

Scilab Textbook Companion for
Introduction to Electrical Engineering
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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

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

```

19 disp(I1,"The current through 4 ohm resistor in A is"
    );
20 // current through 2 ohm resistor
21 I= I1-I2;// in A
22 disp(I,"The current through 2 ohm resistor in A is")
    ;
23 disp(I2,"The current through 6 ohm resistor in A is"
    );
24 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

```

1 // Exa 1.2
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 V = 100;// in V
8 I3= 10;// in A
9 R1 = 10;// in ohm
10 R2 = 5;// in ohm
11 //  $I_1 = (V - V_A)/R_1$ 
12 //  $I_2 = (V_A - 0)/R_2$ 
13 // Using KCL at node A,  $I_1 - I_2 + I_3 = 0$  or
14  $V_A = (R_1 * R_2) / (R_1 + R_2) * (I_3 + V/R_1)$ ;// in V
15  $I_1 = (V - V_A)/R_1$ ;// in A
16  $I_2 = (V_A - 0)/R_2$ ;// in A
17 disp(I1,"The current through 10 ohm resistor in A is
    ");
18 disp(I2,"The current through 5 ohm resistor in A is"
    );
19 disp(I3,"The current through 20 ohm resistor in A is
    ");

```

Scilab code Exa 1.3 Voltage source to current source

```
1 // Exa 1.3
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 // Part (a)
8 V = 30; // in V
9 R = 6; // in ohm
10 I = V/R; // the equivalent current in A
11 disp(I,"The equivalent current in A is");
12 // Part (b)
13 I = 10; // in A
14 R = 5; // in ohm
15 V = I*R; // the equivalent voltage in V
16 disp(V,"The equivalent voltage in V is");
```

Scilab code Exa 1.4 Value of current

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

```

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

```

Scilab code Exa 1.5 Value of I1 and I2

```

1 // Exa 1.5
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R1= 40; // in ohm
8 R2= 20; // in ohm
9 R3= 25; // in ohm
10 R4= 60; // in ohm
11 R5= 50; // in ohm
12 V1= 120; // in V
13 V2= 60; // in V
14 V3= 40; // in V
15 // Applying KVL in Mesh ABEFA, we get  $-I1*(R1+R2+R3$ 
     $+I2*R3=V2-V1$  (i)
16 // Applying KVL in Mesh BCEDB, we get  $R3*I1-I2*(R3+$ 
     $R4+R5)= V3-V2$  (ii)
17 A= [-(R1+R2+R3) R3; R3 -(R3+R4+R5)];
18 B= [V2-V1 V3-V2];
19 I= B*A^-1; //Solving eq(i) and (ii) by Matrix method
20 I1= I(1); // in A
21 I2= I(2); // in A
22 disp(I1,"The value of I1 in A is : ");
23 disp(I2,"The value of I2 in A is : ");

```

Scilab code Exa 1.6 Current through each battery and load current

```
1 // Exa 1.6
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R1= 2; // in ohm
8 R2= 4; // in ohm
9 R3= 6; // in ohm
10 V1= 4; // in V
11 V2= 44; // in V
12 //Applying KVL in ABEFA :  $-R1*I1 + R2*I2 = V1$ 
    (i)
13 //Applying KVL in BCDEB:  $R3*I1 + I2*(R2+R3)=V2$  (ii)
14 A= [-R1 R3; R2 (R2+R3)]; // assumed
15 B= [V1 V2]; // assumed
16 I= B*A^-1; // Solving eq(i) and (ii) by Matrix method
17 I1= I(1); // in A
18 I2= I(2); // in A
19 I_L= I1+I2; // in A
20 disp(I1,"The value of I1 in A is : ");
21 disp(I2,"The value of I2 in A is : ");
22 disp(I_L,"The value of I_L in A is : ");
```

Scilab code Exa 1.7 Mesh analysis

```
1 // Exa 1.7
2 clc;
3 clear;
4 close;
```

```

5 format('v',6)
6 // Given data
7 R1= 1; // in ohm
8 R2= 1; // in ohm
9 R3= 2; // in ohm
10 R4= 1; // in ohm
11 R5= 1; // in ohm
12 V1= 1.5; // in V
13 V2= 1.1; // in V
14 //Applying KVL in ABCFA : I1*(R1+R2+R3) + R3*I2 =
      V1          (i)
15 //Applying KVL in BCDEB: R3*I1 + I2*(R3+R4+R5)=V2
      (ii)
16 A= [(R1+R2+R3) R3; R3 (R3+R4+R5)];
17 B= [V1 V2];
18 I= B*A^-1; // Solving eq(i) and (ii) by Matrix method
19 I1= I(1); // in A
20 I2= I(2); // in A
21 disp(I1,"The value of I1 in A is : ");
22 disp(I2,"The value of I2 in A is : ");

```

Scilab code Exa 1.8 Current in 6 ohm resistor

```

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

```



```

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

```

Scilab code Exa 1.9 Current in each element

```

1 // Exa 1.9
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R1= 30; // in ohm
8 R2= 40; // in ohm
9 R3= 20; // in ohm
10 R4= 60; // in ohm
11 R5= 50; // in ohm
12 V= 240; // in V
13 //Applying KVL in ABDA :  $I1*-(R1+R2+R3) + R2*I2 + R3$ 

```

```

    *I3 =0                                (i)
14 //Applying KVL in BCDB : I1*R2+I2*-(R2+R4+R5)+I3*
    R5 = 0                                (ii)
15 //Applying KVL in CFEADC: I1*R3+ R5*I2+I3*-(R3+R5)=-
    V                                     (iii)
16 A= [-(R1+R2+R3) R2 R3; R2 -(R2+R4+R5) R5; R3 R5 -(R3
    +R5)];
17 B= [0 0 -V];
18 I= B*A^-1; // Solving eq(i), (ii) and (iii) by Matrix
    method
19 I1= I(1); // in A
20 I2= I(2); // in A
21 I3= I(3); // in A
22 I30_ohm_resistor= I1; // in A
23 I60_ohm_resistor= I2; // in A
24 I50_ohm_resistor= I2-I3; // in A
25 I20_ohm_resistor= I1-I3; // in A
26 I40_ohm_resistor= I1-I2; // in A
27 disp(I30_ohm_resistor,"The current through 30 ohm
    resistance in A is : ")
28 disp(I60_ohm_resistor,"The current through 60 ohm
    resistance in A is : ")
29 disp(I50_ohm_resistor,"The current through 50 ohm
    resistance in A is : ")
30 disp(I20_ohm_resistor,"The current through 20 ohm
    resistance in A is : ")
31 disp(I40_ohm_resistor,"The current through 40 ohm
    resistance in A is : ")
32
33 // 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

```
1 // Exa 1.10
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R1= 5; // in ohm
8 R2= 5; // in ohm
9 R3= 10; // in ohm
10 R4= 10; // in ohm
11 R5= 5; // in ohm
12 V1= 50; // in V
13 V2= 20; // in V
14 //Applying KCL at node A:  $VA*(R1*R3+R3*R2+R2*R1)+VB$ 
     $*-R1*R3 = V1*R2*R3$  (i)
15 //Applying KCL at node B:  $VA*R4*R5+VB*-(R2*R4+R4*R5$ 
     $+R5*R2) = -V2*R2*R4$  (ii)
16 A=[(R1*R3+R2*R3+R2*R1) R4*R5; -R1*R3 -(R2*R4+R4*R5+
    R5*R2)]
17 B= [V1*R2*R3 -V2*R2*R4];
18 V= B*A^-1; // Solving eq(i) and (ii) by Matrix method
19 VA= V(1); // in V
20 VB= V(2); // in V
21 I_through_R3= VA/R3; // in A
22 I_through_R4= VB/R4; // in A
23 disp(I_through_R3,"The current in R3 in A is : ")
24 disp(I_through_R4,"The current in R4 in A is : ")
```

Scilab code Exa 1.11 Current through each resistor

```
1 // Exa 1.11
2 clc;
3 clear;
```

```

4 close;
5 format('v',7)
6 // Given data
7 R1= 1; // in ohm
8 R2= 1; // in ohm
9 R3= 0.5; // in ohm
10 R4= 2; // in ohm
11 R5= 1; // in ohm
12 V1= 15; // in V
13 V2= 20; // in V
14 //Applying KCL at node A:  $VA*(R1*R2+R2*R3+R3*R1)+VB$ 
     $*-R1*R2 = V1*R2*R3$  (i)
15 //Applying KCL at node B:  $VA*R4*R5+VB*-(R3*R4+R4*R5$ 
     $+R5*R3) = V2*R3*R4$  (ii)
16 A=[(R1*R2+R2*R3+R3*R1) R4*R5; -R1*R2 -(R3*R4+R4*R5+
    R5*R3)]
17 B= [V1*R2*R3 -V2*R3*R4];
18 V= B*A^-1; // Solving eq(i) and (ii) by Matrix method
19 VA= V(1); // in V
20 VB= V(2); // in V
21 I1= (VA-V1)/R1; // in A
22 I2= VA/R2; // in A
23 I3= (VA-VB)/R3; // in A
24 I4= VB/R4; // in A
25 I5= (VB-V2)/R5; // in A
26 disp(I1,"The value of I1 in A is : ")
27 disp(I2,"The value of I2 in A is : ")
28 disp(I3,"The value of I3 in A is : ")
29 disp(I4,"The value of I4 in A is : ")
30 disp(I5,"The value of I5 in A is : ")

```

Scilab code Exa 1.12 Current in each branch

```

1 // Exa 1.12
2 clc;

```

```

3 clear;
4 close;
5 format('v',7)
6 // Given data
7 V1 = 12; // in V
8 V2 = 10; // in V
9 VB = 0; // in V
10 R1 = 2; // in ohm
11 R2 = 1; // in ohm
12 R3 = 10; // in ohm
13 // Using KCL at node A :
14 VA= (V1*R2*R3+V2*R3*R1)/(R1*R2+R2*R3+R3*R1); // in V
15 I1 = (V1-VA)/R1; // in A
16 I2 = (V2-VA)/R2; // in A
17 I3 = (VA-VB)/R3; // in A
18 disp(I1,"The value of I1 in A is : ")
19 disp(I2,"The value of I2 in A is : ")
20 disp(I3,"The value of I3 in A is : ")

```

Scilab code Exa 1.13 Voltage at node 1 and 2

```

1 // Exa 1.13
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R1= 1; // in ohm
8 R2= 2; // in ohm
9 R3= 2; // in ohm
10 R4= 1; // in ohm
11 I1= 1; // in A
12 I5= 2; // in A
13 // Using KCL at node 1:  $V1*(R2+R3)-V2*R2= I1*R2*R3$ 
    (i)

```

```

14 // Using KCL at node 2:  $V1 \cdot R4 - V2 \cdot (R3 + R4) = -I5 \cdot (R3 \cdot R4)$ 
    (ii)
15 A= [(R2+R3) R4; -R2 -(R3+R4)];
16 B= [I1*R2*R3 -I5*R3*R4];
17 V= B*A^-1; // Solving eq(i) and (ii) by Matrix method
18 V1= V(1); // in V
19 V2= V(2); // in V
20 disp(V1,"The voltage at node 1 in volts is : ")
21 disp(V2,"The voltage at node 2 in volts is : ")

```

Scilab code Exa 1.14 Current I1 and I2

```

1 // Exa 1.14
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R1= 2; // in ohm
8 R2= 6; // in ohm
9 R3= 3; // in ohm
10 V1= 10; // in V
11 V2= 6; // in V
12 V3= 2; // in V
13 //Applying KVL in ABEFA :  $I1 \cdot (R1 + R2) - R2 \cdot I2 = V1 - V2$ 
    (i)
14 //Applying KVL in BCDEB :  $-I1 \cdot R2 + I2 \cdot (R2 + R3) = V2 - V3$ 
    (ii)
15 A= [(R1+R2) -R2; -R2 (R2+R3)];
16 B= [(V1-V2) (V2-V3)];
17 I= B*A^-1; // Solving eq(i), and (ii) by Matrix
    method
18 I1= I(1); // in A
19 I2= I(2); // in A
20 disp(I1,"The value of I1 in A is : ")

```

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

Scilab code Exa 1.15 Current I1 and I2

```
1 // Exa 1.15
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R1= 2; // in ohm
8 R2= 6; // in ohm
9 R3= 4; // in ohm
10 R4= 3; // in ohm
11 R5= 5; // in ohm
12 V1= 10; // in V
13 V2= 6; // in V
14 V3= 2; // in V
15 //Applying KVL in ABEFA :  $I1*(R1+R2+R3) - R2*I2 =$   
     $V1-V2$  (i)
16 //Applying KVL in BCDEB :  $I1*-R2+I2*(R2+R4+R5) =V2-$   
     $V3$  (ii)
17 A= [(R1+R2+R3) -R2; -R2 (R2+R4+R5)];
18 B= [(V1-V2) (V2-V3)];
19 I= B*A^-1; // Solving eq(i) and (ii) by Matrix method
20 I1= I(1); // in A
21 I2= I(2); // in A
22 disp(I1,"The value of I1 in A is : ")
23 disp(I2,"The value of I2 in A is : ")
```

Scilab code Exa 1.16 Current in resistor R1

```
1 // Exa 1.16
```

```

2  clc;
3  clear;
4  close;
5  format('v',7)
6  // Given data
7  R1= 10;// in ohm
8  R2= 5;// in ohm
9  R3= 5;// in ohm
10 R4= 5;// in ohm
11 V2= 10;// in V
12 I= 1;// in A
13 V1= R4*I;// in V
14 //Applying KVL in ABEFA :  $I_1*(R1+R2+R3) + R1*I_2 =$ 
    V1 (i)
15 //Applying KVL in BCDEB :  $I_1*R1+I_2*(R1+R4) =V_2$ 
    (ii)
16 A= [(R1+R2+R3) R1; R1 (R1+R4)];
17 B= [V1 V2];
18 I= B*A^-1;// Solving eq(i) and (ii) by Matrix method
19 I1= I(1);// in A
20 I2= I(2);// in A
21 I10_ohm= I1+I2;// in A
22 disp(I10_ohm,"The current through 10 ohm resistor in
    A is : ")

```

Scilab code Exa 1.17 Current in 10 ohm resistor

```

1  // Exa 1.17
2  clc;
3  clear;
4  close;
5  format('v',7)
6  // Given data
7  R1= 4;// in ohm
8  R2= 5;// in ohm

```



```

 9 R3= 10; // in ohm
10 R4= 6; // in ohm
11 R5= 4; // in ohm
12 V1= 15; // in V
13 V2= 30; // in V
14 //Applying KCL at node A:   $VA*(R1*R2+R2*R3+R3*R1)+VB$ 
     $*-R1*R2 = V1*R1*R3$  (i)
15 //Applying KCL at node B:   $VA*R4*R5+VB*-(R3*R4+R4*R5$ 
     $+R5*R3) = -V2*R3*R4$  (ii)
16 A=[(R1*R2+R2*R3+R3*R1) R4*R5; -R1*R2 -(R3*R4+R4*R5+
    R5*R3)]
17 B= [V1*R1*R3 -V2*R3*R4];
18 V= B*A^-1; // Solving eq(i) and (iii) by Matrix
    method
19 VA= V(1); // in V
20 VB= V(2); // in V
21 I10_ohm= abs((VA-VB)/R3); // in A
22 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

```

1 // Exa 1.19
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R1= 10; // in ohm
8 R2= 10; // in ohm
9 R3= 20; // in ohm
10 R4= 20; // in ohm
11 R5= 20; // in ohm
12 V= 10; // in V
13 I1= 1; // in A

```

```

14 I7=0.5; // in A
15 //Applying KCL at node A: VA*(R1+R2)+VB*-R1 = I1*R1
    *R2
    (i)
16 //Applying KCL at node B: VA*R3*R4+VB*-(R2*R3+R3*R4
    +R4*R2)+VC*R2*R3 = V*R2*R4 (ii)
17 //Applying KCL at node C: -VB*R5+VC*(R4+R5)=I7*R4*R5
    (iii)
18 A=[(R1+R2) R3*R4 0; -R1 -(R2*R3+R3*R4+R4*R2) -R5;0
    R2*R3 (R4+R5)]
19 B= [I1*R1*R2 V*R2*R4 I7*R4*R5];
20 Value= B*A^-1; // Solving eq(i), (ii) and (iii) by
    Matrix method
21 VA= Value(1); // in V
22 VB= Value(2); // in V
23 VC= Value(3)
24 I2= VA/R1; // in A
25 I3= (VA-VB)/R2; // in A
26 I4= (VB+V)/R3; // in A
27 I5= (VC-VB)/R4; // in A
28 I6= VC/R5; // in A
29 disp(I1,"The value of I1 in A is : ");
30 disp(I2,"The value of I2 in A is : ");
31 disp(I3,"The value of I3 in A is : ");
32 disp(I4,"The value of I4 in A is : ");
33 disp(I5,"The value of I5 in A is : ");
34 disp(I6,"The value of I6 in A is : ");
35 disp(I7,"The value of I7 in A is : ");

```

Scilab code Exa 1.20 Current in 8 ohm resistor

```
1 // Exa 1.20
```

```

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

```

Scilab code Exa 1.21 Current drawn from the source

```

1  // Exa 1.21
2  clc;
3  clear;
4  close;
5  format('v',6)

```

```

6 // Given data
7 V= 100; // in V
8 R12 = 3; // in ohm
9 R31 = 2; // in ohm
10 R23 = 4; // in ohm
11 R4= 6; // in ohm
12 R5=2; // in ohm
13 R6= 5; // in ohm
14 R1 = (R12*R31)/(R12+R23+R31); // in ohm
15 R2 = (R31*R23)/(R12+R23+R31); // in ohm
16 R3 = (R23*R12)/(R12+R23+R31); // in ohm
17 R_S= R6+R1; // in ohm
18 R_P1= R2+R4; // in ohm
19 R_P2= R3+R5; // in ohm
20 R_P= R_P1*R_P2/(R_P1+R_P2); // in ohm
21 R= R_P+R_S; // in ohm
22 I= V/R; // in A
23 disp(I,"The current drawn from the source in A is :
    ")

```

Scilab code Exa 1.22 Current in all branch

```

1 // Exa 1.22
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R1= 10; // in ohm
8 R2= 5; // in ohm
9 R3= 20; // in ohm
10 V= 100; // in V
11 I2= 10; // in A
12 // Applying KVL in ABEFA :  $-R1*I1 - R2*(I1+I2) + V = 0$ 
13 I1= (V-R2*I2)/(R1+R2); // in A

```

```

14 I10_ohm= I1;//current through 10 ohm resistance in A
15 I5_ohm= I1+I2;//current through 5 ohm resistance in
    A
16 I20_ohm= I2;//current through 20 ohm resistance in A
17 disp("Part (i) : Using by KVL")
18 disp(I10_ohm,"The current through 10 ohm resistance
    in A is : ")
19 disp(I5_ohm,"The current through 5 ohm resistance in
    A is : ")
20 disp(I20_ohm,"The current through 20 ohm resistance
    in A is : ")
21 // Applying KCL at node A :
22 VA= (V*R2+I2*R1*R2)/(R1+R2);// in V
23 I10_ohm= (VA-V)/R1;// in A
24 I5_ohm= VA/R2;// in A
25 I20_ohm= I2;// in A
26 disp("Part (ii) : Using by KVL")
27 disp(I10_ohm,"The current through 10 ohm resistance
    in A is : ")
28 disp(I5_ohm,"The current through 5 ohm resistance in
    A is : ")
29 disp(I20_ohm,"The current through 20 ohm resistance
    in A is : ")

```

Scilab code Exa 1.23 Current and voltage across 2 ohm resistor

```

1 // Exa 1.23
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R1= 5;// in ohm
8 R2= 10;// in ohm
9 R3= 3;// in ohm

```

```

10 R4= 2; // in ohm
11 V1= 10; // in V
12 V2= 20; // in V
13 I= 5; // in A
14 // Applying KCL at node A:  $V_A*(R_1+R_2)+V_B*-R_1 = I*R_1*$ 
     $R_2+V_1*R_1$ 
    (
    i)
15 // Applying KCL at node B:  $V_A*R_3*R_4+V_B*-(R_2*R_3+R_4*R_3$ 
     $+R_4*R_2) = V_1*R_3*R_4+V_2*R_2*R_3$  (ii)
16 A=[(R1+R2) R3*R4; -R1 -(R3*R2+R4*R3+R4*R2)]
17 B= [(I*R1*R2+V1*R1) (V1*R3*R4+V2*R2*R3)];
18 V= B*A^-1; // Solving eq(i) and (ii) by Matrix method
19 VA= V(1); // in V
20 VB= V(2); // in V
21 I4= (VB+V2)/R4; // in A
22 V4= R4*I4; // in V
23 disp(I4,"The current through 2 ohm resistor in A is
    : ")
24 disp(V4,"The voltage across 2 ohm resistor in V is :
    ")

```

Scilab code Exa 1.24 Voltage across 6 ohm resistor

```

1 // Exa 1.24
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R1= 6; // in ohm
8 R2= 12; // in ohm
9 R3= 2; // in ohm
10 R4= 6; // in ohm
11 V2= 12; // in V

```

```

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

```

Scilab code Exa 1.25 Resistance between point B and C

```

1 // Exa 1.25
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 6; // in ohm
8 R2 = 2; // in ohm
9 R3 = 2; // in ohm
10 R4 = 4; // in ohm
11 R5 = 4; // in ohm
12 R6 = 6; // in ohm
13 R12= R1*R2/(R1+R2); // in ohm
14 R34= R3*R4/(R3+R4); // in ohm
15 R56= R5*R6/(R5+R6); // in ohm
16 // Resistance between the point B and C
17 R_BC= (R12+R34)*R56/((R12+R34)+R56); // in ohm
18 disp(R_BC,"The resistance between the point B and C

```

in ohm is : ")

Scilab code Exa 1.26 Voltage across R1 and R2

```
1 // Exa 1.26
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R1 = 10; // in ohm
8 R2 = 10; // in ohm
9 R4 = 80; // in ohm
10 V1= 100; // in V
11 I2= 0.5; // in A
12 V2= I2*R4; // in V
13 // Applying KVL :  $-R1*I1 - V2 + V1 - R1*I2 = 0$ 
14 I1= (V1-V2)/(R1+R2); // in A
15 V_R1= I1*R1; // voltage across R1 resistor in V
16 V_R2= I1*R2; // voltage across R2 resistor in V
17 disp(V_R1,"The voltage across R1 resistor in V is :
    ")
18 disp(V_R2,"The voltage across R2 resistor in V is :
    ")
```

Scilab code Exa 1.27 Current I1 and I2

```
1 // Exa 1.27
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
```



```

7 R1 = 8; // in ohm
8 R2 = 4; // in ohm
9 R3 = 4; // in ohm
10 R4 = 4; // in ohm
11 R5 = 8; // in ohm
12 R6 = 8; // in ohm
13 I=10; // in A
14 V= 20; // in V
15 // Applying KVL in ABEFA :  $I_1*(R_1+R_2+R_3)+I_2*(R_3)= I*$ 
    R2-V      (i)
16 // Applying KVL in BCDEB :  $I_1*R_3-I_2*(R_3+R_4+R_5)= R_4*I$ 
    +V      (ii)
17 A= [(R1+R2+R3) R3; R3 -(R3+R4+R5)];
18 B= [I*R2-V R4*I+V];
19 I= B*A^-1;///// Solving equations by matrix
    multiplication
20 I1= I(1); // in A
21 I2= I(2); // in A
22 disp(I1,"The value of I1 in A is : ");
23 disp(I2,"The value of I2 in A is : ");

```

Chapter 2

Network Theorems

Scilab code Exa 2.1 Current through load resistance

```
1 // Exa 2.1
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 6; // in ohm
8 R2 = 6; // in ohm
9 R3 = 6; // in ohm
10 V = 24; // in V
11 R_T = R1+R1*R2/(R1+R2); // in ohm
12 I_T = V/R_T; // in A
13 I1 = (R1/(R1+R2))*I_T; // in A
14 V = 12; // in V
15 I_T = V/R_T; // in A
16 I2 = (R1/(R1+R2))*I_T; // in A
17 I = I1+I2; // in A
18 disp(I,"The current in A is");
```

Scilab code Exa 2.2 Value of current across 12 ohm

```
1 // Exa 2.2
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 5; // in ohm
8 Vth= 10; // in ohm
9 R2 = 7; // in ohm
10 R3=10; // in ohm
11 R_L = 12; // in ohm
12 V = 20; // in ohm
13 Vth = (Vth*V)/(R1+R3); // in V
14 Rth = R2 + ((Vth*R1)/(Vth+R1)); // in ohm
15 // The current through 12 ohm resistor
16 I = Vth/(Rth+R_L); // in A
17 disp(I,"The current through 12 ohm resistor in A is"
    );
```

Scilab code Exa 2.3 Value of current across 12 ohm

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

```

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

```

Scilab code Exa 2.4 Load resistor

```

1 // Exa 2.4
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 5;// in ohm
8 R2 = 10;// in ohm
9 R3 = 7;// in ohm
10 V = 20;// in V
11 Vth = R2*V/(R1+R2);// in V
12 Rth = R3 + ((R2*R1)/(R2+R1));// in ohm
13 R_L = Rth;// in ohm
14 disp(R_L,"The value of load resistance in ohm is");
15 Pmax = (Vth^2)/(4*R_L);// in W
16 disp(Pmax,"The magnitude of maximum power in W is");

```

Scilab code Exa 2.5 Current across 4 ohm resistor

```

1 // Exa 2.5
2 clc;
3 clear;
4 close;
5 format('v',5)

```

```

6 // Given data
7 V1 = 12; // in V
8 V2 = 10; // in V
9 R1 = 6; // in ohm
10 R2 = 7; // in ohm
11 R3 = 4; // in ohm
12 R_T = R1 + ( (R2*R3)/(R2+R3) ); // in ohm
13 I_T = V1/R_T; // in A
14 I1 = (R2/(R2+R3))*I_T; // in A
15 R_T = R2 + ( (R1*R3)/(R1+R3) ); // in ohm
16 I_T = V2/R_T; // in A
17 I2 = (R1*I_T)/(R1+R3); // in A
18 // current across 4 ohm resistor
19 I = I1+I2; // in A
20 disp(I,"The current across 4 ohm resistor in A is");

```

Scilab code Exa 2.6 Current in branch AB

```

1 // Exa 2.6
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 2; // in ohm
8 R2 = 3; // in ohm
9 R3 = 1; // in ohm
10 R4= 2; // in ohm
11 V1 = 4.2; // in V
12 V2 = 3.5; // in V
13 R_T =R1+R3+R2*R4/(R2+R4); // in ohm
14 I_T = V1/R_T; // in A
15 I1 = (R1/(R1+R2))*I_T; // in A
16 R = R1+R3; // in ohm
17 R_desh = (R*R2)/(R+R2); // in ohm

```

```

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

```

Scilab code Exa 2.7 Current through 8 ohm resistor

```

1 // Exa 2.7
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 2; // in ohm
8 R2 = 4; // in ohm
9 R3 = 8; // in ohm
10 Ig = 2; // in A
11 V = 20; // in V
12 R_T = R1+R3; // in ohm
13 I1 = V/R_T; // in A
14 I2 = (R1/(R1+R3))*Ig; // in A
15 // current through in 8 ohm resistor
16 I = I1-I2; // in A
17 disp(I,"The current through in 8 ohm resistor in A
    is");

```

Scilab code Exa 2.8 Current across 16 ohm resistor

```

1 // Exa 2.8
2 clc;

```

```

3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R1 = 4; // in ohm
8 R2 = 24; // in ohm
9 R_L = 16; // in ohm
10 V1 = 20; // in V
11 V2 = 30; // in V
12 //  $V1 - R1 * I - R2 * I - V2 = 0$ ;
13 I = (V1 - V2) / (R1 + R2)
14 //  $V1 - R1 * I - V_{th} = 0$ ;
15 Vth = V1 - R1 * I; // in V
16 Rth = (R1 * R2) / (R1 + R2); // in ohm
17 // current through 16 ohm resistor
18 I_L = Vth / (Rth + R_L); // in A
19 disp(I_L, "The current through 16 ohm resistor in A
    is");

```

Scilab code Exa 2.9 Current through 6 ohm resistor

```

1 // Exa 2.9
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 6; // in ohm
8 R2 = 4; // in ohm
9 R3 = 3; // in ohm
10 R_L = 6; // in ohm
11 V1 = 6; // in V
12 V2 = 15; // in V
13 //  $V1 - R1 * I - R3 * I - V2 = 0$ 
14 I = (V1 - V2) / (R1 + R3);

```

```

15 // Vth - R3*I - V2 = 0;
16 Vth = V2 + R3*I; // in V
17 Rth = ((R1*R3)/(R1+R3)) + R2; // in ohm
18 // current through 6 ohm resistance
19 I_L = Vth/(Rth+R_L); // in A
20 disp(I_L, "The current through 6 ohm resistance in A
    is");

```

Scilab code Exa 2.10 Current in 10 ohm resistor

```

1 // Exa 2.10
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R1 = 8; // in ohm
8 R2 = 5; // in ohm
9 R3 = 2; // in ohm
10 R_L = 10; // in ohm
11 V1 = 20; // in V
12 V2 = 12; // in V
13 // V1 - R3*I - R2*I = 0;
14 I = V1/(R2+R3); // in A
15 // Vth + V2 - R3*I = 0;
16 Vth = R3*I - V2; // in V
17 Rth = ((R2*R3)/(R2+R3)) + R1; // in ohm
18 // current through 10 ohm resistance
19 I_L = abs(Vth)/(Rth+R_L); // in A
20 disp(I_L, "The current through 10 ohm resistance in A
    is");

```

Scilab code Exa 2.11 Current in 5 ohm resistor


```

1 // Exa 2.11
2 clc;
3 clear;
4 close;
5 format('v',4)
6 // Given data
7 R1 = 4; // in ohm
8 R2 = 3; // in ohm
9 R3 = 2; // in ohm
10 R_L = 5; // in ohm
11 I = 6; // in A
12 V = 15; // in V
13 //  $V - R1*I1 - R3*(I1+I) = 0$ ;
14 I1 = (V - R3*I)/(R1+R3); // in A
15 I = I1 + I; // in A
16 Vth = R3*I; // in V
17 Rth = ((R1*R3)/(R1+R3)) + R2; // in ohm
18 // current in 5 ohm resistance
19 I_L = Vth/(Rth+R_L); // in A
20 disp(I_L,"The current in 5 ohm resistance in A is");

```

Scilab code Exa 2.12 Thevenins equivalent of the network

```

1 // Exa 2.12
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 8; // in ohm
8 R2 = 32; // in ohm
9 V = 60; // in V
10 I1= 5; // in A
11 I2= 3; // in A
12 //  $Vth - R1*I1 - (I1+I2)*R2 - V = 0$ 

```

```

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

```

Scilab code Exa 2.13 Current in 6 ohm resistor

```

1  clc;
2  clear;
3  close;
4  format('v',5)
5  // Given data
6  R1 = 6; // in ohm
7  R2 = 4; // in ohm
8  R3 = 3; // in ohm
9  R_L = 6; // in ohm
10 V1 = 6; // in V
11 V2= 15; // in V
12 // V1 - R1*I - R3*I -V2 = 0;
13 I= (V1-V2)/(R1+R3)
14 Vth = V2 + (R3*I); // in V
15 Rth = ((R1*R3)/(R1+R3)) + R2; // in ohm
16 I_N = Vth/Rth; // in A
17 // current through 6 ohm resistor
18 I = (I_N*Rth)/(Rth+R_L); // in A
19 disp(I,"The current through 6 ohm resistor in A is")
   ;

```

Scilab code Exa 2.14 Current in 10 ohm resistor

```

1 // Exa 2.14
2 clc;
3 clear;

```

```

4 close;
5 format('v',7)
6 // Given data
7 R1 = 5; // in ohm
8 R2 = 2; // in ohm
9 R3 = 8; // in ohm
10 V1 = 20; // in V
11 V2 = 12; // in V
12 //  $V1 - R2 * I - R1 * I = 0$ ;
13 I = V1 / (R1 + R2); // in A
14 //  $V_{th} + V2 - R2 * I = 0$ ;
15 Vth = (R2 * I) - V2; // in V
16 Rth = ((R1 * R2) / (R1 + R2)) + R3; // in ohm
17 I_N = Vth / Rth; // in A
18 R_L = 10; // in ohm
19 // current through 10 ohm resistace
20 I = (abs(I_N) * Rth) / (Rth + R_L); // in A
21 disp(I, "The current through 10 ohm resistace in A is
    ");

```

Scilab code Exa 2.15 Current in 5 ohm resistor

```

1 // Exa 2.15
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V = 15; // in V
8 R1 = 4; // in ohm
9 R2 = 3; // in ohm
10 R3 = 2; // in ohm
11 R_L = 5; // in ohm
12 Ig = 6; // in A
13 //  $V - R1 * I1 - R3 * (I1 + Ig) = 0$ ;

```

```

14 I1 = (V-R3*Ig)/(R1+R3); // in A
15 I = I1 + Ig; // in A
16 Vth = R3*I; // in V
17 Rth = ((R1*R3)/(R1+R3)) + R2; // in ohm
18 I_N = Vth/Rth; // in A
19 // current through 5 ohm resistor
20 I = (I_N*Rth)/(Rth+R_L); // in A
21 disp(I,"The current through 5 ohm resistor in A is")
    ;

```

Scilab code Exa 2.16 Value of R

```

1 // Exa 2.16
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 V = 6; // in V
8 R1 = 2; // in ohm
9 R2 = 1; // in ohm
10 R3 = 3; // in ohm
11 R4 = 2; // in ohm
12 Rth=(R1*R2/(R1+R2)+R3)*R4/((R1*R2/(R1+R2)+R3)+R4)
13 R_L = Rth; // in ohm
14 disp(R_L,"The value of R in ohm is");

```

Scilab code Exa 2.17 Load Resistance and power delivered to load

```

1 // Exa 2.17
2 clc;
3 clear;
4 close;

```

```

5 format('v',6)
6 // Given data
7 R1 = 10; // in ohm
8 R2 = 10; // in ohm
9 R3 = 4; // in ohm
10 V = 20; // in V
11 //  $V - R1*I1 - R2*I1 = 0$ ;
12 I1 = V/(R1+R2); // in A
13 Vth = R1*I1; // in V
14 Rth = R1*R2/(R1+R2)+R3
15 R_L = Rth; // in ohm
16 disp(R_L,"The value of load resistance in ohm is");
17 Pmax = (Vth^2)/(4*Rth); // in W
18 disp(Pmax,"The power delivered to the load in W is")
    ;

```

Scilab code Exa 2.18 Current in 6 ohm resistor

```

1 // Exa 2.18
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 3; // in ohm
8 R2 = 9; // in ohm
9 R3 = 6; // in ohm
10 V1 = 120; // in V
11 V2 = 60; // in V
12 R = (R3*R2)/(R3+R2); // in ohm
13 R_T = R+R1; // in ohm
14 I_T = V1/R_T; // in A
15 I1 = (R2/(R2+R3)) * I_T; // in A
16 R_T = 2 + R2; // in ohm
17 I_T = V2/R_T; // in A

```

```

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

```

Scilab code Exa 2.19 Current in 8 ohm resistor

```

1 // Exa 2.19
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 36; // in ohm
8 R2 = 12; // in ohm
9 R3 = 8; // in ohm
10 V1 = 90; // in V
11 V2 = 60; // in V
12 R_T = (R2*R3)/(R2+R3)+R1; // in ohm
13 I_T = V1/R_T; // in A
14 I1 = (R2/(R2+R3)) * I_T; // in A
15 R = (R1*R3)/(R1+R3); // in ohm
16 R_T = R2+R; // in ohm
17 I_T = V2/R_T; // in A
18 I2 = (R1/(R1+R3))*I_T; // in A
19 Ra = (R1*R2)/(R1+R2); // in ohm asumed
20 I_T = 2; // in A
21 I3 = (Ra/(Ra+R3))*I_T; // in A
22 // current in 8 ohm resistor
23 I = I1+I2+I3; // in A
24 disp(I,"The current in 8 ohm resistor in A is");

```

Scilab code Exa 2.20 Thevenins equivalent circuit

```
1 // Exa 2.20
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 5; // in ohm
8 R2 = 10; // in ohm
9 R3 = 5; // in ohm
10 V1 = 60; // in v
11 V2 = 30; // in V
12 // -R1*i1 - R3*i1 - V2+V1 = 0;
13 i1 = (V2-V1)/(R1+R3); // in A
14 V_acrossR3 = R3*i1; // in V
15 Vth = V_acrossR3+V1; // in V
16 V_AB = Vth; // in V
17 disp(V_AB, "The Thevenins voltage in V is");
18 R = (R1*R3)/(R1+R3); // in ohm
19 Rth = R2+R; // in ohm
20 disp(Rth, "The Thevenins resistance in ohm is");
```

Scilab code Exa 2.21 Current in 5 ohm resistor

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

```

11 V = 15; // in V
12 I2 = 6; // in A
13 // -R1*I1 - R3*I1 + R3*I2 + V = 0;
14 I1 = (V+R3*I2)/(R1+R3); // in A
15 Vth = I2/R3; // in V
16 V_CD = Vth; // in V
17 Rth = (R1*R3)/(R1+R3)+R2; // in ohm
18 I = Vth/(Rth+R_L); // in A
19 disp(I,"The current flowing through 5 ohm resistor
    in A is");

```

Scilab code Exa 2.22 Norton equivalent circuit

```

1 // Exa 2.22
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R1 = 20; // in ohm
8 R2 = 5; // in ohm
9 R3 = 3; // in ohm
10 R4 = 2; // in ohm
11 V = 30; // in V
12 I1=4; // in A
13 V1= I1*R3; // in V
14 // R1*I -R2*I+V = 0;
15 I = V/(R1+R2); // in A
16 V_acrossR2= R2*I; // in V
17 V_AB = V_acrossR2-V1; // in V
18 Vth = abs(V_AB); // in V
19 Rth = (R1*R2)/(R1+R2)+R3+R4; // in ohm
20 disp(Rth,"The value of Rth in ohm is");
21 I_N = Vth/Rth; // in A
22 disp(I_N,"The value of I_N in A is");

```

Scilab code Exa 2.23 Vth and Rth

```
1 // Exa 2.23
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 2; // in ohm
8 R2 = 4; // in ohm
9 R3 = 6; // in ohm
10 R4 = 4; // in ohm
11 V = 16; // in v
12 I1= 8; // in A
13 V1= I1*R2; // in V
14 I2= 16; // in A
15 V2= I2*R3; // in V
16 // Applying KVL :  $R2*I+V1+R3*I-V2+V+R1*I$ 
17 I= (V2-V1-V)/(R1+R2+R3); // in A
18 Vth= V2-R3*I; // in V
19 Rth= (R1+R2)*R3/((R1+R2)+R3)+R4; // in ohm
20 disp(Vth,"The value of Vth in volts is : ")
21 disp(Rth,"The value of Rth in ohm is : ")
```

Scilab code Exa 2.24 Load resistance

```
1 // Exa 2.24
2 clc;
3 clear;
4 close;
5 format('v',5)
```

```

6 // Given data
7 R1 = 3; // in ohm
8 R2 = 2; // in ohm
9 R3 = 1; // in ohm
10 R4 = 8; // in ohm
11 R5 = 2; // in ohm
12 V = 10; // in V
13 R = ((R1+R2)*R5)/((R1+R2)+R5); // in ohm
14 Rth = R + R3; // in ohm
15 R_L = Rth; // in ohm
16 disp(R_L,"The value of load resistance in ohm is");

```

Scilab code Exa 2.25 Load resistance and maximum power

```

1 // Exa 2.25
2 clc;
3 clear;
4 close;
5 format('v',8)
6 // Given data
7 V = 250; // in V
8 R1 = 10; // in ohm
9 R2 = 10; // in ohm
10 R3 = 10; // in ohm
11 R4 = 10; // in ohm
12 I2 = 20; // in A.
13 //Applying KVL in GEFHG :  $-R1*I1 - R2*I1 - R2*I2 + V = 0$ ;
14 I1 = (V - R2*I2)/(R1+R2); // in A
15 V_AB = R3*I2 + V - R1*I1; // in V
16 Vth = V_AB; // in V
17 Rth = (R1*R2)/(R1+R2) + R3 + R4; // in ohm
18 R_L = Rth; // in ohm
19 disp(R_L,"The value of R_L in ohm is");
20 Pmax = (Vth^2)/(4*R_L); //maximum power in W

```

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

Scilab code Exa 2.26 Value of current

```
1 // Exa 2.26
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R1 = 2; // in ohm
8 R2 = 4; // in ohm
9 R_L = 4; // in ohm
10 V1 = 6; // in v
11 V2 = 12; // in V
12 //  $-R2 \cdot I_x - R1 \cdot I_x - V1 + V2 = 0$ ;
13 Ix = (V2-V1)/(R1+R2); // in A
14 Vth = V1+R1*Ix; // in V
15 Rth = (R1*R2)/(R1+R2); // in ohm
16 I_N = Vth/Rth; // in A
17 I = (I_N*Rth)/(Rth+R_L); // in A
18 disp(I,"The current in A is");
19
20 // 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

```
1 // Exa 2.27
2 clc;
3 clear;
4 close;
```

```

5 format('v',5)
6 // Given data
7 R1 = 3; // in ohm
8 R2 = 6; // in ohm
9 R_L = 4; // in ohm
10 V = 27; // in V
11 I=3; // in A
12 // -I1+I2= I      (i)
13 // Applying KVL: I1*R1+I2*R2=V  (ii)
14 A= [-1 R1; 1 R2];
15 B= [I V]
16 I= B*A^-1; // Solving eq(i) and (2) by Matrix method
17 I1= I(1); // in A
18 I2= I(2); // in A
19 Vth= R2*I2; // in V
20 Rth= R1*R2/(R1+R2); // in ohm
21 // current in 4 ohm resistor
22 I= Vth/(Rth+R_L); // in A
23 disp(I,"The current in 4 ohm resistor in A is : ")

```

Scilab code Exa 2.28 Current in 20 ohm resistor

```

1 // Exa 2.28
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R1 = 20; // in ohm
8 R2 = 12; // in ohm
9 R3 = 8; // in ohm
10 V1 = 90; // in V
11 V2 = 60; // in V
12 R_T = R1 + ((R2*R3)/(R2+R3)); // in ohm
13 I_T = V1/R_T; // in A

```

```

14 I1 = I_T; // in A
15 R_T = R2 + ((R1*R3)/(R1+R3)); // in ohm
16 I_T = V2/R_T; // in A
17 I2 = (R3/(R3+R1))*I_T; // in A
18 R_T = R1 + ((R2*R3)/(R2+R3)); // in ohm
19 I_T = 2; // in A (given)
20 R = (R2*R3)/(R2+R3); // in ohm
21 I3 = (R/(R1+R))*I_T; // in A
22 // current in 20 ohm resistor
23 I20 = I1-I2-I3; // in A
24 disp(I20,"The current in 20 ohm resistor in A is");

```

Scilab code Exa 2.29 Current in resistor R2

```

1 // Exa 2.29
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R1 = 10; // in ohm
8 R2 = 20; // in ohm
9 R3 = 60; // in ohm
10 R4 = 30; // in ohm
11 E1 = 120; // in V
12 E2 = 60; // in V
13 R_T = ((R2*R3)/(R2+R3)) + R4+R1; // in ohm
14 I_T = E1/R_T; // in A
15 I1 = (R3/(R2+R3))*I_T; // in A
16 R_T = ( ((R1+R4)*R2)/((R1+R4)+R2) ) + R3; // in ohm
17 I_T = E2/R_T; // in A
18 I2 = ((R1+R4)/(R1+R4+R2))*I_T; // in A
19 // current through R2 resistor
20 I= I1+I2; // in A
21 disp(I,"The current through R2 resistor in A is");

```

Scilab code Exa 2.30 Current in all resistor

```
1 // Exa 2.30
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 4; // in ohm
8 R2 = 4; // in ohm
9 R3 = 8; // in ohm
10 Ig = 3; // in A
11 V = 15; // in V
12 I1 = R1/(R1+R2)*Ig; // in A
13 I2 = -I1; // in A
14 I3 = 0; // in A
15 R_T = ((R1+R2)*R3)/((R1+R2)+R3); // in ohm
16 I_T = V/R_T; // in A
17 I_2 = R3/(R1+R2+R3)*I_T; // in A
18 I_1 = I_2; // in A
19 // Total current through upper 4 resistor
20 tot_cur_up_4ohm = I1+I2; // in A
21 // Total current through lower 4 resistor
22 tot_cur_low_4ohm = I_1+I_2; // in A
23 // Total current through 8 resistor
24 tot_cur_8ohm = I3+I_T; // in A
25 disp(tot_cur_up_4ohm,"Total current through upper 4
    resistor in A is : ")
26 disp(tot_cur_low_4ohm,"Total current through lower 4
    resistor in A is : ")
27 disp(tot_cur_8ohm,"Total current through 8
    resistor in A is : ")
```

Scilab code Exa 2.31 Current in all resistor

```
1 // Exa 2.31
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 R1 = 5; // in ohm
8 R2 = 5; // in ohm
9 R3 = 10; // in ohm
10 V = 10; // in V
11 Ig = 2; // in A
12 I2 = (R1/R3)*Ig; // in A
13 I1 = I2; // in A
14 I3 = 0; // in A
15 R_T = ((R1+R2)*R3)/((R1+R2)+R3); // in ohm
16 I_T = V/R_T; // in A
17 I_2 = (R3/((R1+R2)+R3))*I_T; // in A
18 I_1 = I_2; // in A
19 I_3 = I_1; // in A
20 // Total current through upper in 5 resistor
21 tot_cur_up_5ohm = I1-I2; // in A
22 // Total current through lower in 5 resistor
23 tot_cur_low_5ohm = I_1+I_2; // in A
24 // Total current through 10 resistor
25 tot_cur_10ohm = I3+I_3; // in A
26 disp(tot_cur_up_5ohm , "The total current through
    upper in 5 resistor in A is");
27 disp(tot_cur_low_5ohm, "The total current through
    lower in 5 resistor in A is");
28 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

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

Scilab code Exa 3.3 Value of current

```
1 // Exa 3.3
2 clc;
3 clear;
4 close;
5 format('v',8)
6 // Given data
7 f = 60; // in Hz
8 Im = 120; // in A
9 t = 1/360; // in sec
10 omega = 2*pi*f; // in rad/sec
11 i = Im*sin(omega*t); // in A
12 disp(i,"The value of current after 1/360 sec in A is
    ");
13 i = 96; // in A
14 // i = Im*sind(omega*t);
15 t = (asin(i/Im))/omega; // in sec
16 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

```
1 // Exa 3.4
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 i1 = 0; // in A
8 i2 = 10; // in A
9 i3 = 20; // in A
10 i4 = 30; // in A
11 i5 = 20; // in A
12 i6 = 10; // in A
```

```

13 n = 6; // unit less
14 Iav = (i1+i2+i3+i4+i5+i6)/n; // in A
15 disp(Iav,"The average value in A is");
16 Irms = sqrt(((i1^2) + (i2^2) + (i3^2) + (i4^2) + (
    i5^2) + (i6^2) )/n); // in A
17 disp(Irms,"The RMS value in A is");
18 k_f = Irms/Iav; // unit less
19 disp(k_f,"The form factor is");
20 Im = 30; // in A
21 k_p = Im/Irms; // unit less
22 disp(k_p,"The peak factor is");

```

Scilab code Exa 3.5 Phase difference

```

1 // Exa 3.5
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 theta1 = 60; // in degree
8 theta2 = -45; // in degree
9 // phase difference
10 phi = theta1-theta2; // in degree
11 disp(phi,"The phase difference in degree is");

```

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

```

1 // Exa 3.6
2 clc;
3 clear;
4 close;
5 format('v',7)

```

```

6 // Given data
7 V1= 60*expm(%i*0*%pi/180); // in V
8 V2= 40*expm(%i*-%pi/3); // in V
9 add_V= V1+V2; // in V
10 diff_V= V1-V2; // in V
11 disp("The sum of V1 and V2 is : ")
12 disp(string(abs(add_V))+ " sin (theta"+string(atan2(
    imag(add_V),real(add_V)))+ " ) V")
13 disp("The difference of V1 and V2 is : ")
14 disp(string(abs(diff_V))+ " sin (theta"+string(atan2(
    imag(diff_V),real(diff_V)))+ " ) V")

```

Scilab code Exa 3.7 Average value effective value and form factor

```

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

```

Scilab code Exa 3.8 Average and RMS value

```

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

```

Scilab code Exa 3.9 Rectangular form of voltage

```

1 // Exa 3.9
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Vm = 100;// in V
8 phi = %pi/6;// in degree
9 Vrms = Vm/(sqrt(2));// in V
10 // Rectangular form of the voltage
11 RectForm= Vrms*expm(%i*phi)
12 disp(RectForm,"Rectangular form of the voltage in V
    is : ")
13 disp("Polar form of the voltage :")
14 disp("Magnitude of voltage in V is : "+string(abs(
    RectForm))+ " V")
15 disp("Angle is : "+string(atan(imag(RectForm),real(
    RectForm)))+ " ")

```

Scilab code Exa 3.10 Phasor diagram

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

Scilab code Exa 3.11 Value of current

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

```

13 i = 10; // in A
14 // i = Im*sind(omega*t);
15 t = (asin(i/Im))/omega; // in sec
16 t = t * 10^3; // in ms
17 disp(t,"The time to reach 10 A in ms is");
18 Iav = Im*0.637; // in A
19 disp(Iav,"The average value in A is");

```

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

```

1 // Exa 3.12
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 Im = 42.42; // in A
8 omega = 628; // in rad/sec
9 t = 1/6.977; // in sec assumed
10 i = Im*sind(omega*t); // in A
11 disp(i,"The maximum value of current in A is");
12 // omega = 2*%pi*f;
13 f = omega/(2*%pi); // in Hz
14 disp(f,"The frequency in Hz is");
15 Irms = Im/(sqrt(2)); // in A
16 disp(Irms,"The rms value in A is");
17 Iav = (2*Im)/%pi; // in A
18 disp(Iav,"The average value in A is");
19 k_f = Irms/Iav;
20 disp(k_f,"The form factor is");

```

Scilab code Exa 3.13 Power factor and RMS value of current

```

1 // Exa 3.13
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 phi = %pi/6;
8 // Power factor
9 powerfactor = cos(phi); // in lag
10 disp(powerfactor,"The power factor is");
11 Im = 22; // in A
12 // The R.M.S value of current
13 Irms = Im/sqrt(2); // in A
14 disp(Irms,"The R.M.S value of current in A is");
15 omega = 314; // in rad/sec
16 // omega = 2*%pi*f;
17 f = omega/(2*%pi); // in Hz
18 disp(f,"The frequency in Hz is");

```

Scilab code Exa 3.14 RMS value average value and form factor

```

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

```

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

Scilab code Exa 3.15 Form factor

```
1 // Exa 3.15
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 A= 2*10; // area under curve for a cycle
8 B= 2; // base of half cycle
9 Vav= 1/2*A/B; // in V
10 // For line AB
11 y1= 0;
12 y2= 10;
13 x1= 0;
14 x2= 1;
15 m_for_AB= (y2-y1)/(x2-x1);
16 // For line BC
17 y1= 10;
18 y2= 0;
19 x1= 1;
20 x2= 2;
21 m_for_BC= (y2-y1)/(x2-x1);
22 Vrms= sqrt((integrate('(m_for_AB*t)^2','t',0,1)+
    integrate('(m_for_BC*t+20)^2','t',1,2))/2); // in
    V
23 kf= Vrms/Vav;
24 disp(kf,"The form factor is : ")
```

Chapter 4

Three Phase AC Circuits

Scilab code Exa 4.1 Current and power consumed

```
1 // Exa 4.1
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R = 10; // inohm
8 V = 230; // in V
9 f = 50; // in Hz
10 I = V/R; // in A
11 disp(I,"The current in A is");
12 P =V*I; // in W
13 disp(P,"The power consumed in W is");
14 Vm = sqrt(2)*V; // in V
15 Im =sqrt(2)*I; // in A
16 omega = 2*%pi*f; // in rad/sec
17 //Equation for voltage: V = Vm*sind(omega*t)
18 //Equation for current: i = Im*sind(omega*t)
19 disp("Voltage equation : v = "+string(Vm)+" sin (" +
    string(round(omega))+ " t)")
20 disp("Current equation : i = "+string(Im)+" sin (" +
```

```
string(round(omega))+” t)”)
```

Scilab code Exa 4.2 Instantaneous power and average power

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

Scilab code Exa 4.3 Inductive reactance

```
1 // Exa 4.3
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 I = 10; // in A
8 V = 230; // in V
9 f = 50; // in Hz
10 X_L = V/I; // in ohm
11 disp(X_L,"Inductive reactance in ohm is");
12 // X.L = 2*%pi*f*L;
```

```

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

```

Scilab code Exa 4.4 Capacitive reactance

```

1 // Exa 4.4
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // GIven data
7 C = 318; // in F
8 C = C * 10^-6; // in F
9 V = 230; // in V
10 f = 50; // in Hz
11 X_C = 1/(2*%pi*f*C); // in ohm
12 disp(X_C,"The capacitive reactance in ohm is");
13 I = V/X_C; // in A
14 disp(I,"The R.M.S value of current in A is");
15 Vrms = V; // in V
16 Irms = I; // in A
17 Vm = Vrms*sqrt(2); // in V
18 Im = Irms*sqrt(2); // in A
19 omega = 2*%pi*f; // in rad/sec

```

```

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

```

Scilab code Exa 4.5 Circuit current

```

1 // Exa 4.5
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R = 7; // in ohm
8 L = 31.8; // in mH
9 L = L * 10^-3; // in H
10 V = 230; // in V
11 f = 50; // in Hz
12 X_L = 2*%pi*f*L; // in ohm
13 Z = sqrt( (R^2)+(X_L^2) ); // in ohm
14 I = V/Z; // in A
15 disp(I,"The circuit current in A is");
16 // tand(phi) = X_L/R;
17 phi = atand(X_L/R); // in degree lag
18 disp(phi,"The phase angle in degree is");
19 // Power factor
20 powerfactor = cosd(phi); // in lag
21 disp(powerfactor,"The power factor is");
22 P = V*I*cosd(phi); // in W
23 disp(P,"The power consumed in W is");

```

Scilab code Exa 4.6 Value of R and L

```
1 // Exa 4.6
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 400; // in W
8 f = 50; // in Hz
9 V = 120; // in V
10 phi= acosd(0.8); // in
11 // P =V*I*cos(phi);
12 I = P/(V*cosd(phi)); // in A
13 Z= V/I; // in ohm
14 Z= Z*expm(%i*phi*%pi/180); // ohm
15 R= real(Z); // in ohm
16 XL= imag(Z); // in ohm
17 // Formula XL= 2*%pi*f*L
18 L= XL/(2*%pi*f); // in H
19 disp(R,"The value of R in      is : ")
20 disp(L,"The value of L in H is : ")
```

Scilab code Exa 4.7 Active and reactive component of current

```
1 // Exa 4.7
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R = 17.32; // in ohm
```

```

8 L = 31.8; // in mH
9 L = L * 10^-3; // in H
10 V = 200; // in V
11 f = 50; // in Hz
12 X_L = 2*%pi*f*L; // in ohm
13 Z = sqrt( (R^2) + (X_L^2) ); // in ohm
14 I = V/Z; // in A
15 phi =acosd( R/Z); // in
16 ActiveCom= I*cosd(phi); // in A
17 ReactiveCom= I*sind(phi); // in A
18 disp(ActiveCom,"The active component of current in A
      is : ")
19 disp(ReactiveCom,"The reactive component of current
      in A is : ")
20 P= V*I*cosd(phi); // in W
21 disp(P,"The active power in W is : ")
22 Q= V*I*sind(phi); // in VAR
23 disp(Q,"The reactive power in VAR is : ")
24
25 // 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

```

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

```

```

12 Im = 10.8; // in A
13 I = Im/sqrt(2); // in A
14 V_R = I*R; // in V
15 disp(V_R,"The voltage across 20 resistor in V is :
    ")
16 //Vc = I*X_C and X_C = 1/omega*C;
17 omega = 2*pi*f; // in rad/sec
18 Vc = I * 1/(omega*C); // in V
19 disp(Vc,"The voltage across 200 F capacitor in V
    is");
20 V = sqrt( (V_R^2) + (Vc^2) ); // in V
21 disp(V,"The voltage across the circuit in V is");

```

Scilab code Exa 4.9 Resistance and inductance

```

1 // Exa 4.9
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 f= 60; // in Hz
8 disp("Part (a)")
9 Z= 12+30*i;
10 R= real(Z); // in ohm
11 XL= imag(Z); // in ohm
12 // Formula XL= 2*pi*f*L
13 L= XL/(2*pi*f); // in H
14 L= L*10^3; // in mH
15 disp(R,"The value of resistance in is : ")
16 disp(L,"The value of inductance in mH is : ")
17 L= L*10^-3; // in H
18 disp("Part (b)")
19 Z= 0-60*i;
20 R= real(Z); // in ohm

```

```

21 XC= (abs(imag(Z))); // in ohm
22 // Formula XC= 1/(2*%pi*f*C)
23 C= 1/(2*%pi*XC*f); // in H
24 C= C*10^6; // in F
25 disp(R,"The value of resistance in      is : ")
26 disp(C,"The value of inductance in F  is : ")
27 C= C*10^-6; // in F
28 disp("Part (c)")
29 Z= 20*expm(60*i*%pi/180)
30 R= real(Z); // in ohm
31 XL= imag(Z); // in ohm
32 // Formula XL= 2*%pi*f*L
33 L= XL/(2*%pi*f); // in H
34 L= L*10^3; // in mH
35 disp(R,"The value of resistance in      is : ")
36 disp(L,"The value of inductance in mH is : ")

```

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

```

1 // Exa 4.10
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R = 120; // in ohm
8 XC = 250; // in ohm
9 I = 0.9; // in A
10 Z= R-i*XC; // in ohm
11 phi= atand(imag(Z),real(Z))
12 V=I*Z; // in V
13 VR = I*R; // in V
14 VC= I*XC; // in V
15 P= abs(V)*I*cosd(phi); // in W
16 Q= abs(V)*I*sind(phi); // in VAR

```



```

17 disp(cosd(phi),"The power factor is : ")
18 disp("Supply voltage : ")
19 disp("Magnitude is : "+string(abs(V))+ " V and angle
      is : "+string(atan(imag(V),real(V)))+ " ")
20 disp(VR,"The voltage across resistance in V is : ")
21 disp(VC,"The voltage across capacitance in V is : ")
22 disp(P,"The active power in W is : ")
23 disp(Q,"The reactive power in VAR is : ")

```

Scilab code Exa 4.11 Impedance current power factor and power consumed

```

1 // Exa 4.11
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 V = 230; // in V
8 f = 50; // in Hz
9 L = 0.06; // in H
10 R = 2.5; // in ohm
11 C = 6.8; // in F
12 C = C * 10^-6; // in F
13 X_L = 2*%pi*f*L; // in ohm
14 X_C = 1/(2*%pi*f*C); // in ohm
15 Z = sqrt( (R^2) + ((X_L-X_C)^2) ); // in ohm
16 disp(Z,"The impedance in ohm is");
17 I = V/Z; // in A
18 disp(I,"The current in A is");
19 // tan(phi) = (X_L-X_C)/R;
20 phi = atand( (X_L-X_C)/R ); // in lead
21 disp("The phase angle between current and voltage is
      : "+string(abs(phi))+ " lead");
22 phi = acosd(R/Z);
23 disp("The power factor is : "+string(cosd(phi))+ "

```

```

    lead");
24 P = V*I*cosd(phi); // in W
25 disp(P,"The power consumed in W is");

```

Scilab code Exa 4.12 The resonant frequency

```

1 // Exa 4.12
2 clc;
3 clear;
4 close;
5 format('v',9)
6 // Given data
7 R = 100; // in ohm
8 L = 100; // in H
9 L = L * 10^-6; // in H
10 C = 100; // in pF
11 C = C * 10^-12; // in F
12 V = 10; // in V
13 // The resonant frequency
14 f_r = 1/(2*pi*sqrt(L*C)); // in Hz
15 disp(f_r,"The resonant frequency in Hz is");
16 // current at resonance
17 Ir = V/R; // in A
18 disp(Ir,"The current at resonance in A is");
19 X_L = 2*pi*f_r*L; // in ohm
20 // voltage across L at resonance
21 V_L = Ir*X_L; // in V
22 disp(V_L,"The voltage across L at resonance in V is"
    );
23 X_C = X_L; // in ohm
24 // voltage across C at resonance
25 V_C = Ir*X_C; // in V
26 disp(V_C,"The voltage across C at resonance in V is"
    );
27 Q= 1/R*sqrt(L/C);

```

28 `disp(Q,"The Q-factor is : ")`

Scilab code Exa 4.13 Frequency at resonance

```
1 // Exa 4.13
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R = 10; // in ohm
8 L = 0.2; // in H
9 C = 40; // in F
10 C = C * 10^-6; // in F
11 V = 100; // in V
12 f_r = 1/(2*%pi*sqrt(L*C)); // in Hz
13 disp(f_r,"The frequency at resonance in Hz is");
14 Im = V/R; // in A
15 disp(Im,"The current in A is");
16 Pm = (Im^2)*R; // in W
17 disp(Pm,"The power in W is");
18 // voltage across R
19 V_R = Im*R; // in V
20 disp(V_R,"The voltage across R in V is");
21 X_L = 2*%pi*f_r*L; // in ohm
22 // voltage across L
23 V_L = Im*X_L; // in V
24 disp(V_L,"The voltage across L in V is");
25 X_C = 1/(2*%pi*f_r*C); // in ohm
26 // voltage across C
27 V_C = Im*X_C; // in V
28 disp(V_C,"The voltage across C in V is");
29 omega = 2*%pi*f_r; // in rad/sec
30 Q = (omega*L)/R;
31 disp(Q,"The quality factor is");
```

```

32 del_F = R/(4*%pi*L);
33 f1 = f_r-del_F;// in Hz
34 f2 = f_r+del_F;// in Hz
35 disp("The half power frequencies are : "+string(f1)+
      " Hz and "+string(f2)+" Hz");
36 BW = f2-f1;// in Hz
37 disp(BW,"The bandwidth in Hz is : ")

```

Scilab code Exa 4.14 Bandwidth

```

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

```

Scilab code Exa 4.15 Half power points

```

1 // Exa 4.15
2 clc;
3 clear;

```

```

4 close;
5 format('v',6)
6 // Given data
7 R = 1000; // in ohm
8 L = 100; // in mH
9 L = L * 10^-3; // in H
10 C = 10; // in F
11 C = C * 10^-12; // in F
12 f_r = 1/(2*pi*sqrt(L*C)); // in Hz
13 disp(f_r*10^-3,"The resonant frequency in kHz is");
14 Q = (1/R)*(sqrt(L/C));
15 disp(Q,"The quality factor is");
16 f1 = f_r - R/(4*pi*L); // in Hz
17 f1 = f1 * 10^-3; // in kHz
18 f2 = f_r + R/(4*pi*L); // in Hz
19 f2 = f2 * 10^-3; // in kHz
20 disp("The half point frequencies are : "+string(f1)+
      " Hz and "+string(f2)+" Hz")

```

Scilab code Exa 4.16 Power factor and power consumed

```

1 // Exa 4.16
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R = 20; // in ohm
8 L = 31.8; // in mH
9 L = L * 10^-3; // in H
10 V = 230; // in V
11 f = 50; // in Hz
12 I_R = V/R; // in A
13 X_L = 2*pi*f*L; // in ohm
14 I_L = V/X_L; // in A

```

```

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

```

Scilab code Exa 4.17 Power factor and power consumed

```

1 // Exa 4.17
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 C = 50;// in F
8 C = C * 10^-6;// in F
9 R = 20;// in ohm
10 L = 0.05;// in H
11 V = 200;// in V
12 f = 50;// in Hz
13 X_C = 1/(2*%pi*f*C);// in ohm
14 Z1 = X_C;// in ohm
15 I1 = V/X_C;// in A
16 X_L = 2*%pi*f*L;// in ohm
17 Z2 = sqrt( (R^2) + (X_L^2) );// in ohm
18 I2 = V/Z2;// in A
19 // tan(phi2) = X_L/R;
20 phi2 = atand(X_L/R);// in degree
21 phi1 = 90;// in degree
22 I_cos_phi = I1*cosd(phi1) + I2*cosd(phi2);// in A
23 I_sin_phi = I1*sind(phi1) - I2*sind(phi2);// in A
24 phi= atand(I_sin_phi/I_cos_phi);// in
25 I= sqrt(I_cos_phi^2+I_sin_phi^2);// in A

```

```

26 P= V*I*cosd(phi); // in W
27 disp(I,"The line current in A is : ")
28 disp("The power factor is : "+string(cosd(phi))+
    lag");
29 disp(P,"The power consumed in W is : ")

```

Scilab code Exa 4.18 Power factor

```

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

```

Scilab code Exa 4.19 Supply current and power factor

```

1 // Exa 4.19
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R1 = 50; // in ohm

```

```

 8 L = 318; // in mH
 9 L = L * 10^-3; // in H
10 R2 = 75; // in ohm
11 C = 159; // in F
12 C = C * 10^-6; // in F
13 V = 230; // in V
14 f = 50; // in Hz
15 XL= 2*%pi*f*L; // in ohm
16 Z1= R1+XL*%i; // in ohm
17 I1= V/Z1; // in A
18 XC= 1/(2*%pi*f*C); // in ohm
19 Z2= R2-%i*XC; // in ohm
20 I2= V/Z2; // in A
21 I= I1+I2; // in A
22 phi= atand(imag(I),real(I)); // in
23 disp("Supply current : ")
24 disp("Magnitude is : "+string(abs(I))+ " A")
25 disp("Angle : "+string(phi)+" ")
26 disp("Power factor is : "+string(cosd(phi))+ " lag")

```

Scilab code Exa 4.20 Supply current and power factor

```

1 // Exa 4.20
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V=250; // in V
8 Z1= 70.7+70.7*%i; // in ohm
9 Z2= 120+160*%i; // in ohm
10 Z3= 120+90*%i; // in ohm
11 Y1= 1/Z1; // in S
12 Y2= 1/Z2; // in S
13 Y3= 1/Z3; // in S

```



```

14 Y_T= Y1+Y2+Y3; // in S
15 phi= atand(imag(Y_T),real(Y_T)); // in
16 disp("Total admittance of the circuit : ")
17 disp("Magnitude is : "+string(abs(Y_T))+ " mho")
18 disp("Angle is : "+string(phi)+" ")
19 I= V*Y_T; // in A
20 disp("The supply current : ")
21 disp("Magnitude is : "+string(abs(I))+ " A")
22 disp("Angle is : "+string(phi)+" ")
23 disp("Power factor is : "+string(cosd(phi))+ " lag
    ")

```

Scilab code Exa 4.21 Power and power factor

```

1 // Exa 4.21
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Vm = 100; // in V
8 phi1= 30; // in
9 Im = 15; // in A
10 phi2= 60; // in
11 V= Vm/sqrt(2)*expm(phi1*i*pi/180); // in V
12 I= Im/sqrt(2)*expm(phi2*i*pi/180); // in A
13 Z= V/I; // in ohm
14 R= real(Z); // in ohm
15 XC= abs(imag(Z)); // in ohm
16 phi= atand(imag(Z),real(Z)); // in
17 P= abs(V)*abs(I)*cosd(phi); // in W
18 disp("The impedance is : "+string(Z)+" ")
19 disp("The resistance is : "+string(R)+" ")
20 disp("The reactance is : "+string(XC)+" ")
21 disp("The power is : "+string(P)+" W")

```

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

Scilab code Exa 4.22 Value of pure inductance

```
1 // Exa 4.22  
2 clc;  
3 clear;  
4 close;  
5 format('v',6)  
6 // Given data  
7 P = 100; // in W  
8 V = 120; // in V  
9 f = 50; // in Hz  
10 I = P/V; // in A  
11 V = 200; // in V  
12 V_R = 120; // in V  
13 V_L = sqrt((V^2) - (V_R^2)); // in V  
14 // V_L = I*X_L;  
15 X_L = V_L/I; // in ohm  
16 // X_L = 2*%pi*f*L;  
17 L = X_L/(2*%pi*f); // in H  
18 disp(L,"The value of pure inductance in H is");  
19  
20 // 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

```
1 // Exa 4.23  
2 clc;  
3 clear;
```

```

4 close;
5 format('v',6)
6 // Given data
7 V=230; // in V
8 f= 50; // in Hz
9 Z1= 10*expm(-30*%i*%pi/180); // in ohm
10 Z2= 20*expm(60*%i*%pi/180); // in ohm
11 Z3= 40*expm(0*%i*%pi/180); // in ohm
12 Y1= 1/Z1; // in S
13 Y2= 1/Z2; // in S
14 Y3= 1/Z3; // in S
15 Y= Y1+Y2+Y3; // in S
16 phi= atand(imag(Y),real(Y)); // in
17 Z=1/Y; // in ohm
18 P= V^2*abs(Y); // in W
19 disp("The circuit admittance is : "+string(abs(Y))+
      mho");
20 disp("The circuit impedance is : "+string(abs(Z))+
      ");
21 disp(P,"The power consumed in W is : ")
22 disp("The power factor is : "+string(cosd(phi))+
      lead")

```

Scilab code Exa 4.24 Current and power absorbed by each branch

```

1 // Exa 4.24
2 clc;
3 clear;
4 close;
5 format('v',8)
6 // Given data
7 Z1= 10+15*%i; // in ohm
8 Z2= 6-8*%i; // in ohm
9 R1= 10; // in ohm
10 R2= 6; // in ohm

```

```

11 I_T= 15; // in A
12 I1= I_T*Z2/(Z1+Z2); // in A
13 I2= I_T*Z1/(Z1+Z2); // in A
14 P1= (abs(I1))^2*R1; // in W
15 P2= (abs(I2))^2*R2; // in W
16 disp(P1,"The value of P1 in W is : ")
17 disp(P2,"The value of P2 in W is : ")

```

Scilab code Exa 4.25 Voltage across the condenser

```

1 // Exa 4.25
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 R = 8; // in ohm
8 L = 0.12; // in H
9 C = 140; // in F
10 C = C * 10^-6; // in F
11 V = 230; // in V
12 f = 50; // in Hz
13 XL = 2*%pi*f*L; // in ohm
14 XC= 1/(2*%pi*f*C); // in ohm
15 Z= R+%i*XL-%i*XC; // in ohm
16 I= V/Z; // in A
17 phi= atand(imag(I),real(I)); // in
18 PowerFactor= cosd(phi);
19 VC= abs(I)*XC; // in V
20 disp("Impedence of the entire circuit : ")
21 disp("Magnitude is : "+string(abs(Z))+");
22 disp("Angle is : "+string(atand(imag(Z),real(Z)))+")
23 disp("Current flowing through the condensor : ")
24 disp("Magnitude is : "+string(abs(I))+");

```

```

25 disp("Angle is : "+string(atan(imag(I),real(I)))+
    ")
26 disp("Power factor of the circuit is : "+string(cosd
    (phi))+ " lag")
27 disp(Vc,"The voltage across the condensor in V is :
    ")

```

Scilab code Exa 4.26 Half power frequencies

```

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

```

Scilab code Exa 4.27 Value of capacitor

```

1 // Exa 4.27
2 clc;
3 clear;

```

```

4 close;
5 format('v',6)
6 // Given data
7 R = 15;// in ohm
8 X_L = 10;// in ohm
9 f_r = 50;// in Hz
10 // X_L = 2*%pi*f_r*L;
11 L = X_L/(2*%pi*f_r);// in H
12 // value of capacitance
13 C = 1/( L*( ((f_r*2*%pi)^2)+((R^2)/(L^2)) ));// in F
14 C = C*10^6;// in F
15 disp(C,"The value of capacitance in F is");

```

Scilab code Exa 4.28 Current and power drawn

```

1 // Exa 4.28
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Z1= 3+4*%i;// in ohm
8 Z2= 6+8*%i;// in ohm
9 V= 230;// in V
10 I1= V/Z1;// in A
11 I2= V/Z2;// in A
12 I_T= I1+I2;// in A
13 phi= atand(imag(I_T),real(I_T));// in
14 P= V*abs(I_T)*cosd(phi);//in V
15 disp("The value of current : ")
16 disp(abs(I_T),"The magnitude in A is : ")
17 disp(phi,"The phase angle in degree is : ")
18 disp(P,"The power drawn from the source in W is : ")

```

Scilab code Exa 4.29 Total power supplied by source

```
1 // Exa 4.29
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Z1= 1.6+%i*7.2;// in ohm
8 Z2= 4+%i*3;// in ohm
9 Z3= 6-%i*8;// in ohm
10 V= 100;// in V
11 Y2= 1/Z2;// in mho
12 disp(Y2,"The admittance in mho is : ")
13 Y3= 1/Z3;// in mho
14 disp(Y3,"The admittance in mho is : ")
15 ZT= Z1+1/(Y2+Y3);
16 phi= atand(imag(ZT),real(ZT));
17 disp("Total circuit impedance : ")
18 disp("Magnitude : "+string(abs(ZT))+" ")
19 disp("Angle : "+string(phi)+" ");
20 IT= V/ZT;// in A
21 PT= V*abs(IT)*cosd(phi);// in W
22 disp(PT,"The total power supplied in W is : ")
```

Scilab code Exa 4.30 Q factor of the circuit

```
1 // Exa 4.30
2 clc;
3 clear;
4 close;
5 format('v',6)
```

```
6 // Given data
7 R = 4; // in ohm
8 L = 0.5; // in H
9 V = 100; // in V
10 f = 50; // in Hz
11 X_L = 2*pi*f*L; // in ohm
12 X_C = X_L; // in ohm
13 // X_C = 1/(2*pi*f*C);
14 C = 1/(X_C*2*pi*f); // in F
15 C = C * 10^6; // in F
16 disp(C,"The value of capacitance in F is");
17 I = V/R; // in A]
18 V_C = I*X_C; // in V
19 disp(V_C,"The voltage across the capacitance in V");
20 omega = 2*pi*f; // in rad/sec
21 Q = (omega*L)/R;
22 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

```
1 // Exa 5.1
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R = 20; // in ohm
8 X_L = 15; // in ohm
9 V_L = 400; // in V
10 f = 50; // in Hz
11 V_Ph = V_L/sqrt(3); // in V
12 Z_Ph = sqrt( (R^2) + (X_L^2) ); // in ohm
13 I_Ph = V_Ph/Z_Ph; // in A
14 I_L = I_Ph; // in A
15 disp(I_L,"The line current in A is");
16 //pf = cos(phi) = R_Ph/Z_Ph;
17 R_Ph = R; // in ohm
18 phi= acosd(R_Ph/Z_Ph);
19 // Power factor
20 pf= cosd(phi); // in
21 disp("The power factor is : "+string(pf)+" lag.");
```

```

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

```

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

```

1 // Exa 5.2
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R_Ph = 16; // in ohm
8 X_L = 12; // in ohm
9 V_L = 400; // in V
10 disp(V_L,"The line voltage in V is");
11 f = 50; // in Hz
12 V_Ph = V_L/sqrt(3); // in V
13 disp(V_Ph,"The phase voltage in V is");
14 Z_Ph = R_Ph + %i*X_L; // in ohm
15 I_Ph= V_Ph/Z_Ph; // in A
16 I_L= I_Ph; // in A
17 phi= atand(imag(I_L),real(I_L));
18 cos_phi= R_Ph/abs(Z_Ph);
19 disp(abs(I_L),"The line current in A is : ")
20 disp(abs(I_Ph),"The line current in A is : ")
21 disp("Power factor is : "+string(cos_phi)+" lagging"
    )
22 P= sqrt(3)*V_L*abs(I_L)*cos_phi; // in W
23 disp(P,"The power absorbed in W is : ")

```

Scilab code Exa 5.3 Resistance and inductance of coil

```

1 // Exa 5.3

```

```

2  clc;
3  clear;
4  close;
5  format('v',7)
6  // Given data
7  P = 1.5; // in kW
8  P = P * 10^3; // in W
9  pf = 0.2; // in lag
10 phi= acosd(pf);
11 V_L = 400; // in V
12 f = 50; // in Hz
13 V_Ph = V_L/sqrt(3); // in V
14 //P = sqrt(3)*V_L*I_L*cos(phi);
15 I_L = P/(sqrt(3)*V_L*cosd(phi)); // in A
16 I_Ph = I_L; // in A
17 Z_Ph = V_Ph/I_Ph; // in ohm
18 R_Ph = Z_Ph*cosd(phi); // in ohm
19 disp(R_Ph,"The Resistance in      is");
20 X_Ph = sqrt( (Z_Ph^2) - (R_Ph^2) ); // in ohm
21 L_Ph = X_Ph/(2*pi*f); // in H
22 disp(L_Ph,"The inductance in H is");

```

Scilab code Exa 5.4 Line current and power absorbed

```

1  // Exa 5.4
2  clc;
3  clear;
4  close;
5  format('v',6)
6  // Given data
7  R = 5; // in ohm
8  L =0.02; // in H
9  V_L = 440; // in V
10 f = 50; // in Hz
11 X_L = 2*pi*f*L; // in ohm

```

```

12 Z_Ph = sqrt( (R^2)+(X_L^2) );// in ohm
13 V_Ph = V_L;// in V
14 I_Ph = V_Ph/Z_Ph;// in A
15 I_L = sqrt(3)*I_Ph;// in A
16 disp(I_L,"The line current in A is");
17 phi = acosd(R/Z_Ph);// in lag
18 P = sqrt(3)*V_L*I_L*cosd(phi);// in W
19 P= P*10^-3;// in kW
20 disp(P,"The total power absorbed in kW is");
21
22 // 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

```

1 // Exa 5.5
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V_L = 400;// in V
8 f = 50;// in Hz
9 I_L = 17.32;// in A
10 pf = 0.8;//in lag
11 I_Ph = I_L/sqrt(3);// in A
12 disp(I_Ph,"The phase current in A is");
13 V_Ph = V_L;// in V
14 Z_Ph = V_Ph/I_Ph;// in ohm
15 phi = acosd(pf)// in lag
16 R_Ph = Z_Ph*cosd(phi);// in ohm
17 disp(R_Ph,"The resistance of coil in is");
18 X_Ph = sqrt( (Z_Ph^2) - (R_Ph^2) );// in ohm
19 // X_Ph = 2*%pi*f*L;

```

```

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

```

Scilab code Exa 5.6 Power factor of the load

```

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

```

Scilab code Exa 5.7 Power factor of circuit

```

1 // Exa 5.7
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 W1 = 2000; // in W
8 W2 = 500; // in W
9 phi = (atand( sqrt(3)*((W1-W2)/(W1+W2)) )); // in lag

```

```

10 // power factor
11 pf= cosd(phi);// lagging
12 disp("Part (i) : Power factor is : "+string(pf)+"
      lagging");
13 W2 = -W2;// in W
14 phi = (atand( sqrt(3)*((W1-W2)/(W1+W2)) ));// in lag
15 // power factor
16 pf= cosd(phi);// lagging
17 disp("Part (ii) : Power factor is : "+string(pf)+"
      lagging");

```

Scilab code Exa 5.8 Power factor of motor at no load

```

1 // Exa 5.8
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 W1 = 375;// in W
8 W2 = -50;// in W
9 // tan(phi) = sqrt(3)*((W1-W2)/(W1+W2));
10 phi = atand(sqrt(3)*((W1-W2)/(W1+W2)));// in degree
11 // power factor
12 pf= cosd(phi);// lag
13 disp("The power factor is : "+string(pf)+" lag.");

```

Scilab code Exa 5.9 Input power factor line current and output

```

1 // Exa 5.9
2 clc;
3 clear;
4 close;

```

```

5 format('v',6)
6 // Given data
7 W1 = 300; // in kW
8 W2 = 100; // in kW
9 V_L= 2000; // in V
10 Eta= 90/100;
11 P = W1+W2; // in kW
12 disp(P,"The power input in kW is");
13 // tan(phi) = sqrt(3)*((W1-W2)/(W1+W2));
14 phi = atand(sqrt(3)*((W1-W2)/(W1+W2)));
15 pf = cosd(phi); // power factor
16 disp(pf,"The power factor is");
17 // P = sqrt(3)*V_L*I_L*cosd(phi);
18 I_L = (P*10^3)/(sqrt(3)*V_L*pf); // in A
19 disp(I_L,"The line current in A is");
20 output = P*Eta; // in kW
21 disp(output,"The power output in kW is");

```

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

```

1 // Exa 5.10
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 12; // in kW
8 P = P * 10^3; // in W
9 V_L = 400; // in V
10 I_L = 20; // in A
11 I_Ph = I_L; // in A
12 disp(I_Ph,"The phase current in A is");
13 V_Ph = V_L/sqrt(3); // in V
14 Z_Ph = V_Ph/I_Ph; // in ohm
15 disp(Z_Ph,"The impedance of load in ohm is");

```

```

16 // P = sqrt(3)*V_L*I_L*cos(phi);
17 phi= acosd(P/(sqrt(3)*V_L*I_L));// in lag
18 // power factor
19 pf= cosd(phi);// lag
20 disp("The power factor is : "+string(pf)+" lag.");

```

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

```

1 // Exa 5.11
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Z_Ph= 8+6%i;// in ohm
8 V_L= 400;// in V
9 V_Ph= V_L/sqrt(3);// in V
10 I_Ph= V_Ph/Z_Ph;// in A
11 I_L= I_Ph;// in A
12 phi= atand(imag(I_L),real(I_L));// in
13 disp(abs(I_L),"The line current in A is : ")
14 // power factor
15 pf= cosd(phi);// lagging
16 disp("Power factor is : "+string(pf)+" lagging")
17 P= sqrt(3)*V_L*abs(I_L)*cosd(phi);// in W
18 disp(P,"The three phase power in W is : ")
19 S= sqrt(3)*V_L*abs(I_L);// in VA.
20 disp(S,"The three phase volt-ampere in VA is : ")

```

Scilab code Exa 5.12 Power and power factor of load

```

1 // Exa 5.12
2 clc;

```



```

3 clear;
4 close;
5 format('v',7)
6 // Given data
7 W1 = 20; // in kW
8 W2 = -5; // in kW
9 P = W1+W2; // in kW
10 disp(P,"The power in kW is : ")
11 phi = (atand( sqrt(3)*((W1-W2)/(W1+W2)) )); // in lag
12 // Power factor of the load
13 pf= cosd(phi)
14 disp(pf,"The power factor of the load is : ");

```

Scilab code Exa 5.13 Reading of two wattmeters

```

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

```

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

```

1 // Exa 5.14
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V_L = 400; // in V
8 f = 50; // in Hz
9 I_L = 17.32; // in A
10 phi = acosd(0.8);
11 I_Ph = I_L/sqrt(3); // in A
12 disp(I_Ph,"The phase current in A is");
13 V_Ph=V_L; // in V
14 Z_Ph = V_Ph/I_Ph; // in ohm
15 Z_Ph= Z_Ph*expm(phi*i*pi/180); // in ohm
16 R= real(Z_Ph); // in ohm
17 XL= imag(Z_Ph); // in ohm
18 L= XL/(2*pi*f); // in H
19 L= L*10^3; // in mH
20 disp(R,"The resistance of the coil in is : ")
21 disp(L,"The inductance of the coil in mH is : ")
22 // The power drawn by each coil
23 P_Ph= V_Ph*I_Ph*cosd(phi); // in W
24 disp(P_Ph,"The power drawn by each coil in W is : ")

```

Scilab code Exa 5.15 Reading of each wattmeter

```

1 // Exa 5.15
2 clc;
3 clear;
4 close;
5 format('v',8)
6 // Given data
7 P = 30; // in kW
8 pf = 0.7;

```

```

9 // cosd(phi) = pf;
10 phi = acosd(pf); // in degree
11 // P = sqrt(3)*V_L*I_L*cosd(phi);
12 theta = 30; // in degree
13 V_LI_L = P/(sqrt(3)*cosd(phi));
14 W1 = V_LI_L*cosd(theta-phi); // in kW
15 disp(W1,"The reading of first wattmeter in kW is");
16 W2 = V_LI_L*cosd(theta+phi); // in kW
17 disp(W2,"The reading of second wattmeter in kW is");

```

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

```

1 // Exa 5.16
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 P = 18; // in kW
8 P= P*10^3; // in W
9 I_L = 60; // in A
10 V_L = 440; // in V
11 f= 50; // in Hz
12 // P = sqrt(3)*V_L*I_L*cosd(phi);
13 phi= acosd(P/(sqrt(3)*V_L*I_L)); // in
14 I_L= I_L*expm(phi*%pi*i/180); // in A
15 I_Ph= I_L; // in A
16 V_Ph= V_L/sqrt(3); // in V
17 Z_Ph= V_Ph/I_Ph; // in ohm
18 R= real(Z_Ph); // in ohm
19 XC=abs(imag(Z_Ph)); // in ohm
20 C = 1/(2*%pi*f*XC); // in F
21 C=C*10^6; // in F
22 // Power factor
23 pf= cosd(phi); // lead

```

```

24 disp("The power factor is : "+string(pf)+" leading")
25 disp(R,"The resistance in      is : ")
26 disp(C,"The capacitance in F is : ");
27 disp("The load is capacitive in nature.")

```

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

```

1 // Exa 5.17
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 V_L = 400; // in V
8 f = 50; // in Hz
9 W1 = 8000; // in W
10 W2 = 4000; // in W
11 W = W1+W2; // in W
12 phi =(atand( sqrt(3)*((W1-W2)/(W1+W2)) )); // in lag
13 P = W; // in W
14 //P = sqrt(3)*V_L*I_L*cosd(phi);
15 I_L = P/(sqrt(3)*V_L*cosd(phi)); // in A
16 V_Ph = V_L/sqrt(3); // in V
17 I_Ph = I_L; // in A
18 Z_Ph = V_Ph/I_Ph; // in ohm
19 Z_Ph= Z_Ph*expm(phi*i*pi/180); // ohm
20 R_Ph= real(Z_Ph); // in ohm
21 XL_Ph= imag(Z_Ph); // in ohm
22 L_Ph= XL_Ph/(2*pi*f); // in H
23 // power factor
24 pf= cosd(phi);
25 disp(pf,"The power factor is : ")
26 disp(I_L,"The line current in A is");
27 disp(Z_Ph,"The impedance of each phase in      is : ")
28 disp(R_Ph,"The resistance of each phase in      is : ")

```

```
)  
29 disp(L_Ph,"The inductance of each phase in H is : ")
```

Chapter 6

Measuring Instruments

Scilab code Exa 6.1 Required shunt resistance

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

Scilab code Exa 6.2 Multiplying factor

```

1 // Exa 6.2
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Rm = 6; // in ohm
8 Rsh = 0.025; // in ohm
9 N = 1 + (Rm/Rsh); // multiplying factor
10 disp(N,"The multiplying factor is");

```

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

```

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

```

Scilab code Exa 6.4 Current range

```

1 // Exa 6.4
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 V=250;// full scale voltage reading in V
8 Rm = 2;// in ohm
9 Rsh = 2;// in m ohm
10 Rsh = Rsh * 10^-3;// in ohm
11 R = 5000;// in ohm
12 Im = V/(Rm+R);// in A
13 Ish = (Im*Rm)/Rsh;// in A
14 // Current range of instrument
15 I = Im+Ish;// in A
16 disp(I,"The current range of instrument in A is");

```

Scilab code Exa 6.5 Percentage error

```

1 // Exa 6.5
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V = 230;// in V
8 I = 35;// in A
9 N = 200;
10 t = 64;// in sec
11 kwh = 500;
12 phi= acosd(0.8);// in
13 Er = N/kwh;// in kWh
14 Et = V*I*cosd(phi)*t;// in Joules
15 Et = Et/3600;// in W hour
16 Et = Et * 10^-3;// in kWh

```



```

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

```

Scilab code Exa 6.6 Percentage error

```

1 // Exa 6.6
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 I = 50; // in A
8 V = 230; // in V
9 N = 61;
10 t = 37; // in sec
11 KWh = 500;
12 phi= acosd(1); // in
13 Er = N/KWh; // in kWh
14 Et = V*I*cosd(phi)*t; // in Joules
15 Et = Et/3600; // in Wh
16 Et = Et*10^-3; // in kWh
17 // Percentage error
18 PerError = ((Er-Et)/Et)*100; // in %
19 disp(PerError,"The percentage error in % is");

```

Scilab code Exa 6.7 Series resistance

```

1 // Exa 6.7
2 clc;
3 clear;
4 close;
5 format('v',9)

```

```

6 // Given data
7 Im = 20; // in mA
8 Im = Im * 10^-3; // in A
9 Vm = 50; // in mV
10 Vm = Vm * 10^-3; // in V
11 V = 500; // in V
12 Rm = Vm/Im; // in ohm
13 Rs = (V/Im)-Rm; // in ohm
14 disp(Rs,"The series resistance in ohm is");

```

Scilab code Exa 6.8 Value of Rs and Rsh

```

1 // Exa 6.8
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Rm = 50; // in ohm
8 Im = 10; // in mA
9 Im = Im * 10^-3; // in A
10 V = 100; // in V
11 Rs = (V/Im)-Rm; // in ohm
12 disp(Rs,"The value of Rs in      is");
13 N = 1/Im;
14 Rsh = Rm/(N-1); // in ohm
15 disp(Rsh,"The value of Rsh in      is");

```

Scilab code Exa 6.9 Percentage error

```

1 // Exa 6.9
2 clc;
3 clear;

```

```

4 close;
5 format('v',5)
6 // Given data
7 I = 40; // in A
8 V = 230; // in V
9 N = 600;
10 t = 46; // in sec
11 phi= acosd(1); // in
12 P = V*I*cosd(phi); // in W
13 P = P * 10^-3; // in kW
14 // 1 kWh = 500 revolution
15 P = P * 500; // in revolution
16 T = (3600/t)*60; // in revolution
17 // Percentage error
18 PerError = ((T-P)/P)*100; // in %
19 disp(PerError,"The percentage error in % is");

```

Scilab code Exa 6.10 Number of revolution

```

1 // Exa 6.10
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 N = 100;
8 I = 20; // in A
9 V = 210; // in V
10 pf = 0.8; // in lad
11 Er = 350; // in rev
12 a = 3.36; // assumed
13 Et = (a*3600)/3600; // in kWh
14 // 1 kWh = 100; // revolution
15 Et = Et*N; // revolution
16 // Percentage error

```

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

Scilab code Exa 6.11 Percentage error

```
1 // Exa 6.11
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 I = 5; // in A
8 V = 230; // in V
9 N = 61; // number of revolution
10 t = 37; // in sec
11 // speed of the disc
12 discSpeed= 500; // in rev/kWh
13 Er = N/discSpeed;
14 Et = (V*I*t)/(3600*100);
15 // percentage error
16 PerError = ((Er-Et)/Et)*100; // in %
17 disp(PerError,"The percentage error in % is");
```

Chapter 8

Magnetic Circuits

Scilab code Exa 8.1 Required current

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

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

```
1 // Exa 8.2
2 clc;
3 clear;
4 close;
5 format('v',8)
6 // Given data
7 N = 300;
8 miu_r = 900;
9 l = 40; // in cm
10 a = 5; // in cm^2
11 R = 100; // in ohm
12 V = 250; // in V
13 miu_o = 4*%pi*10^-7;
14 I = V/R; // in A
15 mmf = N*I; // in AT
16 disp(mmf,"The coil mmf in AT is");
17 H = (N*I)/(1*10^-2); // in AT/m
18 disp(H,"The field strength in AT/m is");
19 B = miu_o*miu_r*H; // in Wb/m^2
20 phi = B*a*10^-4; // in Wb
21 disp(phi,"Total flux in Wb is");
22 S = mmf/phi; // in AT/Wb
23 disp(S,"The reluctance of the ring in AT/Wb is");
24 // Permeance is reciprocal of reluctance
25 Permeance = 1/S; // in Wb/AT
26 disp(Permeance,"Permeance of the ring in Wb/AT is");
```

Scilab code Exa 8.3 Ampere turns

```
1 // Exa 8.3
```

```

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

```

Scilab code Exa 8.4 Total flux in the ring

```

1  // Exa 8.4
2  clc;
3  clear;
4  close;
5  format('v',6)
6  // Given data
7  N = 500;
8  R = 4;// in ohm
9  d = 0.25;// in m
10 a = 700;// in mm^2
11 a = a*10^-6;// in m^2
12 V = 6;// in V
13 miu_r = 550;
14 miu_o = 4*%pi*10^-7;
15 // Evaluation of current by ohm's law
16 I = V/R;// in A
17 l = %pi*d;// in m

```

```

18 H = (N*I)/l;// in A/m
19 // Evaluation of flux density
20 B = miu_o*miu_r*H;// in T
21 // Evaluation of total flux
22 phi = B*a;// in Wb
23 phi= phi*10^3;// in mWb
24 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

```

1 // Exa 8.5
2 clc;
3 clear;
4 close;
5 format('v',8)
6 // Given data
7 d_r = 8;// diameter of ring in cm
8 d_r = d_r*10^-2;// in m
9 d_i = 1;// diameter of iron in cm
10 d_i = d_i * 10^-2;// in m
11 Permeability = 900;
12 gap = 2;// in mm
13 gap = gap * 10^-3;// in m
14 N = 400;
15 I = 3.5;// in A
16 l_i = (%pi*d_r)-gap;// length of iron in m
17 a = (%pi/4)*(d_i^2);// in m^2
18 mmf = N*I;// in AT
19 disp(mmf,"The mmf in AT is");
20 miu_o = 4*%pi*10^-7;
21 miu_r = 900;
22 Si = l_i/(miu_o*miu_r*a);// in AT/Wb
23 miu_r = 1;
24 Sg = gap/(miu_o*miu_r*a);// in AT/Wb
25 S_T = Si+Sg;// in AT/Wb

```



```

26 disp(S_T,"The total reluctance in AT/Wb is");
27 phi = mmf/S_T;// in Wb
28 disp(phi,"The flux in Wb is");
29 // phi = B*a;
30 B = phi/a;// in Wb/m^2
31 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

```

1 // Exa 8.6
2 clc;
3 clear;
4 close;
5 format('v',8)
6 // Given data
7 miu_r = 1400;
8 l = 70;// in cm
9 l = l * 10^-2;// in m
10 a = 5;// in cm^2
11 a = a * 10^-4;// in m^2
12 N = 1000;
13 miu_o = 4*pi*10^-7;
14 S = 1/(miu_o*miu_r*a);// in AT/Wb
15 disp(S,"The reluctance of the magnetic circuit in AT
    /Wb is");
16 format('v',7)
17 // Calculation of inductance of the coil
18 L = (N^2)/S;// in H
19 disp(L,"The inductance of the coil in H is");
20
21 // 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

```
1 // Exa 8.7
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 l1 = 25; // in cm
8 l1 = l1 * 10^-2; // in m
9 miu_o = 4*%pi*10^-7;
10 miu_r = 750;
11 a1 = 2.5*2.5*10^-4; // in m
12 S1 = l1/(miu_o*miu_r*a1); // in AT/Wb
13 l2 = 40; // in cm
14 l2 = l2 * 10^-2; // in m
15 S2 = l2/(miu_o*miu_r*a1); // in AT/Wb
16 phi2 = 2.5*10^-3; // in Wb
17 N = 500;
18 //mmf = phi1*S1 = phi2*S2;
19 phi1 = (phi2*S2)/S1; // in Wb
20 phi = phi1+phi2; // in Wb
21 // Sum of mmf required for AEFB
22 S_AEFB = S2; // in AT/Wb
23 mmfforAEFB = S_AEFB*phi; //mmf for AEFB in AT
24 totalmmf = mmfforAEFB+(phi1*S1); //total mmf in AT
25 // N*I = totalmmf;
26 // Calculation of current
27 I = totalmmf/N; // in A
28 disp(I,"The current in A is");
```

Scilab code Exa 8.8 Exciting current needed in a coil

```
1 // Exa 8.8
2 clc;
```

```

3 clear;
4 close;
5 format('v',6)
6 // Given data
7 a = 16*10^-4; // in m^2
8 lg = 2*10^-3; // in m
9 N = 1000;
10 phi = 4*10^-3; // in Wb
11 miu_r = 2000;
12 miu_o = 4*pi*10^-7;
13 l=25; // length of magnetic in cm
14 w= 20; // in cm (width)
15 t= 4; // in cm (thickness)
16 li= {[w-t]*t/2+[l-t]*t/2-0.2}; // in cm
17 li= li*10^-2; // in m
18 S_T= 1/(miu_o*a)*(li/miu_r+lg)
19 // Calculation of current with the help of flux
20 //phi = mmf/S_T = N*I/S_T;
21 I = (phi*S_T)/N; // in A
22 disp(I,"The current in A is");

```

Scilab code Exa 8.9 Total flux in the ring

```

1 // Exa 8.9
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 N = 500;
8 R = 4; // in ohm
9 d_mean = 0.25; // in m
10 a = 700; // in mm^2
11 a = a * 10^-6; // in m
12 V = 6; // in V

```

```

13 miu_r = 550;
14 miu_o = 4*%pi*10^-7;
15 l_i = %pi*d_mean;// in m
16 S = l_i/(miu_o*miu_r*a);// in AT/Wb
17 I = V/R;// in A
18 // Calculation of mmf
19 mmf = N*I;// in AT
20 // total flux
21 phi = mmf/S;// in Wb
22 phi = phi * 10^6;// in Wb
23 disp(phi,"The total flux in the ring in Wb is");
24
25 // 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

```

1 // Exa 8.10
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 N = 1000;
8 a = 5;// in cm^2
9 a = a * 10^-4;// in m^2
10 l_g = 2;// in mm
11 l_g = l_g * 10^-3;// in m
12 B = 0.5;// in T
13 miu_r= %inf;
14 phi = B*a;// in Wb
15 miu_o = 4*%pi*10^-7;
16 S = l_g/(miu_o*a);// in AT/Wb
17 // Calculation of current with the help of flux

```

```

18 //phi = mmf/S = N*I/S;
19 I = (phi*S)/N;// in A
20 disp(I,"The current required in A is");
21 // Evaluation of coil inductance
22 L = (N^2)/S;// in H
23 disp(L,"The coil inductance in H is");

```

Scilab code Exa 8.11 Ampere turns

```

1 // Exa 8.11
2 clc;
3 clear;
4 close;
5 format('v',8)
6 // Given data
7 l_g = 4;// in mm
8 l_g = l_g * 10^-3;// in m
9 Bg = 1.3;// in Wb/m^2
10 miu_o = 4*pi*10^-7;
11 Hg = Bg/miu_o;
12 // Ampere turns for the gap
13 AT = Hg*l_g;// in AT
14 disp(AT,"The ampere turns in AT is");

```

Scilab code Exa 8.12 Required MMF

```

1 // Exa 8.12
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 phi = 0.015;// in Wb

```

```

8 l_g = 2.5; // in mm
9 l_g = l_g * 10^-3; // in m
10 a = 200; // in cm^2
11 a = a * 10^-4; // in m^2
12 miu_o = 4*%pi*10^-7;
13 // Calculation of reluctance of air gap
14 Sg = l_g/(miu_o*a); // in AT/Wb
15 mmf = phi*Sg; // in AT
16 disp(mmf,"The mmf required in AT is");

```

Scilab code Exa 8.13 Flux density of air gap

```

1 // Exa 8.13
2 clc;
3 clear;
4 close;
5 format('v',9)
6 // Given data
7 a = 12; // in cm^2
8 a = a * 10^-4; // in m^2
9 l_i = 50; // in cm
10 l_i = l_i * 10^-2; // in m
11 l_g = 0.4; // in cm
12 l_g = l_g * 10^-2; // in m
13 N = 2*400;
14 I = 1; // in A
15 miu_r = 1300;
16 miu_o = 4*%pi*10^-7;
17 Si = l_i/(miu_o*miu_r*a); // in AT/Wb
18 disp(Si,"The reluctance of magnetic circuit in AT/Wb
    is");
19 miu_r = 1;
20 Sg = l_g/(miu_o*miu_r*a); // in AT/Wb
21 disp(Sg,"The reluctance of air gap in AT/Wb is");
22 S_T = Si+Sg; // in AT/Wb

```

```

23 disp(S_T,"Total reluctance in AT/Wb is");
24 format('v',7)
25 mmf = N*I;// in AT
26 phi_T = mmf/S_T;// in Wb
27 phi_T= phi_T*10^3;// in mWb
28 disp(phi_T,"The total flux in mWb is");
29 phi_T= phi_T*10^-3;// in Wb
30 //phi_T =B*a;
31 B = (phi_T)/a;// in Wb/m^2
32 disp(B,"The flux density of air gap in Wb/m^2 is");

```

Scilab code Exa 8.14 Required current

```

1 // Exa 8.14
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 l = 30;// in cm
8 d = 2;// in cm
9 N = 500;
10 phi = 0.5;// in mWb
11 Airgap = 1;// in mm
12 miu_r = 4000;
13 miu_o = 4*%pi*10^-7;
14 Ac = (%pi/4)*(d^2);// in cm^2
15 Ac = Ac * 10^-4;// in m^2
16 l_i = (l*10^-2)-(Airgap*10^-3);// in m
17 l_g = 1;// in mm
18 l_g = l_g * 10^-3;// in m
19 Si = l_i/(miu_r*miu_o*Ac);// in AT/Wb
20 Sg = l_g/(miu_o*Ac);// in AT/Wb
21 S =Si+Sg;// in AT/Wb
22 //phi = mmf/S = N*I/S;

```

```
23 I = (phi*10^-3*S)/N; // in A
24 disp(I,"The current required in A is");
```

Scilab code Exa 8.15 Coil inductance

```
1 // Exa 8.15
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 l = 40; // in cm
8 l = l * 10^-2; // in m
9 a = 4; // in cm^2
10 a = a * 10^-4; // in m^2
11 miu_r = 1000;
12 miu_o = 4*pi*10^-7;
13 l_g = 1; // in mm
14 l_g = l_g * 10^-3; // in m
15 N = 1000;
16 l_i = l-l_g; // in m
17 Si = l_i/(miu_r*miu_o*a); // in AT/Wb
18 Sg = l_g/(miu_o*a); // in AT/Wb
19 S = Si+Sg; // in AT/Wb
20 // The inductance of the coil
21 L = (N^2)/S; // in H
22 disp(L,"The inductance of the coil in H is");
```

Chapter 9

Single Phase Transformer

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

```
1 // Exa 9.1
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V1 = 3000; // in V
8 V2 = 300; // in V
9 N2 = 86; // in Turns
10 Rating = 60*10^3; // in VA
11 K = V2/V1;
12 //Transformer ratio , N2/N1 = K;
13 N1 = N2/K; // in turns
14 disp(N1,"The numbers of primary turns is");
15 I2 = Rating/V2; // in A
16 disp(I2,"The secondary full load current in A is");
17 I1 = Rating/V1; // in A
18 disp(I1,"The primary full load current in A is");
```

Scilab code Exa 9.2 Maximum flux density

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

Scilab code Exa 9.3 Maximum core flux

```
1 // Exa 9.3
2 clc;
3 clear;
4 close;
5 format('v',5)
6 // Given data
7 N1 = 500;
8 N2 = 40;
9 E1 = 3000; // in V
10 f = 50; // in Hz
11 K = N2/N1;
12 Rating = 25*10^3; // in VA
13 I1 = Rating/E1; // in A
14 disp(I1,"The primary full load current in A is");
15 I2 = I1/K; // in A
```

```

16 disp(I2,"The secondary full load current in A is");
17 // K = E2/E1;
18 E2 = K*E1;// in V
19 disp(E2,"The secondary emf in V is");
20 // e.m.f equation of the transformer , E1 = 4.44*
    phi_m*f*N1;
21 phi_m = E1/(4.44*f*N1);// in Wb
22 phi_m = phi_m*10^3;// in mWb
23 disp(phi_m,"The maximum core flux in mWb is");

```

Scilab code Exa 9.4 Two component of current

```

1 // Exa 9.4
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Rating = 25;// in KVA
8 f = 50;// in Hz
9 Io = 15;// in A
10 Wo = 350;// in W
11 Vo = 230;// in V
12 // No load power factor
13 phi_o = acosd(Wo/(Vo*Io));
14 // active component of current
15 Ic = Io*cosd(phi_o);// in A
16 disp(Ic,"The active component of current in A is");
17 // magnetizing component of current
18 Im = Io*sind(phi_o);// in A
19 disp(Im,"The magnetizing component of current in A
    is");

```

Scilab code Exa 9.5 Equivalent Resistance reactance and impedance referred to primary

```

1 // Exa 9.5
2 clc;
3 clear;
4 close;
5 format('v',8)
6 // Given data
7 V1 = 2200; // in V
8 V2 = 110; // in V
9 R1 = 1.75; // in ohm
10 R2 = 0.0045; // in ohm
11 X1 = 2.6; // in ohm
12 X2 = 0.0075; // in ohm
13 K = V2/V1;
14 //R1e = R1+R_2 = R1 + (R2/(K^2));
15 R1e = R1 + (R2/(K^2)); // in ohm
16 disp(R1e,"Equivalent resistance referred to primary
    in ohm is");
17 // R2e = R2+R_1 = R2+((K^2)*R1);
18 R2e = R2+((K^2)*R1); // in ohm
19 disp(R2e,"Equivalent resistance referred to
    secondary in ohm is");
20 //X1e = X1+X_2 = X1+(X2/(K^2));
21 X1e = X1+(X2/(K^2)); // in ohm
22 disp(X1e,"Equivalent reactance referred to primary
    in ohm is");
23 // X2e = X2+X_1 = X2 + ((K^2)*X1);
24 X2e = X2 + ((K^2)*X1); // in ohm
25 disp(X2e,"Equivalent reactance referred to secondary
    in ohm is");
26 Z1e= R1e+%i*X1e; // in ohm
27 Z2e= R2e+%i*X2e; // in ohm
28 disp(abs(Z1e),"Equivalent impedance referred to
    primary in ohm is : ")
29 disp(abs(Z2e),"Equivalent impedance referred to
    secondary in ohm is : ")

```

Scilab code Exa 9.6 Total copper loss

```
1 // Exa 9.6
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 V1 = 2200; // in V
8 V2 = 440; // in V
9 R1 = 0.3; // in ohm
10 R2 = 0.01; // in ohm
11 X1 = 1.1; // in ohm
12 X2 = 0.035; // in ohm
13 K = V2/V1;
14 Rating = 100; // in KVA
15 I1 = (Rating*10^3)/V1; // in A
16 I2 = (Rating*10^3)/V2; // in A
17 R1e = R1 + (R2/(K^2)); // in ohm
18 X1e = X1+(X2/(K^2)); // in ohm
19 Z1e = sqrt( (R1e^2) + (X1e^2) ); // in ohm
20 disp(Z1e,"The equivalent impedance of the
    transformer referred to primary in ohm is");
21 // Total copper loss
22 totalcopperloss = (I1^2)*R1e; // in W
23 disp(totalcopperloss,"The total copper loss in W is"
    );
```

Scilab code Exa 9.7 Efficiency of transformer

```
1 // Exa 9.7
2 clc;
```

```

3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Rating = 150000; // in VA
8 phi= acosd(0.8); // in
9 Pcu = 1600; // in W
10 Pi = 1400; // in W
11 n = 1/4;
12 // Total loss of 25% load
13 totalloss = Pi + (n^2)*Pcu; // in W
14 // efficiency of transformer of 25% load
15 Eta = n*Rating*cosd(phi)/(n*Rating*cosd(phi)+Pi+n^2*
    Pcu)*100; // in %
16 disp(Eta,"The efficiency in % is");

```

Scilab code Exa 9.8 Efficiency on unity power factor

```

1 // Exa 9.8
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Rating = 25; // in KVA
8 V1 = 2000; // in V
9 V2 = 200; // in V
10 Pi = 350; // in W
11 Pi = Pi * 10^-3; // in kW
12 Pcu = 400; // in W
13 Pcu = Pcu * 10^-3; // in kW
14 phi= acosd(1); // in
15 output = Rating;
16 losses = Pi+Pcu;
17 Eta = (output/(output + losses))*100; // %Eta in %

```

```

18 disp(Eta,"The efficiency of full load power in % is"
    );
19 // For half load
20 output = Rating/2; // in kW
21 h = 1;
22 Pcu = Pcu*((h/2)^2); // in kW
23 losses = Pi+Pcu;
24 // efficiency of half load power
25 Eta = (output/(output+losses))*100; // in %
26 disp(Eta,"The efficiency of half load power in % is"
    );

```

Scilab code Exa 9.9 Maximum efficiency

```

1 // Exa 9.9
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 Rating = 250*10^3; // in VA
8 Pi = 1.8; // in kW
9 Pi = Pi * 10^3; // in W
10 Pcu_f1 = 2000; // in W
11 phi= acosd(0.8); // in
12 Eta = ((Rating*cosd(phi))/((Rating*cosd(phi))+Pi+
    Pcu_f1))*100; // %Eta in %
13 disp(Eta,"The efficiency at full load in % is");
14 // The maximum efficiency
15 Eta_max = Rating * sqrt(Pi/Pcu_f1 ); // in VA
16 Eta_max = Eta_max *10^-3; // in kVA
17 disp(Eta_max,"The maximum efficiency in kVA is");
18 Eta_max = Eta_max *10^3; // in VA
19 Pcu = Pi; // in W
20 Eta_max1 = ((Eta_max*cosd(phi))/((Eta_max*cosd(phi)))

```

```

    + Pi+Pcu ))*100; // in %
21 disp(Eta_max1,"The maximum efficiency in % is");

```

Scilab code Exa 9.10 Iron and full load copper loss

```

1 // Exa 9.10
2 clc;
3 clear;
4 close;
5 format('v',9)
6 // Given data
7 phi= acosd(1); // in
8 Pout = 500; // in kW
9 Pout = Pout*10^3; // in W
10 Eta = 90; // in %
11 n=1/2;
12 // For full load , Eta= Pout*100/(Pout+Pi+Pcu_f1) or
    Pi+Pcu_f1= (Pout*100-Eta*Pout)/Eta
    (i)
13 // 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)
14 // From eq(i) and (ii)
15 Pcu_f1= [(n*Pout*100-n*Eta*Pout)/Eta-(Pout*100-Eta*
    Pout)/Eta]/(n^2-1)
16 Pi=(Pout*100-Eta*Pout)/Eta-Pcu_f1
17 disp(Pi,"The iron loss in W is : ")
18 disp(Pcu_f1,"The full load copper loss in watt")

```

Scilab code Exa 9.11 Maximum core flux

```

1 // Exa 9.11
2 clc;

```



```

3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Io = 10; // in A
8 phi_o= acosd(0.25); // in
9 V1 = 400; // in V
10 f = 50; // in Hz
11 N1 =500;
12 Im = Io*sind(phi_o); // in A
13 disp(Im,"The magnetizing component of no load
    current in A is");
14 Pi = V1*Io*cosd(phi_o); // in W
15 disp(Pi,"The iron loss in W is");
16 E1 = V1; // in V
17 //E1 v= 4.44*f*phi_m*N1;
18 phi_m = E1/(4.44*f*N1); // in Wb
19 phi_m=phi_m*10^3; // in mWb
20 disp(phi_m,"The maximum value of flux in mWb is");

```

Scilab code Exa 9.12 Total copper loss

```

1 // Exa 9.12
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Rating = 30*10^3; // in VA
8 V1 = 2000; // in V
9 V2 = 200; // in V
10 f = 50; // in Hz
11 R1 = 3.5; // in ohm
12 X1 = 4.5; // in ohm
13 R2 = 0.015; // in ohm

```

```

14 X2 = 0.02; // in ohm
15 K = V2/V1;
16 R1e = R1 + (R2/(K^2)); // in ohm
17 disp(R1e,"The equivalent resistance to primary side
    in ohm is");
18 X1e = X1 + (X2/(K^2)); // in ohm
19 disp(X1e,"The equivalent reactance to primary side
    in ohm is");
20 Z1e = sqrt( (R1e^2) + (X1e^2) ); // in ohm
21 disp(Z1e,"The equivalent impedance to primary side
    in ohm is");
22 I1 = Rating/V1; // in A
23 // Total copper loss in transformer
24 Pcu_total = (I1^2)*R1e; // in W
25 disp(Pcu_total,"Total copper loss in W is");

```

Scilab code Exa 9.13 Secondary voltage at full load

```

1 // Exa 9.13
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 Rating = 10; // in KVA
8 phi= acosd(0.8)
9 V1 = 2000; // in V
10 V2 = 400; // in V
11 R1 = 5.5; // in ohm
12 X1 = 12; // in ohm
13 R2 = 0.2; // in ohm
14 X2 = 0.45; // in ohm
15 K = V2/V1;
16 //R1e = R1 + R_2 = R1 + (R2/(K^2));
17 R1e = R1 + (R2/(K^2)); // in ohm

```

```

18 //X1e = X1 + X_ = X1 + (X2/(K^2));
19 X1e = X1 + (X2/(K^2)); // in ohm
20 I2 = (Rating*10^3)/V2; // in A
21 R2e = (K^2)*R1e; // in ohm
22 X2e = (K^2)*X1e; // in ohm
23 Vdrop = I2 * ( (R2e*cosd(phi)) + (X2e*sind(phi)) );
    // voltage drop in V
24 //E2 = V2 +Vd;
25 E2 = V2; // in V
26 // The full load secondary voltage
27 V2 = E2-Vdrop; // in V
28 disp(V2,"The full load secondary voltage in V is");

```

Scilab code Exa 9.14 Percentage of full load

```

1 // Exa 9.14
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Rating = 40*10^3; // in VA
8 Pi = 400; // in W
9 Pcu_f1 = 800; // in W
10 phi= acosd(0.9); // in
11 Eta_f1 = ((Rating*cosd(phi))/( (Rating*cosd(phi)) +
    Pi + Pcu_f1 ))*100; // in %
12 disp(Eta_f1,"Full load efficiency in % is");
13 // percentage of the full load
14 Eta_max = Rating*sqrt( Pi/Pcu_f1); // in KVA
15 Eta_max = Eta_max/Rating*100; // in %
16 disp(Eta_max,"The percentage of the full load in %
    is");

```

Scilab code Exa 9.15 Full load efficiency

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

Scilab code Exa 9.16 Full load efficiency

```
1 // Exa 9.16
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Rating = 10*10^3; // in VA
8 phi= acosd(0.8); // in
9 V1 = 500; // in V
```

```

10 V2 = 250; // in V
11 Pi = 200; // in W
12 Pcu = 300; // in W
13 Isc = 30; // in A
14 I1 = Rating/V1; // in A
15 // Pcu/(Pcu(f1)) = (Isc^2)/(I1^2);
16 Pcu_f1 = Pcu * ((I1^2)/(Isc^2)); // in W
17 // The efficiency at full load
18 Eta_f1 = Rating*cosd(phi)/(Rating*cosd(phi) + Pi +
    Pcu_f1)*100; // in %
19 disp(Eta_f1,"The full load efficiency in % is");

```

Scilab code Exa 9.17 Maximum efficiency of transformer

```

1 // Exa 9.17
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 Rating = 20*10^3; // in VA
8 phi= acosd(0.8); // in
9 V1 = 2000; // in V
10 V2 = 200; // in V
11 Pi = 120; // in W
12 Pcu = 300; // in W
13 Eta_max = Rating*(sqrt( Pi/Pcu )); // in VA
14 Pcu = Pi; // in W
15 // The maximum efficiency of transformer
16 Eta_max = ((Eta_max*cosd(phi))/( Eta_max*cosd(phi) +
    (2*Pi) ))*100; // in %
17 disp(Eta_max,"The maximum efficiency of transformer
    in % is");

```

Scilab code Exa 9.18 Equivalent circuit of the transformer

```
1 // Exa 9.18
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Turnratio = 5;
8 R1 = 0.5; // in ohm
9 R2 = 0.021; // in ohm
10 X1 = 3.2; // in ohm
11 X2 = 0.12; // in ohm
12 Rc = 350; // in ohm
13 Xm = 98; // in ohm
14 N1 = 5;
15 N2 = 1;
16 K = N2/N1;
17 // Evaluation of the equivalent parameters referred
    to secondary side
18 R2e = R2 + ((K^2)*R1); // in ohm
19 disp("The equivalent parameters referred to
    secondary side are : ")
20 disp("The value of R_2e is : "+string(R2e)+" ")
21 X2e = X2 + ((K^2)*X1); // in ohm
22 disp("The value of X_2e is : "+string(X2e)+" ")
23 R_c = (K^2)*Rc; // in ohm
24 disp("The value of R' 'c is : "+string(R_c)+" ")
25 X_m = (K^2)*Xm; // in ohm
26 disp("The value of X' 'm is : "+string(X_m)+" ")
```

Scilab code Exa 9.19 Equivalent circuit parameters

```

1 // Exa 9.19
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 Rating = 100*10^3; // in VA
8 V1 = 11000; // in V
9 V2 = 220; // in V
10 Wo = 2*10^3; // in W
11 Vo = 220; // in V
12 Io = 45; // in A
13 phi_o = acosd(Wo/(Vo*Io));
14 I_c = Io*cosd(phi_o); // in A
15 I_m = Io*sind(phi_o); // in A
16 Ro= V2/I_c; // in ohm
17 Xo= V2/I_m; // in ohm
18 Wsc= 3*10^3; // in W
19 Vsc= 500; // in V
20 Isc= 9.09; // in A
21 R1e= Wsc/Isc^2; // in ohm
22 Z1e= Vsc/Isc; // in ohm
23 X1e= sqrt(Z1e^2-R1e^2); // in ohm
24 K= V2/V1;
25 R2e= K^2*R1e; // in ohm
26 X2e= K^2*X1e; // in ohm
27 Z2e= K^2*Z1e; // in ohm
28 disp("The value of R' 'o is : "+string(Ro)+" ")
29 disp("The value of X' 'o is : "+string(Xo)+" ")
30 disp("The value of R1e is : "+string(R1e)+" ")
31 disp("The value of Z1e is : "+string(Z1e)+" ")
32 disp("The value of X1e is : "+string(X1e)+" ")
33 disp("The value of R2e is : "+string(R2e)+" ")
34 disp("The value of X2e is : "+string(X2e)+" ")
35 disp("The value of Z2e is : "+string(Z2e)+" ")

```

Scilab code Exa 9.20 Efficiency of transformer

```
1 // Exa 9.20
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V1 = 250; // in V
8 V2 = 500; // in V
9 Pcu = 100; // in W
10 Pi = 80; // in W
11 V = V2; // in V
12 A = 12; // in A
13 phi= acosd(0.85); // in
14 // The efficiency of the transformer
15 Eta = ((V*A*cosd(phi))/( V*A*cosd(phi) + Pi+Pcu ))
      *100; // in %
16 disp(Eta,"The efficiency of the transformer in % is"
      );
```

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

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



```

10 phi2= acosd(1); // in
11 Eta_hl = 99.13/100; // in %
12 n = 1/2;
13 //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)
14 //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)
15 // From eq(i) and (ii)
16 Pcu_fl=(n*VA*cosd(phi2)*( 1-Eta_hl)/Eta_hl-VA*cosd(
    phi1)*(1-Eta_fl)/(Eta_fl))/(n^2-1); // in W
17 Pi=VA*cosd(phi1)*(1-Eta_fl)/(Eta_fl)-Pcu_fl; // in W
18 disp(Pi,"The iron loss on full load and half load
    remain same in W which are : ")
19 disp(Pcu_fl,"The copper loss on full load in W is :
    ")
20 // The copper loss on half load
21 C_loss_half_load=n^2*Pcu_fl; // in W
22 disp(C_loss_half_load,"The copper loss on half load
    in W is : ")

```

Scilab code Exa 9.22 Efficiency of transformer

```

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

```

```

11 //Eta_max = (Eta_max1*VA*cosd(phi))/(Eta_max1*VA*cosd
    (phi) + 2*Pi);
12 Pi = (Eta_max1*VA*cosd(phi)/Eta_max - Eta_max1*VA*
    cosd(phi))/2; // in W
13 Pcu = Pi; // in W
14 n = 0.9;
15 // Pcu_fl/Pcu = (VA/(0.9*VA) )^2;
16 Pcu_fl = Pcu*(VA/(0.9*VA) )^2; // in W
17 Eta_fl = ( (VA*cosd(phi))/( (VA*cosd(phi)) + Pi +
    Pcu_fl ) ) * 100; // in %
18 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

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

Scilab code Exa 10.2 Numbers of conductor

```

1 // Exa 10.2
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 8;
8 N = 1200; // in rpm
9 phi = 25; // in mWb
10 phi = phi * 10^-3; // in Wb
11 Eg = 440; // in V
12 A = P;
13 // Eg = (N*P*phi*Z)/(60*A);
14 Z = (Eg*60*A)/(phi*N*P); // in conductors
15 disp(Z,"The numbers of conductors when armature is
    lap wound");
16 A = 2;
17 // Eg = (N*P*phi*Z)/(60*A);
18 Z = (Eg*60*A)/(phi*N*P); // in conductors
19 disp(Z,"The numbers of conductors when armature is
    wave wound ");

```

Scilab code Exa 10.3 Induced voltage

```

1 // Exa 10.3
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 P = 4;
8 phi = 20; // in mWb
9 phi = phi * 10^-3; // in Wb
10 A = 4;
11 P = A;

```

```

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

```

Scilab code Exa 10.4 Generated emf

```

1 // Exa 10.4
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Eg1 = 100; // in V
8 phi1 = 20; // in mWb
9 phi1 = phi1 * 10^-3; // in Wb
10 N1 = 800; // in rpm
11 N2 = 1000; // in rpm
12 // Eg1/Eg2 = (phi1/phi2) * (N1/N2) but phi1 = phi2
13 Eg2 = (Eg1*N2)/N1; // in V
14 disp(Eg2,"Part (i) : The generated emf in V is");
15 phi2 = 24; // in mWb
16 phi2 = phi2 * 10^-3; // in Wb
17 N2 = 900; // in rpm
18 // Eg1/Eg2 = (phi1/phi2) * (N1/N2) ;
19 Eg2 = (Eg1*N2*phi2)/(N1*phi1); // in V
20 disp(Eg2,"Part (ii) : The generated emf in V is");

```

Scilab code Exa 10.5 Total power developed by armature

```

1 // Exa 10.5
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 30; // in kW
8 P = P * 10^3; // in W
9 V = 300; // in V
10 Ra = 0.05; // in ohm
11 Rsh = 100; // in ohm
12 // p = V*I_L;
13 I_L = P/V; // in A
14 Ish = V/Rsh; // in A
15 Ia = I_L+Ish; // in A
16 Eg = V + (Ia*Ra); // in V
17 // power developed by armature
18 power = (Eg*Ia); // in W
19 power = power * 10^-3; // in kW
20 disp(power, "The total power developed by the
    armature in kW is");

```

Scilab code Exa 10.6 Power developed in the armature

```

1 // Exa 10.6
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V = 200; // in V
8 Ra = 0.5; // in ohm
9 Rsh = 200; // in ohm
10 P = 20; // in kW
11 P = P * 10^3; // in W

```

```

12 // P = V*I_L;
13 I_L =P/V;// in A
14 Ish = V/Rsh;// in A
15 Ia = I_L+Ish;// in A
16 Eg = V + (Ia*Ra);// in V
17 // power developed in the armature
18 power = Eg*Ia;// in W
19 power = power * 10^-3;// in kW
20 disp(power,"The power developed in the armature in
    kW is");

```

Scilab code Exa 10.7 Total armature current

```

1 // Exa 10.7
2 clc;
3 clear;
4 close;
5 format('v',8)
6 // Given data
7 P = 60;
8 A =P;
9 Vbrush = 2;// in V/brush
10 Vt = 100;// in V
11 Ra = 0.1;// in ohm
12 Rsh = 80;// in ohm
13 Ish = Vt/Rsh;// in A
14 Ilamp = P/Vt;// in A
15 I_L = 50*Ilamp;// in A
16 // Armature current
17 Ia = I_L+Ish;// in A
18 disp(Ia,"The total armature current in A is");
19 // Evaluation of generated emf
20 Eg = Vt + (Ia*Ra) + Vbrush;// in V
21 disp(Eg,"The generated emf in V is");

```

Scilab code Exa 10.8 Generated voltage

```
1 // Exa 10.8
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V = 440; // in V
8 I_L =40; // in A
9 Rse = 1; // in ohm
10 Rsh = 200; // in ohm
11 Ra = 0.5; // in ohm
12 Ish = V/Rsh; // in A
13 Ia = I_L+Ish; // in A
14 Eg = V + (Ia*(Ra+Rse)); // in V
15 disp(Eg,"The generated voltage for long shunt in V
    is");
16 //Voltage across shunt field , Vsh = V + Ise*Rse = V
    + (I_L*Rse);
17 Vsh = V+(I_L*Rse); // in V
18 Ish = Vsh/Rsh; // in A
19 Ia =I_L+Ia; // in A
20 Eg = V + (I_L*Rse) + (Ia*Ra); // in V
21 disp(Eg,"The generated voltage for short shunt in V
    is");
```

Scilab code Exa 10.9 Back emf

```
1 // Exa 10.9
2 clc;
3 clear;
```



```

4 close;
5 format('v',6)
6 // Given data
7 V = 440; // in V
8 I = 80; // in A
9 Rse = 0.025; // in ohm
10 Ra = 0.1; // in ohm
11 Bd = 2; // brush drop in V
12 Ia = I; // in A
13 Ise = I; // in A
14 Eb = V - (Ia*(Ra+Rse)) - Bd; // in V
15 disp(Eb,"The back emf in V is");

```

Scilab code Exa 10.10 Armature current and back emf

```

1 // Exa 10.10
2 clc;
3 clear;
4 close;
5 format('v',7)
6 // Given data
7 V = 250; // in V
8 I_L = 20; // in A
9 Ra = 0.3; // in ohm
10 Rsh = 200; // in ohm
11 Ish = V/Rsh; // in A
12 // I_L = Ia+Ish;
13 Ia = I_L-Ish; // inA
14 disp(Ia,"The armature current in A is");
15 Eb = V-(Ia*Ra); // in V
16 disp(Eb,"The back emf in V is");

```

Scilab code Exa 10.11 Speed of motor

```

1 // Exa 10.11
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 4;
8 A = 2; //(wave connected)
9 Z = 200;
10 V=250; // in V
11 phi = 25; // in mWb
12 phi = phi * 10^-3; // in Wb
13 Ia = 60; // in A
14 I_L = 60; // in A
15 Ra = 0.15; // in ohm
16 Rse = 0.2; // in ohm
17 //V = Eb + (Ia*Ra) + (Ia*Rse);
18 Eb = V - (Ia*Ra) - (Ia*Rse); // in V
19 // Eb = (phi*P*N*Z)/(60*A);
20 N = (Eb*60*A)/(phi*P*Z); // in rpm
21 disp(N,"The speed in rpm is");

```

Scilab code Exa 10.12 Armature resistance and current

```

1 // Exa 10.12
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Eb = 227; // in V
8 Rsh = 160; // in ohm
9 Ish = 1.5; // in A
10 I_L = 39.5; // in A
11 V = Ish*Rsh; // in V

```

```

12 Ia = I_L-Ish; // in A
13 //V = Eb + (Ia*Ra);
14 Ra = (V-Eb)/Ia; // in ohm
15 disp(Ra,"The armature resistance in ohm is");
16 Ia = V/Ra; // in A
17 disp(Ia,"The armature current in A is");

```

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

```

1 // Exa 10.13
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V = 230; // in V
8 Ra = 0.115; // in ohm
9 Rsh = 115; // in ohm
10 I_L = 100; // in A
11 Ish = V/Rsh; // in A
12 Ia = I_L + Ish; // in A
13 Eg = V + (Ia*Ra); // in V
14 Ia = I_L-Ish; // in A
15 Eb = V - (Ia*Ra); // in V
16 // The ratio of speed as a generator to speed as a
    motor
17 NgBYNm = Eg/Eb;
18 disp(NgBYNm,"The ratio of speed as a generator to
    speed as a motor is");

```

Scilab code Exa 10.14 Induced voltage

```

1 // Exa 10.14

```

```

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

```

Scilab code Exa 10.15 Generated emf

```

1  // Exa 10.15
2  clc;
3  clear;
4  close;
5  format('v',6)
6  // Given data
7  P = 8;
8  phi = 0.1; // in Wb
9  Z = 400;
10 N =300; // in rpm
11 Eg = (N*phi*Z)/(60); // in V (A = p)
12 disp(Eg,"The emf when lap is connected in V is");
13 // For A=2, connected armature
14 A = 2;
15 Eg = (N*phi*P*Z)/(60*A); // in V

```

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

Scilab code Exa 10.16 Power developed in the armature

```
1 // Exa 10.16
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P_L = 20; // in kW
8 P_L = P_L * 10^3; // in W
9 V = 200; // in V
10 Ra = 0.05; // in ohm
11 Rsh = 200; // in ohm
12 // P_L = V*I_L;
13 I_L = P_L/V; // in A
14 Ish = V/Rsh; // in A
15 Ia = I_L+Ish; // in A
16 Eg = V + (Ia*Ra); // in V
17 Pa = Eg*Ia; // in W
18 Pa = Pa * 10^-3; // in kW
19 disp(Pa,"The power developed in armature in kW is");
```

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

```
1 // Exa 10.17
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 N1 = 600; // inrpm
```

```

8 I_L1 = 60; // in A
9 V = 230; // in V
10 Rsh = 115; // in ohm
11 Ra = 0.2; // in ohm
12 Ia2 = 30; // in A
13 Ish = V/Rsh; // in A
14 Ia1 = I_L1 - Ish; // in A
15 Eb1 = V - (Ia1*Ra); // in V
16 Eb2 = V - (Ia2*Ra); // in V
17 // N1/N2 = Eb1/Eb2;
18 N2 = (N1*Eb2)/Eb1; // in rpm
19 disp(N2,"The speed when 30 A current through the
    armature in rpm is");

```

Scilab code Exa 10.18 Speed of motor

```

1 // Exa 10.18
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 6;
8 A = 6;
9 Z = 500;
10 Ra = 0.05; // in ohm
11 Rsh = 25; // in ohm
12 V = 100; // in V
13 I_L = 120; // in A
14 phi = 2*10^-2; // in Wb
15 Ish = V/Rsh; // in A
16 Ia = I_L - Ish; // in A
17 Eb = V - (Ia*Ra); // in V
18 // Eb = (N*P*phi*Z)/(60*A);
19 N = (Eb*60*A)/(P*phi*Z); // in rpm

```

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

Scilab code Exa 10.19 Change in emf induced

```
1 // Exa 10.19
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given ata
7 N1 = 1;
8 N2 = 1.2*N1;
9 phi1 = 1;
10 phi2 = 0.8*phi1;
11 Eg1BYEg2 = (N1/N2) * (phi1/phi2);
12 Eg1 = 1;// assumed
13 // The change in emf
14 Eg2 = (Eg1*phi2*N2)/(phi1*N1);
15 Eg2 = Eg2 * 100;// in %
16 disp(Eg2,"The change in emf in % is");
```

Scilab code Exa 10.20 Total power developed by armature

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

```

11 Rsh = 100; // in ohm
12 // Pout = Vt*I_L;
13 I_L = Pout/Vt; // in A
14 Ish = Vt/Rsh; // in A
15 Ia = I_L+Ish; // in A
16 Eg = Vt + (Ia*Ra); // in V
17 // Total armature power developed when working as a
    generator
18 Pdeveloped = Eg*Ia; // in W
19 Pdeveloped = Pdeveloped * 10^-3; // in kW
20 disp(Pdeveloped, "Total armature power developed in
    kW is");
21 Ia = I_L-Ish; // in A
22 Eb = Vt - (Ia*Ra); // in V
23 // Total armature power developed when working as a
    motor
24 Pdeveloped = Eb*Ia; // in W
25 Pdeveloped = Pdeveloped * 10^-3; // in kW
26 disp(Pdeveloped, "Total armature power developed when
    working as a motor in kW is");

```

Scilab code Exa 10.21 Useful flux per pole

```

1 // Exa 10.21
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 4;
8 A = 4;
9 Turns = 100;
10 N = 600; // in rpm
11 Eg = 220; // in V
12 n = 2; // no of total conductors

```



```
13 Z = n*Turns;
14 // Eg = (N*P*phi*Z)/(60*A);
15 phi = (Eg*60*A)/(N*P*Z); // in Wb
16 disp(phi,"The useful flux per mole when armature is
    LAP connected in Wb is");
17 A = 2;
18 // Eg = (N*P*phi*Z)/(60*A);
19 phi = (Eg*60*A)/(N*P*Z); // in Wb
20 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

```
1 // Exa 11.1
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 4;
8 f = 50; // in Hz
9 Ns = (120*f)/P; // in rpm
10 disp(Ns,"The synchronous speed in rpm is");
11 s = 4;
12 //s = ((Ns-N)/Ns)*100;
13 N = Ns - ( (s*Ns)/100 ); // in rpm
14 disp(N,"The speed of the motor in rpm is");
15 N = 1000; // in rpm
16 s = ((Ns-N)/Ns);
17 f_desh= s*f; // in Hz
18 disp(f_desh,"The rotor current frequency in Hz is");
```

Scilab code Exa 11.2 Slip and speed of motors

```
1 // Exa 11.2
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 f = 50; // in Hz
8 P = 4;
9 f_DASH = 2; // in Hz
10 // f_DASH = s*f;
11 s = (f_DASH/f)*100; // in %
12 disp(s,"The slip in % is");
13 N_S = (120*f)/P; // in rpm
14 // s = (N_S-N)/N_S;
15 N = N_S - (s/100*N_S); // in rpm
16 disp(N,"The speed of the motor in rpm is");
```

Scilab code Exa 11.3 Synchronous speed and no load speed

```
1 // Exa 11.3
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 6;
8 f = 50; // in Hz
9 Sn1 = 1/100;
10 Sf1 = 3/100;
11 N_S = (120*f)/P; // in rpm
12 disp(N_S,"The synchronous speed in rpm is");
13 Nn1 = N_S*(1-Sn1); // in rpm
14 disp(Nn1,"No load speed in rpm is");
```

```

15 Nf1 = N_S*(1-Sf1); // in rpm.. correction
16 disp(Nf1,"The full load speed in rpm is");
17 // frequency of rotor current
18 s = 1;
19 Sf = s*f; // in Hz
20 disp(Sf,"The frequency of rotor current in Hz is");
21 // frequency of rotor current at full load
22 f_r = Sf1 * f; // in Hz
23 disp(f_r,"The frequency of rotor current at full
    load in Hz is");
24
25 // 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

```

1 // Exa 11.4
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 Pa= 12;
8 N= 1440; // in rpm
9 Na= 500; // in rpm
10 Nm= 1450; // in rpm
11 fa= Pa*Na/120; // in Hz
12 Pm= round(120*fa/Nm);
13 // Synchronous speed of motor
14 Ns= 120*fa/Pm; // in rpm
15 s= (Ns-N)/Ns*100; // in %
16 disp(Pm,"The numbers of pole is : ")
17 disp(s,"The percentage slip is : ")

```

Scilab code Exa 11.5 Frequency of rotor emf in running condition

```
1 // Exa 11.5
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 K = 1/2;
8 P = 4;
9 f = 50; // in Hz
10 N = 1445; // in rpm
11 E1line = 415; // in V
12 Ns = (120*f)/P; // in rpm
13 N = 1455; // in rpm
14 s = (Ns-N)/Ns*100; // in %
15 f_r = s/100*f; // in Hz
16 disp(f_r,"The frequency of rotor in Hz is");
17 E1ph = E1line/sqrt(3); // in V
18 //E2ph/E1ph = K;
19 E2ph = E1ph*K; // in V
20 disp(E2ph,"The magnitude of induced emf in V is");
21 E2r = s/100*E2ph; // in V
22 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

```
1 // Exa 11.6
2 clc;
3 clear;
4 close;
```

```

5 format('v',6)
6 // Given data
7 P = 4;
8 S =4/100;
9 f = 50;// in Hz
10 Ns = (120*f/P);// in rpm
11 disp(Ns,"The value of Ns in rpm is");
12 // The rotor speed when slip is 4 %
13 N = Ns*(1-S);// in rpm
14 disp(N,"The rotor speed when slip is 4% in rpm is");
15 // The rotor speed when rotor runs at 600 rpm
16 N1 = 600;// in rpm
17 s1 = ((Ns-N1)/Ns)*100;// in %
18 f_r = (s1/100)*f;// in Hz
19 disp(f_r,"The rotor frequency when rotor runs at 600
rpm in Hz is");

```

Scilab code Exa 11.7 Number of poles

```

1 // Exa 11.7
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V_L = 230;// in V
8 f = 50;// in Hz
9 N = 950;// in rpm
10 E2 = 100;// in V
11 Ns =1000;// in rpm
12 // Ns = 120*f/P;
13 P = (120*f)/Ns;
14 disp(P,"The Number of poles is");
15 s = ((Ns-N)/Ns)*100;// %s in %
16 disp(s,"The percentage of full load slip in % is");

```

```

17 // The rotor induced voltage at full load
18 E2r = (s/100)*E2;// in V
19 disp(E2r,"The rotor induced voltage in V is");
20 // The rotor frequency at full load
21 f_r = (s/100)*f;// in Hz
22 disp(f_r,"The frequency at full load in Hz is");

```

Scilab code Exa 11.8 Number of poles in the machine

```

1 // Exa 11.8
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 V = 440;// in V
8 f = 50;// in Hz
9 N = 1450;// in rpm
10 Ns = 1450;// in rpm
11 Nr = 1450;// in rpm
12 P = round((120*f)/Ns);
13 disp(P,"The number of poles in the machine is");
14 P = 4;
15 Ns = (120*f)/P;// in rpm
16 disp(Ns,"Speed of rotation air gap field in rpm is")
    ;
17 k = 0.8/1;
18 //Pemf = k*E1 = k*V;
19 Pemf = k*V;// produced emf in rotor in V
20 disp(Pemf,"Produced emf in rotor in V is");
21 s = ((Ns-Nr)/Ns)*100;// in %
22 Ivoltage = k*(s/100)*V;// rotor induces voltage in V
23 f_r = (s/100)*f;// in Hz
24 disp(f_r,"The frequency of rotor current in Hz is ")
    ;

```

Scilab code Exa 11.9 Full load speed and corresponding speed

```
1 // Exa 11.9
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 8;
8 f = 50; // in Hz
9 f_r = 2; // in Hz
10 // f_r = s*f;
11 s = (f_r/f)*100; // in %
12 disp(s,"The full load slip in % is");
13 // s = Ns-N/Ns;
14 Ns = (120*f)/P; // in rpm
15 N = Ns*(1-(s/100)); // in rpm
16 disp(N,"The corresponding speed in rpm is");
```

Scilab code Exa 11.10 Speed at which maximum torque is developed

```
1 // Exa 11.10
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 R2 = 0.024; // in per phase
8 X2 = 0.6; // in ohm per phase
9 s = R2/X2;
10 f = 50; // in Hz
```



```

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

```

Scilab code Exa 11.11 Rotor speed in rpm

```

1 // Exa 11.11
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 4;
8 f =60; // in Hz
9 s = 0.03;
10 Ns = (120*f)/P; // in rpm
11 N = Ns*(1-s); // in rpm
12 disp(Ns,"The synchronous speed in rpm is : ")
13 disp(N,"The rotor speed in rpm is");
14 f_r = s*f; // in Hz
15 disp(f_r,"The rotor current frequency in Hz is");
16 // Rotor magnetic field rotates at speed
17 Rm = (120*f_r)/P; // in rpm
18 disp(Rm,"The rotor magnetic field rotates at speed
    in rpm is");

```

Scilab code Exa 11.12 Slip and frequency of rotor induced emf

```

1 // Exa 11.12
2 clc;

```

```

3 clear;
4 close;
5 format('v',6)
6 // Given data
7 N = 960; // in rpm
8 f = 50; // in Hz
9 Ns = 1000; // in rpm
10 s = ((Ns-N)/Ns)*100; // %s in %
11 disp(s,"The slip in % is");
12 f_r = (s/100)*f; // in Hz
13 disp(f_r,"The frequency of rotor induced emf in Hz
    is");
14 // Ns = (120*f)/P;
15 P = (120*f)/Ns;
16 disp(P,"The number of poles is");
17 // Speed of rotor field with respect to rotor
    structure
18 s1 = (120*f_r)/P; //in rpm
19 disp(s1,"Speed of rotor field with respect to rotor
    structure in rpm is");

```

Scilab code Exa 11.13 Full load speed of motor

```

1 // Exa 11.13
2 clc;
3 clear;
4 close;
5 format('v',6)
6 // Given data
7 P = 4;
8 f = 50; // in Hz
9 Sfl = 4/100;
10 Ns = (120*f)/P; // in rpm
11 //The full load speed, Sfl = (Ns-Nfl)/Ns;
12 Nfl = Ns - (Sfl*Ns); // in rpm

```

```
13 disp(Nf1,"The full load speed in rpm is");
```
