Vrms=%.0f V \n",Vrms)
//(ii)
Vavg=Vrms/kf
printf("\n Vavg=%.1f V \n",Vavg)
```

# Chapter 4

# Three Phase Circuits

**Scilab code Exa 4.1** Calculation of Z

```
//Chapter 4,Ex4.1,Pg 4.8
funcprot(0)
function [polar] = rect2polar(x,y) //Function to
   convert rectangular coordinates to polar
   coordinates
    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] = polar2rect(r,theta) //Function to
   convert polar coordinates to rectangular
   coordinates
    rect=ones(1,2)
    theta=(theta*%pi)/180
    rect(1)=r*cos(theta)
    rect(2)=r*sin(theta)
endfunction
clc;
//Refer to the data given in the question
Vl=440 //Supply voltage
```

```
f=50 //Freq in hertz
Vph=Vl/sqrt(3) //Phase voltage
printf("\n Vph=%.2f V \n",Vph)
Zbarph=rect2polar(8,10) //Converting Zbarph from
    rectangular coordinates to polar coordinates
printf("\n r=%.2f \n",Zbarph(1))
printf("\n theta=%.2f \n",Zbarph(2))
Iph=Vph/Zbarph(1) //Phase current
printf("\n Iph=%.2f A \n",Iph)
Il=Iph //Line current
P=sqrt(3)*Il*Vl*cos(Zbarph(2)*%pi/180)
P=P*(10^-3) //Active power
Q=sqrt(3)*Vl*Il*sin(Zbarph(2)*%pi/180)
Q=Q*(10^-3) //Reactive power
printf("\n P=%.2f kW \n",P)
printf("\n Q=%.2f kVAR \n",Q)
```

**Scilab code Exa 4.2** Calculation of Z

```
funcprot(0)
function [polar] = rect2polar(x,y)
    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] = polar2rect(r,theta)
    rect=ones(1,2)
    theta=(theta*%pi)/180
    rect(1)=r*cos(theta)
    rect(2)=r*sin(theta)
endfunction
//Refer to the data given in the question
clc;
Vl=230 //Line voltage in volts
```

```
f=50 //freq in hertz
Vph=Vl
Zbarph=rect2polar(8,-6)
r=Zbarph(1)
printf("\n r=%.0f \n",r)
phi=Zbarph(2)
printf("\n phi=%.2f degrees \n",Zbarph(2))
pf=cos(phi*%pi/180)
printf("\n Power factor=%.1f (leading) \n",pf)
Iph=Vph/Zbarph(1)
printf("\n Iph=%.0f A \n",Iph)
Il=sqrt(3)*Iph
printf("\n Il=%.2f A \n",Il)
Q=sqrt(3)*Vl*Il*sin(phi*%pi/180)
Q=Q*(10^-3)
printf("\n Reactive power Q=%.2f kVAR \n",Q)
```

**Scilab code Exa 4.3** Calculation of active power reactive power and total power

```
//Chapter4,Ex4.3,Pg4.9
funcprot(0)
function [polar] = rect2polar(x,y)
    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] = polar2rect(r,theta)
    rect=ones(1,2)
    theta=(theta*%pi)/180
    rect(1)=r*cos(theta)
    rect(2)=r*sin(theta)
endfunction
//Refer to the data given in the question
```

```
clc;
R=8 //Resistance in ohms
L=0.02 //Inductance in Henry
Vl=230 //Line voltage in volts
f=50
Vph=Vl/sqrt(3) //Phase voltage
printf("\n Vph=%.2f V \n",Vph)
Xl=2*%pi*f*L
Zbarph=rect2polar(R,Xl) //Converting rectangular coordinates to polar coordinates
r=Zbarph(1)
phi=Zbarph(2)
printf("\n Zph=%.2f ohms \n",r)
printf("\n phi=%.2f degrees \n",phi)
phi=phi*%pi/180 //Converting degrees to radians
printf("\n Power factor =%.2f (lagging) \n",cos(phi))
Iph=Vph/r
printf("\n Iph=%.2f A \n",Iph)
Il=Iph
P=sqrt(3)*Vl*Il*cos(phi)
P=P*(10^-3)
printf("\n Active power =%.2f kW \n",P)
Q=sqrt(3)*Vl*Il*sin(phi)
Q=Q*(10^-3)
printf("\n Reactive power Q=%.2f kVAR \n",Q)
S=sqrt(3)*Vl*Il
S=S*(10^-3)
printf("\n Total power =%.3f kVA \n",S)
```

**Scilab code Exa 4.4** Calculation of P

```
funcprot(0)
function [polar] = rect2polar(x,y) //Function to convert rectangular coordinates to polar
```

```
coordinates
    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] = polar2rect(r,theta) //Function to convert polar coordinates to rectangular coordinates
    rect=ones(1,2)
    theta=(theta*%pi)/180
    rect(1)=r*cos(theta)
    rect(2)=r*sin(theta)
endfunction
clc
R=8 //Resistance in ohms
L=0.02 //Inductance in henry
Vl=400 //Line voltage
f=50 //Freq in hertz
Xl=2*%pi*f*L
Zbarph=rect2polar(R,Xl)
r=Zbarph(1)
phi=Zbarph(2)
printf("\n Zph=%.2f ohms \n",r)
printf("\n phi=%.2f degrees \n",phi)
phi=phi*%pi/180 //Converting degrees to radians
Iph=Vl/r
printf("\n Iph=%.2f A \n",Iph)
Il=sqrt(3)*Iph
printf("\n Il=%.2f A \n",Il)
P=sqrt(3)*Vl*Il*cos(phi) //Active power
printf("\n P=%.2f kW \n",P*(10^-3))
```

**Scilab code Exa 4.5** Calculation of different powers for line and phase voltages

```
funcprot(0)
function [polar] = rect2polar(x,y) //Function to convert rectangular coordinates to polar coordinates
    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] = polar2rect(r,theta) //Function to convert polar coordinates to rectangular coordinates
    rect=ones(1,2)
    theta=(theta*%pi)/180
    rect(1)=r*cos(theta)
    rect(2)=r*sin(theta)
endfunction
clc;
//Refer to the data given in the question
R=9 //resistance in ohms
Xl=12 //Reactance in ohms
f= 50// Frequence of supply in hertz
Vl=440 //Supply voltage in V
Vph=Vl //For delta connected load
Zbarph=rect2polar(9,12)
r=Zbarph(1)
phi=Zbarph(2)
printf("\n Zph=%.2f ohms \n",r)
printf("\n phi=%.2f degrees \n",phi)
phi=phi*%pi/180 //Converting degrees to radians
Iph=Vph/r
printf("\n Iph=%.2f A \n",Iph)
Il=sqrt(3)*Iph
printf("\n Il=%.1f A \n",Il)
printf("\n Power factor =%.1f (lagging) \n",cos(phi)
)
S=sqrt(3)*Vl*Il //Total power
printf("\n S=%.2f kVA \n",S*(10^-3))
```

```
P=sqrt(3)*Vl*Il*cos(phi)
printf("\n P=%.2f kW \n",P*(10^-3))
Q=sqrt(3)*Vl*Il*sin(phi)
printf("\n Q=%.2f kVAR \n",Q*(10^-3))
//If the coils were in star connection
Vph=Vl/sqrt(3)
printf("\n Vph=%.2f V \n",Vph)
Iph=Vph/r
Il=Iph
printf("\n Iph=%.2f A \n",Iph)
pf=cos(phi)
printf("\n Power factor=%.1f (lagging) \n",pf)
S=sqrt(3)*Vl*Il
printf("\n total power=%.2f kVA \n",S*(10^-3))
P=sqrt(3)*Iph*pf
printf("\n P=%.2f kVA \n",P*(10^-3))
Q=sqrt(3)*Vl*Iph*(sqrt(1-pf^2))
printf("\n Q=%.2f kVAR \n",Q*(10^-3))
```

**Scilab code Exa 4.6** Calculation of different powers for line and phase voltages

```
funcprot(0)
function [polar] = rect2polar(x,y) //Function to
   convert rectangular coordinates to polar
   coordinates
    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] = polar2rect(r,theta) //Function to
   convert polar coordinates to rectangular
   coordinates
    rect=ones(1,2)
```

```
    theta=(theta*%pi)/180
    rect(1)=r*cos(theta)
    rect(2)=r*sin(theta)
endfunction
clc
//Refer to the data given in the question
Vl=415
R=15
L=0.1
f=50
C=177*(10^-6)
Vph=Vl/sqrt(3)
Xl=2*%pi*f*L
Xc=1/(2*%pi*f*C)
Zbarph=rect2polar(R,(Xl-Xc))
r=Zbarph(1)
printf("\n Zph=%.2f ohms \n",Zbarph(1))
phi=Zbarph(2)
printf("\n phi=%.2f degrees \n",Zbarph(2))
phi=phi*%pi/180
pf=cos(phi)
printf("\n Power factor=%.3f (lagging) \n",pf)
Iph=Vph/r
printf("\n Iph=%.1f A \n",Iph)
P=sqrt(3)*Vl*Il*cos(phi)
printf("\n P=%.2f kW \n",P*(10^-3))
Q=sqrt(3)*Vl*Il*sin(phi)
printf("\n Q=%.2f kVAR \n",Q*(10^-3))
S=sqrt(3)*Vl*Il
printf("\n Total power =%.2f kVA \n",S*(10^-3))
//If the same impedance is connected in delta
Vph=Vl
Iph=Vph/r
printf("\n Iph=%.2f A \n",Iph)
Il=sqrt(3)*Iph
printf("\n Il=%.2f A \n",Il)
P=sqrt(3)*Vl*Il*cos(phi)
printf("\n P=%.2f kW \n",P*(10^-3))
```

**Scilab code Exa 4.7** Calculation of different powers for line and phase voltages

```
funcprot(0)
function [polar] = rect2polar(x,y) //Function to
   convert rectangular coordinates to polar
   coordinates
    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] = polar2rect(r,theta) //Function to
   convert polar coordinates to rectangular
   coordinates
    rect=ones(1,2)
    theta=(theta*%pi)/180
    rect(1)=r*cos(theta)
    rect(2)=r*sin(theta)
endfunction
clc
//Refer to the data given in the question
L=50*(10^-3) //load inductance in mH
R=50 //Resistance in ohms
C=50*(10^-6) //Capacitance in microfarads
Vl=550 //Line voltage in volts
w=800 //Angular frequency
Vph=Vl //For delta connected load,phase voltage=line
    voltage
Xl=w*L
Xc=1/(w*C)
printf("\n Xl=%.0f ohms \n",Xl)
printf("\n Xc=%.0f ohms \n",Xc)
Zbarph=rect2polar(10,20)
```

```
r=Zbarph(1)
printf("\n Zph=%.2f \n",r)
printf("\n phi=%.2f \n",Zbarph(2))
Iph=Vph/r
printf("\n Iph=%.2f A \n",Iph)
pf=cos(Zbarph(2)*%pi/180)
printf("\n Power factor=%.3f (lagging) \n",pf)
Il=sqrt(3)*Iph
P=sqrt(3)*Vl*Il*pf
printf("\n P=%.2f kW \n",P*(10^-3))
Q=sqrt(3)*Vl*Il*sin(Zbarph(2)*%pi/180)
printf("\n Q=%.1f kVAR \n",Q*(10^-3))
S=sqrt(3)*Vl*Il
printf("\n S=%.2f kVA \n",S*(10^-3))
```

**Scilab code Exa 4.8** Calculation of P

```
funcprot(0)
function [polar] = rect2polar(x,y) //Function to convert rectangular coordinates to polar coordinates
  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] = polar2rect(r,theta) //Function to convert polar coordinates to rectangular coordinates
  rect=ones(1,2)
  theta=(theta*%pi)/180
  rect(1)=r*cos(theta)
  rect(2)=r*sin(theta)
endfunction
clc
```

```
//Refer to the data given in the question
Vl=440 //Line voltage
P=50*(10^3) //Active power in watts
Il=90 //Load current in amperes
Vph=Vl //For delta connected load phase voltage=line
    voltage
Iph=Il/sqrt(3)
printf("\n Iph=%.2f A \n",Iph)
//Since P, Il and Vl have been given, the power
   factor can be calculated easily
pf=P/(sqrt(3)*Vl*Il)
printf("\n Power factor=%.2f (lagging) \n",pf)
S=sqrt(3)*Vl*Il
printf("\n S=%.2f kVA \n",S*(10^-3))
```

**Scilab code Exa 4.9** Calculation of active power reactive power and total power

```
funcprot(0)
function [polar] = rect2polar(x,y) //Function to
   convert rectangular coordinates to polar
   coordinates
    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] = polar2rect(r,theta) //Function to
   convert polar coordinates to rectangular
   coordinates
    rect=ones(1,2)
    theta=(theta*%pi)/180
    rect(1)=r*cos(theta)
    rect(2)=r*sin(theta)
endfunction
```

```
clc
//Refer to the data given in the question
Il=15 //Current in amperes
P=11*(10^3) //Active power in kilowatts
S=15*(10^3)
Vl=S/(sqrt(3)*Il)
printf("\n Vl=%.2f V \n",Vl)
Vph=Vl/sqrt(3)
printf("\n Vph=%.2f V \n",Vph)
pf=P/S //Power factor
printf("\n Power factor=%.3f \n",pf)
phi=acos(pf)
phi=phi*180/%pi
printf("\n phi=%.2f degrees \n",phi)
Q=sqrt(3)*Vl*Il*sin(phi*%pi/180)
printf("\n Q=%.1f kVAR \n",Q*10^-3)
//For star connected load, Il=Iph
Zph=Vph/Il
printf("\n Zph=%.2f ohms \n",Zph)
R=Zph*pf
printf("\n R=%.2f ohms \n",R)
Xl=Zph*sqrt(1-(pf^2))
printf("\n Xl=%.2f ohms \n",Xl)
Vph=Vl //If the coils are connected in delta
Iph=Vph/Zph
Il=sqrt(3)*Iph
printf("\n Il=%.0f A \n",Il)
P=sqrt(3)*Vl*Il*pf
printf("\n P=%.2f kW \n",P*(10^-3))
Q=sqrt(3)*Vl*Il*sqrt(1-(pf^2))
printf("\n Q=%.2f kVAR \n",Q*(10^-3))
```

**Scilab code Exa 4.11** Calculation of phase resistance and phase impedance

```
funcprot(0)
```

```
function [polar] = rect2polar(x,y) //Function to convert rectangular coordinates to polar coordinates
    polar=ones(1,2)
    polar(1)=sqrt((x^2)+(y^2))
    polar(2)=atan(y/x)
    polar(2)=(polar(2)*180)/%pi
endfunction
clc
//Refer to the data given in the question
Vl=208 //Line voltage
P=1800 //Active power
Il=10 //Line current
Vph=Vl/sqrt(3)
printf("\n Vph=%.2f V \n",Vph)
Iph=Il
Zph=Vph/Iph
printf("\n Zph=%.2f ohms \n",Zph)
//Since the active power,line voltage and line current are given, the power factor can be calculated easily
pf=P/(sqrt(3)*Vl*Il)
printf("\n Power factor=%.2f \n",pf)
phi=acos(pf)
phi=phi*180/%pi
printf("\n phi=%.0f degrees \n",phi)
Rph=Zph*pf
printf("\n Rph=%.2f ohms \n",Rph)
Xph=Zph*sqrt(1-pf^2)
printf("\n Xph=%.2f ohms \n",Xph)
```

**Scilab code Exa 4.13** Calculation of phase resistance and phase reactance

```
//Chapter 4,Ex4.1,Pg 4.8
funcprot(0)
```

```
function [polar] = rect2polar(x,y) //Function to
    convert rectangular coordinates to polar
    coordinates
    polar=ones(1,2)
    polar(1)=sqrt((x^2)+(y^2))
    polar(2)=atan(y/x)
    polar(2)=(polar(2)*180)/%pi
endfunction
clc;
//Refer to the data given in the question
Vl=400 //Supply voltage
Il=34.65 //Current in Amperes
P=14.4*10^3 //Active power in volts
Vph=Vl
Iph=Il/sqrt(3)
printf("\n Iph=%.0f A \n",Iph)
Zph=Vph/Iph
printf("\n Zph=%.0f ohms \n",Zph)
//We can calculate the power factor easily from the
    given data
pf=P/(sqrt(3)*400*34.65)
printf("\n Power factor=%.1f \n",pf)
phi=acos(pf)
phi=phi*180/%pi
printf("\n phi=%.2f degrees \n",phi)
Rph=Zph*pf
printf("\n Rph=%.0f ohms \n",Rph)
Xph=Zph*sqrt(1-pf^2)
printf("\n Xph=%.0f ohms \n",Xph)
```

**Scilab code Exa 4.14** Calculation of Q

```
funcprot(0)
function [polar] = rect2polar(x,y) //Function to
    convert rectangular coordinates to polar
```

```
    coordinates
    polar=ones(1,2)
    polar(1)=sqrt((x^2)+(y^2))
    polar(2)=atan(y/x)
    polar(2)=(polar(2)*180)/%pi
endfunction
clc
//Refer to the data given in the question
P=10.44*10^3 //Power in kWh
Vl=200 //Line voltage
pf=0.5 //Leading power factor
Vph=Vl //For delta connected load
//Since we have the value of active power,line
    voltage and power factor we can easily calculate
    the value of line current
Il=P/(sqrt(3)*Vl*pf)
printf("\n Il=%.2f A \n",Il)
Iph=Il/sqrt(3)
printf("\n Iph=%.1f A \n",Iph)
Zph=Vph/Iph
printf("\n Zph=%.2f ohms \n",Zph)
Rph=Zph*pf
printf("\n Rph=%.3f ohms \n",Rph)
Xph=Zph*(sqrt(1-pf^2))
printf("\n Xph=%.2f ohms \n",Xph)
Q=sqrt(3)*Vl*Il*sqrt(1-pf^2)
printf("\n Q=%.2f kVAR \n",Q*10^-3)
```

**Scilab code Exa 4.17** Calculation of active and reactive components of phase current

```
funcprot(0)
function [polar] = rect2polar(x,y) //Function to
    convert rectangular coordinates to polar
    coordinates
```

```
    polar=ones(1,2)
    polar(1)=sqrt((x^2)+(y^2))
    polar(2)=atan(y/x)
    polar(2)=(polar(2)*180)/%pi
endfunction
clc
Po=200*10^3 //Output Power
f=50 //frequency in hertz
Vl=440
n=91 //efficiency
pf=0.86
Vph=Vl //For a delta connected load
//Since the efficiency and output power have been
   given in the question, the input power can be
   easily calculated
Pi=(Po/n)*100
printf("\n Input power=%.2f kW \n",Pi*10^-3)
//Since the input power is now known we can
   calculate the line current
Il=Pi/(sqrt(3)*Vl*pf)
printf("\n Il=%.1f A \n",Il)
Iph=Il/sqrt(3)
printf("\n Iph=%.1f A \n",Iph)
apc=Iph*pf //Active component of phase current
printf("\n Active component of phase current=%.1f A
   \n",apc)
rpc=Iph*sqrt(1-pf^2)
printf("\n Reactive component of phase current=%.1f
   A \n",rpc)
```

**Scilab code Exa 4.20** Calculation of P

```
clc
Vl=400 //Three phase supply voltage
Zph=100 //Impedance in ohms
```

```
Vph=Vl/sqrt(3) //For a star connected load
printf("\n Vph=%.2f V \n",Vph)
Iph=Vph/Zph
printf("\n Iph=%.2f A \n",Iph)
Il=Iph
pf=1
P=sqrt(3)*Vl*Il*pf
printf("\n P=%.1f W \n",P)
Vph=Vl //For a delta connected load
Iph=Vph/Zph
printf("\n Iph=%.0f A \n",Iph)
Il=sqrt(3)*Iph
printf("\n Il=%.2f A \n",Il)
P=sqrt(3)*Vl*Il*pf
printf("\n P=%.2f W \n",P)
```

# Chapter 5

# Single phase Transformer

**Scilab code Exa 5.1** Example number 1

```
//Chapter5,Ex5.1,Pg5.4
clc;
//(i)
V2=110*110/220 // V2/V1 = E2/E1
printf("\n V2=%.0f V \n",V2)
//(ii)
printf("\n V2=%.0f V \n",0)
```

**Scilab code Exa 5.2** Example number 2

```
//Chapter5,Ex5.2,Pg5.5
clc;
//Given data: Flux required=4.13mWb,V1=110V f=50,
N1=110/(4.44*50*0.001*4.13) //No. of turns= Voltage
    of operation/(Flux required*4.44*frequency of
    input signal)
printf("\n No. of turns=%.0f turns \n",N1)
```

**Scilab code Exa 5.3** Example number 3

```
//Chapter 5,Ex5.3,Pg5.5
clc;
//Given f=50Hz V1=240V N1=80 N2=280 A=200sq cm
//V1 is approximately equal to E1 for a transformer
//(i)
B=240/(4.44*50*200*0.0001*80) //E1=4.44fBmAN1
printf("\n Maximum flux density Bm=%.2f Wb/m2 \n",B)
//(ii)
E2=(280/80)*240 //Induced Emf E2=N2/N1*E1
printf("\n Induced EMF E2=%.0f V \n",E2)
```

**Scilab code Exa 5.4** Example number 4

```
//Chapter 5,Ex5.4,Pg5.5
clc;
//Given E1=3200V E2=400V f=50Hz N2=111
//Part(i)
N1=(3200/400)*111 //E2/E1=N2/N1
printf("\n No of turns in primary=%.0f turns \n",N1)
//Part(ii)
I2=80*1000/400 //I2=KVA Rating*1000/V2 where I2=
    secondary current
printf("\n Secondary current I2=%.0f A \n",I2)
//Part(iii)
A=400/(4.44*50*1.2*111) //Using the formula E=4.44
    BmAfN2
printf("\n Cross sectional area=%.4f sq m \n",A)
```

**Scilab code Exa 5.5** Example number 5

```
//Chapter5,Ex5.5,Pg5.6
clc;
//Given: kVA rating=5kVA E1=240V E2=2400V f=50Hz Bm
    =1.2Tesla
N1=240/8 //Since it is given that EMF per turn is 8
//(i)
printf("\n No. of turns in primary=%.0f \n",N1)
//(ii)
N2=(2400/240)*N1 //E2/E1=N2/N1
A=2400/(4.44*50*1.2*300) //using the formula E=4.44
    BmAfN2
printf("\n Cross sectional area=%.2f sq m \n",A)
//(iii)
I1=5*1000/240 //Using the formula I=kVA rating*1000/
    V1
printf("\n I1=%.2f A \n",I1)
I2=5*1000/2400
printf("\n I2=%.2f A \n",I2)
```

**Scilab code Exa 5.6** Example 6

```
//Chapter5,Ex5.6,Pg5.6
clc;
//Given: kVA rating=250kVA f=50Hz N2/N1=0.1 E2=240V
//(i)
E1=240/0.1 //E2/E1=N2/N1
printf("\n Primary EMF E1=%.0f V \n",E1)
//(ii)
I1=250*1000/2400 //Using the formula I=kVA rating
    *1000/V
printf("\n I1=%.2f A \n",I1)
I2=250*1000/240
printf("\n I2=%.2f A \n",I2)
```

**Scilab code Exa 5.7** Example 7

```
//Chapter 5,Ex5.7,Pg 5.8
clc;
W0=200 //Power
R1=3.5 //Primary resistance
V1=2300 //Primary voltage
I0=0.3 //no load current
cl=(I0^2)*R1
printf("\n Copper loss=%.3f W \n",cl)
coreloss=W0-cl //Core loss=Input power-copper loss
printf("\n Core loss=%.3f W \n",coreloss)
pf=W0/(V1*I0)
printf("\n Power factor = %.2f (lagging) \n",pf)
```

**Scilab code Exa 5.8** Example number 8

```
//Chapter 5,Ex5.8,Pg 5.8
clc;
//Primary voltage=230V no-load primary current=5A pf
    =0.25 N1=200 f=50Hz
//(i)
fluxm=230/(4.44*50*200) //Using E=4.44fN1*fluxm
printf("\n Max flux in the core=%.5f Wb \n",fluxm)
//(ii)
W=230*5*0.25 //Using the formula W=V1*I0*powerfactor
printf("\n Core loss =%.1f W \n",W)
//(iii)
x=sqrt(1-(0.25^2)) //x=sin(phi)
Iu=5*x
printf("\n Magnetising current=%.2f A \n",Iu)
```

**Scilab code Exa 5.9** Example number 9

```
//Chapter 5,Ex5.9,Pg 5.13
clc;
tr=4 //tr=N1/N2=4 which is given in the question
K=1/tr
Rp=50/(K^2) // Using the formula Equivalent
    resistance referred to primary=R'=R/(K^2)
printf("\n Rp=%.0f ohms \n",Rp)
```

---

**Scilab code Exa 5.11** Example number 11

```
//Chapter 5,Ex5.10,Pg5.13
clc;
E1=6600 //Primary voltage
E2=400 //Secondary voltage
R1=2.5 //Primary resistance
X1=3.9 //Primary reactance
X2=0.025 //Secondary reactance
R2=0.01 //Secondary resistance
K=E2/E1
//Equivalent resistance referred to primary
R01=R1+(R2/(K^2))
printf("\n Equivalent resistance referred to primary
    =%.2f ohms \n",R01)
//Equivalent reactance referred to primary
X01=X1+(X2/(K^2))
printf("\n Equivalent reactance referred to
    secondary =%.2f ohms \n",X01)
//Equivalent resistance referred to secondary
R02=R2+((K^2)*R1)
```

```
printf("\n Equivalent resistance referred to secondary=%.2f ohms \n",R02)
//Equivalent resistance referred to secondary
X02=X2+((K^2)*X2)
printf("\n Equivalent resistance referred to secondary=%.2f ohms \n",X02)
```

**Scilab code Exa 5.12** Example number 12

```
//Chapter 5,Ex5.12,Pg5.14
clc;
E1=4400 //Primary EMF
R1=3.45 //Primary resistance in ohms
X1=5.2 //Primary reactance in ohms
E2=220 //Secondary EMF
R2=0.009 //Secondary resistance in ohms
X2=0.015 //Secondary reactance in ohms
K=E2/E1
I1=50*1000/E1 //Using the formula I1=kVA rating*1000/E
printf("\n Full load Primary current I1=%.2f A \n",I1)
I2=50*1000/220
printf("\n Full load secondary current I2=%.2f A \n",I2)
R01=R1+(R2/(K*K))
printf("\n Equivalent resistance referred to primary=%.2f ohms \n",R01)
X01=X1+(X2/(K*K))
printf("\n Equivalent reactance referred to primary=%.1f ohms \n",X01)
Z01=sqrt((R01^2)+(X01*X01))
printf("\n Equivalent impedance referred to primary=%.2f ohms \n",Z01)
R02=(K^2)*R01
```

```
printf("\n Equivalent resistance referred to
   secondary=%.2f ohms \n",R02)
X02=(K^2)*X01
printf("\n Equivalent reactance referred to
   secondary=%.3f ohms \n",X02)
Z02=(K^2)*Z01
printf("\n Equivalent impedance referred to
   secondary=%.2f ohms \n",Z02)
CL1=(I1^2)*R1 + (I2^2)*R2
printf("\n Copper losses with individual resistances
   =%.2f W \n",CL1)
CL2=(I1^2)*R01
printf("\n Copper loss with equivalent resistances=%
   .1f W \n",CL2)
```

**Scilab code Exa 5.13** Example number 13

```
//Chapter 5,Ex5.13,Pg5.17
clc;
E2=440 //Secondary voltage
V2=400 //voltage at full load
//Given that power factor=0.8(lagging)
percentreg=((E2-V2)/E2)*100
printf("\n Percentage regulation=%.2f percent\n",
   percentreg)
```

**Scilab code Exa 5.15** Example number 15

```
//Chapter 5,Ex5.16,Pg5.18
clc;
//Let x=cos(phi) and y=sin(phi)
x=0.8
y=0.6
```

```
vr=1
vx=5
//For 0.8 lagging power factor
percentreg=vr*x+vx*y
printf("\n Percentage regulation=%.1f percent \n",
   percentreg)
//For unity power factor
x=1
y=0
percentreg=vr*x+vx*y
printf("\n Percent regulation=%.0f percent \n",
   percentreg)
//For 0.8 leading pf
x=0.8
y=0.6
percentreg=vr*x-vx*y
printf("\n Percent regulation=%.1f percent \n",
   percentreg)
```

---

**Scilab code Exa 5.17** Example number 17

```
//Chapter5,Ex5.17,Pg5.19
clc;
E1=230 //EMF in primary winding
E2=460 //EMF in secondary winding
R1=0.2 //Primary resistance
R2=0.75 //Secondary resistance
X1=0.5 //Reactance in ohms
X2=1.8 //Secondary reactance in ohms
I2=10 //secondary current in amperes
pf=0.8 //cos(phi)=0.8
K=E2/E1
printf("K=%.0f \n",K)
R02=R2+(K^2)*R1 //Effective secondary resistance
X02=X2+(K^2)*X1 //Effective secondary reactance
```

```
y=sqrt(1-(pf^2)) //sin(phi)=y
V2=E2-I2*((R02*pf)+(X02*y))
printf("\n Secondary terminal voltage=%.1f V \n",V2)
```

**Scilab code Exa 5.18** Example number 18

```
//Example 5.18,Pg5.20
clc;
//Given Full load kVA=100kVA
//Wi=600W(iron loss)
//WCu=1.5kW(copper loss)
//(i)
x=1 //Full load
pf=0.8
n=(x*100*pf/((x*100*pf)+0.6+((x^2)*1.5)))*100
printf("\n Efficiency=%.2f percent \n",n)
//(ii)
x=0.5
pf=1
n=(x*100*pf/((x*100*pf)+0.6+((x^2)*1.5)))*100
printf("\n Efficiency=%.2f percent \n",n)
```

**Scilab code Exa 5.19** Example number 19

```
//Ex5.19,Pg5.21
clc;
flkva=25 //Full load kVA
R1=1.8 //Primary resistance in ohms
R2=0.02 //Secondary resistance in ohms
E1=2200 //Primary EMF in volts
E2=220 //Secondary EMF in volts
Wi=1000 //Iron loss in watts
I2=flkva*1000/220
```

```
printf("\n I2=%.2f A \n",I2)
K=E2/E1
printf("\n K=%.1f \n",K)
R02=R2+(K^2)*R1
printf("\n Effective secondary resistance=%.3f ohms \n",R02)
Wcu=(I2^2)*R02
printf("\n Copper loss=%.2f W \n",Wcu)
//(i)
x=1 //Full load
pf=1
n=(x*flkva*pf/((x*flkva*pf)+Wi/1000+((x^2)*Wcu/1000)))*100
printf("\n Efficiency=%.2f percent \n",n)
//(ii)
x=0.5
pf=0.8
n=(x*flkva*pf/((x*flkva*pf)+Wi/1000+((x^2)*Wcu/1000)))*100
printf("\n Efficiency=%.2f percent \n",n)
```

**Scilab code Exa 5.20** Example number 20

```
//Ex5.20,Pg5.22
clc;
n1=98.135 //Given efficiency
n2=97.751 //Given efficiency
x=1 //Full load
pf=0.8 //Power factor
//Using the above data we have to solve 2 simultaneous equations by substituting the values in the formula for calculating the efficiency
A=[1 1;1 0.25]
B=[3.8; 2.3]
W=A\B
```

```
printf("\n Full load copper loss =%.0f kW \n",W(2))
printf("\n Iron loss =%.1f kW \n",W(1))
```

**Scilab code Exa 5.21** Example number 21

```
//Ex5.21,Pg5.23
clc;
//Given x=1 and pf=1 we obtain the first equation
//With x=0.5 and pf=1 we obtain the second equation
A=[1 1;1 0.25]
B=[52.2;26.1]
W=A\B
printf("\n Copper loss=%.1f kW \n",W(2))
printf("\n Iron loss=%.1f kW \n",W(1))
//Now if x=0.6 and pf=1
n= (0.6*600*1/((0.6*600*1)+W(1)+((0.6^2)*W(2))))*100
printf("\n Efficiency=%.2f percent \n",n)
```

**Scilab code Exa 5.22** Example number 22

```
//Ex5.22,Pg5.23
clc;
flkva=150 //Given
Wi=1.4 //Iron loss in kW
Wcu=1.6 //Copper loss in kW
//(a)
lkva=flkva*sqrt(Wi/Wcu)
printf("\n Load kVA=%.2f kVA \n",lkva)
//For maximum efficiency Wi=Wcu=1.4kW and pf=0.8
n= (lkva*0.8/((lkva*0.8)+Wi+Wcu))*100
printf("\n Efficiency=%.2f percent \n",n)
//(b)
```

```
n= (0.5*flkva*0.8/((0.5*flkva*0.8)+Wi+(0.5^2)*Wcu))
    *100
printf("\n Efficiency=%.2f percent \n",n)
```

**Scilab code Exa 5.23** Example number 23

```
//Example5.23,Pg5.24
clc;
flkva=100 //Full load kVA given
x=1 //Full load
pf=0.8 //Power factor lagging
A=[1 1;1 -0.64]
B=[2.474;0]
W=A\B
n= (x*flkva*pf/((x*flkva*pf) + W(1) +(x^2)*W(2)))
    *100
printf("\n Efficiency=%.2f percent \n",n)
```

**Scilab code Exa 5.28** Example number 28

```
//Example5.28,Pg5.28
clc;
Wi=1 //Iron loss in kW
op=50*0.8*10+25*0.6*10+0*4
Wcu=1.2 //Copper loss in kW
Culoss=1*1.2*10+(25/50)*1.2*10+0 //Copper loss in
    the entire day considering the load cycle for a
    day as given in the question
Iloss=1*24
nallday= (op/(op+Iloss+Culoss))*100
printf("\n All day efficiency=%.2f percent \n",
    nallday)
```

# Chapter 6

# Electrical Machines

**Scilab code Exa 6.1** Example 1

```
//Chapter6,Pg6.6,Ex6.1
clc;
P=6 //Number of poles in armature
phi=0.018 //Flux per pole in Wb
N=600 //Angular velocity in rpm
Z=840 //Number of conductors
A=P //For lap wound armature, number of parallel
   paths=number of poles
Eg=(phi*Z*N*P)/(60*A)
printf("\n Eg=%.1f V \n",Eg)
```

**Scilab code Exa 6.2** Example number 2

```
//Pg6.6,Ex6.2
clc;
P=6 //Number of poles
A=2 //No of parallel paths
Z=300 //Number of conductors
```

```
N=1000 //Angular velocity
Eg=400 //Generated Emf
phi=(60*Eg*A)/(Z*N*P)
printf("\n phi=%.4f Wb\n",phi)
```

**Scilab code Exa 6.3** Example number 3

```
//Pg6.7,Ex6.3
clc;
n=80 //Number of slots on armature
cps=10 //number of conductors per slot
Eg=400 //Generated EMF
N=1000 //Angular velocity
//part(i)
ctotal=n*cps
phi=(Eg*60)/(N*ctotal) //Since A=P
printf("\n phi=%.2f Wb \n",phi)
//part(ii)
Eg=220
N=(Eg*60)/(phi*ctotal)
printf("\n N=%.0f rpm \n",N)
```

**Scilab code Exa 6.4** Example number 4

```
//Pg 6.7,Ex6.4
clc;
P=4 //Number of poles
V=200 //Supply voltage
Rf=80 //field resistance in ohms
Ra=0.1 //Armature resistance in ohms
Il=100 //Load current in amperes
//part(i)
If=V/Rf
```

```
printf("\n Il=%.1f A \n",Il)
Ia=Il+If
printf("\n Ia=%.1f A \n",Ia)
//part(ii)
A=P //For lap wound generator
cpp=Ia/4
printf("\n Current per armature path=%.3f A \n",cpp)
//Current per armature path=total current divided by
    total number of conductors
///part(iii)
Eg=V+(Ia*Ra)+(0.1*2) //Where the last term in the
   addition is brush drop
printf("\n Eg=%.2f V \n",Eg)
```

**Scilab code Exa 6.5** Example number 5

```
//Pg 6.5,ex6.8
clc;
V=250 //Terminal voltage
Il=450 //Load current
Rf=50 //Field resistance in ohms
Ra=0.05 //Armature resistance in ohms
P=4 //Number of poles
phi=0.05 //Flux per pole in Wb
If=V/Rf
printf("\n If=%.0f A \n",If)
Ia=Il+If
printf("\n Ia=%.0f A \n",Ia)
Eg=V+(Ia*Ra)
printf("\n Eg=%.2f V \n",Eg)
n=120 //Number of slots in armature
cpp=4 //Conductors per slot
Z=n*cpp //Total number of conductors on armature
A=P //For lap wound generator
N=(Eg*60*A)/(phi*Z*P)
```

```
printf("\n N=%.0f rpm \n",N)
```

**Scilab code Exa 6.6** Example number 6

```
//Ex6.6,Pg6.8
clc;
V=230 //Supply voltage
Il=40 //Current in amperes
Ra=0.5 //Armature winding
Rf=115 //Resistance in ohms
//Generator operation
disp("Generator operation")
Il=40 //Load current in amperes
If=V/Rf
printf("\n If=%.0f A \n",If)
Ia=Il+If
printf("\n Ia=%.0f A \n",Ia)
Eg=V+(Ia*Ra)
printf("\n Eg=%.0f V \n",Eg)
//Motor operation
disp("Motor operation")
Il=40
If=2
Ia=Il-If
printf("\n Ia=%.0f A \n",Ia)
Eb=V-(Ia*Ra)
printf("\n Eb=%.0f V \n",Eb)
n=Eb/Eg
printf("\n N2/N1=% .4f \n",n)
```

**Scilab code Exa 6.7** Example number 7

```
//Ex6.7
```

```
clc;
V=100
Il=200
Rs=0.03
Rf=60
Ra=0.04
Vsfw=Il*Rs
printf("\n Voltage drop in series field winding =%.0
    f V \n",Vsfw)
If=(V+(Il*Rs))/Rf
printf("\n If=%.2f A \n",If)
Ia=Il+If
printf("\n Ia=%.2f A \n",Ia)
Eg=V+(Il*Rs)+(Ia*Ra)
printf("\n Generated EMF=%.2f V \n",Eg)
```

# Chapter 7

# Semiconductor devices and rectifiers

**Scilab code Exa 7.1** Calculation of base current

```
//Chapter7,Pg7.4,Ex1
clc;
I=(20-4)/2.2*10^3 //Diode D1 will be forward biased
    and diode D2 will be reverse biased
printf("\n I=%.2f mA \n",I*10^-3)
```

---

**Scilab code Exa 7.2** Calculation of alpha dc

```
//Chapter7,Pg7.4,Ex7.2
clc;
Bdc=90 //
Ic=15 //Collector current
Ib=Ic/Bdc
printf("\n Ib=%.2f uA \n",Ib*10^3)
Ie=Ib+Ic
printf("\n Emitter current Ie=%.2f mA \n",Ie)
```

```
Adc=Bdc/(Bdc+1)
printf("\n Adc=%.2f \n",Adc)
```

**Scilab code Exa 7.4** Calculation of collector current

```
//Chapter 7,Ex7.4,Pg7.15
clc;
B=100
Icbo=4 //current in microamperes
Ib=40 //Current in microamperes
Ic=B*Ib+(B+1)*Icbo
printf("\n Ic=%.1f mA \n",Ic*10^-3)
```

**Scilab code Exa 7.5** Calculation of emitter current

```
//Chapter7,Ex7.5,Pg7.15
clc;
B=50
Ib=20 //Base current in microamperes
Ic=B*Ib
printf("\n Ic=%.0f mA \n",Ic*10^-3)
Ie=Ic+Ib
printf("\n Ie=%.2f mA \n",Ie*10^-3)
```

**Scilab code Exa 7.6** Calculation of base current

```
//Chapter 7,Ex7.6,Pg 7.15
clc;
a=0.9
Ie=10^-3
```

```
Ic=a*Ie //a=Ic/Ie
Ib=Ie-Ic
printf("\n Ib=%.1f mA \n",Ib*10^3)
```

**Scilab code Exa 7.7** Calculation of base current

```
//Chapter 7,Ex 7.7,Pg 7.15
clc;
a=0.98
Vce=0.2
Ic=2*10^-3
Vcc=12
Rc=4
b=a/(1-a)
printf("\n Beta=%.0f \n",b)
Ice=(Vcc-Vce)/Rc
printf("\n Ic=%.2f mA \n",Ic*10^3)
Ib=Ic/b
printf("\n Ib(sat)=%.2f uA \n",Ib*10^6)
```

**Scilab code Exa 7.13** Calculation of Idc

```
//Chapter 7,Ex7.13,Pg7.30
clc;
Vrms=66.64
Rl=15
Vm=sqrt(2)*Vrms
printf("\n Vm=%.2f V \n",Vm)
Im=Vm/Rl
printf("\n Im=%.2f A \n",Im)
Idc=Im/%pi
printf("\n Idc=%.0f A \n",Idc)
```

**Scilab code Exa 7.14** Calculation of peak value of current

```
//Chapter 7,Ex7.14,Pg7.30
clc;
Vdc=300
Rl=3000
Vm=Vdc*%pi/2 //For full wave rectifier
printf("\n Vm=%.2f V \n",Vm)
Vrms=Vm/sqrt(2) //RMS value of secondary voltage
Im=Vm/Rl //Peak diode current
printf("\n Im=%.2f A \n",Im)
```

---

**Scilab code Exa 7.16** Calculation of Vrms

```
//Chapter 7,Ex7.16,Pg7.30
clc;
Vdc=50
Rl=800
Rf=25
Vm=(Vdc*%pi*(Rf+Rl))/Rl
printf("\n Vm=%.0f \n",Vm)
Vrms=Vm/sqrt(2)
printf("\n Vrms=%.2f V \n",Vrms)
```

---

**Scilab code Exa 7.17** Calculation of percent regulation

```
//Chapter 7,Ex 7.17,Pg 7.31
clc;
Rf=1
```

```
Idc=100
Vrms=12.6
Rs=3
Vm=sqrt(2)*Vrms
printf("\n Vm=%.2f V \n",Vm)
Im=Idc*%pi
printf("\n Im=%.3f mA \n",Im)
//Let us use the formula Im=Vm/(Rs+Rf+Rl) to obtain
   the value of Rl
Rl=(17.82-Im*(Rs+Rf))/Im
printf("\n Rl=%.2f V \n",Rl)
Vdc=Idc*Rl
printf("\n Vdc=%.3f V \n",Vdc)
Vnl=Vm/%pi
Vfl=Idc*Rl
percentreg=((Vnl-Vfl)/Vnl)*100
printf("\n Percent regulation=%.2f \n",percentreg
   *10^-3)
```

**Scilab code Exa 7.18** To find out voltage across conducting diode

```
//Chapter7,Example 7.18,Pg 7.32
clc;
Vrms=20 //Root mean square voltage
Rl=500 //Load resistance in ohms
Rf=20 //diode forward resistance
Vm=sqrt(2)*Vrms
printf("\n Vm=%.2f V \n",Vm)
Im=Vm/(Rf+Rl)
printf("\n Im=%.5f A \n",Im)
Idc=2*Im/%pi
printf("\n Idc=%.2f mA \n",Idc*10^3)
Vdc=(2*Vm/%pi)-Idc*Rf
printf("\n Vdc=%.2f V \n",Vdc)
Irms=Im/sqrt(2)
```

```
printf("\n Irms=%.2f mA \n",Irms*10^3)
Pi=(Irms^2)*(Rf+Rl)
printf("\n Input power=%.3f W \n",Pi)
r=sqrt(((Irms/Idc)^2)-1)
printf("\n Ripple factor=%.3f \n",r)
vcd=Idc*Rf
printf("\n Voltage across conducting diode=%.4f V \n
    ",vcd)
disp("Voltage across non conducting diode=20V")
```

**Scilab code Exa 7.19** Percentage regulation

```
//Chapter7.19,Ex7.19,Pg7.33
clc;
Vrms=40
Rf=1 //Diode forward resistance in ohms
Rl=19 //load resistance
Vm=sqrt(2)*Vrms
printf("\n Vm=%.2f V \n",Vm)
Im=Vm/(Rf+Rl)
Idc=(2*Im)/%pi
printf("\n Idc=%.1f A \n",Idc)
Pdc=(Idc^2)*Rl
printf("\n DC load power=%.1f W \n",Pdc)
Pac=((Im/sqrt(2))^2)*(Rf+Rl)
printf("\n Pac=%.2f W \n",Pac)
n=(Pdc/Pac)*100
printf("\n Efficiency=%.2f percent \n",n)
Vnl=(2*Vm)/%pi
Vfl=Idc*Rl
printf("\n Vfl=%.1f V \n",Vfl)
percentreg=((Vnl-Vfl)/Vnl)*100
printf("\n Percentage Regulation=%.2f percent \n",
    percentreg)
```

**Scilab code Exa 7.21** Peak inverse voltage

```
//Chapter7,Ex7.21,Pg7.36
clc;
Vrms=250
Rl=3000
IdcRf=1
Vm=Vrms*sqrt(2)
printf("\n Vm=%.2f V \n",Vm)
Vdc=(2*Vm/%pi)-IdcRf
printf("\n Vdc=%.3f V \n",Vdc)
Idc=Vdc/Rl
printf("\n Idc=%.4f A \n",Idc)
Pdc=(Idc^2)*Rl
printf("\n Pdc=%.2f W \n",Pdc)
Rf=1/Idc
printf("\n Rf=%.2f ohms \n",Rf)
Irms=Vm/((Rf+Rl)*sqrt(2))
printf("\n Irms=%.3f A \n",Irms)
Pac=(Irms^2)*(Rf+Rl)
printf("\n Pac=%.2f W \n",Pac)
PIV=2*Vm //Peak inverse voltage
printf("\n PIV=%.1f V \n",PIV)
```