Scilab Textbook Companion for Introduction to Electrical Engineering by Er. J. P. Navani and Er. S. Sapra[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.

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Chapter 1

D C Circuit Analysis

Scilab code Exa 1.1 Current in each element

```
// Exa 1.1
clc;
clear;
close;
format('v',5)
// Given data
R1=4;// in ohm
R2= 6;// in ohm
R3= 2;// in ohm
V1= 24;// in V
V2= 12;// in V
// Applying KVL in Mesh ABEFA, V1 = (R1+R3)*I1 - R3*I2    (i)
// Applying KVL in Mesh BCDEB, V2 = R3*I1 - (R2+R3)*I2    (ii)
A= [(R1+R3) R3;-R3 -(R2+R3)];// assumed
B= [V1 V2];// assumed
I= B*A^-1;// Solving equations by matrix multiplication
I1= I(1);// in A
I2= I(2);// in A
```

```
disp(I1,"The current through 4 ohm resistor in A is");
// current through 2 ohm resistor
I= I1-I2;// in A
disp(I,"The current through 2 ohm resistor in A is");
disp(I2,"The current through 6 ohm resistor in A is");
disp("That is "+string(abs(I2))+" A current flows in 6 ohm resistor from C to B")
```

Scilab code Exa 1.2 Current in each branch

```
// Exa 1.2
clc;
clear;
close;
format('v',5)
// Given data
V = 100;// in V
I3= 10;// in A
R1 = 10;// in ohm
R2 = 5;// in ohm
// I1 = (V - V_A)/R1
// I2 = (V_A-0)/R2
// Using KCL at note A, I1-I2+I3=0 or
V_A= (R1*R2)/(R1+R2)*(I3+V/R1);// in V
I1 = (V - V_A)/R1;// in A
I2 = (V_A-0)/R2;// in A
disp(I1,"The current through 10 ohm resistor in A is");
disp(I2,"The current through 5 ohm resistor in A is");
disp(I3,"The current through 20 ohm resistor in A is");
```

Scilab code Exa 1.3 Voltage source to current source

```
// Exa 1.3
clc;
clear;
close;
format('v',5)
// Given data
// Part (a)
V = 30;// in V
R = 6;// in ohm
I = V/R;// the equivalent current in A
disp(I,"The equivalent current in A is");
// Part (b)
I = 10;// in A
R = 5;// in ohm
V = I*R;// the equivalent voltage in V
disp(V,"The equivalent voltage in V is");
```

Scilab code Exa 1.4 Value of current

```
// Exa 1.4
clc;
clear;
close;
format('v',7)
// Given data
R1= 6;// in ohm
R2= 2;// in ohm
R3= 5;// in ohm
I2= 4;// in A
```

```
V=24;//in V
// Applying KVL to the loop ABCDA, -R1*I1-R3*I+V=0
   (i)
// but I1= I+I2 , so from eq(i)
I= (V-R1*I2)/(R1+R3);// in A
disp(I,"The current in A is");
```

Scilab code Exa 1.5 Value of I1 and I2

```
// Exa 1.5
clc;
clear;
close;
format('v',7)
// Given data
R1= 40;// in ohm
R2= 20;// in ohm
R3= 25;// in ohm
R4= 60;// in ohm
R5= 50;// in ohm
V1= 120;// in V
V2= 60;// in V
V3= 40;// in V
// Applying KVL in Mesh ABEFA, we get  -I1*(R1+R2+R3
   )+I2*R3=V2-V1          (i)
// Applying KVL in Mesh BCEDB, we get  R3*I1-I2*(R3+
   R4+R5)= V3-V2          (ii)
A= [-(R1+R2+R3) R3; R3 -(R3+R4+R5)];
B= [V2-V1 V3-V2];
I= B*A^-1;//Solving eq(i) and (ii) by Matrix method
I1= I(1);// in A
I2= I(2);// in A
disp(I1,"The value of I1 in A is : ");
disp(I2,"The value of I2 in A is : ");
```

Scilab code Exa 1.6 Current through each battery and load current

```
// Exa 1.6
clc;
clear;
close;
format('v',6)
// Given data
R1= 2;// in ohm
R2= 4;// in ohm
R3= 6;// in ohm
V1= 4;// in V
V2= 44;// in V
//Applying KVL in ABEFA :  -R1*I1 + R2*I2 = V1
    (i)
//Applying KVL in BCDEB:  R3*I1 + I2*(R2+R3)=V2 (ii)
A= [-R1 R3; R2 (R2+R3)]; // assumed
B= [V1 V2];// assumed
I= B*A^-1;// Solving eq(i) and (ii) by Matrix method
I1= I(1);// in A
I2= I(2);// in A
I_L= I1+I2;// in A
disp(I1,"The value of I1 in A is : ");
disp(I2,"The value of I2 in A is : ");
disp(I_L,"The value of I_L in A is : ");
```

Scilab code Exa 1.7 Mesh analysis

```
// Exa 1.7
clc;
clear;
close;
```

```
format('v',6)
// Given data
R1= 1;// in ohm
R2= 1;// in ohm
R3= 2;// in ohm
R4= 1;// in ohm
R5= 1;// in ohm
V1= 1.5;// in V
V2= 1.1;// in V
//Applying KVL in ABCFA :  I1*(R1+R2+R3) + R3*I2 =
    V1        (i)
//Applying KVL in BCDEB:  R3*I1 + I2*(R3+R4+R5)=V2
              (ii)
A= [(R1+R2+R3) R3; R3 (R3+R4+R5)];
B= [V1 V2];
I= B*A^-1;// Solving eq(i) and (ii) by Matrix method
I1= I(1);// in A
I2= I(2);// in A
disp(I1,"The value of I1 in A is : ");
disp(I2,"The value of I2 in A is : ");
```

Scilab code Exa 1.8 Current in 6 ohm resistor

```
// Exa 1.8
clc;
clear;
close;
format('v',7)
// Given data
R1= 2;// in ohm
R2= 4;// in ohm
R3= 1;// in ohm
R4= 6;// in ohm
R5= 4;// in ohm
V1= 10;// in V
```

```
V2= 20;// in V
//Applying KVL in ABGHA :  I1*(R1+R2) - R2*I2 = V1     (i)
//Applying KVL in BCFGB :  I1*R5-I2*(R3+R4+R5)+I3*R4 = 0     (ii)
//Applying KVL in CDEFC:  R4*I2-I3*(R2+R4)=V2     (iii)
A= [(R1+R2) R5 0; -R2 -(R3+R4+R5) R4; 0 R4 -(R2+R4)];
B= [V1 0 V2];
I= B*A^-1;// Solving eq(i), (ii) and (iii) by Matrix method
I1= I(1);// in A
I2= I(2);// in A
I3= I(3);// in A
I6_ohm_resistor= I2-I3;//The current through 6 ohm resistance  in A
disp(I6_ohm_resistor,"The current through 6 ohm resistance in A is : ")
```

Scilab code Exa 1.9 Current in each element

```
// Exa 1.9
clc;
clear;
close;
format('v',6)
// Given data
R1= 30;// in ohm
R2= 40;// in ohm
R3= 20;// in ohm
R4= 60;// in ohm
R5= 50;// in ohm
V= 240;// in V
//Applying KVL in ABDA  :  I1*-(R1+R2+R3) + R2*I2+R3
```

```
*I3 =0                          (i)
//Applying KVL in BCDB  :  I1*R2+I2*-(R2+R4+R5)+I3*R5 = 0    (ii)
//Applying KVL in CFEADC: I1*R3+ R5*I2+I3*-(R3+R5)=-V     (iii)
A= [-(R1+R2+R3) R2 R3; R2 -(R2+R4+R5) R5; R3 R5 -(R3+R5)];
B= [0 0 -V];
I= B*A^-1;// Solving eq(i), (ii) and (iii) by Matrix method
I1= I(1);// in A
I2= I(2);// in A
I3= I(3);// in A
I30_ohm_resistor= I1;// in A
I60_ohm_resistor= I2;// in A
I50_ohm_resistor= I2-I3;// in A
I20_ohm_resistor= I1-I3;// in A
I40_ohm_resistor= I1-I2;// in A
disp(I30_ohm_resistor,"The current through 30 ohm resistance in A is : ")
disp(I60_ohm_resistor,"The current through 60 ohm resistance in A is : ")
disp(I50_ohm_resistor,"The current through 50 ohm resistance in A is : ")
disp(I20_ohm_resistor,"The current through 20 ohm resistance in A is : ")
disp(I40_ohm_resistor,"The current through 40 ohm resistance in A is : ")

// Note: In the book there is a mistake in eq(iii), the R.H.S of eq(iii) should be -24 not -240. Since they divide the L.H.S of eq(iii) by 10 and R.H.S not divided, So the answer in the book is wrong
```

Scilab code Exa 1.10 Value of R3 and R4

```
// Exa 1.10
clc;
clear;
close;
format('v',7)
// Given data
R1= 5;// in ohm
R2= 5;// in ohm
R3= 10;// in ohm
R4= 10;// in ohm
R5= 5;// in ohm
V1= 50;// in V
V2= 20;// in V
//Applying KCL at node A: VA*(R1*R3+R3*R2+R2*R1)+VB
    *-R1*R3 = V1*R2*R3                    (i)
//Applying KCL at node B: VA*R4*R5+VB*-(R2*R4+R4*R5
    +R5*R2) = -V2*R2*R4                   (ii)
A=[(R1*R3+R2*R3+R2*R1) R4*R5; -R1*R3 -(R2*R4+R4*R5+
    R5*R2)]
B= [V1*R2*R3 -V2*R2*R4];
V= B*A^-1;// Solving eq(i) and (ii) by Matrix method
VA= V(1);// in V
VB= V(2);// in V
I_through_R3= VA/R3;// in A
I_through_R4= VB/R4;// in A
disp(I_through_R3,"The current in R3 in A is : ")
disp(I_through_R4,"The current in R4 in A is : ")
```

Scilab code Exa 1.11 Current through each resistor

```
// Exa 1.11
clc;
clear;
```

```
close;
format('v',7)
// Given data
R1= 1;// in ohm
R2= 1;// in ohm
R3= 0.5;// in ohm
R4= 2;// in ohm
R5= 1;// in ohm
V1= 15;// in V
V2= 20;// in V
//Applying KCL at node A:  VA*(R1*R2+R2*R3+R3*R1)+VB
    *-R1*R2 = V1*R2*R3                     (i)
//Applying KCL at node B:  VA*R4*R5+VB*-(R3*R4+R4*R5
    +R5*R3) = V2*R3*R4                     (ii)
A=[(R1*R2+R2*R3+R3*R1) R4*R5; -R1*R2 -(R3*R4+R4*R5+
    R5*R3)]
B= [V1*R2*R3 -V2*R3*R4];
V= B*A^-1;// Solving eq(i) and (ii) by Matrix method
VA= V(1);// in V
VB= V(2);// in V
I1= (VA-V1)/R1;// in A
I2= VA/R2;// in A
I3= (VA-VB)/R3;// in A
I4= VB/R4;// in A
I5= (VB-V2)/R5;// in A
disp(I1,"The value of I1 in A is : ")
disp(I2,"The value of I2 in A is : ")
disp(I3,"The value of I3 in A is : ")
disp(I4,"The value of I4 in A is : ")
disp(I5,"The value of I5 in A is : ")
```

Scilab code Exa 1.12 Current in each branch

```
// Exa 1.12
clc;
```

```
clear;
close;
format('v',7)
// Given data
V1 = 12;// in V
V2 = 10;// in V
VB = 0;// in V
R1 = 2;// in ohm
R2 = 1;// in ohm
R3 = 10;// in ohm
// Using KCL at node A :
VA= (V1*R2*R3+V2*R3*R1)/(R1*R2+R2*R3+R3*R1);// in V
I1 = (V1-VA)/R1;// in A
I2 = (V2-VA)/R2;// in A
I3 = (VA-VB)/R3;// in A
disp(I1,"The value of I1 in A is : ")
disp(I2,"The value of I2 in A is : ")
disp(I3,"The value of I3 in A is : ")
```

Scilab code Exa 1.13 Voltage at node 1 and 2

```
// Exa 1.13
clc;
clear;
close;
format('v',7)
// Given data
R1= 1;// in ohm
R2= 2;// in ohm
R3= 2;// in ohm
R4= 1;// in ohm
I1= 1;// in A
I5= 2;// in A
// Using KCL at node 1: V1*(R2+R3)-V2*R2= I1*R2*R3
      (i)
```

```
// Using KCL at node 2: V1*R4-V2*(R3+R4)= -I5*(R3*R4)   (ii)
A= [(R2+R3) R4; -R2 -(R3+R4)];
B= [I1*R2*R3 -I5*R3*R4];
V= B*A^-1;// Solving eq(i) and (ii) by Matrix method
V1= V(1);// in V
V2= V(2);// in V
disp(V1,"The voltage at node 1 in volts is : ")
disp(V2,"The voltage at node 2 in volts is : ")
```

Scilab code Exa 1.14 Current I1 and I2

```
// Exa 1.14
clc;
clear;
close;
format('v',6)
// Given data
R1= 2;// in ohm
R2= 6;// in ohm
R3= 3;// in ohm
V1= 10;// in V
V2= 6;// in V
V3= 2;// in V
//Applying KVL in ABEFA  :  I1*(R1+R2) - R2*I2=V1-V2   (i)
//Applying KVL in BCDEB  :  -I1*R2+I2*(R2+R3)=V2-V3   (ii)
A= [(R1+R2) -R2; -R2 (R2+R3)];
B= [(V1-V2) (V2-V3)];
I= B*A^-1;// Solving eq(i), and (ii) by Matrix method
I1= I(1);// in A
I2= I(2);// in A
disp(I1,"The value of I1 in A is : ")
```

```
disp(I2,"The value of I2 in A is : ")
```

Scilab code Exa 1.15 Current I1 and I2

```
// Exa 1.15
clc;
clear;
close;
format('v',6)
// Given data
R1= 2;// in ohm
R2= 6;// in ohm
R3= 4;// in ohm
R4= 3;// in ohm
R5= 5;// in ohm
V1= 10;// in V
V2= 6;// in V
V3= 2;// in V
//Applying KVL in ABEFA :  I1*(R1+R2+R3) - R2*I2 = V1-V2  (i)
//Applying KVL in BCDEB :  I1*-R2+I2*(R2+R4+R5) =V2-V3  (ii)
A= [(R1+R2+R3) -R2; -R2 (R2+R4+R5)];
B= [(V1-V2) (V2-V3)];
I= B*A^-1;// Solving eq(i) and (ii) by Matrix method
I1= I(1);// in A
I2= I(2);// in A
disp(I1,"The value of I1 in A is : ")
disp(I2,"The value of I2 in A is : ")
```

Scilab code Exa 1.16 Current in resistor R1

```
// Exa 1.16
```

```
clc;
clear;
close;
format('v',7)
// Given data
R1= 10;// in ohm
R2= 5;// in ohm
R3= 5;// in ohm
R4= 5;// in ohm
V2= 10;// in V
I= 1;// in A
V1= R4*I;// in V
//Applying KVL in ABEFA : I1*(R1+R2+R3) + R1*I2 = V1 (i)
//Applying KVL in BCDEB : I1*R1+I2*(R1+R4) =V2 (ii)
A= [(R1+R2+R3) R1; R1 (R1+R4)];
B= [V1 V2];
I= B*A^-1;// Solving eq(i) and (ii) by Matrix method
I1= I(1);// in A
I2= I(2);// in A
I10_ohm= I1+I2;// in A
disp(I10_ohm,"The current through 10 ohm resistor in A is : ")
```

Scilab code Exa 1.17 Current in 10 ohm resistor

```
// Exa 1.17
clc;
clear;
close;
format('v',7)
// Given data
R1= 4;// in ohm
R2= 5;// in ohm
```

```
R3= 10;// in ohm
R4= 6;// in ohm
R5= 4;// in ohm
V1= 15;// in V
V2= 30;// in V
//Applying KCL at node A:  VA*(R1*R2+R2*R3+R3*R1)+VB
   *-R1*R2 = V1*R1*R3                     (i)
//Applying KCL at node B:  VA*R4*R5+VB*-(R3*R4+R4*R5
   +R5*R3) = -V2*R3*R4                    (ii)
A=[(R1*R2+R2*R3+R3*R1) R4*R5; -R1*R2 -(R3*R4+R4*R5+
   R5*R3)]
B= [V1*R1*R3 -V2*R3*R4];
V= B*A^-1;// Solving eq(i) and (iii) by Matrix
   method
VA= V(1);// in V
VB= V(2);// in V
I10_ohm= abs((VA-VB)/R3);// in A
disp(I10_ohm,"The current through 10 ohm resistor
   from right to left in A is : ")
```

Scilab code Exa 1.19 Current in each branch

```
// Exa 1.19
clc;
clear;
close;
format('v',7)
// Given data
R1= 10;// in ohm
R2= 10;// in ohm
R3= 20;// in ohm
R4= 20;// in ohm
R5= 20;// in ohm
V= 10;// in V
I1= 1;// in A
```

```
I7=0.5;// in A
//Applying KCL at node A:  VA*(R1+R2)+VB*-R1 = I1*R1*R2                                (i)
//Applying KCL at node B:  VA*R3*R4+VB*-(R2*R3+R3*R4+R4*R2)+VC*R2*R3 = V*R2*R4        (ii)
//Applying KCL at node C: -VB*R5+VC*(R4+R5)=I7*R4*R5                                   (iii)
A=[(R1+R2) R3*R4 0; -R1 -(R2*R3+R3*R4+R4*R2) -R5;0 R2*R3 (R4+R5)]
B= [I1*R1*R2 V*R2*R4 I7*R4*R5];
Value= B*A^-1;// Solving eq(i), (ii) and (iii) by Matrix method
VA= Value(1);// in V
VB= Value(2);// in V
VC= Value(3)
I2= VA/R1;// in A
I3= (VA-VB)/R2;// in A
I4= (VB+V)/R3;// in A
I5= (VC-VB)/R4;// in A
I6= VC/R5;// in A
disp(I1,"The value of I1 in A is : ");
disp(I2,"The value of I2 in A is : ");
disp(I3,"The value of I3 in A is : ");
disp(I4,"The value of I4 in A is : ");
disp(I5,"The value of I5 in A is : ");
disp(I6,"The value of I6 in A is : ");
disp(I7,"The value of I7 in A is : ");
```

Scilab code Exa 1.20 Current in 8 ohm resistor

```
// Exa 1.20
```

```
clc;
clear;
close;
format('v',7)
// Given data
R1 = 3;// in ohm
R2 = 8;// in ohm
R3 = 4;// in ohm
R4 = 12;// in ohm
R5 = 14;// in ohm
V1 = 10;// in V
V2 = 3;// in V
V3 = 6;// in V
//Applying KCL at node A:  VA*(R1*R2+R2*R3+R3*R1)+VB*-R1*R2 = V1*R2*R3+V2*R1*R2              (i)
//Applying KCL at node B:  VA*R4*R5+VB*-(R3*R4+R4*R5+R5*R3) = V2*R4*R5-V3*R3*R4             (ii)
A=[(R1*R2+R2*R3+R3*R1) R4*R5; -R1*R2 -(R3*R4+R4*R5+R5*R3)]
B= [(V1*R2*R3+V2*R1*R2) (V2*R4*R5-V3*R3*R4)];
V= B*A^-1;// Solving eq(i) and (ii) by Matrix method
VA= V(1);// in V
VB= V(2);// in V
I8_ohm= VA/R2;//The current through 8 ohm resistance in A
disp(I8_ohm,"The current through 8 ohm resistance in A is : ")
```

Scilab code Exa 1.21 Current drawn from the source

```
// Exa 1.21
clc;
clear;
close;
format('v',6)
```

```
// Given data
V= 100;// in V
R12 = 3;// in ohm
R31 = 2;// in ohm
R23 = 4;// in ohm
R4= 6;// in ohm
R5=2;// in ohm
R6= 5;// in ohm
R1 = (R12*R31)/(R12+R23+R31);// in ohm
R2 = (R31*R23)/(R12+R23+R31);// in ohm
R3 = (R23*R12)/(R12+R23+R31);// in ohm
R_S= R6+R1;// in ohm
R_P1= R2+R4;// in ohm
R_P2= R3+R5;// in ohm
R_P= R_P1*R_P2/(R_P1+R_P2);// in ohm
R= R_P+R_S;// in ohm
I= V/R;// in A
disp(I,"The current drawn from the source in A is :
    ")
```

Scilab code Exa 1.22 Current in all branch

```
// Exa 1.22
clc;
clear;
close;
format('v',6)
// Given data
R1= 10;// in ohm
R2= 5;// in ohm
R3= 20;// in ohm
V= 100;// in V
I2= 10;// in A
// Applying KVL in ABEFA : -R1*I1-R2*(I1+I2)+V= 0
I1= (V-R2*I2)/(R1+R2);// in A
```

```
I10_ohm= I1;//current through 10 ohm resistance in A
I5_ohm= I1+I2;//current through 5 ohm resistance in A
I20_ohm= I2;//current through 20 ohm resistance in A
disp("Part (i) : Using by KVL")
disp(I10_ohm,"The current through 10 ohm resistance in A is : ")
disp(I5_ohm,"The current through 5 ohm resistance in A is : ")
disp(I20_ohm,"The current through 20 ohm resistance in A is : ")
// Applying KCL at node A :
VA= (V*R2+I2*R1*R2)/(R1+R2);// in V
I10_ohm= (VA-V)/R1;// in A
I5_ohm= VA/R2;// in A
I20_ohm= I2;// in A
disp("Part (ii) : Using by KVL")
disp(I10_ohm,"The current through 10 ohm resistance in A is : ")
disp(I5_ohm,"The current through 5 ohm resistance in A is : ")
disp(I20_ohm,"The current through 20 ohm resistance in A is : ")
```

Scilab code Exa 1.23 Current and voltage across 2 ohm resistor

```
// Exa 1.23
clc;
clear;
close;
format('v',7)
// Given data
R1= 5;// in ohm
R2= 10;// in ohm
R3= 3;// in ohm
```

```
R4= 2;// in ohm
V1= 10;// in V
V2= 20;// in V
I= 5;// in A
//Applying KCL at node A:  VA*(R1+R2)+VB*-R1 =I*R1*R2+V1*R1                                                    (i)
//Applying KCL at node B:  VA*R3*R4+VB*-(R2*R3+R4*R3+R4*R2) =V1*R3*R4+V2*R2*R3 (ii)
A=[(R1+R2) R3*R4; -R1 -(R3*R2+R4*R3+R4*R2)]
B= [(I*R1*R2+V1*R1) (V1*R3*R4+V2*R2*R3)];
V= B*A^-1;// Solving eq(i) and (ii) by Matrix method
VA= V(1);// in V
VB= V(2);// in V
I4= (VB+V2)/R4;// in A
V4= R4*I4;// in V
disp(I4,"The current through 2 ohm resistor in A is : ")
disp(V4,"The voltage across 2 ohm resistor in V is : ")
```

Scilab code Exa 1.24 Voltage across 6 ohm resistor

```
// Exa 1.24
clc;
clear;
close;
format('v',7)
// Given data
R1= 6;// in ohm
R2= 12;// in ohm
R3= 2;// in ohm
R4= 6;// in ohm
V2= 12;// in V
```

```
V3= 30;// in V
//Applying KVL in ABEFA : I1*(R1+R2) - R2*I2=V3-V2 (i)
//Applying KVL in BCDEB : -I1*R2+I2*(R1+R2+R3)=V2 (ii)
A= [(R1+R2) -R2; -R2 (R1+R2+R3)];
B= [(V3-V2) (V2)];
I= B*A^-1;// Solving eq(i), and (ii) by Matrix method
I1= I(1);// in A
I2= I(2);// in A
V1= I2*R1;//voltage across 6 ohm resistor in V
disp(V1,"The voltage across 6 ohm resistor in V is : ")
```

Scilab code Exa 1.25 Resistance between point B and C

```
// Exa 1.25
clc;
clear;
close;
format('v',5)
// Given data
R1 = 6;// in ohm
R2 = 2;// in ohm
R3 = 2;// in ohm
R4 = 4;// in ohm
R5 = 4;// in ohm
R6 = 6;// in ohm
R12= R1*R2/(R1+R2);// in ohm
R34= R3*R4/(R3+R4);// in ohm
R56= R5*R6/(R5+R6);// in ohm
// Resistance between the point B and C
R_BC= (R12+R34)*R56/((R12+R34)+R56);// in ohm
disp(R_BC,"The resistance between the point B and C
```

```
in ohm is : ")
```

Scilab code Exa 1.26 Voltage across R1 and R2

```
// Exa 1.26
clc;
clear;
close;
format('v',7)
// Given data
R1 = 10;// in ohm
R2 = 10;// in ohm
R4 = 80;// in ohm
V1= 100;// in V
I2= 0.5;// in A
V2= I2*R4;// in V
// Applying KVL : -R1*I1-V2+V1-R1*I2=0
I1= (V1-V2)/(R1+R2);// in A
V_R1= I1*R1;//voltage across R1 resistor  in V
V_R2= I1*R2;//voltage across R2 resistor  in V
disp(V_R1,"The voltage across R1 resistor in V is : ")
disp(V_R2,"The voltage across R2 resistor in V is : ")
```

Scilab code Exa 1.27 Current I1 and I2

```
// Exa 1.27
clc;
clear;
close;
format('v',5)
// Given data
```

```
R1 = 8;// in ohm
R2 = 4;// in ohm
R3 = 4;// in ohm
R4 = 4;// in ohm
R5 = 8;// in ohm
R6 = 8;// in ohm
I=10;// in A
V= 20;// in V
// Applying KVL in ABEFA : I1*(R1+R2+R3)+I2*(R3)= I*R2-V    (i)
// Applying KVL in BCDEB : I1*R3-I2*(R3+R4+R5)= R4*I+V    (ii)
A= [(R1+R2+R3) R3; R3 -(R3+R4+R5)];
B= [I*R2-V R4*I+V];
I= B*A^-1;//// Solving equations by matrix multiplication
I1= I(1);// in A
I2= I(2);// in A
disp(I1,"The value of I1 in A is : ");
disp(I2,"The value of I2 in A is : ");
```

Chapter 2

Network Theorems

Scilab code Exa 2.1 Current through load resistance

```
// Exa 2.1
clc;
clear;
close;
format('v',5)
// Given data
R1 = 6;// in ohm
R2 = 6;// in ohm
R3 = 6;// in ohm
V = 24;// in V
R_T =R1+R1*R2/(R1+R2);// in ohm
I_T = V/R_T;// in A
I1 = (R1/(R1+R2))*I_T;// in A
V = 12;// in V
I_T = V/R_T;// in A
I2 = (R1/(R1+R2))*I_T;// in A
I = I1+I2;// in A
disp(I,"The current in A is");
```

Scilab code Exa 2.2 Value of current across 12 ohm

```
// Exa 2.2
clc;
clear;
close;
format('v',5)
// Given data
R1 = 5;// in ohm
Vth= 10;// in ohm
R2 = 7;// in ohm
R3=10;// in ohm
R_L = 12;// in ohm
V = 20;// in ohm
Vth = (Vth*V)/(R1+R3);// in V
Rth = R2 + ((Vth*R1)/(Vth+R1));// in ohm
// The current through 12 ohm resistor
I = Vth/(Rth+R_L);// in A
disp(I,"The current through 12 ohm resistor in A is"
    );
```

Scilab code Exa 2.3 Value of current across 12 ohm

```
// Exa 2.3
clc;
clear;
close;
format('v',6)
// Given data
R1 = 6;// in ohm
R2 = 7;// in ohm
R3 = 4;// in ohm
R_L = 12;// in ohm
V = 30;// in V
Vth = (R3*V)/(R3+R1);// in V
```

```
Rth = R2 + ((R3*R1)/(R3+R1)) ;// in ohm
I_N = Vth/Rth;// in A
//The current through 12 ohm resistor
I = (I_N*Rth)/(Rth+R_L);// in ohm
disp(I,"The current through 12 ohm resistor in A is"
   );
```

Scilab code Exa 2.4 Load resistor

```
// Exa 2.4
clc;
clear;
close;
format('v',5)
// Given data
R1 = 5;// in ohm
R2 = 10;// in ohm
R3 = 7;// in ohm
V = 20;// in V
Vth = R2*V/(R1+R2);// in V
Rth = R3 + ((R2*R1)/(R2+R1));// in ohm
R_L = Rth;// in ohm
disp(R_L,"The value of load resistance in ohm is");
Pmax = (Vth^2)/(4*R_L);// in W
disp(Pmax,"The magnitude of maximum power in W is");
```

Scilab code Exa 2.5 Current across 4 ohm resistor

```
// Exa 2.5
clc;
clear;
close;
format('v',5)
```

```
// Given data
V1 = 12;// in V
V2 = 10;// in V
R1 = 6;// in ohm
R2 = 7;// in ohm
R3 = 4;// in ohm
R_T = R1 + ( (R2*R3)/(R2+R3) );// in ohm
I_T = V1/R_T;// in A
I1 = (R2/(R2+R3))*I_T;// in A
R_T = R2 + ( (R1*R3)/(R1+R3) );// in ohm
I_T = V2/R_T;// in A
I2 = (R1*I_T)/(R1+R3);// in A
// current across 4 ohm resistor
I = I1+I2;// in A
disp(I,"The current across 4 ohm resistor in A is");
```

Scilab code Exa 2.6 Current in branch AB

```
// Exa 2.6
clc;
clear;
close;
format('v',5)
// Given data
R1 = 2;// in ohm
R2 = 3;// in ohm
R3 = 1;// in ohm
R4= 2;// in ohm
V1 = 4.2;// in V
V2 = 3.5;// in V
R_T =R1+R3+R2*R4/(R2+R4);// in ohm
I_T = V1/R_T;// in A
I1 = (R1/(R1+R2))*I_T;// in A
R = R1+R3;// in ohm
R_desh = (R*R2)/(R+R2);// in ohm
```

```
R_T = R_desh+R1;// in ohm
I_T = V2/R_T;// in A
I2 = (R2/(R2+R))*I_T;// in A
// current in the branch AB
I = I2-I1;// in A
disp(I,"The current in the branch AB of the circuit
   in A is");
```

Scilab code Exa 2.7 Current through 8 ohm resistor

```
// Exa 2.7
clc;
clear;
close;
format('v',5)
// Given data
R1 = 2;// in ohm
R2 = 4;// in ohm
R3 = 8;// in ohm
Ig = 2;// in A
V = 20;// in V
R_T = R1+R3;// in ohm
I1 = V/R_T;// in A
I2 = (R1/(R1+R3))*Ig;// in A
// current through in 8 ohm resistor
I = I1-I2;// in A
disp(I,"The current through in 8 ohm resistor in A
   is");
```

Scilab code Exa 2.8 Current across 16 ohm resistor

```
// Exa 2.8
clc;
```

```
clear;
close;
format('v',7)
// Given data
R1 = 4;// in ohm
R2 = 24;// in ohm
R_L = 16;// in ohm
V1 = 20;// in V
V2 = 30;// in V
// V1-R1*I-R2*I-V2 = 0;
I= (V1-V2)/(R1+R2)
// V1-R1*I-Vth = 0;
Vth = V1-R1*I;// in V
Rth = (R1*R2)/(R1+R2);// in ohm
// current through 16 ohm resistor
I_L = Vth/(Rth+R_L);// in A
disp(I_L,"The current through 16 ohm resistor in A
    is");
```

Scilab code Exa 2.9 Current through 6 ohm resistor

```
// Exa 2.9
clc;
clear;
close;
format('v',5)
// Given data
R1 = 6;// in ohm
R2 = 4;// in ohm
R3 = 3;// in ohm
R_L = 6;// in ohm
V1 = 6;// in V
V2 = 15;// in V
// V1 - R1*I - R3*I -V2 = 0
I= (V1-V2)/(R1+R3);
```

```
// Vth − R3*I −V2 = 0;
Vth =V2+R3*I;// in V
Rth = ((R1*R3)/(R1+R3)) + R2;// in ohm
// current through 6 ohm resistance
I_L = Vth/(Rth+R_L);// in A
disp(I_L,"The current through 6 ohm resistance in A
    is");
```

Scilab code Exa 2.10 Current in 10 ohm resistor

```
// Exa 2.10
clc;
clear;
close;
format('v',7)
// Given data
R1 = 8;// in ohm
R2 = 5;// in ohm
R3 = 2;// in ohm
R_L = 10;// in ohm
V1= 20;// in V
V2= 12;// in V
// V1−R3*I − R2*I = 0;
I = V1/(R2+R3);// in A
// Vth + V2 − R3*I = 0;
Vth = R3*I - V2;// in V
Rth = ((R2*R3)/(R2+R3)) + R1;// in ohm
// current through 10 ohm resistance
I_L = abs(Vth)/(Rth+R_L);// in A
disp(I_L,"The current through 10 ohm resistance in A
     is");
```

Scilab code Exa 2.11 Current in 5 ohm resistor

```
// Exa 2.11
clc;
clear;
close;
format('v',4)
// Given data
R1 = 4;// in ohm
R2 = 3;// in ohm
R3 = 2;// in ohm
R_L = 5;// in ohm
I = 6;// in A
V = 15;// in V
// V-R1*I1-R3*(I1+I) = 0;
I1 = (V-R3*I)/(R1+R3);// in A
I = I1 + I;// in A
Vth = R3*I;// in V
Rth = ((R1*R3)/(R1+R3)) + R2;// in ohm
// current in 5 ohm resistance
I_L = Vth/(Rth+R_L);// in A
disp(I_L,"The current in 5 ohm resistance in A is");
```

Scilab code Exa 2.12 Thevenins equivalent of the netword

```
// Exa 2.12
clc;
clear;
close;
format('v',5)
// Given data
R1 = 8;// in ohm
R2 = 32;// in ohm
V = 60;// in V
I1= 5;// in A
I2= 3;// in A
// Vth-R1*I1-(I1+I2)*R2-V=0
```

```
Vth= R1*I1+(I1+I2)*R2+V
Rth = R1+R2;// in ohm
disp(Vth,"The value of Vth in volts is : ")
disp(Rth,"The value of Rth in ohm is : ");
```

Scilab code Exa 2.13 Current in 6 ohm resistor

```
clc;
clear;
close;
format('v',5)
// Given data
R1 = 6;// in ohm
R2 = 4;// in ohm
R3 = 3;// in ohm
R_L = 6;// in ohm
V1 = 6;// in V
V2= 15;// in V
// V1 - R1*I - R3*I -V2 = 0;
I= (V1-V2)/(R1+R3)
Vth = V2 + (R3*I);// in V
Rth = ((R1*R3)/(R1+R3)) + R2;// in ohm
I_N = Vth/Rth;// in A
// current through 6 ohm resistor
I = (I_N*Rth)/(Rth+R_L);// in A
disp(I,"The current through 6 ohm resistor in A is")
    ;
```

Scilab code Exa 2.14 Current in 10 ohm resistor

```
// Exa 2.14
clc;
clear;
```

```
close;
format('v',7)
// Given data
R1 = 5;// in ohm
R2 = 2;// in ohm
R3 = 8;// in ohm
V1 = 20;// in V
V2 = 12;// in V
// V1-R2*I-R1*I = 0;
I = V1/(R1+R2);// in A
// Vth + V2 - R2*I = 0;
Vth = (R2*I) - V2;// in V
Rth = ((R1*R2)/(R1+R2)) + R3;// in ohm
I_N = Vth/Rth;// in A
R_L = 10;// in ohm
// current through 10 ohm resistace
I = (abs(I_N)*Rth)/(Rth+R_L);// in A
disp(I,"The current through 10 ohm resistace in A is
   ");
```

Scilab code Exa 2.15 Current in 5 ohm resistor

```
// Exa 2.15
clc;
clear;
close;
format('v',6)
// Given data
V = 15;// in V
R1 = 4;// in  ohm
R2 = 3;// in ohm
R3 = 2;// in ohm
R_L = 5;// in ohm
Ig = 6;// in A
// V - R1*I1 - R3*(I1+Ig) = 0;
```

```
I1 = (V-R3*Ig)/(R1+R3);// in A
I = I1 + Ig;// in A
Vth = R3*I;// in V
Rth = ((R1*R3)/(R1+R3)) + R2;// in ohm
I_N = Vth/Rth;// in A
// current through 5 ohm resistor
I = (I_N*Rth)/(Rth+R_L);// in A
disp(I,"The current through 5 ohm resistor in A is")
    ;
```

Scilab code Exa 2.16 Value of R

```
// Exa 2.16
clc;
clear;
close;
format('v',5)
// Given data
V = 6;// in V
R1 = 2;// in ohm
R2 = 1;// in ohm
R3 = 3;//in ohm
R4 = 2;// in ohm
Rth=(R1*R2/(R1+R2)+R3)*R4/((R1*R2/(R1+R2)+R3)+R4)
R_L = Rth;// in ohm
disp(R_L,"The value of R in ohm is");
```

Scilab code Exa 2.17 Load Resistance and power delivered to load

```
// Exa 2.17
clc;
clear;
close;
```

```
format('v',6)
// Given data
R1 = 10;// in ohm
R2 = 10;// in ohm
R3 = 4;// in ohm
V = 20;// in V
// V - R1*I1 - R2*I1 = 0;
I1 = V/(R1+R2);// in A
Vth = R1*I1;// in V
Rth =R1*R2/(R1+R2)+R3
R_L = Rth;// in ohm
disp(R_L,"The value of load resistance in ohm is");
Pmax = (Vth^2)/(4*Rth);// in W
disp(Pmax,"The power delivered to the load in W is")
    ;
```

Scilab code Exa 2.18 Current in 6 ohm resistor

```
// Exa 2.18
clc;
clear;
close;
format('v',5)
// Given data
R1 = 3;// in ohm
R2 = 9;// in ohm
R3 = 6;// in ohm
V1 = 120;// in V
V2 = 60;// in V
R = (R3*R2)/(R3+R2);// in ohm
R_T = R+R1;// in ohm
I_T = V1/R_T;// in A
I1 = (R2/(R2+R3)) * I_T;// in A
R_T = 2 + R2;// in  ohm
I_T = V2/R_T;// in A
```

```
I2 = (R1/(R1+R3)) * I_T;// in A
// current through 6 ohm resistor
I = I1-I2;// in A
disp(I,"The current through 6 ohm resistor in A is")
    ;
```

Scilab code Exa 2.19 Current in 8 ohm resistor

```
// Exa 2.19
clc;
clear;
close;
format('v',5)
// Given data
R1 = 36;// in ohm
R2 = 12;// in ohm
R3 = 8;// in ohm
V1 = 90;// in V
V2 = 60;// in V
R_T = (R2*R3)/(R2+R3)+R1;// in ohm
I_T = V1/R_T;// in A
I1 = (R2/(R2+R3)) * I_T;// in A
R = (R1*R3)/(R1+R3);// in ohm
R_T = R2+R;// in ohm
I_T = V2/R_T;// in A
I2 = (R1/(R1+R3))*I_T;// in A
Ra = (R1*R2)/(R1+R2);// in ohm asumed
I_T = 2;// in A
I3 = (Ra/(Ra+R3))*I_T;// in A
// current in 8 ohm resistor
I = I1+I2+I3;// in A
disp(I,"The current in 8 ohm resistor in A is");
```

Scilab code Exa 2.20 Thevenins equivalent circuit

```
// Exa 2.20
clc;
clear;
close;
format('v',5)
// Given data
R1 = 5;// in ohm
R2 = 10;// in ohm
R3 = 5;// in ohm
V1 = 60;// in v
V2 = 30;// in V
//-R1*i1 - R3*i1 - V2+V1 = 0;
i1 = (V2-V1)/(R1+R3);// in A
V_acrossR3 = R3*i1;// in V
Vth = V_acrossR3+V1;// in V
V_AB =Vth;// in V
disp(V_AB,"The Thevenins voltage in V is");
R = (R1*R3)/(R1+R3);// in ohm
Rth = R2+R;// in ohm
disp(Rth,"The Thevenins resistance in ohm is");
```

Scilab code Exa 2.21 Current in 5 ohm resistor

```
// Exa 2.21
clc;
clear;
close;
format('v',6)
// Given data
R1 = 4;// in ohm
R2 = 3;// in  ohm
R3 = 2;// in ohm
R_L = 5;// in ohm
```

```
V = 15;// in V
I2 = 6;// in A
// −R1∗I1 − R3∗I1 + R3∗I2 + V = 0;
I1 = (V+R3*I2)/(R1+R3);// in A
Vth = I2/R3;// in V
V_CD = Vth;// in V
Rth = (R1*R3)/(R1+R3)+R2;// in ohm
I = Vth/(Rth+R_L);// in A
disp(I,"The current flowing through 5 ohm resistor
    in A is");
```

Scilab code Exa 2.22 Norton equivalent circuit

```
// Exa 2.22
clc;
clear;
close;
format('v',6)
// Given data
R1 = 20;// in ohm
R2 = 5;// in ohm
R3 = 3;// in ohm
R4 = 2;// in ohm
V = 30;// in V
I1=4;// in A
V1= I1*R3;// in V
// R1∗I −R2∗I+V = 0;
I = V/(R1+R2);// in A
V_acrossR2= R2*I;// in V
V_AB = V_acrossR2-V1;// in V
Vth = abs(V_AB);// in V
Rth = (R1*R2)/(R1+R2)+R3+R4;// in ohm
disp(Rth,"The value of Rth in ohm is");
I_N = Vth/Rth;// in A
disp(I_N,"The value of I_N in A is");
```

Scilab code Exa 2.23 Vth and Rth

```
// Exa 2.23
clc;
clear;
close;
format('v',5)
// Given data
R1 = 2;// in ohm
R2 = 4;// in ohm
R3 = 6;// in ohm
R4 = 4;// in ohm
V = 16;// in v
I1= 8;// in A
V1= I1*R2;// in V
I2= 16;// in A
V2= I2*R3;// in V
// Applying KVL : R2*I+V1+R3*I-V2+V+R1*I
I= (V2-V1-V)/(R1+R2+R3);// in A
Vth= V2-R3*I;// in V
Rth= (R1+R2)*R3/((R1+R2)+R3)+R4;// in ohm
disp(Vth,"The value of Vth in volts is : ")
disp(Rth,"The value of Rth in ohm is : ")
```

Scilab code Exa 2.24 Load resistance

```
// Exa 2.24
clc;
clear;
close;
format('v',5)
```

```
// Given data
R1 = 3;// in ohm
R2 = 2;// in ohm
R3 = 1;// in ohm
R4 = 8;// in ohm
R5 = 2;// in ohm
V = 10;// in V
R = ((R1+R2)*R5)/((R1+R2)+R5);// in ohm
Rth = R + R3;// in ohm
R_L = Rth;// in ohm
disp(R_L,"The value of load resistance in ohm is");
```

Scilab code Exa 2.25 Load resistance and maximum power

```
// Exa 2.25
clc;
clear;
close;
format('v',8)
// Given data
V = 250;// in V
R1 = 10;// in ohm
R2 = 10;// in ohm
R3 = 10;// in ohm
R4 = 10;// in ohm
I2 = 20;// in A.
//Applying KVL in GEFHG :  -R1*I1-R2*I1-R2*I2 + V =
    0;
I1= (V-R2*I2)/(R1+R2);// in A
V_AB= R3*I2+V-R1*I1;// in V
Vth = V_AB;// in V
Rth = (R1*R2)/(R1+R2)+R3+R4;// in ohm
R_L = Rth;// in ohm
disp(R_L,"The value of R_L in ohm is");
Pmax = (Vth^2)/(4*R_L);//maximum power  in W
```

```
disp(Pmax,"The value of maximum power in W is");
```

Scilab code Exa 2.26 Value of current

```
// Exa 2.26
clc;
clear;
close;
format('v',7)
// Given data
R1 = 2;// in ohm
R2 = 4;// in ohm
R_L = 4;// in ohm
V1 = 6;// in v
V2 = 12;// in V
// -R2*Ix -R1*Ix-V1+V2= 0;
Ix = (V2-V1)/(R1+R2);// in A
Vth = V1+R1*Ix;// in V
Rth = (R1*R2)/(R1+R2);// in ohm
I_N = Vth/Rth;// in A
I = (I_N*Rth)/(Rth+R_L);// in A
disp(I,"The current in A is");

// Note: At last , there is calculation error to find
    the value of I, so the answer in the book is
    wrong.
```

Scilab code Exa 2.27 Current in 4 ohm resistor

```
// Exa 2.27
clc;
clear;
close;
```

```
format('v',5)
// Given data
R1 = 3;// in ohm
R2 = 6;// in ohm
R_L = 4;// in ohm
V = 27;// in V
I=3;// in A
// −I1+I2= I      (i)
// Applying KVL: I1∗R1+I2∗R2=V  (ii)
A= [-1 R1; 1 R2];
B= [I V]
I= B*A^-1;// Solving eq(i) and (2) by Matrix method
I1= I(1);// in A
I2= I(2);// in A
Vth= R2*I2;// in V
Rth= R1*R2/(R1+R2);// in ohm
// current in 4 ohm resistor
I= Vth/(Rth+R_L);// in A
disp(I,"The current in 4 ohm resistor in A is : ")
```

Scilab code Exa 2.28 Current in 20 ohm resistor

```
// Exa 2.28
clc;
clear;
close;
format('v',6)
// Given data
R1 = 20;// in ohm
R2 = 12;// in ohm
R3 = 8;// in ohm
V1 = 90;// in V
V2 = 60;// in V
R_T = R1 + ((R2*R3)/(R2+R3));// in ohm
I_T = V1/R_T;// in A
```

```
I1 = I_T;// in A
R_T = R2 + ((R1*R3)/(R1+R3));// in ohm
I_T = V2/R_T;// in A
I2 = (R3/(R3+R1))*I_T;// in A
R_T = R1 + ((R2*R3)/(R2+R3));// in ohm
I_T = 2;// in A (given)
R = (R2*R3)/(R2+R3);// in ohm
I3 = (R/(R1+R))*I_T;// in A
// current in 20 ohm resistor
I20 = I1-I2-I3;// in A
disp(I20,"The current in 20 ohm resistor in A is");
```

Scilab code Exa 2.29 Current in resistor R2

```
// Exa 2.29
clc;
clear;
close;
format('v',7)
// Given data
R1 = 10;// in ohm
R2 = 20;// in ohm
R3 = 60;// in ohm
R4 = 30;// in ohm
E1 = 120;// in V
E2 = 60;// in V
R_T = ((R2*R3)/(R2+R3)) + R4+R1;// in ohm
I_T = E1/R_T;// in A
I1 = (R3/(R2+R3))*I_T;// in A
R_T = ( ((R1+R4)*R2)/((R1+R4)+R2) ) + R3;// in ohm
I_T = E2/R_T;// in A
I2 = ((R1+R4)/(R1+R4+R2))*I_T;// in A
// current through R2 resistor
I= I1+I2;// in A
disp(I,"The current through R2 resistor in A is");
```

Scilab code Exa 2.30 Current in all resistor

```
// Exa 2.30
clc;
clear;
close;
format('v',5)
// Given data
R1 = 4;// in ohm
R2 = 4;// in ohm
R3 = 8;// in ohm
Ig = 3;// in A
V = 15;// in V
I1 = R1/(R1+R2)*Ig;// in A
I2 = -I1;// in A
I3 = 0;// in A
R_T = ((R1+R2)*R3)/((R1+R2)+R3);// in ohm
I_T = V/R_T;// in A
I_2= R3/(R1+R2+R3)*I_T;// in A
I_1 = I_2;// in A
// Total current through upper 4    resistor
tot_cur_up_4ohm= I1+I2;// in A
// Total current through lower 4    resistor
tot_cur_low_4ohm= I_1+I_2;// in A
// Total current through 8   resistor
tot_cur_8ohm= I3+I_T;// in A
disp(tot_cur_up_4ohm,"Total current through upper 4
      resistor in A is : ")
disp(tot_cur_low_4ohm,"Total current through lower 4
      resistor in A is : ")
disp(tot_cur_8ohm,"Total current through 8
   resistor in A is : ")
```

Scilab code Exa 2.31 Current in all resistor

```
// Exa 2.31
clc;
clear;
close;
format('v',5)
// Given data
R1 = 5;// in ohm
R2 = 5;// in ohm
R3 = 10;// in ohm
V = 10;// in V
Ig = 2;// in A
I2 = (R1/R3)*Ig;// in A
I1 = I2;// in A
I3 = 0;// in A
R_T = ((R1+R2)*R3)/((R1+R2)+R3);// in ohm
I_T = V/R_T;// in A
I_2 = (R3/((R1+R2)+R3))*I_T;// in A
I_1 = I_2;// in A
I_3 = I_1;// in A
// Total current through upper in 5   resistor
tot_cur_up_5ohm = I1-I2;// in A
// Total current through lower in 5   resistor
tot_cur_low_5ohm = I_1+I_2;// in A
// Total current through 10   resistor
tot_cur_10ohm =  I3+I_3;// in A
disp(tot_cur_up_5ohm ,"The total current through
    upper in 5   resistor in A is");
disp(tot_cur_low_5ohm,"The total current through
    lower in 5   resistor in A is");
disp(tot_cur_10ohm,"The total current through in 10
        resistor in A is");
```

Chapter 3

AC fundamental

Scilab code Exa 3.2 Time period

```
// Exa 3.2
clc;
clear;
close;
format('v',7)
// Given data
Im = 141.4;// in A
t = 3;// in ms
t = t * 10^-3;// in sec
disp(Im,"The maximum value of current in A is");
omega = 314;// in rad/sec
// omega = 2*%pi*f;
f = round(omega/(2*%pi));// in Hz
disp(f,"The frequency in Hz is");
T = 1/f;// in sec
disp(T,"The time period in sec is");
i = 141.4 * sin(omega*t);// in A
disp(i,"The instantaneous value in A is");
```

Scilab code Exa 3.3 Value of current

```
// Exa 3.3
clc;
clear;
close;
format('v',8)
// Given data
f = 60;// in Hz
Im = 120;// in A
t = 1/360;// in sec
omega = 2*%pi*f;// in rad/sec
i = Im*sin(omega*t);// in A
disp(i,"The value of current after 1/360 sec in A is
   ");
i = 96;// in A
// i = Im*sind(omega*t);
t = (asin(i/Im))/omega;// in sec
disp(t,"The time taken to reach 96 A for the first
   time in sec is");
```

Scilab code Exa 3.4 Average and RMS value

```
// Exa 3.4
clc;
clear;
close;
format('v',6)
// Given data
i1 = 0;// in A
i2 = 10;// in A
i3 = 20;// in A
i4 = 30;// in A
i5 = 20;//in A
i6 = 10;// in A
```

```
n = 6;// unit less
Iav = (i1+i2+i3+i4+i5+i6)/n;// in A
disp(Iav,"The average value in A is");
Irms = sqrt(( (i1^2) + (i2^2) + (i3^2) + (i4^2) + (i5^2) + (i6^2) )/n);// in A
disp(Irms,"The RMS value in A is");
k_f = Irms/Iav;// unit less
disp(k_f,"The form factor is");
Im = 30;// in A
k_p = Im/Irms;// unit less
disp(k_p,"The peak factor is");
```

Scilab code Exa 3.5 Phase difference

```
// Exa 3.5
clc;
clear;
close;
format('v',6)
// Given data
theta1 = 60;// in degree
theta2 = -45;// in degree
// phase difference
phi = theta1-theta2;// in degree
disp(phi,"The phase difference in degree is");
```

Scilab code Exa 3.6 Instantaneous values of sum and difference of voltage

```
// Exa 3.6
clc;
clear;
close;
format('v',7)
```

```
// Givven data
V1= 60*expm(%i*0*%pi/180);// in V
V2= 40*expm(%i*-%pi/3);// in V
add_V= V1+V2;// in V
diff_V= V1-V2;// in V
disp("The sum of V1 and V2 is : ")
disp(string(abs(add_V))+" sin (theta"+string(atand(imag(add_V),real(add_V)))+" ) V")
disp("The difference of V1 and V2 is : ")
disp(string(abs(diff_V))+" sin (theta+"+string(atand(imag(diff_V),real(diff_V)))+" ) V")
```

Scilab code Exa 3.7 Average value effective value and form factor

```
// Exa 3.7
clc;
clear;
close;
format('v',6)
// Givven data
Vo= 1;// in V (assumed)
Vav= integrate('Vo*sin(theta)','theta',0,%pi)/(2*%pi);
Vrms= sqrt(integrate('Vo^2*(1-cos(2*theta))/2','theta',0,%pi))*sqrt(1/(2*%pi));
kf= Vrms/Vav;
disp("The average value of output voltage in volts is : "+string(Vav)+"*Vo or Vo/%pi")
disp("The R.M.S value of output voltage in volts is : "+string(Vrms)+"*Vo or Vo/2")
disp(kf,"The form factor is : ")
```

Scilab code Exa 3.8 Average and RMS value

```
// Exa 3.8
clc;
clear;
close;
format('v',5)
// Given data
T = 0.3;// in sec
V = 20;// in V
Vav = 1/T*V*integrate('1','t',0,0.1)
disp(Vav,"The average value of voltage in V is");
Vrms =sqrt(1/T*V^2*integrate('1','t',0,0.1))
disp(Vrms,"The R.M.S value of voltage in V is");
```

Scilab code Exa 3.9 Rectangular form of voltage

```
// Exa 3.9
clc;
clear;
close;
format('v',6)
// Given data
Vm = 100;// in V
phi = %pi/6;// in degree
Vrms = Vm/(sqrt(2));// in V
// Rectangular form of the voltage
RectForm= Vrms*expm(%i*phi)
disp(RectForm,"Rectangular form of the voltage in V is : ")
disp("Polar form of the voltage :")
disp("Magnitude of voltage in V is : "+string(abs(RectForm))+" V")
disp("Angle is : "+string(atand(imag(RectForm),real(RectForm)))+"  ")
```

Scilab code Exa 3.10 Phaser diagram

```
// Exa 3.10
clc;
clear;
close;
format('v',7)
// Given data
V1= 100/sqrt(2)*expm(%i*0*%pi/180);// in V
V2= 200/sqrt(2)*expm(%i*60*%pi/180);// in V
V3= 50/sqrt(2)*expm(%i*-90*%pi/180);// in V
V4= 150/sqrt(2)*expm(%i*-45*%pi/180);// in V
// The R.M.S. value of the resultant
V_R= real(V1)+real(V2)+real(V3)+real(V4);// in V
disp(V_R,"The R.M.S. value of the resultant in volts
    is : ")
```

Scilab code Exa 3.11 Value of current

```
// Exa 3.11
clc;
clear;
close;
format('v',7)
// Given data
Im = 15;// in A
f = 60;// in Hz
omega = 2*%pi * f;// in rad/sec
t = 1/200;// in sec
i = Im*sin(omega*t);// in A
disp(i,"The value of current after 1/200 sec in A is
   ");
```

```
i = 10;// in A
// i = Im*sind(omega*t);
t = (asin(i/Im))/omega;// in sec
t = t * 10^3;// in ms
disp(t,"The time to reach 10 A in ms is");
Iav = Im*0.637;// in A
disp(Iav,"The average value in A is");
```

Scilab code Exa 3.12 Maximum current frequency and RMS value and form factor

```
// Exa 3.12
clc;
clear;
close;
format('v',5)
// Given data
Im = 42.42;// in A
omega = 628;// in rad/sec
t = 1/6.977;// in sec assumed
i = Im*sind(omega*t);// in A
disp(i,"The maximum value of current in A is");
// omega = 2*%pi*f;
f = omega/(2*%pi);// in Hz
disp(f,"The frequency in Hz is");
Irms = Im/(sqrt(2));// in A
disp(Irms,"The rms value in A is");
Iav = (2*Im)/%pi;// in A
disp(Iav,"The average value in A is");
k_f = Irms/Iav;
disp(k_f,"The form factor is");
```

Scilab code Exa 3.13 Power factor and RMS value of current

```
// Exa 3.13
clc;
clear;
close;
format('v',6)
// Given data
phi = %pi/6;
// Power factor
powerfactor = cos(phi);// in lag
disp(powerfactor,"The power factor is");
Im = 22;// in A
// The R.M.S value of current
Irms = Im/sqrt(2);// in A
disp(Irms,"The R.M.S value of current in A is");
omega = 314;// in rad/sec
// omega = 2*%pi*f;
f = omega/(2*%pi);// in Hz
disp(f,"The frequency in Hz is");
```

Scilab code Exa 3.14 RMS value average value and form factor

```
// Exa 3.14
clc;
clear;
close;
format('v',6)
// Given data
Im= 100;// in A
Irms= sqrt(Im^2/2*integrate('1-cos(2*theta)','theta',0,%pi)/%pi);// in A
disp(Irms,"The R.M.S value of current in A is : ")
Iav= Im*integrate('sin(theta)','theta',0,%pi)/%pi;// in A
disp(Iav,"The average value of current in A is : ")
// The form factor
```

```
kf= Irms/Iav;
disp(kf,"The form factor is : ")
```

Scilab code Exa 3.15 Form factor

```
// Exa 3.15
clc;
clear;
close;
format('v',6)
// Given data
A= 2*10;// area under curve for a cycle
B= 2;// base of half cycle
Vav= 1/2*A/B;// in V
// For line AB
y1= 0;
y2= 10;
x1= 0;
x2= 1;
m_for_AB= (y2-y1)/(x2-x1);
// For line BC
y1= 10;
y2= 0;
x1= 1;
x2= 2;
m_for_BC= (y2-y1)/(x2-x1);
Vrms= sqrt((integrate('(m_for_AB*t)^2','t',0,1)+
    integrate('(m_for_BC*t+20)^2','t',1,2))/2);// in
    V
kf= Vrms/Vav;
disp(kf,"The form factor is : ")
```

Chapter 4

Three Phase AC Circuits

Scilab code Exa 4.1 Current and power consumed

```
// Exa 4.1
clc;
clear;
close;
format('v',6)
// Given data
R = 10;// inohm
V = 230;// in V
f = 50;// in Hz
I = V/R;// in A
disp(I,"The currrent in A is");
P =V*I;// in W
disp(P,"The power consumed in W is");
Vm = sqrt(2)*V;// in V
Im =sqrt(2)*I;// in A
omega = 2*%pi*f;// in rad/sec
//Equation for voltage: V = Vm*sind(omega*t)
//Equation for current: i = Im*sind(omega*t)
disp("Voltage equation : v = "+string(Vm)+" sin ("+
   string(round(omega))+" t)")
disp("Current equation : i = "+string(Im)+" sin ("+
```

```
string(round(omega))+" t)")
```

Scilab code Exa 4.2 Instantaneous power and average power

```
// Exa 4.2
clc;
clear;
close;
format('v',6)
// Given data
R = 100;// in ohm
i= '3*cos(omega*t)';// in A
A= R*3^2;// assumed
disp("Instantaneous power taken by resistor in watts
    is : ")
disp(string(A/2)+" (1+cos(2*omega*t))")
P= R*3^2/2*(1+cos(%pi/2));// in watts
disp(P,"The average power in watts is : ")
```

Scilab code Exa 4.3 Inductive reactance

```
// Exa 4.3
clc;
clear;
close;
format('v',6)
// Given data
I = 10;// in A
V = 230;// in V
f = 50;// in Hz
X_L = V/I;// in ohm
disp(X_L,"Inductive reactance in ohm is");
// X_L = 2*%pi*f*L;
```

```
L = X_L/(2*%pi*f);// in H
disp(L,"Inductance of the coil in H is");
Vrms = V;// in V
Irms = I;// in A
Vm = Vrms*sqrt(2);// in V
Im = Irms*sqrt(2);// in A
omega = 2*%pi*f;// in rad/sec
//Equation for voltage: V = Vm*sind(omega*t)
//Equation for current: i = Im*sind(omega*t)
disp("Voltage equation : v = "+string(Vm)+" sin ("+
   string(round(omega))+" t)")
disp("Current equation : i = "+string(Im)+" sin ("+
   string(round(omega))+" t - %pi/2)")
```

Scilab code Exa 4.4 Capacitive reactance

```
// Exa 4.4
clc;
clear;
close;
format('v',6)
// GIven data
C = 318;// in   F
C = C * 10^-6;// in F
V = 230;// in V
f = 50;// in Hz
X_C = 1/(2*%pi*f*C);// in ohm
disp(X_C,"The capacitive reactance in ohm is");
I = V/X_C;// in A
disp(I,"The R.M.S value of current in A is");
Vrms = V;// in V
Irms = I;// in A
Vm = Vrms*sqrt(2);// in V
Im = Irms*sqrt(2);// in A
omega = 2*%pi*f;// in rad/sec
```

```
// V = Vm*sind(omega*t);
// i = Im*sind((omega*t)+(%pi/2));
//Equation for voltage: V = Vm*sind(omega*t)
//Equation for current: i = Im*sind(omega*t)
disp("Voltage equation : v = "+string(Vm)+" sin ("+
    string(round(omega))+" t)")
disp("Current equation : i = "+string(Im)+" sin ("+
    string(round(omega))+" t + %pi/2)")
```

Scilab code Exa 4.5 Circuit current

```
// Exa 4.5
clc;
clear;
close;
format('v',6)
// Given data
R = 7;// in ohm
L = 31.8;// in mH
L = L * 10^-3;// in H
V = 230;// in V
f = 50;// in Hz
X_L = 2*%pi*f*L;// in ohm
Z = sqrt( (R^2)+(X_L^2) );// in ohm
I = V/Z;// in A
disp(I,"The circuit current in A is");
// tand(phi) = X_L/R;
phi = atand(X_L/R);// in degree lag
disp(phi,"The phase angle in degree is");
// Power factor
powerfactor = cosd(phi);// in lag
disp(powerfactor,"The power factor is");
P = V*I*cosd(phi);// in W
disp(P,"The power consumed in W is");
```

Scilab code Exa 4.6 Value of R and L

```
// Exa 4.6
clc;
clear;
close;
format('v',6)
// Given data
P = 400;// in W
f = 50;// in Hz
V = 120;// in V
phi= acosd(0.8);// in
// P =V*I*cos(phi);
I = P/(V*cosd(phi));// in A
Z= V/I;// in ohm
Z= Z*expm(%i*phi*%pi/180);// ohm
R= real(Z);// in ohm
XL= imag(Z);// in ohm
// Formula XL= 2*%pi*f*L
L= XL/(2*%pi*f);// in H
disp(R,"The value of R in   is : ")
disp(L,"The value of L in H is : ")
```

Scilab code Exa 4.7 Active and reactive component of current

```
// Exa 4.7
clc;
clear;
close;
format('v',6)
// Given data
R = 17.32;// in ohm
```

```
L = 31.8;// in mH
L = L * 10^-3;// in H
V = 200;// in V
f = 50;// in Hz
X_L = 2*%pi*f*L;// in ohm
Z = sqrt( (R^2) + (X_L^2) );// in ohm
I = V/Z;// in A
phi =acosd( R/Z);// in
ActiveCom= I*cosd(phi);// in A
ReactiveCom= I*sind(phi);// in A
disp(ActiveCom,"The active component of current in A is : ")
disp(ReactiveCom,"The reactive component of current in A is : ")
P= V*I*cosd(phi);// in W
disp(P,"The active power in W is : ")
Q= V*I*sind(phi);// in VAR
disp(Q,"The reactive power in VAR is : ")

// Note: There is calculation error to evaluate the value of P, so the answer in the book is wrong.
```

Scilab code Exa 4.8 Voltage across each component and circuit

```
// Exa 4.8
clc;
clear;
close;
format('v',7)
// Given data
R = 20;// in ohm
C = 200;// in  F
C=C*10^-6
f =50;// in Hz
//I = 10.8 sin(314*t)
```

```
Im = 10.8;// in A
I = Im/sqrt(2);// in A
V_R = I*R;// in V
disp(V_R,"The voltage across 20  resistor in V is : ")
//Vc = I*X_C and  X_C = 1/omega*C;
omega = 2*%pi*f;// in rad/sec
Vc = I * 1/(omega*C);// in V
disp(Vc,"The voltage across 200  F capacitor in V is");
V = sqrt( (V_R^2) + (Vc^2) );// in V
disp(V,"The voltage across the circuit in V is");
```

Scilab code Exa 4.9 Resistance and inductance

```
// Exa 4.9
clc;
clear;
close;
format('v',6)
// Given data
f= 60;// in Hz
disp("Part (a)")
Z= 12+30*%i;
R= real(Z);// in ohm
XL= imag(Z);// in ohm
// Formula XL= 2*%pi*f*L
L= XL/(2*%pi*f);// in H
L= L*10^3;// in mH
disp(R,"The value of resistance in   is : ")
disp(L,"The value of inductance in mH is : ")
L= L*10^-3;// in H
disp("Part (b)")
Z= 0-60*%i;
R= real(Z);// in ohm
```

```
XC= (abs(imag(Z)));// in ohm
// Formula XC= 1/(2*%pi*f*C)
C= 1/(2*%pi*XC*f);// in H
C= C*10^6;// in  F
disp(R,"The value of resistance in   is : ")
disp(C,"The value of inductance in  F is : ")
C= C*10^-6;// in F
disp("Part (c)")
Z= 20*expm(60*%i*%pi/180)
R= real(Z);// in ohm
XL= imag(Z);// in ohm
// Formula XL= 2*%pi*f*L
L= XL/(2*%pi*f);// in H
L= L*10^3;// in mH
disp(R,"The value of resistance in   is : ")
disp(L,"The value of inductance in mH is : ")
```

Scilab code Exa 4.10 Power factor supply voltage and active and reactive power

```
// Exa 4.10
clc;
clear;
close;
format('v',7)
// Given data
R = 120;// in ohm
XC = 250;// in ohm
I = 0.9;// in A
Z= R-%i*XC;// in ohm
phi= atand(imag(Z),real(Z))
V=I*Z;// in V
VR = I*R;// in V
VC= I*XC;// in V
P= abs(V)*I*cosd(phi);// in W
```

```
Q= abs(V)*I*sind(phi);// in VAR
disp(cosd(phi),"The power factor is : ")
disp("Supply voltage : ")
disp("Magnitude is : "+string(abs(V))+" V and angle
    is : "+string(atand(imag(V),real(V)))+"   ")
disp(VR,"The voltage across resistance in V is : ")
disp(VC,"The voltage across capacitance in V is : ")
disp(P,"The active power in W is : ")
disp(Q,"The reactive power in VAR is : ")
```

Scilab code Exa 4.11 Impedance current power factor and power consumed

```
// Exa 4.11
clc;
clear;
close;
format('v',7)
// Given data
V = 230;// in V
f = 50;// in Hz
L = 0.06;// in H
R = 2.5;// in ohm
C = 6.8;// in  F
C = C * 10^-6;// in F
X_L = 2*%pi*f*L;// in ohm
X_C = 1/(2*%pi*f*C);// in ohm
Z = sqrt( (R^2) + ((X_L-X_C)^2) );// in ohm
disp(Z,"The impedance in ohm is");
I = V/Z;// in A
disp(I,"The current in A is");
// tan(phi) = (X_L-X_C)/R;
phi = atand( (X_L-X_C)/R );// in lead
disp("The phase angle between current and voltage is
     : "+string(abs(phi))+" lead");
phi = acosd(R/Z);
```

```
disp("The power factor is : "+string(cosd(phi))+"
    lead");
P = V*I*cosd(phi);// in W
disp(P,"The power consumed in W is");
```

Scilab code Exa 4.12 The resonant frequency

```
// Exa 4.12
clc;
clear;
close;
format('v',9)
// GIven data
R = 100;// in ohm
L = 100;// in  H
L = L * 10^-6;// in H
C = 100;// in  pF
C = C * 10^-12;// in F
V = 10;// in V
// The resonant frequency
f_r = 1/(2*%pi*sqrt(L*C));// in Hz
disp(f_r,"The resonant frequency in Hz is");
// current at resonance
Ir = V/R;// in A
disp(Ir,"The current at resonance in A is");
X_L = 2*%pi*f_r*L;// in ohm
// voltage across L at resonance
V_L = Ir*X_L;// in V
disp(V_L,"The voltage across L at resonance in V is"
    );
X_C = X_L;// in ohm
// voltage across C at resonance
V_C = Ir*X_C;// in V
disp(V_C,"The voltage across C at resonance in V is"
    );
```

```
Q= 1/R*sqrt(L/C);
disp(Q,"The Q-factor is : ")
```

Scilab code Exa 4.13 Frequency at resonance

```
// Exa 4.13
clc;
clear;
close;
format('v',7)
// Given data
R = 10;// in ohm
L = 0.2;// in H
C = 40;// in   F
C = C * 10^-6;// in F
V = 100;// in V
f_r = 1/(2*%pi*sqrt(L*C));// in Hz
disp(f_r,"The frequency at resonace in Hz is");
Im = V/R;// in A
disp(Im,"The current in A is");
Pm = (Im^2)*R;// in W
disp(Pm,"The power in W is");
// voltage across R
V_R = Im*R;// in V
disp(V_R,"The voltage across R in V is");
X_L = 2*%pi*f_r*L;// in ohm
// voltage across L
V_L = Im*X_L;// in V
disp(V_L,"The voltage across L in V is");
X_C = 1/(2*%pi*f_r*C);// in ohm
// voltage across  C
V_C = Im*X_C;// in V
disp(V_C,"The voltage across  C in V is");
omega = 2*%pi*f_r;// in rad/sec
Q = (omega*L)/R;
```

```
disp(Q,"The quality factor is");
del_F = R/(4*%pi*L);
f1 = f_r-del_F;// in Hz
f2 = f_r+del_F;// in Hz
disp("The half power frequencies are : "+string(f1)+
    " Hz and "+string(f2)+" Hz");
BW = f2-f1;// in Hz
disp(BW,"The bandwidth in Hz is : ")
```

Scilab code Exa 4.14 Bandwidth

```
// Exa 4.14
clc;
clear;
close;
format('v',6)
// Given data
R = 10;// in ohm
L = 15;// in  H
L = L * 10^-6;// in H
C = 100;// in pF
C = C * 10^-12;// in F
f_r = 1/(2*%pi*sqrt(L*C));// in Hz
X_L = 2*%pi*f_r*L;// in ohm
Q = X_L/R;// in ohm
BW = f_r/Q;// in Hz
BW = BW * 10^-3;// in kHz
disp(BW,"The bandwidth in kHz is");
```

Scilab code Exa 4.15 Half power points

```
// Exa 4.15
clc;
```

```
clear;
close;
format('v',6)
// Given data
R = 1000;// in ohm
L = 100;// in mH
L = L * 10^-3;// in H
C = 10;// in    F
C = C * 10^-12;// in F
f_r = 1/(2*%pi*sqrt(L*C));// in Hz
disp(f_r*10^-3,"The resonant frequency in kHz is");
Q = (1/R)*(sqrt(L/C));
disp(Q,"The quality factor is");
f1 = f_r - R/(4*%pi*L);// in Hz
f1 = f1 * 10^-3;// in kHz
f2 = f_r + R/(4*%pi*L);// in Hz
f2 = f2 * 10^-3;// in kHz
disp("The half point frequencies are : "+string(f1)+
    " Hz and "+string(f2)+" Hz")
```

Scilab code Exa 4.16 Power factor and power consumed

```
// Exa 4.16
clc;
clear;
close;
format('v',6)
// Given data
R = 20;// in ohm
L = 31.8;// in mH
L = L * 10^-3;// in H
V = 230;// in V
f = 50;// in Hz
I_R = V/R;// in A
X_L = 2*%pi*f*L;// in ohm
```

```
I_L = V/X_L;// in A
I = sqrt( (I_R^2) + (I_L^2) );// in A
disp(I,"The line current in A is");
phi= acosd( I_R/I);
disp("The power factor is : "+string(cosd(phi))+"
   lag");
P = V*I*cosd(phi);// in W
disp(P,"The power consumed in W is");
```

Scilab code Exa 4.17 Power factor and power consumed

```
// Exa 4.17
clc;
clear;
close;
format('v',6)
// Given data
C = 50;// in  F
C = C * 10^-6;// in F
R = 20;// in ohm
L = 0.05;// in H
V = 200;// in V
f = 50;// in Hz
X_C = 1/(2*%pi*f*C);// in ohm
Z1 = X_C;// in ohm
I1 = V/X_C;// in A
X_L = 2*%pi*f*L;// in ohm
Z2 = sqrt( (R^2) + (X_L^2) );// in ohm
I2 = V/Z2;// in A
// tan(phi2) = X_L/R;
phi2 = atand(X_L/R);// in degree
phi1 = 90;// in degree
I_cos_phi = I1*cosd(phi1) + I2*cosd(phi2);// in A
I_sin_phi = I1*sind(phi1) - I2*sind(phi2);// in A
phi= atand(I_sin_phi/I_cos_phi);// in
```

```
I= sqrt(I_cos_phi^2+I_sin_phi^2);// in A
P= V*I*cosd(phi);// in W
disp(I,"The line current in A is : ")
disp("The power factor is : "+string(cosd(phi))+" lag");
disp(P,"The power consumed in W is : ")
```

Scilab code Exa 4.18 Power factor

```
// Exa 4.18
clc;
clear;
close;
format('v',6)
// Given data
V= 68+154*%i;// in V
I1= 10+14*%i;// in A
I2= 2+8*%i;// in A
I= I1+I2;// in A
phi= atand(imag(V),real(V))-atand(imag(I),real(I)); // in
disp(phi,"The phase angle in    is : ")
disp("The power factor is : "+string(cosd(phi))+" lag")
```

Scilab code Exa 4.19 Supply current and power factor

```
// Exa 4.19
clc;
clear;
close;
format('v',6)
// Given data
```

```
R1 = 50;// in ohm
L = 318;// in mH
L = L * 10^-3;// in H
R2 = 75;// in ohm
C = 159;// in   F
C =C * 10^-6;// in F
V = 230;// in V
f = 50;// in Hz
XL= 2*%pi*f*L;// in ohm
Z1= R1+XL*%i;// in ohm
I1= V/Z1;// in A
XC= 1/(2*%pi*f*C);// in ohm
Z2= R2-%i*XC;// in ohm
I2= V/Z2;// in A
I= I1+I2;// in A
phi= atand(imag(I),real(I));// in
disp("Supply current : ")
disp("Magnitude is : "+string(abs(I))+" A")
disp("Angle : "+string(phi)+"   ")
disp("Power factor is : "+string(cosd(phi))+" lag")
```

Scilab code Exa 4.20 Supply current and power factor

```
// Exa 4.20
clc;
clear;
close;
format('v',6)
// Given data
V=250;// in V
Z1= 70.7+70.7*%i;// in ohm
Z2= 120+160*%i;// in ohm
Z3= 120+90*%i;// in ohm
Y1= 1/Z1;// in S
Y2= 1/Z2;// in S
```

```
Y3= 1/Z3;// in S
Y_T= Y1+Y2+Y3;// in S
phi= atand(imag(Y_T),real(Y_T));// in
disp("Total admittance of the circuit : ")
disp("Magnitude is : "+string(abs(Y_T))+" mho")
disp("Angle is : "+string(phi)+"   ")
I= V*Y_T;// in A
disp("The supply current : ")
disp("Magnitude is : "+string(abs(I))+" A")
disp("Angle is : "+string(phi)+"   ")
disp("Power factor is : "+string(cosd(phi))+"     lag
  ")
```

Scilab code Exa 4.21 Power and power factor

```
// Exa 4.21
clc;
clear;
close;
format('v',6)
// Given data
Vm = 100;// in V
phi1= 30;// in
Im = 15;// in A
phi2= 60;// in
V= Vm/sqrt(2)*expm(phi1*%i*%pi/180);// in V
I= Im/sqrt(2)*expm(phi2*%i*%pi/180);// in A
Z= V/I;// in ohm
R= real(Z);// in ohm
XC= abs(imag(Z));// in ohm
phi= atand(imag(Z),real(Z));// in
P= abs(V)*abs(I)*cosd(phi);// in W
disp("The impedance is : "+string(Z)+"   ")
disp("The resistance is : "+string(R)+"   ")
disp("The reactance is : "+string(XC)+"   ")
```

```
disp("The power is : "+string(P)+" W")
disp("The power factor is : "+string(cosd(phi))+"
   leading")
```

Scilab code Exa 4.22 Value of pure indutance

```
// Exa 4.22
clc;
clear;
close;
format('v',6)
// Given data
P = 100;// in W
V = 120;// in V
f= 50;// in Hz
I = P/V;// in A
V = 200;// in V
V_R = 120;// in V
V_L = sqrt( (V^2) - (V_R^2) );// in V
// V_L = I*X_L;
X_L = V_L/I;// in ohm
// X_L = 2*%pi*f*L;
L = X_L/(2*%pi*f);// in H
disp(L,"The value of pure inductance in H is");

// Note: There is calculation error to find the
   value of V_L, So the answer in the book is wrong
    and coding is correct.
```

Scilab code Exa 4.23 Power factor and power consumed

```
// Exa 4.23
clc;
```

```
clear;
close;
format('v',6)
// Given data
V=230;// in V
f= 50;// in Hz
Z1= 10*expm(-30*%i*%pi/180);// in ohm
Z2= 20*expm(60*%i*%pi/180);// in ohm
Z3= 40*expm(0*%i*%pi/180);// in ohm
Y1= 1/Z1;// in S
Y2= 1/Z2;// in S
Y3= 1/Z3;// in S
Y= Y1+Y2+Y3;// in S
phi= atand(imag(Y),real(Y));// in
Z=1/Y;// in ohm
P= V^2*abs(Y);// in W
disp("The circuit admittance is : "+string(abs(Y))+"
    mho");
disp("The circuit impedance is : "+string(abs(Z))+"
     ");
disp(P,"The power consumed in W is : ")
disp("The power factor is : "+string(cosd(phi))+"
   lead")
```

Scilab code Exa 4.24 Current and power absorbed by each branch

```
// Exa 4.24
clc;
clear;
close;
format('v',8)
// Given data
Z1= 10+15*%i;// in ohm
Z2= 6-8*%i;// in ohm
R1= 10;// in ohm
```

```
R2= 6;// in ohm
I_T= 15;// in A
I1= I_T*Z2/(Z1+Z2);// in A
I2= I_T*Z1/(Z1+Z2);// in A
P1= (abs(I1))^2*R1;// in W
P2= (abs(I2))^2*R2;// in W
disp(P1,"The value of P1 in W is : ")
disp(P2,"The value of P2 in W is : ")
```

Scilab code Exa 4.25 Voltage across the condenser

```
// Exa 4.25
clc;
clear;
close;
format('v',7)
// Given data
R = 8;// in ohm
L = 0.12;// in H
C = 140;// in  F
C = C * 10^-6;// in F
V = 230;// in V
f = 50;// in Hz
XL = 2*%pi*f*L;// in ohm
XC= 1/(2*%pi*f*C);// in ohm
Z= R+%i*XL-%i*XC;// in ohm
I= V/Z;// in A
phi= atand(imag(I),real(I));// in
PowerFactor= cosd(phi);
VC= abs(I)*XC;// in V
disp("Impedence of the entire circuit : ")
disp("Magnitude is : "+string(abs(Z))+"   ");
disp("Angle is : "+string(atand(imag(Z),real(Z)))+"
    ")
disp("Current flowing through the condensor : ")
```

```
disp("Magnitude is : "+string(abs(I))+"   ");
disp("Angle is : "+string(atand(imag(I),real(I)))+"
    ")
disp("Power factor of the circuit is : "+string(cosd
   (phi))+" lag")
disp(VC,"The voltage across the condensor in V is :
   ")
```

Scilab code Exa 4.26 Half power frequencies

```
// Exa 4.26
clc;
clear;
close;
format('v',8)
// Given data
R = 10;// in ohm
L = 0.1;// in H
C = 8;// in  F
C = C * 10^-6;// in F
f_r = 1/(2*%pi*sqrt(L*C));// in Hz
Q = (1/R) * (sqrt(L/C));
del_F = R/(4*%pi*L);
// The half power frequencies
f1 = f_r - del_F;// in Hz
f2 = f_r+del_F;// in Hz
disp("The half power frequencies are : "+string(f1)+
   " Hz and "+string(f2)+" Hz")
```

Scilab code Exa 4.27 Value of capacitor

```
// Exa 4.27
clc;
```

```
clear;
close;
format('v',6)
// Given data
R = 15;// in ohm
X_L = 10;// in ohm
f_r = 50;// in Hz
// X_L = 2*%pi*f_r*L;
L = X_L/(2*%pi*f_r);// in H
// value of capacitance
C = 1/( L*( ((f_r*2*%pi)^2)+((R^2)/(L^2)) ));// in F
C = C*10^6;// in  F
disp(C,"The value of capacitance in  F is");
```

Scilab code Exa 4.28 Current and power drawn

```
// Exa 4.28
clc;
clear;
close;
format('v',6)
// Given data
Z1= 3+4*%i;// in ohm
Z2= 6+8*%i;// in ohm
V= 230;// in V
I1= V/Z1;// in A
I2= V/Z2;// in A
I_T= I1+I2;// in A
phi= atand(imag(I_T),real(I_T));// in
P= V*abs(I_T)*cosd(phi);//in V
disp("The value of current : ")
disp(abs(I_T),"The magnitude in A is : ")
disp(phi,"The phase angle in degree is : ")
disp(P,"The power drawn from the source in W is : ")
```

Scilab code Exa 4.29 Total power supplied by source

```
// Exa 4.29
clc;
clear;
close;
format('v',6)
// Given data
Z1= 1.6+%i*7.2;// in ohm
Z2= 4+%i*3;// in ohm
Z3= 6-%i*8;// in ohm
V= 100;// in V
Y2= 1/Z2;// in mho
disp(Y2,"The admittance in mho is : ")
Y3= 1/Z3;// in mho
disp(Y3,"The admittance in mho is : ")
ZT= Z1+1/(Y2+Y3);
phi= atand(imag(ZT),real(ZT));
disp("Total circuit impedance : ")
disp("Magnitude : "+string(abs(ZT))+"    ")
disp("Angle : "+string(phi)+"    ");
IT= V/ZT;// in A
PT= V*abs(IT)*cosd(phi);// in W
disp(PT,"The total power supplied in W is : ")
```

Scilab code Exa 4.30 Q factor of the circuit

```
// Exa 4.30
clc;
clear;
close;
format('v',6)
```

```
// Given data
R = 4;// in ohm
L = 0.5;// in H
V = 100;// in V
f = 50;// in Hz
X_L = 2*%pi*f*L;// in ohm
X_C = X_L;// in ohm
// X_C = 1/(2*%pi*f*C);
C = 1/(X_C*2*%pi*f);// in F
C = C * 10^6;// in F
disp(C,"The value of capacitance in  F is");
I = V/R;// in A]
V_C = I*X_C;// in V
disp(V_C,"The voltage across the capacitance in V");
omega = 2*%pi*f;// in rad/sec
Q = (omega*L)/R;
disp(Q,"The Q factor of the circuit is");
```

Chapter 5

Three Phase AC Circuits

Scilab code Exa 5.1 Line current power factor and power supplied

```
// Exa 5.1
clc;
clear;
close;
format('v',6)
// Given data
R = 20;// in ohm
X_L = 15;// in ohm
V_L = 400;// in V
f = 50;// in Hz
V_Ph = V_L/sqrt(3);// in V
Z_Ph = sqrt( (R^2) + (X_L^2) );// in ohm
I_Ph = V_Ph/Z_Ph;// in A
I_L = I_Ph;// in A
disp(I_L,"The line current in A is");
//pf = cos(phi) = R_Ph/Z_Ph;
R_Ph = R;// in ohm
phi= acosd(R_Ph/Z_Ph);
// Power factor
pf= cosd(phi);// in
disp("The power factor is : "+string(pf)+"   lag.");
```

```
P = sqrt(3)*V_L*I_L*cosd(phi);// in W
disp(P,"The power supplied in W is");
```

Scilab code Exa 5.2 Line ans phase voltage and current and power factor

```
// Exa 5.2
clc;
clear;
close;
format('v',6)
// Given data
R_Ph = 16;// in ohm
X_L = 12;// in ohm
V_L = 400;// in V
disp(V_L,"The line voltage in V is");
f = 50;// in Hz
V_Ph = V_L/sqrt(3);// in V
disp(V_Ph,"The phase voltage in V is");
Z_Ph = R_Ph + %i*X_L;// in ohm
I_Ph= V_Ph/Z_Ph;// in A
I_L= I_Ph;// in A
phi= atand(imag(I_L),real(I_L));
cos_phi= R_Ph/abs(Z_Ph);
disp(abs(I_L),"The line current in A is : ")
disp(abs(I_Ph),"The line current in A is : ")
disp("Power factor is : "+string(cos_phi)+" lagging"
    )
P= sqrt(3)*V_L*abs(I_L)*cos_phi;// in W
disp(P,"The power absorbed in W is : ")
```

Scilab code Exa 5.3 Resistance and inductance of coil

```
// Exa 5.3
```

```
clc;
clear;
close;
format('v',7)
// Given data
P = 1.5;// in kW
P = P * 10^3;// in W
pf = 0.2;// in lag
phi= acosd(pf);
V_L = 400;// in V
f = 50;// in Hz
V_Ph = V_L/sqrt(3);// in V
//P = sqrt(3)*V_L*I_L*cos(phi);
I_L = P/(sqrt(3)*V_L*cosd(phi));// in A
I_Ph = I_L;// in A
Z_Ph = V_Ph/I_Ph;// in ohm
R_Ph = Z_Ph*cosd(phi);// in ohm
disp(R_Ph,"The Resistance in    is");
X_Ph = sqrt( (Z_Ph^2) - (R_Ph^2) );// in  ohm
L_Ph = X_Ph/(2*%pi*f);// in H
disp(L_Ph,"The inductance in H is");
```

Scilab code Exa 5.4 Line current and power absorbed

```
// Exa 5.4
clc;
clear;
close;
format('v',6)
// Given data
R = 5;// in ohm
L =0.02;// in H
V_L = 440;// in V
f = 50;// in Hz
X_L = 2*%pi*f*L;// in  ohm
```

```
Z_Ph = sqrt( (R^2)+(X_L^2) );// in ohm
V_Ph = V_L;// in V
I_Ph = V_Ph/Z_Ph;// in A
I_L = sqrt(3)*I_Ph;// in A
disp(I_L,"The line current in A is");
phi = acosd(R/Z_Ph);// in lag
P = sqrt(3)*V_L*I_L*cosd(phi);// in W
P= P*10^-3;// in kW
disp(P,"The total power absorbed in kW is");

// Note: To evaluate the value of P, the wrong value of I_L is putted , so the calculated value of P in the book is not correct
```

Scilab code Exa 5.5 Phase current and resistance and inductance of coil and power drawn by coil

```
// Exa 5.5
clc;
clear;
close;
format('v',6)
// Given data
V_L = 400;// in V
f = 50;// in Hz
I_L = 17.32;// in A
pf = 0.8;//in lag
I_Ph = I_L/sqrt(3);// in A
disp(I_Ph,"The phase current in A is");
V_Ph = V_L;// in V
Z_Ph = V_Ph/I_Ph;// in ohm
phi = acosd(pf)// in lag
R_Ph = Z_Ph*cosd(phi);// in ohm
disp(R_Ph,"The resistance of coil in   is");
X_Ph = sqrt( (Z_Ph^2) - (R_Ph^2) );// in ohm
```

```
// X_Ph = 2*%pi*f*L;
L = X_Ph/(2*%pi*f);// in H
L = L * 10^3;// in mH
disp(L,"The inductance of coil in mH is");
P = V_Ph*I_Ph*cosd(phi);// in W
disp(P,"The power drawn by each coil in W is");
```

Scilab code Exa 5.6 Power factor of the load

```
// Exa 5.6
clc;
clear;
close;
format('v',5)
// Given data
W1 = 1000;// in W
W2 = 550;// in W
phi = (atand( sqrt(3)*((W1-W2)/(W1+W2)) ));//in
// power factor
pf= cosd(phi);// lag
disp("The power factor of the load is : "+string(
    cosd(phi))+" lag.");
```

Scilab code Exa 5.7 Power factor of circuit

```
// Exa 5.7
clc;
clear;
close;
format('v',6)
// Given data
W1 = 2000;// in W
W2 = 500;// in W
```

```
phi = (atand( sqrt(3)*((W1-W2)/(W1+W2)) ));// in lag
// power factor
pf= cosd(phi);// lagging
disp("Part (i) : Power factor is : "+string(pf)+"
    lagging");
W2 = -W2;// in W
phi = (atand( sqrt(3)*((W1-W2)/(W1+W2)) ));// in lag
// power factor
pf= cosd(phi);// lagging
disp("Part (ii) : Power factor is : "+string(pf)+"
    lagging");
```

Scilab code Exa 5.8 Power factor of motor at no load

```
// Exa 5.8
clc;
clear;
close;
format('v',6)
// Given data
W1 = 375;// in W
W2 = -50;// in W
// tan(phi) = sqrt(3)*((W1-W2)/(W1+W2));
phi = atand(sqrt(3)*((W1-W2)/(W1+W2)));// in degree
// power factor
pf= cosd(phi);// lag
disp("The power factor is : "+string(pf)+" lag.");
```

Scilab code Exa 5.9 Input power factor line current and output

```
// Exa 5.9
clc;
clear;
```

```
close;
format('v',6)
// Given data
W1 = 300;// in kW
W2 = 100;// in kW
V_L= 2000;// in V
Eta= 90/100;
P = W1+W2;// in kW
disp(P,"The power input in kW is");
// tan(phi) = sqrt(3)*((W1-W2)/(W1+W2));
phi = atand(sqrt(3)*((W1-W2)/(W1+W2)));
pf = cosd(phi);// power factor
disp(pf,"The power factor is");
// P = sqrt(3)*V_L*I_L*cosd(phi);
I_L = (P*10^3)/(sqrt(3)*V_L*pf);// in A
disp(I_L,"The line current in A is");
output = P*Eta;// in kW
disp(output,"The power output in kW is");
```

Scilab code Exa 5.10 Impedance of the load phase current and power factor

```
// Exa 5.10
clc;
clear;
close;
format('v',6)
// Given data
P = 12;// in kW
P = P * 10^3;// in W
V_L = 400;// in V
I_L = 20;// in A
I_Ph = I_L;// in A
disp(I_Ph,"The phase current in A is");
V_Ph = V_L/sqrt(3);// in V
```

```
Z_Ph = V_Ph/I_Ph;// in ohm
disp(Z_Ph,"The impedance of load in ohm is");
// P = sqrt(3)*V_L*I_L*cos(phi);
phi= acosd(P/(sqrt(3)*V_L*I_L));// in lag
// power factor
pf= cosd(phi);// lag
disp("The power factor is : "+string(pf)+" lag.");
```

Scilab code Exa 5.11 Line current power factor three phase current and volt amperes

```
// Exa 5.11
clc;
clear;
close;
format('v',6)
// Given data
Z_Ph= 8+6*%i;// in ohm
V_L= 400;// in V
V_Ph= V_L/sqrt(3);// in V
I_Ph= V_Ph/Z_Ph;// in A
I_L= I_Ph;// in A
phi= atand(imag(I_L),real(I_L));// in
disp(abs(I_L),"The line current in A is : ")
// power factor
pf= cosd(phi);// lagging
disp("Power factor is : "+string(pf)+" lagging")
P= sqrt(3)*V_L*abs(I_L)*cosd(phi);// in W
disp(P,"The three phase power in W is : ")
S= sqrt(3)*V_L*abs(I_L);// in VA.
disp(S,"The three phase volt-amperes in VA is : ")
```

Scilab code Exa 5.12 Power and power factor of load

```
// Exa 5.12
clc;
clear;
close;
format('v',7)
// Given data
W1 = 20;// in kW
W2 = -5;// in kW
P = W1+W2;// in kW
disp(P,"The power in kW is : ")
phi = (atand( sqrt(3)*((W1-W2)/(W1+W2)) ));// in lag
// Power factor of the load
pf= cosd(phi)
disp(pf,"The power factor of the load is : ");
```

Scilab code Exa 5.13 Reading of two wattmeters

```
// Exa 5.13
clc;
clear;
close;
format('v',6)
// Given data
V_L = 400;// in V
I_L = 10;// in A
W2= 1;// assumed
W1= 2*W2;
phi= atand(sqrt(3)*(W1-W2)/(W1+W2));
W1= V_L*I_L*cosd(30-phi);// in W
W2= V_L*I_L*cosd(30+phi);// in W
disp(W1,"The reading of first wattmeter in W is : ")
disp(W2,"The reading of second wattmeter in W is : "
   )
```

Scilab code Exa 5.14 Phase current resistance and inductance of coil and power drawn by coil

```
// Exa 5.14
clc;
clear;
close;
format('v',6)
// Given data
V_L = 400;// in V
f = 50;// in Hz
I_L = 17.32;// in A
phi = acosd(0.8);
I_Ph =I_L/sqrt(3);// in A
disp(I_Ph,"The phase current in A is");
V_Ph=V_L;// in V
Z_Ph = V_Ph/I_Ph;// in ohm
Z_Ph= Z_Ph*expm(phi*%i*%pi/180);// in ohm
R= real(Z_Ph);// in ohm
XL= imag(Z_Ph);// in ohm
L= XL/(2*%pi*f);// in H
L= L*10^3;// in mH
disp(R,"The resistance of the coil in   is : ")
disp(L,"The inductance of the coil in mH is : ")
// The power drawn by each coil
P_Ph= V_Ph*I_Ph*cosd(phi);// in W
disp(P_Ph,"The power drawn by each coil in W is : ")
```

Scilab code Exa 5.15 Reading of each wattmeter

```
// Exa 5.15
clc;
```

```
clear;
close;
format('v',8)
// Given data
P = 30;// in kW
pf = 0.7;
// cosd(phi) = pf;
phi = acosd(pf);// in degree
// P = sqrt(3)*V_L*I_L*cosd(phi);
theta = 30;// in degree
V_LI_L = P/(sqrt(3)*cosd(phi));
W1 = V_LI_L*cosd(theta-phi);// in kW
disp(W1,"The reading of first wattmeter in kW is");
W2 = V_LI_L*cosd(theta+phi);// in kW
disp(W2,"The reading of second wattmeter in kW is");
```

Scilab code Exa 5.16 Values and nature of load components and power factor

```
// Exa 5.16
clc;
clear;
close;
format('v',7)
// Given data
P = 18;// in kW
P= P*10^3;// in W
I_L = 60;// in A
V_L = 440;// in V
f= 50;// in Hz
// P = sqrt(3)*V_L*I_L*cosd(phi);
phi= acosd(P/(sqrt(3)*V_L*I_L));// in
I_L= I_L*expm(phi*%pi*%i/180);// in A
I_Ph= I_L;// in A
V_Ph= V_L/sqrt(3);// in V
```

```
Z_Ph= V_Ph/I_Ph;// in ohm
R= real(Z_Ph);// in ohm
XC=abs(imag(Z_Ph));// in ohm
C = 1/(2*%pi*f*XC);// in F
C=C*10^6;// in  F
// Power factor
pf= cosd(phi);// lead
disp("The power factor is : "+string(pf)+" leading")
disp(R,"The resistance in   is : ")
disp(C,"The capacitance in  F is : ");
disp("The load is capacitive in nature.")
```

Scilab code Exa 5.17 Line current impedance of each phase and resistance and inductance of each phase

```
// Exa 5.17
clc;
clear;
close;
format('v',7)
// Given data
V_L = 400;// in V
f = 50;// in Hz
W1 = 8000;// in W
W2 = 4000;// in W
W = W1+W2;// in W
phi =(atand( sqrt(3)*((W1-W2)/(W1+W2)) ));// in lag
P = W;// in W
//P = sqrt(3)*V_L*I_L*cosd(phi);
I_L = P/(sqrt(3)*V_L*cosd(phi));// in A
V_Ph = V_L/sqrt(3);// in V
I_Ph = I_L;// in A
Z_Ph = V_Ph/I_Ph;// in  ohm
Z_Ph= Z_Ph*expm(phi*%i*%pi/180);// ohm
R_Ph= real(Z_Ph);// in ohm
```

```
XL_Ph= imag(Z_Ph);// in ohm
L_Ph= XL_Ph/(2*%pi*f);// in H
// power factor
pf= cosd(phi);
disp(pf,"The power factor is : ")
disp(I_L,"The line current in A is");
disp(Z_Ph,"The impedance of each phase in     is : ")
disp(R_Ph,"The resistance of each phase in     is : "
   )
disp(L_Ph,"The inductance of each phase in H is : ")
```

Chapter 6

Measuring Instruments

Scilab code Exa 6.1 Required shunt resistance

```
// Exa 6.1
clc;
clear;
close;
format('v',6)
// Given data
Rm = 8;// in ohm
Im = 20;// in mA
Im = Im * 10^-3;// in A
I = 1;// in A
// Multiplying factor
N = I/Im;
// Shunt resistance
Rsh = Rm/(N-1);// in ohm
disp(Rsh,"The shunt resistance required in    is");
```

Scilab code Exa 6.2 Multiplying factor

```
// Exa 6.2
clc;
clear;
close;
format('v',6)
// Given data
Rm = 6;// in ohm
Rsh = 0.025;// in ohm
N = 1 + (Rm/Rsh);// multiplying factor
disp(N,"The multiplying factor is");
```

Scilab code Exa 6.3 Resistance to be connected in parallel and series

```
// Exa 6.3
clc;
clear;
close;
format('v',7)
// Given data
Rm = 5;// in ohm
Im = 15;// in mA
Im = Im * 10^-3;// in A
I = 1;// in A
N = I/Im;// multiplying factor
Rsh = Rm/(N-1);// in ohm
disp(Rsh,"The resiatnce to be connected in parallel
   in    is");
V = 10;// in V
Rs = (V/Im)-Rm;// in ohm
disp(Rs,"The resiatnce to be connected in series in
      is");
```

Scilab code Exa 6.4 Current range

```
// Exa 6.4
clc;
clear;
close;
format('v',5)
// Given data
V=250;// full scale voltage reading in V
Rm = 2;// in ohm
Rsh = 2;// in m ohm
Rsh = Rsh * 10^-3;// in ohm
R = 5000;// in ohm
Im = V/(Rm+R);// in A
Ish = (Im*Rm)/Rsh;// in A
// Current range of instrument
I = Im+Ish;// in A
disp(I,"The current range of instrument in A is");
```

Scilab code Exa 6.5 Percentage error

```
// Exa 6.5
clc;
clear;
close;
format('v',6)
// Given data
V = 230;// in V
I = 35;// in A
N = 200;
t = 64;// in sec
kwh = 500;
phi= acosd(0.8);// in
Er = N/kwh;// in kWh
Et =  V*I*cosd(phi)*t;// in Joules
Et = Et/3600;// in W hour
Et = Et * 10^-3;// in kWh
```

```
// percentage error
PerError = ((Er-Et)/Et)*100;// in %
disp(PerError,"The percentage error in % is");
```

Scilab code Exa 6.6 Percentage error

```
// Exa 6.6
clc;
clear;
close;
format('v',6)
// Given data
I = 50;// in A
V = 230;// in V
N = 61;
t = 37;// in sec
KWh = 500;
phi= acosd(1);// in
Er = N/KWh;// in kWh
Et = V*I*cosd(phi)*t;// in Joules
Et = Et/3600;// in Wh
Et = Et*10^-3;// in kWh
// Percentage error
PerError = ((Er-Et)/Et)*100;// in %
disp(PerError,"The percentage error in % is");
```

Scilab code Exa 6.7 Series resistance

```
// Exa 6.7
clc;
clear;
close;
format('v',9)
```

```
// Given data
Im = 20;// in mA
Im =  Im * 10^-3;// in A
Vm = 50;// in mV
Vm = Vm * 10^-3;// in V
V = 500;// in V
Rm = Vm/Im;// in ohm
Rs = (V/Im)-Rm;// in ohm
disp(Rs,"The series resistance in ohm is");
```

Scilab code Exa 6.8 Value of Rs and Rsh

```
// Exa 6.8
clc;
clear;
close;
format('v',6)
// Given data
Rm = 50;// in ohm
Im = 10;// in mA
Im = Im * 10^-3;// in A
V = 100;// in V
Rs = (V/Im)-Rm;// in ohm
disp(Rs,"The value of Rs in    is");
N = 1/Im;
Rsh = Rm/(N-1);// in ohm
disp(Rsh,"The value of Rsh in    is");
```

Scilab code Exa 6.9 Percentage error

```
// Exa 6.9
clc;
clear;
```

```
close;
format('v',5)
// Given data
I = 40;// in A
V = 230;// in V
N = 600;
t = 46;// in sec
phi= acosd(1);// in
P = V*I*cosd(phi);// in W
P = P * 10^-3;// in kW
// 1 kWh = 500 revolution
P = P * 500;// in revolution
T = (3600/t)*60;// in revolution
// Percentage error
PerError = ((T-P)/P)*100;// in %
disp(PerError,"The percentage error in % is");
```

Scilab code Exa 6.10 Number of revolution

```
// Exa 6.10
clc;
clear;
close;
format('v',6)
// Given data
N = 100;
I = 20;// in A
V = 210;// in V
pf = 0.8;// in lad
Er = 350;// in rev
a = 3.36;// assumed
Et = (a*3600)/3600;// in kWh
// 1 kWh = 100;//  revolution
Et = Et*N;// revolution
// Percentage error
```

```
PerError = ((Er-Et)/Et)*100;// in %
disp(PerError,"The percentage error in % is");
```

Scilab code Exa 6.11 Percentage error

```
// Exa 6.11
clc;
clear;
close;
format('v',6)
// Given data
I = 5;// in A
V = 230;// in V
N = 61;// number of revolution
t = 37;// in sec
// speed of the disc
discSpeed= 500;// in rev/kWh
Er = N/discSpeed;
Et = (V*I*t)/(3600*100);
// percentage error
PerError = ((Er-Et)/Et)*100;// in %
disp(PerError,"The percentage error in % is");
```

Chapter 8

Magnetic Circuits

Scilab code Exa 8.1 Required current

```
// Exa 8.1
clc;
clear;
close;
format('v',6)
// Given data
a = 3;// in cm^2
a = a * 10^-4;// in m^2
d = 20;// in cm
N = 500;
phi = 0.5*10^-3;// in Wb
miu_r = 833.33;
miu_o = 4*%pi*10^-7;
l = %pi*d;// in cm
l = l * 10^-2;// in m
S = l/(miu_o*miu_r*a);// in AT/Wb
//Calculation of the current with the help of flux
//Formula  phi = (m*m*f)/S = (N*I)/S;
I = (phi*S)/N;// in A
disp(I,"The current in A is");
```

Scilab code Exa 8.2 Coil mmf field strength total flux reluctance and permeance of the ring

```
// Exa 8.2
clc;
clear;
close;
format('v',8)
// Given data
N = 300;
miu_r = 900;
l = 40;// in cm
a = 5;// in cm^2
R = 100;// in ohm
V = 250;// in V
miu_o = 4*%pi*10^-7;
I = V/R;// in A
mmf = N*I;// in AT
disp(mmf,"The coil mmf in AT is");
H = (N*I)/(l*10^-2);// in AT/m
disp(H,"The field strength in AT/m is");
B = miu_o*miu_r*H;// in Wb/m^2
phi = B*a*10^-4;// in Wb
disp(phi,"Total flux in Wb is");
S = mmf/phi;// in AT/Wb
disp(S,"The reluctance of the ring in AT/Wb is");
// Permeance is recipocal of reluctance
Permeance = 1/S;// in Wb/AT
disp(Permeance,"Permeance of the ring in Wb/AT is");
```

Scilab code Exa 8.3 Ampere turns

```
// Exa 8.3
clc;
clear;
close;
format('v',6)
// Given data
Ig = 4;// in mm
Ig = Ig * 10^-3;// in m
B = 1.3;// in Wb/m^2
miu_r = 1;
miu_o = 4*%pi*10^-7;
H = B/(miu_o*miu_r);// in AT/m
Hg = H;// in AT/m
// Ampere turn required for air gap
AT = Hg*Ig;// AT for air gap in AT
disp(AT,"The amphere turns for the gap in AT is");
```

Scilab code Exa 8.4 Total flux in the ring

```
// Exa 8.4
clc;
clear;
close;
format('v',6)
// Given data
N = 500;
R = 4;// in ohm
d = 0.25;// in m
a = 700;// in mm^2
a = a*10^-6;// in m^2
V = 6;// in V
miu_r = 550;
miu_o = 4*%pi*10^-7;
// Evaluation of current by ohm's law
I = V/R;// in A
```

```
l = %pi*d;// in m
H = (N*I)/l;// in A/m
// Evaluation of flux density
B = miu_o*miu_r*H;// in T
// Evaluation of total flux
phi = B*a;// in Wb
phi= phi*10^3;// in mWb
disp(phi,"The total flux in the coil in m/Wb is");
```

Scilab code Exa 8.5 MMF total reluctance flux and flux density of the ring

```
// Exa 8.5
clc;
clear;
close;
format('v',8)
// Given data
d_r = 8;// diameter of ring in cm
d_r = d_r*10^-2;// in m
d_i = 1;// diameter of iron in cm
d_i = d_i * 10^-2;// in m
Permeability = 900;
gap = 2;// in mm
gap = gap * 10^-3;// in m
N = 400;
I = 3.5;// in A
l_i = (%pi*d_r)-gap;// length of iron in m
a = (%pi/4)*(d_i^2);// in m^2
mmf = N*I;// in AT
disp(mmf,"The mmf in AT is");
miu_o = 4*%pi*10^-7;
miu_r = 900;
Si = l_i/(miu_o*miu_r*a);// in AT/Wb
miu_r = 1;
```

```
Sg = gap/(miu_o*miu_r*a);// in AT/Wb
S_T = Si+Sg;// in AT/Wb
disp(S_T,"The total reluctance in AT/Wb is");
phi = mmf/S_T;// in Wb
disp(phi,"The flux in Wb is");
// phi = B*a;
B = phi/a;// in Wb/m^2
disp(B,"The flux density of the ring in Wb/m^2");
```

Scilab code Exa 8.6 Reluctance of magnetic circuit and inductance of coil

```
// Exa 8.6
clc;
clear;
close;
format('v',8)
// Given data
miu_r = 1400;
l = 70;// in cm
l = l * 10^-2;// in m
a = 5;// in cm^2
a = a * 10^-4;// in m^2
N = 1000;
miu_o = 4*%pi*10^-7;
S = l/(miu_o*miu_r*a);// in AT/Wb
disp(S,"The reluctance of the magnetic circuit in AT
    /Wb is");
format('v',7)
// Calculation of inductance of the coil
L = (N^2)/S;// in H
disp(L,"The inductance of the coil in H is");

// Note: In the book the calculated value of L is
    correct but at last they print its value wrong
```

Scilab code Exa 8.7 Required current

```
// Exa 8.7
clc;
clear;
close;
format('v',7)
// Given data
l1 = 25;// in cm
l1 = l1 * 10^-2;// in m
miu_o = 4*%pi*10^-7;
miu_r = 750;
a1 = 2.5*2.5*10^-4;// in m
S1 = l1/(miu_o*miu_r*a1);// in AT/Wb
l2 = 40;// in cm
l2 = l2 * 10^-2;// in m
S2 = l2/(miu_o*miu_r*a1);// in AT/Wb
phi2 = 2.5*10^-3;// in Wb
N = 500;
//mmf = phi1*S1 = phi2*S2;
phi1 = (phi2*S2)/S1;// in Wb
phi = phi1+phi2;// in Wb
// Sum of mmf required for AEFB
S_AEFB = S2;// in AT/Wb
mmfforAEFB = S_AEFB*phi;//mmf for AEFB in AT
totalmmf = mmfforAEFB+(phi1*S1);//total mmf in AT
// N*I = totalmmf;
// Calculation of current
I = totalmmf/N;// in A
disp(I,"The current in A is");
```

Scilab code Exa 8.8 Exciting current needed in a coil

```
// Exa 8.8
clc;
clear;
close;
format('v',6)
// Given data
a = 16*10^-4;// in m^2
lg = 2*10^-3;// in m
N = 1000;
phi = 4*10^-3;// in Wb
miu_r = 2000;
miu_o = 4*%pi*10^-7;
l=25;// length of magnetic in cm
w= 20;// in cm (width)
t= 4;// in cm (thickness)
li= {[w-t]*t/2+[l-t]*t/2-0.2};// in cm
li= li*10^-2;// in m
S_T= 1/(miu_o*a)*(li/miu_r+lg)
// Calculation of current with the help of flux
//phi = mmf/S_T = N*I/S_T;
I = (phi*S_T)/N;// in A
disp(I,"The current in A is");
```

Scilab code Exa 8.9 Total flux in the ring

```
// Exa 8.9
clc;
clear;
close;
format('v',7)
// Given data
N = 500;
R = 4;// in ohm
d_mean = 0.25;// in m
a = 700;// in mm^2
```

```
a = a * 10^-6;// in m
V = 6;// in V
miu_r = 550;
miu_o = 4*%pi*10^-7;
l_i = %pi*d_mean;// in m
S = l_i/(miu_o*miu_r*a);// in AT/Wb
I = V/R;// in A
// Calculation of mmf
mmf = N*I;// in AT
// total flux
phi = mmf/S;// in Wb
phi = phi * 10^6;// in  Wb
disp(phi,"The total flux in the ring in  Wb is");

// Note: In the book the value of flux calculated correct in  Wb but at last they print only in Wb , so the answer in the book is wrong.
```

Scilab code Exa 8.10 Coil inductance

```
// Exa 8.10
clc;
clear;
close;
format('v',7)
// Given data
N = 1000;
a = 5;// in cm^2
a = a * 10^-4;// in m^2
l_g = 2;// in mm
l_g = l_g * 10^-3;// in m
B = 0.5;// in T
miu_r= %inf;
phi = B*a;// in Wb
miu_o = 4*%pi*10^-7;
```

```
S = l_g/(miu_o*a);// in AT/Wb
// Calculation of current with the help of flux
//phi = mmf/S = N*I/S;
I = (phi*S)/N;// in A
disp(I,"The current required in A is");
// Evaluation of coil inductance
L = (N^2)/S;// in H
disp(L,"The coil inductance in H is");
```

Scilab code Exa 8.11 Ampere turns

```
// Exa 8.11
clc;
clear;
close;
format('v',8)
// Given data
l_g = 4;// in mm
l_g = l_g * 10^-3;// in m
Bg = 1.3;// in Wb/m^2
miu_o = 4*%pi*10^-7;
Hg = Bg/miu_o;
// Ampere turns for the gap
AT = Hg*l_g;// in AT
disp(AT,"The amphere turns in AT is");
```

Scilab code Exa 8.12 Required MMF

```
// Exa 8.12
clc;
clear;
close;
format('v',6)
```

```
// Given data
phi = 0.015;// in Wb
l_g = 2.5;// in mm
l_g = l_g * 10^-3;// in m
a = 200;// in cm^2
a = a * 10^-4;// in m^2
miu_o = 4*%pi*10^-7;
// Calculation of reluctance of air gap
Sg = l_g/(miu_o*a);// in AT/Wb
mmf = phi*Sg;// in AT
disp(mmf,"The mmf required in AT is");
```

Scilab code Exa 8.13 Flux density of air gap

```
// Exa 8.13
clc;
clear;
close;
format('v',9)
// Given data
a = 12;// in cm^2
a = a * 10^-4;// in m^2
l_i = 50;// in cm
l_i = l_i * 10^-2;// in m
l_g = 0.4;// in cm
l_g = l_g * 10^-2;// in m
N = 2*400;
I = 1;// in A
miu_r = 1300;
miu_o = 4*%pi*10^-7;
Si = l_i/(miu_o*miu_r*a);// in AT/Wb
disp(Si,"The reluctance of magnetic circuit in AT/Wb is");
miu_r = 1;
Sg = l_g/(miu_o*miu_r*a);// in AT/Wb
```

```
disp(Sg,"The reluctance of air gap in AT/Wb is");
S_T = Si+Sg;// in AT/Wb
disp(S_T,"Total reluctance in AT/Wb is");
format('v',7)
mmf = N*I;// in AT
phi_T = mmf/S_T;// in Wb
phi_T= phi_T*10^3;// in mWb
disp(phi_T,"The total flux in mWb is");
phi_T= phi_T*10^-3;// in Wb
//phi_T =B*a;
B = (phi_T)/a;// in Wb/m^2
disp(B,"The flux density of air gap in Wb/m^2 is");
```

Scilab code Exa 8.14 Required current

```
// Exa 8.14
clc;
clear;
close;
format('v',7)
// Given data
l = 30;// in cm
d = 2;// in cm
N = 500;
phi = 0.5;// in mWb
Airgap = 1;// in mm
miu_r = 4000;
miu_o = 4*%pi*10^-7;
Ac = (%pi/4)*(d^2);// in cm^2
Ac = Ac * 10^-4;// in m^2
l_i = (l*10^-2)-(Airgap*10^-3);// in m
l_g = 1;// in mm
l_g = l_g * 10^-3;// in m
Si = l_i/(miu_r*miu_o*Ac);// in AT/Wb
Sg = l_g/(miu_o*Ac);// in AT/Wb
```

```
S =Si+Sg;// in AT/Wb
//phi = mmf/S = N*I/S;
I = (phi*10^-3*S)/N;// in A
disp(I,"The current required in A is");
```

Scilab code Exa 8.15 Coil inductance

```
// Exa 8.15
clc;
clear;
close;
format('v',7)
// Given data
l = 40;// in cm
l = l * 10^-2;// in m
a = 4;// in cm^2
a = a * 10^-4;// in m^2
miu_r = 1000;
miu_o = 4*%pi*10^-7;
l_g = 1;// in mm
l_g = l_g * 10^-3;// in m
N = 1000;
l_i = l-l_g;// in m
Si = l_i/(miu_r*miu_o*a);// in AT/Wb
Sg = l_g/(miu_o*a);// in AT/Wb
S = Si+Sg;// in AT/Wb
// The inductnace of the coil
L = (N^2)/S;// in H
disp(L,"The inductnace of the coil in H is");
```

Chapter 9

Single Phase Transformer

Scilab code Exa 9.1 Primary turns primary and secondary full load current

```
// Exa 9.1
clc;
clear;
close;
format('v',6)
// Given data
V1 = 3000;// in V
V2 = 300;// in V
N2 = 86;// in Turns
Rating = 60*10^3;// in VA
K = V2/V1;
//Transformer ratio , N2/N1 = K;
N1 = N2/K;// in turns
disp(N1,"The numbers of primary turns is");
I2 = Rating/V2;// in A
disp(I2,"The secondary full load current in A is");
I1 = Rating/V1;// in A
disp(I1,"The primary full load current in A is");
```

Scilab code Exa 9.2 Maximum flux density

```
// Exa 9.2
clc;
clear;
close;
format('v',5)
// Given data
E1 = 3000;// in V
E2 = 200;// in V
f = 50;// in Hz
a = 150;// in cm^2
N2 = 80;// turns
//Formula E2 = 4.44*phi_m*f*N2;
phi_m = E2/(4.44*f*N2);// in Wb
Bm = phi_m/(a*10^-4);// in Wb/m^2
disp(Bm,"The maximum flux density in Wb/m^2 is");
```

Scilab code Exa 9.3 Maximum core flux

```
// Exa 9.3
clc;
clear;
close;
format('v',5)
// Given data
N1 = 500;
N2 = 40;
E1 = 3000;// in V
f = 50;// in Hz
K = N2/N1;
Rating = 25*10^3;// in VA
```

```
I1 = Rating/E1;// in A
disp(I1,"The primary full load current in A is");
I2 = I1/K;// in A
disp(I2,"The secondary full load current in A is");
// K = E2/E1;
E2 = K*E1;// in V
disp(E2,"The secondary emf in V is");
// e.m.f equation of the transformer, E1 = 4.44*phi_m*f*N1;
phi_m = E1/(4.44*f*N1);// in Wb
phi_m = phi_m*10^3;// in mWb
disp(phi_m,"The maximum core flux in mWb is");
```

Scilab code Exa 9.4 Two component of current

```
// Exa 9.4
clc;
clear;
close;
format('v',6)
// Given data
Rating = 25;// in KVA
f = 50;// in Hz
Io = 15;// in A
Wo = 350;// in W
Vo = 230;// in V
// No load power factor
phi_o = acosd(Wo/(Vo*Io));
// active component of current
Ic = Io*cosd(phi_o);// in A
disp(Ic,"The active component of current in A is");
// magnetizing component of current
Im = Io*sind(phi_o);// in A
disp(Im,"The magnetizing component of current in A is");
```

Scilab code Exa 9.5 Equivalent Resistance reactance and impedence reffered to primary and secondary

```
// Exa 9.5
clc;
clear;
close;
format('v',8)
// Given data
V1 = 2200;// in V
V2 = 110;// in V
R1 = 1.75;// in ohm
R2 = 0.0045;// in ohm
X1 = 2.6;// in ohm
X2 = 0.0075;// in ohm
K = V2/V1;
//R1e = R1+R_2 = R1 + (R2/(K^2));
R1e = R1 + (R2/(K^2));// in ohm
disp(R1e,"Equivalent resistance reffered to primary
     in ohm is");
// R2e = R2+R_1 = R2+((K^2)*R1);
R2e = R2+((K^2)*R1);// in ohm
disp(R2e,"Equivalent resistance reffered to
    secondary  in ohm is");
//X1e = X1+X_2 = X1+(X2/(K^2));
X1e = X1+(X2/(K^2));// in ohm
disp(X1e,"Equivalent reactance reffered to primary
    in ohm is");
// X2e = X2+X_1 = X2 + ((K^2)*X1);
X2e = X2 + ((K^2)*X1);// in ohm
disp(X2e,"Equivalent reactance reffered to secondary
     in ohm is");
Z1e= R1e+%i*X1e;// in ohm
Z2e= R2e+%i*X2e;// in ohm
```

```
disp(abs(Z1e),"Equivalent impedance reffered to primary in ohm is : ")
disp(abs(Z2e),"Equivalent impedance reffered to secondary in ohm is : ")
```

Scilab code Exa 9.6 Total copper loss

```
// Exa 9.6
clc;
clear;
close;
format('v',7)
// Given data
V1 = 2200;// in V
V2 = 440;// in V
R1 = 0.3;// in ohm
R2 = 0.01;// in ohm
X1 = 1.1;// in ohm
X2 = 0.035;// in ohm
K = V2/V1;
Rating = 100;// in KVA
I1 = (Rating*10^3)/V1;// in A
I2 = (Rating*10^3)/V2;// in A
R1e = R1 + (R2/(K^2));// in ohm
X1e = X1+(X2/(K^2));// in ohm
Z1e = sqrt( (R1e^2) + (X1e^2) );// in ohm
disp(Z1e,"The equivalent impedance of the transformer reffered to primary in ohm is");
// Total copper loss
totalcopperloss = (I1^2)*R1e;// in W
disp(totalcopperloss,"The total copper loss in W is");
```

Scilab code Exa 9.7 Efficiency of transformer

```
// Exa 9.7
clc;
clear;
close;
format('v',6)
// Given data
Rating = 150000;// in VA
phi= acosd(0.8);// in
Pcu = 1600;// in W
Pi = 1400;// in W
n = 1/4;
// Total loss of 25% load
totalloss = Pi + (n^2)*Pcu;// in W
// efficiency of transformer of 25% load
Eta = n*Rating*cosd(phi)/(n*Rating*cosd(phi)+Pi+n^2*
    Pcu)*100;// in %
disp(Eta,"The efficiency in % is");
```

Scilab code Exa 9.8 Efficiency on unity power factor

```
// Exa 9.8
clc;
clear;
close;
format('v',6)
// Given data
Rating = 25;// in KVA
V1 = 2000;// in V
V2 = 200;// in V
Pi = 350;// in W
Pi = Pi * 10^-3;// in kW
Pcu = 400;// in W
Pcu = Pcu * 10^-3;// in kW
```

```
phi= acosd(1);// in
output = Rating;
losses = Pi+Pcu;
Eta = (output/(output + losses))*100;// %Eta in %
disp(Eta,"The efficiency of full load power in % is");
// For half load
output = Rating/2;// in kW
h = 1;
Pcu = Pcu*((h/2)^2);// in kW
losses = Pi+Pcu;
// efficiency of half load power
Eta = (output/(output+losses))*100;// in %
disp(Eta,"The efficiency of half load power in % is");
```

Scilab code Exa 9.9 Maximum efficiency

```
// Exa 9.9
clc;
clear;
close;
format('v',7)
// Given data
Rating = 250*10^3;// in VA
Pi = 1.8;// in kW
Pi = Pi * 10^3;// in W
Pcu_f1 = 2000;// in W
phi= acosd(0.8);// in
Eta = ((Rating*cosd(phi))/((Rating*cosd(phi))+Pi+Pcu_f1))*100;// %Eta in %
disp(Eta,"The efficiency at full load in % is");
// The maximum efficiency
Eta_max = Rating * sqrt(Pi/Pcu_f1 );// in VA
Eta_max = Eta_max *10^-3;// in kVA
```

```
disp(Eta_max,"The maximum efficiency in kVA is");
Eta_max = Eta_max *10^3;// in VA
Pcu = Pi;// in W
Eta_max1 = ((Eta_max*cosd(phi))/((Eta_max*cosd(phi)) + Pi+Pcu ))*100;// in %
disp(Eta_max1,"The maximum efficiency in % is");
```

Scilab code Exa 9.10 Iron and full load copper loss

```
// Exa 9.10
clc;
clear;
close;
format('v',9)
// Given data
phi= acosd(1);// in
Pout = 500;// in kW
Pout = Pout*10^3;// in W
Eta = 90;// in %
n=1/2;
// For full load, Eta= Pout*100/(Pout+Pi+Pcu_f1) or Pi+Pcu_f1= (Pout*100-Eta*Pout)/Eta                    (i)
// For half load, Eta= n*Pout*100/(n*Pout+Pi+n^2*Pcu_f1) or Pi+n^2*Pcu_f1= (n*Pout*100-n*Eta*Pout)/Eta     (ii)
// From eq(i) and (ii)
Pcu_fl= [(n*Pout*100-n*Eta*Pout)/Eta-(Pout*100-Eta*Pout)/Eta]/(n^2-1)
Pi=(Pout*100-Eta*Pout)/Eta-Pcu_fl
disp(Pi,"The iron loss in W is : ")
disp(Pcu_fl,"The full load copper loss in watt")
```

Scilab code Exa 9.11 Maximum core flux

```
// Exa 9.11
clc;
clear;
close;
format('v',6)
// Given data
Io = 10;// in A
phi_o= acosd(0.25);// in
V1 = 400;// in V
f = 50;// in Hz
N1 =500;
Im = Io*sind(phi_o);// in A
disp(Im,"The magnetizing component of no load
    current in A is");
Pi = V1*Io*cosd(phi_o);// in W
disp(Pi,"The iron loss in W is");
E1 = V1;// in V
//E1 v= 4.44*f*phi_m*N1;
phi_m = E1/(4.44*f*N1);// in Wb
phi_m=phi_m*10^3;// in mWb
disp(phi_m,"The maximum value of flux in mWb is");
```

Scilab code Exa 9.12 Total copper loss

```
// Exa 9.12
clc;
clear;
close;
format('v',6)
// Given data
Rating = 30*10^3;// in VA
V1 = 2000;// in V
V2 = 200;// in V
```

```
f = 50;// in Hz
R1 = 3.5;// in ohm
X1 = 4.5;// in ohm
R2 = 0.015;// in  ohm
X2 = 0.02;// in ohm
K = V2/V1;
R1e = R1 + (R2/(K^2));// in ohm
disp(R1e,"The equivalent resistance to primary side in ohm is");
X1e = X1 + (X2/(K^2));// in ohm
disp(X1e,"The equivalent reactance to primary side in ohm is");
Z1e = sqrt( (R1e^2) + (X1e^2) );// in ohm
disp(Z1e,"The equivalent impedance to primary side in ohm is");
I1 = Rating/V1;// in A
// Total copper loss in transformer
Pcu_total = (I1^2)*R1e;// in W
disp(Pcu_total,"Total copper loss in W is");
```

Scilab code Exa 9.13 Secondary voltage at full load

```
// Exa 9.13
clc;
clear;
close;
format('v',7)
// Given data
Rating = 10;// in KVA
phi= acosd(0.8)
V1 = 2000;// in V
V2 = 400;// in V
R1 = 5.5;// in ohm
X1 = 12;// in ohm
R2 = 0.2;// in ohm
```

```
X2 = 0.45;// in ohm
K = V2/V1;
//R1e = R1 + R_2 = R1 + (R2/(K^2));
R1e = R1 + (R2/(K^2));// in ohm
//X1e = X1 + X_ = X1 + (X2/(K^2));
X1e = X1 + (X2/(K^2));// in ohm
I2 = (Rating*10^3)/V2;// in A
R2e = (K^2)*R1e;// in ohm
X2e = (K^2)*X1e;// in ohm
Vdrop = I2 * ( (R2e*cosd(phi)) + (X2e*sind(phi)) ); // voltage drop in V
//E2 = V2 +Vd;
E2 = V2;// in V
// The full load secondary voltage
V2 = E2-Vdrop;// in V
disp(V2,"The full load secondary voltage in V is");
```

Scilab code Exa 9.14 Percentage of full load

```
// Exa 9.14
clc;
clear;
close;
format('v',6)
// Given data
Rating = 40*10^3;// in VA
Pi = 400;// in W
Pcu_f1  = 800;// in W
phi= acosd(0.9);// in
Eta_f1 = ((Rating*cosd(phi))/( (Rating*cosd(phi)) + Pi + Pcu_f1 ))*100;// in %
disp(Eta_f1,"Full load efficiency in % is");
// percentage of the full load
Eta_max = Rating*sqrt( Pi/Pcu_f1);// in KVA
Eta_max = Eta_max/Rating*100;// in %
```

```
disp(Eta_max,"The percentage of the full load in %
    is");
```

Scilab code Exa 9.15 Full load efficiency

```
// Exa 9.15
clc;
clear;
close;
format('v',6)
// Given data
Rating = 8*10^3;// in VA
phi= acosd(0.8);// in
V1 = 400;// in V
V2 = 100;// in V
f = 50;// in Hz
Pi = 60;// in W
Wo = Pi;// in W
Pcu = 100;// in W
// The full load efficiency
Eta_f1 = ((Rating*cosd(phi))/((Rating*cosd(phi)) +
    Pi + Pcu))*100;// in %
disp(Eta_f1,"The full load efficiency in % is");
```

Scilab code Exa 9.16 Full load efficiency

```
// Exa 9.16
clc;
clear;
close;
format('v',6)
// Given data
Rating = 10*10^3;// in VA
```

```
phi= acosd(0.8);// in
V1 = 500;// in V
V2 = 250;// in V
Pi = 200;// in W
Pcu = 300;// in W
Isc = 30;// in A
I1 = Rating/V1;// in A
// Pcu/(Pcu(f1)) = (Isc^2)/(I1^2);
Pcu_f1 = Pcu * ((I1^2)/(Isc^2));// in W
// The efficiency at full load
Eta_f1 = Rating*cosd(phi)/(Rating*cosd(phi) + Pi +
   Pcu_f1)*100;// in %
disp(Eta_f1,"The full load efficiency in % is");
```

Scilab code Exa 9.17 Maximum efficiency of transformer

```
// Exa 9.17
clc;
clear;
close;
format('v',7)
// Given data
Rating = 20*10^3;// in VA
phi= acosd(0.8);// in
V1 = 2000;// in V
V2 = 200;// in V
Pi = 120;// in W
Pcu = 300;// in W
Eta_max = Rating*(sqrt( Pi/Pcu ));// in VA
Pcu = Pi;// in W
// The maximum efficiency of transformer
Eta_max = ((Eta_max*cosd(phi))/( Eta_max*cosd(phi) +
    (2*Pi) ))*100;// in %
disp(Eta_max,"The maximum efficiency of transformer
   in % is");
```

Scilab code Exa 9.18 Equivalent circuit of the transformer

```
// Exa 9.18
clc;
clear;
close;
format('v',6)
// Given data
Turnratio = 5;
R1 = 0.5;// in ohm
R2 = 0.021;// in ohm
X1 = 3.2;// in ohm
X2 = 0.12;// in ohm
Rc = 350;// in ohm
Xm = 98;// in ohm
N1 = 5;
N2 = 1;
K = N2/N1;
// Evaluation of the equivalent parameters referred
   to secondary side
R2e = R2 + ((K^2)*R1);// in ohm
disp("The equivalent parameters referred to
   secondary side are : ")
disp("The value of  R_2e  is : "+string(R2e)+"   ")
X2e = X2 + ((K^2)*X1);// in ohm
disp("The value of  X_2e  is : "+string(X2e)+"   ")
R_c = (K^2)*Rc;// in ohm
disp("The value of  R''c  is : "+string(R_c)+"   ")
X_m = (K^2)*Xm;// in ohm
disp("The value of  X''m  is : "+string(X_m)+"   ")
```

Scilab code Exa 9.19 Equivalent circuit parameters

```
// Exa 9.19
clc;
clear;
close;
format('v',7)
// Given data
Rating = 100*10^3;// in VA
V1 = 11000;// in V
V2 = 220;// in V
Wo = 2*10^3;// in W
Vo = 220;// in V
Io = 45;// in A
phi_o = acosd(Wo/(Vo*Io));
I_c = Io*cosd(phi_o);// in A
I_m = Io*sind(phi_o);// in A
Ro= V2/I_c;// in ohm
Xo= V2/I_m;// in ohm
Wsc= 3*10^3;// in W
Vsc= 500;// in V
Isc= 9.09;// in A
R1e= Wsc/Isc^2;// in ohm
Z1e= Vsc/Isc;// in ohm
X1e= sqrt(Z1e^2-R1e^2);// in ohm
K= V2/V1;
R2e= K^2*R1e;// in ohm
X2e= K^2*X1e;// in ohm
Z2e= K^2*Z1e;// in ohm
disp("The value of R''o is : "+string(Ro)+"   ")
disp("The value of X''o is : "+string(Xo)+"   ")
disp("The value of R1e is : "+string(R1e)+"   ")
disp("The value of Z1e is : "+string(Z1e)+"   ")
disp("The value of X1e is : "+string(X1e)+"   ")
disp("The value of R2e is : "+string(R2e)+"   ")
disp("The value of X2e is : "+string(X2e)+"   ")
disp("The value of Z2e is : "+string(Z2e)+"   ")
```

Scilab code Exa 9.20 Efficiency of transformer

```
// Exa 9.20
clc;
clear;
close;
format('v',6)
// Given data
V1 = 250;// in V
V2 = 500;// in V
Pcu = 100;// in W
Pi = 80;// in W
V = V2;// in V
A = 12;// in A
phi= acosd(0.85);// in
// The efficiency of the transformer
Eta = ((V*A*cosd(phi))/( V*A*cosd(phi) + Pi+Pcu ))
    *100;// in %
disp(Eta,"The efficiency of the transformer in % is"
    );
```

Scilab code Exa 9.21 Iron and copper loss at full and half full load

```
// Exa 9.21
clc;
clear;
close;
format('v',8)
// Given data
VA = 400*10^3;// in Mean
Eta_fl = 98.77/100;// in %
phi1= acosd(0.8);// in
```

```
phi2= acosd(1);// in
Eta_hl = 99.13/100;// in %
n = 1/2;
//For full load ,  Eta_fl = ((VA*cosd(phi1))/( VA*
   cosd(phi1) + Pi + Pcu_fl )) or Pi+Pcu_fl = VA*
   cosd(phi1)*(1-Eta_fl)/(Eta_fl)
   (i)
//For half load ,  Eta_hl = n*VA*cosd(phi2)/(n*VA*
   cosd(phi2)+Pi+n^2*Pcu_fl) or Pi+n^2*Pcu_fl = n*VA
   *cosd(phi2)*( 1-Eta_hl)/Eta_hl    (ii)
// From eq(i) and (ii)
Pcu_fl=(n*VA*cosd(phi2)*( 1-Eta_hl)/Eta_hl-VA*cosd(
   phi1)*(1-Eta_fl)/(Eta_fl))/(n^2-1);// in W
Pi=VA*cosd(phi1)*(1-Eta_fl)/(Eta_fl)-Pcu_fl;// in W
disp(Pi,"The iron loss on full load and half load
   remain same in W which are : ")
disp(Pcu_fl,"The copper loss on full load in W is :
   ")
// The copper loss on half load
C_loss_half_load=n^2*Pcu_fl;// in W
disp(C_loss_half_load,"The copper loss on half load
   in W is : ")
```

Scilab code Exa 9.22 Efficiency of transformer

```
// Exa 9.22
clc;
clear;
close;
format('v',7)
// Given data
VA = 100*10^3;// in VA
Eta_max = 98.40/100;// in %
Eta_max1 = 90/100;// in %
phi= acosd(1);// in
```

```
//Eta_max = (Eta_max1*VA*cosd(phi)/(Eta_max1*VA*cosd(phi) + 2*Pi);
Pi = (Eta_max1*VA*cosd(phi)/Eta_max - Eta_max1*VA*cosd(phi))/2;// in W
Pcu = Pi;// in W
n = 0.9;
// Pcu_fl/Pcu = (VA/(0.9*VA) )^2;
Pcu_fl = Pcu*(VA/(0.9*VA) )^2;// in W
Eta_fl = ( (VA*cosd(phi))/( (VA*cosd(phi)) + Pi + Pcu_fl ) )*100;// in %
disp(Eta_fl,"The efficiency of a transformer in % is ");
```

Chapter 10

D C Machines

Scilab code Exa 10.1 emf generated by 4 pole wave wound generator

```
// Exa 10.1
clc;
clear;
close;
format('v',6)
// Given data
A = 2;// in wavewound
N = 1200;// in rpm
phi = 0.02;// in Wb
n = 65;// no of slots
P = 4;
Z = n*12;// total number of conductor
// Emf equation
Eg = (N*P*phi*Z)/(60*A);// in V
disp(Eg,"The emf generated in V is");
```

Scilab code Exa 10.2 Numbers of conductor

```
// Exa 10.2
clc;
clear;
close;
format('v',6)
// Given data
P = 8;
N = 1200;// in rpm
phi = 25;// in mWb
phi = phi * 10^-3;// in Wb
Eg = 440;// in V
A = P;
// Eg = (N*P*phi*Z)/(60*A);
Z = (Eg*60*A)/(phi*N*P);// in conductors
disp(Z,"The numbers of conductors when armature is
    lap wound");
A = 2;
// Eg = (N*P*phi*Z)/(60*A);
Z = (Eg*60*A)/(phi*N*P);// in conductors
disp(Z,"The numbers of conductors when armature is
    wave wound ");
```

Scilab code Exa 10.3 Induced voltage

```
// Exa 10.3
clc;
clear;
close;
format('v',7)
// Given data
P = 4;
phi = 20;// in mWb
phi = phi * 10^-3;// in Wb
A = 4;
P = A;
```

```
N =720;// in rpm
n = 144;// no of slots in slots
n1 = 2;// no of coils
n2 = 2;// no of turns in turns
Z = n*n1*n2;// total number of conductor
// Generated emf
E = (N*P*phi*Z)/(60*A);// in V
disp(E,"The induced voltage in V is");
```

Scilab code Exa 10.4 Generated emf

```
// Exa 10.4
clc;
clear;
close;
format('v',6)
// Given data
Eg1 = 100;// in V
phi1 = 20;// in mWb
phi1 = phi1 * 10^-3;// in Wb
N1 = 800;// in rpm
N2 = 1000;// in rpm
// Eg1/Eg2 = (phi1/phi2) * (N1/N2) but phi1 = phi2
Eg2 = (Eg1*N2)/N1;// in V
disp(Eg2,"Part (i) : The generated emf in V is");
phi2 = 24;// in mWb
phi2 = phi2 * 10^-3;// in Wb
N2 = 900;// in rpm
// Eg1/Eg2 = (phi1/phi2) * (N1/N2) ;
Eg2 = (Eg1*N2*phi2)/(N1*phi1);// in V
disp(Eg2,"Part (ii) : The generated emf in V is");
```

Scilab code Exa 10.5 Total power developed by armature

```
// Exa 10.5
clc;
clear;
close;
format('v',6)
// Given data
P = 30;// in kW
P = P * 10^3;// in W
V = 300;// in V
Ra = 0.05;// in ohm
Rsh = 100;// in ohm
// p = V*I_L;
I_L = P/V;// in A
Ish = V/Rsh;// in A
Ia = I_L+Ish;// in A
Eg = V + (Ia*Ra);// in V
// power developed by armature
power = (Eg*Ia);// in W
power = power * 10^-3;// in kW
disp(power,"The total power developed by the
    armature in kW is");
```

Scilab code Exa 10.6 Power developed in the armature

```
// Exa 10.6
clc;
clear;
close;
format('v',6)
// Given data
V = 200;// in V
Ra = 0.5;// in ohm
Rsh = 200;// in ohm
P = 20;// in kW
P = P * 10^3;// in W
```

```
// P = V*I_L;
I_L =P/V;// in A
Ish = V/Rsh;// in A
Ia = I_L+Ish;// in A
Eg = V + (Ia*Ra);// in V
// power developed in the armature
power = Eg*Ia;// in W
power = power * 10^-3;// in kW
disp(power,"The power developed in the armature in
   kW is");
```

Scilab code Exa 10.7 Total armature current

```
// Exa 10.7
clc;
clear;
close;
format('v',8)
// Given data
P = 60;
A =P;
Vbrush = 2;// in V/brush
Vt = 100;// in V
Ra = 0.1;// in ohm
Rsh = 80;// in ohm
Ish = Vt/Rsh;// in A
Ilamp = P/Vt;// in A
I_L = 50*Ilamp;// in A
// Armature current
Ia = I_L+Ish;// in A
disp(Ia,"The total armature current in A is");
// Evaluation of generated emf
Eg = Vt + (Ia*Ra) + Vbrush;// in V
disp(Eg,"The generated emf in V is");
```

Scilab code Exa 10.8 Generated voltage

```
// Exa 10.8
clc;
clear;
close;
format('v',6)
// Given data
V = 440;// in V
I_L =40;// in A
Rse = 1;// in ohm
Rsh = 200;// in ohm
Ra = 0.5;// in ohm
Ish = V/Rsh;// in A
Ia = I_L+Ish;// in A
Eg = V + (Ia*(Ra+Rse));// in V
disp(Eg,"The generated voltage for long shunt in V
    is");
//Voltage across shunt field , Vsh = V + Ise*Rse = V
    + (I_L*Rse);
Vsh = V+(I_L*Rse);// in V
Ish = Vsh/Rsh;// in A
Ia =I_L+Ia;// in A
Eg = V + (I_L*Rse) + (Ia*Ra);// in V
disp(Eg,"The generated voltage for short shunt in V
    is");
```

Scilab code Exa 10.9 Back emf

```
// Exa 10.9
clc;
clear;
```

```
close;
format('v',6)
// Given data
V = 440;// in V
I = 80;// in A
Rse = 0.025;// in ohm
Ra = 0.1;// in ohm
Bd = 2;// brush drop in V
Ia = I;// in A
Ise = I;// in A
Eb = V - (Ia*(Ra+Rse)) - Bd;// in V
disp(Eb,"The back emf in V is");
```

Scilab code Exa 10.10 Armature current and back emf

```
// Exa 10.10
clc;
clear;
close;
format('v',7)
// Given data
V = 250;// in V
I_L = 20;// in A
Ra = 0.3;// in ohm
Rsh = 200;// in ohm
Ish = V/Rsh;// in A
// I_L = Ia+Ish;
Ia = I_L-Ish;// inA
disp(Ia,"The armature current in A is");
Eb = V-(Ia*Ra);// in V
disp(Eb,"The back emf in V is");
```

Scilab code Exa 10.11 Speed of motor

```
// Exa 10.11
clc;
clear;
close;
format('v',6)
// Given data
P = 4;
A = 2;//(wave connected)
Z = 200;
V=250;// in V
phi = 25;// in mWb
phi = phi * 10^-3;// in Wb
Ia = 60;// in A
I_L = 60;// in A
Ra = 0.15;// in ohm
Rse = 0.2;// in ohm
//V = Eb + (Ia*Ra) + (Ia*Rse);
Eb = V - (Ia*Ra) - (Ia*Rse);// in V
// Eb = (phi*P*N*Z)/(60*A);
N = (Eb*60*A)/(phi*P*Z);// in rpm
disp(N,"The speed in rpm is");
```

Scilab code Exa 10.12 Armature resistance and current

```
// Exa 10.12
clc;
clear;
close;
format('v',6)
// Given data
Eb = 227;// in V
Rsh = 160;// in ohm
Ish = 1.5;// in A
I_L = 39.5;// in A
V = Ish*Rsh;// in V
```

```
Ia = I_L-Ish;// in A
//V = Eb + (Ia*Ra);
Ra = (V-Eb)/Ia;// in ohm
disp(Ra,"The armature resistance in ohm is");
Ia = V/Ra;// in A
disp(Ia,"The armature current in A is");
```

Scilab code Exa 10.13 Ratio of speed as a generator to speed as a motor

```
// Exa 10.13
clc;
clear;
close;
format('v',6)
// Given data
V = 230;// in V
Ra = 0.115;// in ohm
Rsh = 115;// in ohm
I_L = 100;// inA
Ish =V/Rsh;// in A
Ia = I_L + Ish;// in A
Eg = V + (Ia*Ra);// in V
Ia = I_L-Ish;// in A
Eb = V - (Ia*Ra);// in V
// The ratio of speed as a generator to speed as a motor
NgBYNm = Eg/Eb;
disp(NgBYNm,"The ratio of speed as a generator to speed as a motor is");
```

Scilab code Exa 10.14 Induced voltage

```
// Exa 10.14
```

```
clc;
clear;
close;
format('v',7)
// Given data
P = 4;
slots = 144;
phi = 20;// in mWb
phi = phi * 10^-3;// in Wb
N = 720;// in rpm
A = 4;
P =4;
n1 = 2;// in coil/slot
n2 = 2;// in turns/coil
Z = slots*n1*n2;// total number of conductor
Eg = (N*P*phi*Z)/(60*A);// in V
disp(Eg,"The induced voltage in V is");
```

Scilab code Exa 10.15 Generated emf

```
// Exa 10.15
clc;
clear;
close;
format('v',6)
// Given data
P = 8;
phi = 0.1;// in Wb
Z = 400;
N =300;// in rpm
Eg = (N*phi*Z)/(60);// in V (A = p)
disp(Eg,"The emf when lap is connected in V is");
// For A=2, connected armature
A = 2;
Eg = (N*phi*P*Z)/(60*A);// in V
```

```
disp(Eg,"The emf when wave is connected in V is");
```

Scilab code Exa 10.16 Power developed in the armature

```
// Exa 10.16
clc;
clear;
close;
format('v',6)
// Given data
P_L = 20;// in kW
P_L = P_L * 10^3;// in W
V = 200;// in V
Ra = 0.05;// in ohm
Rsh = 200;// in ohm
// P_L = V*I_L;
I_L = P_L/V;// in A
Ish = V/Rsh;// in A
Ia = I_L+Ish;// in A
Eg = V + (Ia*Ra);// in V
Pa = Eg*Ia;// in W
Pa = Pa * 10^-3;// in kW
disp(Pa,"The power developed in armature in kW is");
```

Scilab code Exa 10.17 Speed when the current in armature is 30 A

```
// Exa 10.17
clc;
clear;
close;
format('v',6)
// Given data
N1 = 600;// inrpm
```

```
I_L1 = 60;// in A
V = 230;// in V
Rsh = 115;// in ohm
Ra= 0.2;// in ohm
Ia2 = 30;// in A
Ish = V/Rsh;// in A
Ia1 = I_L1 - Ish;// in A
Eb1 = V-(Ia1*Ra);// in V
Eb2 = V - (Ia2*Ra);// in V
// N1/N2 = Eb1/Eb2;
N2 = (N1*Eb2)/Eb1;// in rpm
disp(N2,"The speed when 30 A current through the
   armature in rpm is");
```

Scilab code Exa 10.18 Speed of motor

```
// Exa 10.18
clc;
clear;
close;
format('v',6)
// Given data
P = 6;
A = 6;
Z = 500;
Ra = 0.05;// in ohm
Rsh =25;// in ohm
V = 100;// in V
I_L = 120;// in A
phi = 2*10^-2;// in Wb
Ish = V/Rsh;// in A
Ia = I_L-Ish;// in A
Eb = V - (Ia*Ra);// in V
// Eb = (N*P*phi*Z)/(60*A);
N = (Eb*60*A)/(P*phi*Z);// in rpm
```

```
disp(N,"The speed of the motor in rpm is");
```

Scilab code Exa 10.19 Change in emf induced

```
// Exa 10.19
clc;
clear;
close;
format('v',6)
// Given ata
N1 = 1;
N2 = 1.2*N1;
phi1 = 1;
phi2 = 0.8*phi1;
Eg1BYEg2 = (N1/N2) * (phi1/phi2);
Eg1 = 1;// assumed
// The change in emf
Eg2 = (Eg1*phi2*N2)/(phi1*N1);
Eg2 = Eg2 * 100;// in %
disp(Eg2,"The change in emf in % is");
```

Scilab code Exa 10.20 Total power developed by armature

```
// Exa 10.20
clc;
clear;
close;
format('v',7)
// Given data
Pout = 25;// in kW
Pout = Pout*10^3;// in W
Vt = 250;// in V
Ra = 0.06;// in ohm
```

```
Rsh = 100;// in ohm
// Pout = Vt*I_L;
I_L = Pout/Vt;// in A
Ish = Vt/Rsh;// in A
Ia = I_L+Ish;// in A
Eg = Vt + (Ia*Ra);// in V
// Total armature power developed when working as a generator
Pdeveloped = Eg*Ia;// in W
Pdeveloped = Pdeveloped * 10^-3;// in kW
disp(Pdeveloped,"Total armature power developed in kW is");
Ia = I_L-Ish;// in A
Eb = Vt - (Ia*Ra);// in V
// Total armature power developed when working as a motor
Pdeveloped = Eb*Ia;// in W
Pdeveloped = Pdeveloped * 10^-3;// in kW
disp(Pdeveloped,"Total armature power developed when working as a motor in kW is");
```

Scilab code Exa 10.21 Useful flux per pole

```
// Exa 10.21
clc;
clear;
close;
format('v',6)
// Given data
P = 4;
A = 4;
Turns = 100;
N = 600;// in rpm
Eg = 220;// in V
n = 2;// no of total conductors
```

```
Z = n*Turns;
// Eg = (N*P*phi*Z)/(60*A);
phi = (Eg*60*A)/(N*P*Z);// in Wb
disp(phi,"The useful flux per mole when armature is
   LAP connected in Wb is");
A = 2;
// Eg = (N*P*phi*Z)/(60*A);
phi = (Eg*60*A)/(N*P*Z);// in Wb
disp(phi,"The useful flux per mole when armature is
   WAVE connected in Wb is");
```

Chapter 11

Induction Motors

Scilab code Exa 11.1 Synchronous Speed

```
// Exa 11.1
clc;
clear;
close;
format('v',6)
// Given data
P = 4;
f = 50;// in Hz
Ns = (120*f)/P;// in rpm
disp(Ns,"The synchronous speed in rpm is");
s = 4;
//s = ((Ns-N)/Ns)*100;
N = Ns - ( (s*Ns)/100 );// in rpm
disp(N,"The speed of the motor in rpm is");
N = 1000;// in rpm
s = ((Ns-N)/Ns);
f_desh= s*f;// in Hz
disp(f_desh,"The rotor current frequency in Hz is");
```

Scilab code Exa 11.2 Slip and speed of motors

```
// Exa 11.2
clc;
clear;
close;
format('v',6)
// Given data
f = 50;// in Hz
P = 4;
f_DASH = 2;// in Hz
// f_DASH = s*f;
s = (f_DASH/f)*100;// in %
disp(s,"The slip in % is");
N_S = (120*f)/P;// in rpm
// s = (N_S-N)/N_S;
N = N_S - (s/100*N_S);// in rpm
disp(N,"The speed of the motor in rpm is");
```

Scilab code Exa 11.3 Synchronous speed and no load speed

```
// Exa 11.3
clc;
clear;
close;
format('v',6)
// Given data
P = 6;
f = 50;// in Hz
Snl = 1/100;
Sfl = 3/100;
N_S = (120*f)/P;// in rpm
disp(N_S,"The synchronous speed in rpm is");
Nnl = N_S*(1-Snl);// in rpm
disp(Nnl,"No load speed in rpm is");
```

```
Nfl = N_S*(1-Sfl);// in rpm.. correction
disp(Nfl,"The full load speed in rpm is");
// frequency of rotor current
s = 1;
Sf = s*f;// in Hz
disp(Sf,"The frequency of rotor current in Hz is");
// frequency of rotor current at full load
f_r = Sfl * f;// in Hz
disp(f_r,"The frequency of rotor current at full
    load in Hz is");

// Note : The calculated value of Nnl is wrong and
    value of Nfl is correct but at last they printed
    wrong.
```

Scilab code Exa 11.4 Number of the pole in the motor

```
// Exa 11.4
clc;
clear;
close;
format('v',6)
// Given data
Pa= 12;
N= 1440;// in rpm
Na= 500;// in rpm
Nm= 1450;// in rpm
fa= Pa*Na/120;// in Hz
Pm= round(120*fa/Nm);
// Synchronous speed of motor
Ns= 120*fa/Pm;// in rpm
s= (Ns-N)/Ns*100;// in %
disp(Pm,"The numbers of pole is : ")
disp(s,"The percentage slip is : ")
```

Scilab code Exa 11.5 Frequency of rotor emf in running condition

```
// Exa 11.5
clc;
clear;
close;
format('v',6)
// Given data
K = 1/2;
P = 4;
f = 50;// in Hz
N = 1445;// in rpm
E1line = 415;// in V
Ns = (120*f)/P;// in rpm
N = 1455;// in rpm
s = (Ns-N)/Ns*100;// in %
f_r = s/100*f;// in Hz
disp(f_r,"The frequency of rotor in Hz is");
E1ph = E1line/sqrt(3);// in V
//E2ph/E1ph = K;
E2ph = E1ph*K;// in V
disp(E2ph,"The magnitude of induced emf in V is");
E2r = s/100*E2ph;// in V
disp(E2r,"The magnitude of induced emf in the
    running condition in V is");
```

Scilab code Exa 11.6 Rotor speed when slip is 4 percent

```
// Exa 11.6
clc;
clear;
close;
```

```
format('v',6)
// Given data
P = 4;
S =4/100;
f = 50;// in Hz
Ns = (120*f/P);// in rpm
disp(Ns,"The value of Ns in rpm is");
// The rotor speed when slip is 4 %
N = Ns*(1-S);// in rpm
disp(N,"The rotor speed when slip is 4% in rpm is");
// The rotor speed when rotor runs at 600 rpm
N1 = 600;// in rpm
s1 = ((Ns-N1)/Ns)*100;// in %
f_r = (s1/100)*f;// in Hz
disp(f_r,"The rotor frequency when rotor runs at 600
    rpm in Hz is");
```

Scilab code Exa 11.7 Number of poles

```
// Exa 11.7
clc;
clear;
close;
format('v',6)
// Given data
V_L = 230;// in V
f = 50;// in Hz
N = 950;// in rpm
E2 = 100;// in V
Ns =1000;// in rpm
// Ns = 120*f/P;
P = (120*f)/Ns;
disp(P,"The Number of ploes is");
s = ((Ns-N)/Ns)*100;// %s in %
disp(s,"The percentage of full load slip in % is");
```

```
// The rotor induced voltage at full load
E2r = (s/100)*E2;// in V
disp(E2r,"The rotor induced voltage in V is");
// The rotor frequency at full load
f_r = (s/100)*f;// in Hz
disp(f_r,"The frequency at full load in Hz is");
```

Scilab code Exa 11.8 Number of poles in the machine

```
// Exa 11.8
clc;
clear;
close;
format('v',6)
// Given data
V = 440;// in V
f = 50;// in Hz
N = 1450;// in rpm
Ns = 1450;// in rpm
Nr = 1450;// in rpm
P = round((120*f)/Ns);
disp(P,"The number of poles in the machine is");
P = 4;
Ns = (120*f)/P;// in rpm
disp(Ns,"Speed of rotation air gap field in rpm is")
    ;
k = 0.8/1;
//Pemf = k*E1 = k*V;
Pemf = k*V;// produced emf in rotor in V
disp(Pemf,"Produced emf in rotor in V is");
s = ((Ns-Nr)/Ns)*100;// in %
Ivoltage = k*(s/100)*V;// rotor induces voltage in V
f_r = (s/100)*f;// in Hz
disp(f_r,"The frequency of rotor current in Hz is ")
    ;
```

Scilab code Exa 11.9 Full load speed and corresponding speed

```
// Exa 11.9
clc;
clear;
close;
format('v',6)
// Given data
P = 8;
f = 50;// in Hz
f_r = 2;// in Hz
// f_r = s*f;
s = (f_r/f)*100;// in %
disp(s,"The full load slip in % is");
// s = Ns-N/Ns;
Ns = (120*f)/P;// in rpm
N = Ns*(1-(s/100));// in rpm
disp(N,"The corresponding speed in rpm is");
```

Scilab code Exa 11.10 Speed at which maximum torque is developed

```
// Exa 11.10
clc;
clear;
close;
format('v',6)
// Given data
R2 = 0.024;// in per phase
X2 = 0.6;// in ohm per phase
s = R2/X2;
f = 50;// in Hz
```

```
P = 4;
Ns = (120*f)/P;// in rpm
// Speed corresponding to maximum torque
N = Ns*(1-s);// in rpm
disp(N,"The speed at which maximum torque is
   developed in rpm is");
```

Scilab code Exa 11.11 Rotor speed in rpm

```
// Exa 11.11
clc;
clear;
close;
format('v',6)
// Given data
P = 4;
f =60;// in Hz
s = 0.03;
Ns = (120*f)/P;// in rpm
N = Ns*(1-s);// in rpm
disp(Ns,"The synchronous speed in rpm is : ")
disp(N,"The rotor speed in rpm is");
f_r = s*f;// in Hz
disp(f_r,"The rotor current frequency in Hz is");
// Rotor magnetic field rorats at speed
Rm = (120*f_r)/P;// in rpm
disp(Rm,"The rotor magnetic field rotates at speed
   in rpm is");
```

Scilab code Exa 11.12 Slip and frequency of rotor induced emf

```
// Exa 11.12
clc;
```

```
clear;
close;
format('v',6)
// Given data
N = 960;// in rpm
f = 50;// in Hz
Ns = 1000;// in rpm
s = ((Ns-N)/Ns)*100;// %s in %
disp(s,"The slip in % is");
f_r = (s/100)*f;// in Hz
disp(f_r,"The frequency of rotor induced emf in Hz is");
// Ns = (120*f)/P;
P = (120*f)/Ns;
disp(P,"The number of ploes is");
// Speed of rotor field with respect to rotor structure
s1 = (120*f_r)/P;//in rpm
disp(s1,"Speed of rotor field with respect to rotor structure in rpm is");
```

Scilab code Exa 11.13 Full load speed of motor

```
// Exa 11.13
clc;
clear;
close;
format('v',6)
// Given data
P = 4;
f = 50;// in Hz
Sfl = 4/100;
Ns = (120*f)/P;// in rpm
//The full load speed, Sfl = (Ns-Nfl)/Ns;
Nfl = Ns - (Sfl*Ns);// in rpm
```

```
disp(Nfl,"The full load speed in rpm is");
```