

Scilab Textbook Companion for  
Basic Electrical Engineering  
by D. C. Kulshreshtha<sup>1</sup>

Created by  
Akhtar Ali Shah  
B.E (EXTC)  
Electronics Engineering  
AI'S Kalsekar Technical Campus New Panvel  
College Teacher  
Mrs.chaya.s  
Cross-Checked by  
Chaitanya Potti

May 15, 2014

<sup>1</sup>Funded by a grant from the National Mission on Education through ICT, <http://spoken-tutorial.org/NMEICT-Intro>. This Textbook Companion and Scilab codes written in it can be downloaded from the "Textbook Companion Project" section at the website <http://scilab.in>

# Book Description

**Title:** Basic Electrical Engineering

**Author:** D. C. Kulshreshtha

**Publisher:** Tata McGraw Hill, New Delhi

**Edition:** 1

**Year:** 2009

**ISBN:** 0-07-014100-2

Scilab numbering policy used in this document and the relation to the above book.

**Exa** Example (Solved example)

**Eqn** Equation (Particular equation of the above book)

**AP** Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

# Contents

List of Scilab Codes	5
2 Ohms law	11
3 Network Analysis	25
4 Network Theorems	51
5 Electromagnetism	61
6 Magnetic Circuits	68
7 Self And Mutual Inductances	72
8 DC Transients	83
9 Alternating Voltage And Current	93
10 AC Circuits	106
11 Resonance in AC Circuits	114
12 Three Phase Circuits And System	123
13 Transformers	130
14 Alternators And Synchronous Motors	148
15 Induction Motors	157

<b>16 DC Machines</b>	<b>166</b>
<b>17 Fractional Horse Power Motors</b>	<b>184</b>
<b>18 Electrical Measuring Instruments</b>	<b>189</b>

# List of Scilab Codes

Exa 2.1	Resistance . . . . .	11
Exa 2.2	Resistance . . . . .	12
Exa 2.3	Resistance . . . . .	12
Exa 2.4	Voltage And Current . . . . .	13
Exa 2.5	Resistance . . . . .	14
Exa 2.6	Current . . . . .	15
Exa 2.7	Current . . . . .	16
Exa 2.8	Voltage . . . . .	16
Exa 2.9	Resistance . . . . .	17
Exa 2.10	Resistance . . . . .	18
Exa 2.11	Resistance . . . . .	19
Exa 2.12	Resistance . . . . .	19
Exa 2.13	Cost . . . . .	20
Exa 2.14	Rating . . . . .	21
Exa 2.15	Resistance . . . . .	21
Exa 2.16	Resistance . . . . .	22
Exa 2.17	Resistance . . . . .	23
Exa 2.18	Temperature . . . . .	23
Exa 3.1	capacitor . . . . .	25
Exa 3.2	Inductor . . . . .	26
Exa 3.3	Inductor . . . . .	27
Exa 3.4	Voltage . . . . .	28
Exa 3.5	Voltage . . . . .	29
Exa 3.6	Voltage And Energy . . . . .	30
Exa 3.7	Capacitor . . . . .	31
Exa 3.8	Voltage And Current . . . . .	32
Exa 3.9	Voltage And Power . . . . .	34
Exa 3.10	Current . . . . .	35

Exa 3.13	Current And Power	36
Exa 3.14	Voltage	37
Exa 3.15	Voltage	37
Exa 3.16	Current	38
Exa 3.17	Resistance	40
Exa 3.18	Current	41
Exa 3.19	Voltage	41
Exa 3.20	Current	42
Exa 3.21	Current	43
Exa 3.22	Voltage	44
Exa 3.23	Current	45
Exa 3.24	Current	46
Exa 3.25	Voltage	47
Exa 2.26	Current	48
Exa 2.27	Current	49
Exa 4.1	Current	51
Exa 4.2	Current	52
Exa 4.3	Voltage	53
Exa 4.4	Current	54
Exa 4.5	Voltage	55
Exa 4.6	Voltage	56
Exa 4.7	Current	56
Exa 4.8	Power	57
Exa 4.9	Power	58
Exa 4.10	Voltage And Power	59
Exa 4.11	Current And Resistance	60
Exa 5.1	Current	61
Exa 5.2	Megnetic Field Strength	61
Exa 5.3	Force	62
Exa 5.4	Force	63
Exa 5.5	Voltage	64
Exa 5.6	Voltage	64
Exa 5.7	Voltage	65
Exa 5.8	Voltage Time And Force	66
Exa 6.1	Megnetic Field Strength And Flux	68
Exa 6.2	Megnetomotive Force	69
Exa 6.3	Reluctance And Current	69
Exa 6.4	Current	70

Exa 7.1	Voltage . . . . .	72
Exa 7.2	Inductor And Voltage . . . . .	72
Exa 7.3	Inductor And Voltage . . . . .	73
Exa 7.4	Inductor And Energy . . . . .	74
Exa 7.5	Megnetic Field Strength And Voltage . . . . .	74
Exa 7.6	Voltage . . . . .	75
Exa 7.7	Inductor And Voltage . . . . .	76
Exa 7.8	Inductor . . . . .	77
Exa 7.9	Inductor . . . . .	78
Exa 7.10	Inductor . . . . .	79
Exa 7.11	Inductor . . . . .	80
Exa 7.12	Inductor . . . . .	81
Exa 8.1	Voltage . . . . .	83
Exa 8.2	Current And Power . . . . .	84
Exa 8.3	Current And Time . . . . .	85
Exa 8.4	Current . . . . .	86
Exa 8.5	Current . . . . .	87
Exa 8.6	Voltage And Current . . . . .	89
Exa 8.7	Voltage And Current . . . . .	90
Exa 8.8	Current . . . . .	91
Exa 9.1	Voltage And Angle . . . . .	93
Exa 9.2	Voltage Time And Frequency . . . . .	93
Exa 9.3	Voltage . . . . .	94
Exa 9.4	Current And Time . . . . .	95
Exa 9.5	Time . . . . .	96
Exa 9.6	Power . . . . .	97
Exa 9.7	Current . . . . .	98
Exa 9.8	Current . . . . .	98
Exa 9.9	Current . . . . .	99
Exa 9.10	Current . . . . .	100
Exa 9.11	Voltage . . . . .	100
Exa 9.12	Voltage . . . . .	101
Exa 9.13	Current And Power Factor . . . . .	102
Exa 9.14	Voltage And Power Factor . . . . .	103
Exa 9.15	Power And Power Factor . . . . .	104
Exa 10.1	Current Power And Power Factor . . . . .	106
Exa 10.2	Current Power And Power Factor . . . . .	107
Exa 10.3	Resistance Voltage And Power . . . . .	108



Exa 10.4	Resistance Power And Power Factor . . . . .	109
Exa 10.5	Reluctance And Inductor . . . . .	110
Exa 10.6	Resistance And Capacitor . . . . .	111
Exa 10.7	Resistance Power And Power Factor . . . . .	112
Exa 11.1	Frequency And Voltage . . . . .	114
Exa 11.2	Capacitor Voltage And Q Factor . . . . .	115
Exa 11.3	Inductor Current And Voltage . . . . .	116
Exa 11.4	Capacitor Current And Energy . . . . .	117
Exa 11.5	Frequency And Q Factor . . . . .	118
Exa 11.6	Frequency . . . . .	119
Exa 11.7	Resistance Current And Capacitor . . . . .	120
Exa 11.8	Frequency And Q Factor . . . . .	121
Exa 12.1	Current . . . . .	123
Exa 12.2	Current . . . . .	124
Exa 12.3	Current . . . . .	125
Exa 12.4	Current Power And Power Factor . . . . .	126
Exa 12.5	Power And Power Factor . . . . .	127
Exa 12.6	Current Power And Power Factor . . . . .	128
Exa 13.1	Magnetic Flux And Voltage . . . . .	130
Exa 13.2	Flux Density Current And Voltage . . . . .	131
Exa 13.3	Turns Ratio . . . . .	132
Exa 13.4	Current . . . . .	132
Exa 13.5	Power . . . . .	133
Exa 13.6	Turns . . . . .	134
Exa 13.7	Current And Power Factor . . . . .	135
Exa 13.8	Power . . . . .	136
Exa 13.9	Current And Power Factor . . . . .	137
Exa 13.10	Resistance And Power . . . . .	138
Exa 13.11	Regulation . . . . .	140
Exa 13.12	Efficiency And Power . . . . .	141
Exa 13.13	Efficiency . . . . .	143
Exa 13.14	Power . . . . .	144
Exa 13.15	Voltage . . . . .	145
Exa 13.16	Current And Resistance . . . . .	146
Exa 14.1	Speed . . . . .	148
Exa 14.2	Distribution Factor . . . . .	149
Exa 14.3	Speed Emf And Voltage . . . . .	149
Exa 14.4	Voltage Regulation . . . . .	150

Exa 14.5	Voltage Regulation . . . . .	152
Exa 14.6	Emf And Angle . . . . .	153
Exa 14.7	Emf . . . . .	154
Exa 14.8	Emf . . . . .	155
Exa 14.9	Current Power And Torque . . . . .	156
Exa 15.1	Speed And Frequency . . . . .	157
Exa 15.2	Speed And Frequency . . . . .	158
Exa 15.3	Speed . . . . .	159
Exa 15.4	Speed And Frequency . . . . .	159
Exa 15.5	Current . . . . .	160
Exa 15.6	Power And Speed . . . . .	162
Exa 15.7	Current Power And Speed . . . . .	163
Exa 15.8	Resistance . . . . .	165
Exa 16.1	Voltage Current And Power . . . . .	166
Exa 16.2	Emf . . . . .	167
Exa 16.3	Emf . . . . .	168
Exa 16.4	Speed And increase in flux . . . . .	168
Exa 16.5	Voltage . . . . .	169
Exa 16.6	Voltage And Current . . . . .	170
Exa 16.7	Emf . . . . .	171
Exa 16.8	Voltage Efficiency And Power . . . . .	172
Exa 16.9	Current And Resistance . . . . .	173
Exa 16.10	Turns . . . . .	174
Exa 16.11	Voltage . . . . .	175
Exa 16.12	Speed . . . . .	175
Exa 16.13	Speed . . . . .	176
Exa 16.14	Speed And Torque . . . . .	177
Exa 16.15	Power . . . . .	178
Exa 16.16	Speed . . . . .	178
Exa 16.17	Current . . . . .	179
Exa 16.18	Speed And Torque . . . . .	180
Exa 16.19	Resistance . . . . .	181
Exa 16.20	Speed . . . . .	182
Exa 17.1	Slip And Efficiency . . . . .	184
Exa 17.2	Current Phase Angle And Power Factor . . . . .	185
Exa 17.3	Capacitor . . . . .	186
Exa 17.4	Revolution Steps And Speed . . . . .	187
Exa 17.5	No of Rotors And Stators . . . . .	187

Exa 17.6	No of Rotors And Stators Theeth . . . . .	188
Exa 18.1	Torque . . . . .	189
Exa 18.2	Resistance . . . . .	190
Exa 18.4	Resistance . . . . .	190
Exa 18.5	Resistance And Multiplying Factor . . . . .	191
Exa 18.6	Voltage And Error . . . . .	192
Exa 18.7	Angle of Deflection . . . . .	193
Exa 18.8	Deflection in the Torque . . . . .	193
Exa 18.9	Angle of Deflection . . . . .	194
Exa 18.10	Current . . . . .	195

# Chapter 2

## Ohms law

Scilab code Exa 2.1 Resistance

```
1
2
3           // Example 2.1
4
5 a1=%pi*2^2/4;           // Relative area of wire-A
6 a2=%pi*1/4;            // Relative area of wire-B
7 l1=1;                   // Relative length of wire-B
8 l2=4;                   // Relative length of wire-B
9 R1=5;                   // Resistance of wire
10 r=(l2/a2)/(l1/a1);
11 disp('The ratio of resistances (R2/R1) = '+string(r)
      + ' ohm');
12 R2=r*R1;
13 disp('Resistance(R2) = '+string(R2)+' ohm');
14
15
16
17
18
19           // p 16           2.1
```

---

### Scilab code Exa 2.2 Resistance

```
1
2                               // Example 2.2
3
4
5 a1=%pi*3/4;                   // Relative area of wire-A
6 a2=%pi*1/4;                   // Relative area of wire-B
7 l1=1;                          // Relative length of wire-A
8 l2=3;                          // Relative length of wire-B
9 R1=10;                          // Resistance of wire
10 r=(l2/a2)/(l1/a1);
11 disp('The ratio of resistances (R2/R1) = '+string(r)
        + ' ohm');
12 R2=r*R1;
13 disp('Resistance (R2) = '+string(R2)+' ohm');
14
15
16
17
18
19
20
21                               // p 16           2.2
```

---

### Scilab code Exa 2.3 Resistance

```
1
2                               // Example 2.3
3
4                               // Rp=(4+4)|| (8+4)
5
```

```

6 Rp=(8*12)/(8+12); // By Voltage divider rule
7 disp(' voltage Across Foue resisrance = '+string(Rp)
+ ' Ohm');
8
9
10
11
12
13 // p 20 2.3

```

---

#### Scilab code Exa 2.4 Voltage And Current

```

1
2
3 // Example 2.4
4
5 v=8.8*{2/(2+2.4)}; // by voltage divider rule
6 disp(' Anknown Voltage across the R1 = '+string(v)+'
voltage');
7
8 v1=8.8*{2.4/(2+2.4)}; // by voltage divider rule
9 disp(' Anknown Voltage across the R1 = '+string(v1)+'
' voltage');
10 i=4.8/4; // I=V/R
11 disp(' Anknown Current I1 = '+string(i)+' Amp');
12 i1=4.8/6; // I=V/R
13 disp(' Anknown Current I2 = '+string(i1)+' Amp');
14
15
16
17
18
19 // p 20 2.4

```

---

## Scilab code Exa 2.5 Resistance

```
1
2           // Example 2.5
3
4           // From the diagram 2.14
5
6 rp=(1/20)+(1/10)+(1/20);           // Parallel
   resistance
7 Rp=1/rp;                           // The resistance Rp
8 Rs=15;                              // Series resistance
9 Rab=Rs+Rp;                          // Effective
   resistance between A & B
10 disp('(a) Effective resistance between A & B for
   diagram (a) = '+string(Rab)+' Ohms');
11
12           // for diagram (b) network above line AB
   i.e R1=[(R+R)||R]+R
13 R1=5/3;                             // Resistance of
   network
14 R2=R1;                              // The lower part is
   also same as R1
15 R12=5/6;                            // Combination of R1
   & R2
16 Rab1=(R12*1)/(R12+1);              // Effective
   resistance between A & B for diagram (b)
17 disp('(b) Effective resistance between A & B for
   diagram (b) = '+string(Rab1)+' R');
18
19           // for diagram (c)
20 r1=(3*6)/(3+6);                   // Parallel
   combination of 3 & 6 Ohms Resistance
21 Ri=r1+18;                          // series of r1 & 18
   Ohms Resistance
```

```

22 rab=(20*20)/(20+20);           // Parallel
    combinatuion of Ri & 20 Ohms Resistance
23 Rab2=rab+5;                   // series of rab & 2
    Ohms Resistance
24 disp('(c) Effective resistance between A & B for
    diagram (c) = '+string(Rab2)+' Ohms');
25
26
27
28
29 // p 23                        2.5

```

---

#### Scilab code Exa 2.6 Current

```

1
2 // Example 2.6
3
4 d=(1/12)+(1/20)+(1/30);
5 Reff=2+(1/d); // Effective Resisrence
6 v=100;
7 I=v/Reff;
8 // ( but 12 i1= 20i2= 30i3 )
9 // i2= 12/20 *i1 & i3= 12/30 *i1
10 // but 10=i1+i2+i3
11 // 0.6i1+0.4i1+i1=10 i.e i1=5
12 i1=5;
13 disp(' Current of I1 if = '+string(i1)+' Amp');
14 i2=0.6*i1;
15 disp(' Current of I2 if = '+string(i2)+' Amp');
16 i3=0.4*i1;
17 disp(' Current of I3 if = '+string(i3)+' Amp');
18
19
20
21 // p 24                        2.6

```



---

### Scilab code Exa 2.7 Current

```
1
2                               // Example 2.7
3
4           //  $p=i_1^2 \cdot R_1$    i.e.  $i_1=p/R_1$ 
5
6 R1=5;                               // Load resistance
7 p=20;                               // Power
8 i1=p/R1;
9           //  $i = i_1 \cdot (R/R+R_1)$    i.e.  $i = i_1 \cdot (R+R_1)/R$ 
10 i=2*(10+5)/10;
11 disp(' Supply Current is = '+string(i)+' Amp');
12
13
14           // p 25      2.7
```

---

### Scilab code Exa 2.8 Voltage

```
1
2                               // Example 2.8
3
4 v=120;                               // Supply voltage
5 p=60;                               // Power
6 R=v^2/p;                             // Resistance
7
8           // the combination R of bulb B & C is Rbc
9           //           =240/2   i.e Rbc=120
10          //           vb=vc
11 Rbc=240/2;                           // R of each bulb
```

```

12 k=240+120;
13 vc=Rbc*(120/k);          // volt across Vc & Vb    {
    using Volt Divider Rule }
14 va=120-40;              // volt across Va
15 disp(' the Voltage across bulb A & B = '+string(vc)+
    ' Volt ');
16 disp(' the Voltage across bulb C = '+string(va)+'
    Volt ');
17 vb=40;
18 p=(va)^2/240+(vb)^2/240+(vc)^2/240;          // p=pa+pb
    +pc    total power
19
20 disp(' Totale Power Dissipated is = '+string(p)+'
    Watt ');
21
22
23     //    p 25         2.8

```

---

### Scilab code Exa 2.9 Resistance

```

1
2           // Example 2.9
3
4           // From the diagram 2.18
5           // Minimum value of Req is obtained if R
           =0
6           // Maximum value of Req is obtained if R
           = Open ckt
7
8 R1=30;          // Given the value of R1
    & R1+R2= 75
9 R2=75-R1;      // The value of R2
10 disp(' The value of R1 is = '+string(R1)+' Ohms ');
11 disp(' The value of R2 is = '+string(R2)+' Ohms ');
12

```

```

13           // From the diagram 2.19
14
15 Req= (30+75)/2;           // Required value of Req
    is Req= (30+75)/2
16 Rp=Req-R1;               // Hence the parallel
    combination of R2 & R
17 disp(' The value of Rp is = '+string(Rp)+' Ohms ');
18 disp('The value of Rp is exactly half of R2= 45,
    hence the value of R should be '+string(R2)+'
    Ohms ');
19
20
21
22
23           // p 26           2.9

```

---

#### Scilab code Exa 2.10 Resistance

```

1
2           // Example 2.10
3
4           // Rx=R+(R||2Rx)
5           // i.e. 2*Rx^2-3R Rx-R^2 =0
6 R=1;
7 Rx={3*R+sqrt(9*R*R+8*R*R)}/4; // Using Roots of
    quadratic Equation
8
9 disp(' Equivalent R is = '+string(Rx)+' R');
10
11
12
13
14
15           // p 26           2.10

```

---

### Scilab code Exa 2.11 Resistance

```
1
2
3           // Example 2.11
4
5           // To convert Pi- Section into T-
           Section.
6           // We have to find Ra, Rb & Rc for T-
           Section
7 R2=9;      // Resistance of 9 Ohms
8 R3=6;      // Resistance of 6 Ohms
9 R1=3;      // Resistance of 3 Ohms
10
11 Ra=(R2*R3)/(R1+R2+R3);
12 disp(' Value of Ra is = '+string(Ra)+' Ohm');
13 Rb=(R1*R3)/(R1+R2+R3);
14 disp(' Value of Rc is = '+string(Rb)+' Ohm');
15 Rc=(R2*R1)/(R1+R2+R3);
16 disp(' Value of Rc is = '+string(Rc)+' Ohm');
17
18
19
20           // p 26      2.11
```

---

### Scilab code Exa 2.12 Resistance

```
1
2
3           // Example 2.12
4
5 Reff= 100/10;      // Effective R
```

```

6
7          // P=v^2/R    i.e Power of coil
8 v=100;
9 R=600;
10 R1=v^2/R;
11                                     // 2 Coil are connected
                                     parallel
12 R2=(R1*10)/(R1-10);                // Using parallel R
    formula
13
14 disp(' Resistance of each coil = '+string(R2)+' Ohm'
    );
15
16
17
18          // p 27    2.12

```

---

### Scilab code Exa 2.13 Cost

```

1
2
3
4          // Example 2.13
5
6 v=115;          // Voltage
7 i=12;          // current
8 t=6;           // Time Required
9 w=v*i*t;       // Energy
10 Rate=2.50;
11 Cost=w*Rate;
12 disp(' cost of boiler Operation is = '+string(Cost
    /1000)+' Rs/kwh');
13
14
15

```

```
16
17
18          // p 27      2.13
```

---

#### Scilab code Exa 2.14 Rating

```
1
2
3
4          // Example  2.14
5
6 v=240;
7 p=1000;          //toaster reted at 1000 w
8 R=v^2/p;        // resistanc raring
9 Imax=p/v;      // Current rating
10 v1=220;
11 I=v1/R;        // Current at 220 v
12 p1=v1*I;
13 disp(' Power rating is = '+string(p1)+' Watt');
14 disp(' there for the Power rating is less then
      original power. ');
15
16
17
18
19
20          //      p 28      2.14
```

---

#### Scilab code Exa 2.15 Resistance

```
1
2          // Example  2.15
3
```

```

4           // To find the Value of Resister
5           // We Sghould know About Colour Code
6
7 Y=4;           // Yelow colour
8 V=7;           // Violet colour
9 O=10^3;       // Oreng colour
10 r=(10*Y+V)*O;
11 R=r*(5/100);
12 disp(' The value of Resistance is = '+string(R)+'
        ohm ');
13
14
15
16
17           // p 30      2.15

```

---

#### Scilab code Exa 2.16 Resistance

```

1
2
3           // Example 2.16
4
5           // To find the Value of Resister
6           // We Sghould know About Colour
           Code
7 Gr=8;         // Gray colour
8 B=6;         // Blue colour
9 G=10^-1;     //Gold colour
10 r=(10*Gr+B)*G;
11 R=r*(5/100);
12 disp(' The value of Resistance is = '+string(R)+'
        ohm ');
13
14
15

```

16  
17 // p 30 2.16

---

### Scilab code Exa 2.17 Resistance

```
1
2
3 // Example 2.17
4
5 R1=126; // Resistance of 126 Ohms
6 T1=20; // temperature at 126 ohms resistor
7 T2=-35; // Temperature ( -35 Digree)
8 ao=0.00426;
9 // By using Temprerature Formula i.e
//  $R1/(1+aoT1) = R2/(1+aoT2)$ 
10 z=(1+ao*T2)/(1+ao*T1);
11 R2=R1*z;
12 disp(' Resistance of the line (at T=-35) = '+string(
// R2)+' Ohm');
13
14
15
16
17
18 // p 31 2.17
```

---

### Scilab code Exa 2.18 Temperature

```
1
2
3 // Example 2.18
4
5 R1=3.42; // Resistance of 3.42 Ohms
```



```

6 T1=20;           // temperature at 3.42 ohms resistor
7 R2=4.22;        // Resistance R2
8 ao=0.00426;
9
10           // By using Temperature Formula  $\implies$  i.e  $R1$ 
           //  $/(1+aoT1) = R2/(1+aoT2)$ 
11
12 z=(R2/R1)*(1+ao*T1);
13 T2=(z-1)/ao;
14 T=T2-T1;       // Temperature Rise
15 disp(' The Temperature Rise is = '+string(T)+'
        Digree Celsius ');
16
17
18
19
20
21           // p 32           2.18

```

---

# Chapter 3

## Network Analysis

Scilab code Exa 3.1 capacitor

```
1
2
3                                     // Exa 3.1
4
5 A=0.113;                            // Area of parallel plate
6 eo=8.854*10^-12;                    // Permittivity of free
   space
7 er=10;                               // Relative Permittivity
8 d=0.1*10^-3;                        // Distance between 2
   Plate
9 C=(eo*er*A)/d;                      // The value of capacitor
   Using case-1
10 disp(' The value of capacitor Using case-1 = '+
   string(C*1000000)+' uF');
11
12 w=0.05;                             // Energy stored
13 v=100;                               // Voltage
14 C1=(2*w)/v^2;                      // The value of capacitor
   Using case-2
15 disp(' The value of capacitor Using case-2 = '+
   string(C1*1000000)+' uF');
```

```

16
17 i=5*10^-3;           // Current
18 dv=100;             // Increase iv voltage
19 dt=0.1;             // Time required
20 C2=i/(dv/dt);       // The value of capacitor
    Using case-3
21 disp(' The value of capacitor Using case-3 = '+
    string(C2*1000000)+' uF');
22
23
24
25
26
27
28 // p 53    3.1

```

---

### Scilab code Exa 3.2 Inductor

```

1
2
3 // Exa 3.2
4
5 w=0.2;               // Energy stored
6 i=0.2;               // Current
7 L1=(2*w)/i^2;       // The value of
    Inductor Using case-1
8 disp(' The value of Inductor Using case-1 = '+string
    (L1)+' H');
9
10 v=10;                // Voltage
11 di1=0.1;            // Increase current
12 dt1=0.2;            // Time required
13 L2=v/(di1/dt1);    // The value of
    Inductor Using case-2
14 disp(' The value of Inductor Using case-2 = '+string

```

```

(L2)+' H');
15
16
17 p=2.5; // Power
18 di2=0.1; // Increase current
19 dt2=0.5; // Time required
20 L3=p/(di2*dt2); // The value of
    Inductor Using case-3
21 disp(' The value of Inductor Using case-3 = '+string
(L3)+' H');
22
23
24
25
26 // p 54 3.2

```

---

### Scilab code Exa 3.3 Inductor

```

1
2 // Exa 3.3
3
4 // Given L1= 2L2
5 // From the Diagram Leq=
6 // there for (L1*L2)/(L1+
7 // L2)= 0.2 ,( where Leq=
8 // 0.7)
9 // i.e (2*L2*L2)/3L2= 0.2;
10 // it means L2= 0.3 H
11 // Value of Inductor 1
12 // Value of Inductor 2
13 disp(' Value of Inductors are L1= '+string(L1)+' H
& L2= '+string(L2)+' H');

```

14  
15  
16  
17  
18  
19

// p 55 3.3

---

### Scilab code Exa 3.4 Voltage

```
1
2 // Exemple 3.4
3
4 C1=0.05; // Capacitor
   1 ( in Micro )
5 C2=0.1; // Capacitor
   2 ( in Micro )
6 C3=0.2; // Capacitor
   3 ( in Micro )
7 C4=0.05; // Capacitor
   4 ( in Micro )
8 C=(1/C1)+(1/C2)+(1/C3)+(1/C4); // Addition
   of capacitors
9 Cs=1/C; // Equivalent
   capacitor
10 disp(' Equivalent capacitor = '+string(Cs)+' uF');
11
12 V=220; // Supply
   voltage
13 Q=Cs*V; // Charge
   transfer
14 V1=Q/C1; // Voltage
   drop across capacitor 1
15 disp(' Voltage drop across capacitor 1 = '+string(V1
   )+' Volt');
16
```

```

17 V2=Q/C2; // Voltage
    drop across capacitor 2
18 disp(' Voltage drop across capacitor 2 = '+string(V2
    )+' Volt');
19
20 V3=Q/C3; // Voltage
    drop across capacitor 3
21 disp(' Voltage drop across capacitor 3 = '+string(V3
    )+' Volt');
22
23 V4=Q/C4; // Voltage
    drop across capacitor 4
24 disp(' Voltage drop across capacitor 4 = '+string(V4
    )+' Volt');
25
26
27
28
29 // p 55 3.4

```

---

### Scilab code Exa 3.5 Voltage

```

1
2 // Exa 3.5
3
4 C1=2*10^-6; // Value of capacitor-1
5 C2=10*10^-6; // Value of capacitor-2
6 Q1=400*10^-6; // Charge of capacitor-1
7 Q2=200*10^-6; // Charge of capacitor-2
8 Q=Q1+Q2; // Total Charge of
    capacitors
9 C=C1+C2; // Equivalentss capacitor
10 V=Q/C; // Voltage across the
    capacitor
11 disp(' Voltage across the capacitor = '+string(V)+'

```

```

    Volt ');
12
13
14
15
16
17
18          // p 55          3.5

```

---

### Scilab code Exa 3.6 Voltage And Energy

```

1
2          // Exa 3.6
3
4 C1=2*10^-6;          // Capacitor
   1
5 C2=8*10^-6;          // Capacitor
   2
6 C=(C1*C2)/(C1+C2);          //
   Equivalentss capacitor
7 V=300;          // Supply
   voltage
8 Q=C*V;          // Charge on
   each capacitor
9 disp('(a) Charge on each capacitor = '+string(Q
   *1000000)+' uC');
10
11 V1=Q/C1;          // Voltage
   drop across capacitor 1
12 disp('(b).1 Voltage drop across capacitor 1 = '+
   string(V1)+' Volt');
13
14 V2=Q/C2;          // Voltage
   drop across capacitor 2
15 disp('(b).2 Voltage drop across capacitor 2 = '+

```

```

    string(V2)+' Volt ');
16
17 V1=240;
18 w1=0.5*C1*V1^2;           // Energy
    stored in capacitor-1
19 disp('(c).1 Energy stored in capacitor-1 = '+string
    (w1*1000)+' mJ');
20
21 V2=60;
22 w2=0.5*C2*V2^2;           // Energy
    stored in capacitor-2
23 disp('(c).2 Energy stored in capacitor-2 = '+string
    (w2*1000)+' mJ');
24
25
26
27
28
29
30 // p 56           3.6

```

---

### Scilab code Exa 3.7 Capacitor

```

1
2
3 // Exa 3.7
4
5 // Given that Ceq= 1 uF
    between A & B
6 // By reducing the
    circuit will get 2
    capacitor.
7 // that is C & C13= 32/9
    uF
8 // there for (1/1)= 1/C+

```



```

9                                     9/32
// Hance  $1/C = 1 - 9/32$ 
10 C=1/{1-(9/32)}; // Value of Capacitor -C
11 disp(' Value of Capacitor C = '+string(C)+' uF');
12
13
14
15
16
17
18
19                                     // p 56      3.7

```

---

### Scilab code Exa 3.8 Voltage And Current

```

1
2                                     // Exa 3.8
3
4                                     // for the extreme value
// of Rl voltage (Vl) &
// Current (Il)
5 E=3; // Supply voltage
6 Ri=1; // I/p Resistance
7 Rl1=100; // Minimum load
// resistance
8 I11=E/(Rl1+Ri); // Current at minimum
// load Rl1
9 V11=E-(I11*Ri); // Voltage at minimum
// load Rl1
10
11 Rl2=1000; // Maximum load
// resistance
12 I12=E/(Rl2+Ri); // Current at maximum
// load Rl2
13 V12=E-(I12*Ri); // Voltage at maximum

```

```

    load Rl2
14
15 I1={(I11-I12)/I11}*100;      // Change in current I1
16 disp(' The % change (a Decrease ) in I1 = '+string(
    I1)+' % ');
17
18 V1={(V11-V12)/V11}*100;     // Change in voltage V1
19 disp(' The % change (a Increase ) in V1 = '+string(-
    V1)+' % ');
20
21 r11=0.001;                  // Minimum load
    resistance (for 2nd case)
22 i11=E/(r11+Ri);            // Current at minimum
    load r11
23 v11=E-(i11*Ri);           // Voltage at minimum
    load r11
24
25 r12=0.01;                   // Maximum load
    resistance (for 2nd case)
26 i12=E/(r12+Ri);           // Current at maximum
    load r12
27 v12=E-(i12*Ri);           // Voltage at maximum
    load r12
28
29 il={(i11-i12)/i11}*100;     // Change in current
    il
30 disp(' The % change (a Decrease ) in I1 = '+string(
    il)+' % ');
31
32 v1={(0.003-0.03)/0.003}*100; // Change in voltage
    v1 ==> (v11=0.003 & v12=0.03)
33 disp(' The % change (a Increase ) in V1 = '+string(-
    v1)+' % ');
34
35
36
37
38

```

### Scilab code Exa 3.9 Voltage And Power

```

1
2
3           // Exa 3.9
4
5 Is=3;           // Source current
6 Rs=2;           // Source resistance
7 Vs=Rs*Is;      // Source voltage
8 Rl=4;           // Load resistance
9 R=(Rs*Rl)/(Rs+Rl); // Equivalent resistance
10 I11=(Is*Rs)/(Rs+Rl); // Load current in case-1
11 disp(' Load current in case-1 = '+string(I11)+' Amp'
      );
12
13 V11=I11*Rl;    // Load voltage in case-1
14 disp(' Load voltage in case-1 = '+string(V11)+' Volt
      ');
15
16 Ps1=Is^2*R;   // Power delivered in case
      -1
17 disp(' Power delivered in case-1 = '+string(Ps1)+'
      Watt');
18
19 I12=Vs/(Rs+Rl); // Load current in case-2
20 disp(' Load current in case-2 = '+string(I12)+' Amp'
      );
21
22 V12=Vs*(Rl/(Rl+Rs)); // Load voltage in case-2
23 disp(' Load voltage in case-2 = '+string(V12)+' Volt
      ');
24
25 Ps2=Vs^2/(Rs+Rl); // Power delivered in case

```

```

-2
26 disp(' Power delivered in case -2 = '+string(Ps2)+'
    Watt ');
27
28
29
30
31 // p 61 3.9

```

---

### Scilab code Exa 3.10 Current

```

1
2 // Exa 3.10
3
4
5 R1=6; // Load resistance
6 Rs=2; // Source resistance
7 Is=16; // Source current
8 I2=Is*(R1/(R1+Rs)); // Current through Rs
9 disp(' Current through Rs (with Current as source )
    = '+string(I2)+' Amp');
10
11 I6=Is-I2; // Current through Rl
12 disp(' Current through Rl (with Current as source )
    = '+string(I6)+' Amp');
13
14 // After transforming the current source
    in to voltage source
15
16 Vs=32; // Source voltage
17 i2=Vs/(R1+Rs); // Current through Rs
18 i6=i2; // Current through Rl
19 disp(' Current through Rs & Rl (with voltage as
    source ) = '+string(i2)+' Amp');
20

```

21  
22  
23  
24  
25

// p 62 3.10

---

### Scilab code Exa 3.13 Current And Power

```
1
2
3 // Exa 3.13
4
5 // From Diagram (3.26)
  Apply KVL to get  $24 - 4I - 2I + 18I = 0$ 
6 I=(-24/12); // Current
7 disp(' The value of Current = '+string(I)+' Amp');
8
9 V1=4*I; // Voltage across 4 Ohm
  Resistor
10 p=-(4.5*V1*I); // Power absorbed
11 disp(' Power absorbed by dependent source = '+string
  (p)+' Watt');
12
13 V=24; // Independent voltage
  source
14 R=V/I; // Resistance Seen from
  Independent source
15 disp(' Resistance Seen from Independent source = '+
  string(R)+' Ohm');
16
17
18
19
20 // p 67 3.13
```

---

Scilab code Exa 3.14 Voltage

```
1
2
3
4           // Examble 3.14
5
6           // From Diagram (3.28)
           Apply KVL to get  $100-40I-60I=0$ 
7 I=100/100;           // Current
8 disp(' The value of Current = '+string(I)+' Amp');
9
10 R=60;           // Resistor
11 V1=I*R;           // Voltage across 60 ohm
           resistor
12 disp(' Voltage across 60 ohm resistor = '+string(V1)
           +' Volt');
13
14           // By using Voltage
           divider concept
15 Vab=-10+V1+0*10+30;           // Voltage Vab
16 disp(' Voltage across open-circuit Vab = '+string(
           Vab)+' Volt');
17
18
19
20           //           p 68           3.14
```

---

Scilab code Exa 3.15 Voltage

```

1
2           // Examle 3.15
3
4           // From Diagram (3.29)
           let us confirm that
           the given voltage
           satisfy KVL
5           // 10-6-4= 0 , satisfy
           KVL
6           // From Diagram Apply KVL to right
           loop get {  $-(-4)+4+V_x=0$  }
7
8 Vx=-4-4;           // Voltage Vx
9 disp(' Voltage across Vx = '+string(Vx)+' Volt ');
10
11           // To find Vcd Stand a point d & walk
           towards c i.e {  $V_{cd}=-4+6$  }
12
13 Vcd=-4+6;           // Voltage Vcd
14 disp(' Voltage across Vcd = '+string(Vcd)+' Volt ');
15
16
17
18
19
20
21           //           p 69           3.15

```

---

### Scilab code Exa 3.16 Current

```

1
2           // Examle 3.16
3
4           // From the diagram (3.30) Apply KVL
           to all the 3 loop.

```

```

5          // Loop-1      5Ix+0Iy-10I1==
              1 0 0.....( i
6          // Loop-2      7Ix+ 2Iy-2I1=
              - 5 0.....( ii
7          // Loop-3      3Ix-5Iy-3I1=
              - 5 0.....( iii
8
9          // By using matrix form will get A*X =
              B   formate
10
11 delta=[5 0 10 ; 7 2 -2 ; 3 -5 -3 ];          //
              value of A
12 d=det(delta);                                //
              Determinant of A
13
14 delta1=[100 0 10 ; -50 2 -2 ; -50 -5 -3 ];   //
              value of A1 (when 1st colomn is replace by B)
15 d1=det(delta1);                              //
              Determinant of A1
16
17 delta2=[5 100 10 ; 7 -50 -2 ; 3 -50 -3 ];    //
              value of A2 (when 2nd colomn is replace by B)
18 d2=det(delta2);                              //
              Determinant of A2
19
20 Ix=d1/d;                                      //
              Current (Ix)
21 disp(' The value of Current (Ix) = '+string(Ix)+'
              Amp');
22
23 Iy=d2/d;                                      //
              Current (Iy)
24 disp(' The value of Current (Iy) = '+string(Iy)+'
              Amp');
25
26
27
28

```



## Scilab code Exa 3.17 Resistance

```

1
2           // Examle 3.17
3
4           // From the diagram (3.31) Apply KCL
           // to node B & C
5           // will get { I1+I2= 20 } & { I3-I2=
           // 30 }
6           // Apply KVL to Bigger loop will get
           // i.e { I1-3I2-2I3= -100 }
7           // By solving All the 3 equation we
           // get
8
9   I1=10;           // Current in loop-1
10  disp(' The value of Current (I1) = '+string(I1)+'
        Amp');
11
12  I2=10;           // Current in loop-2
13  disp(' The value of Current (I2) = '+string(I2)+'
        Amp');
14
15  I3=40;           // Current in loop-3
16  disp(' The value of Current (I3) = '+string(I3)+'
        Amp');
17
18           // For Resistors Apply KVL to loop-1 &
           // loop-3
19           // we get { -0.1I1-20R1+110= 0 } & {
           // 0.2I3-120+30R2= 0 }
20
21  R1=(110-0.1*I1)/20; // Resistance (R1)
22  disp(' The value of Resistance (R1) = '+string(R1)+'

```

```

    Ohm ');
23
24 R2=(120-0.2*I3)/30; // Resistance (R2)
25 disp(' The value of Resistance (R2) = '+string(R2)+'
    Ohm ');
26
27
28
29
30 // p 71 3.17

```

---

#### Scilab code Exa 3.18 Current

```

1
2
3 // Exa 3.18
4
5 // From the diagram (3.33a) Apply KVL
   to Bigger loop i.e (For I1 )
6 // Will get { 10-5(I1-2)-8I1= 0 }
7 // Using loop-circuit analysis
8
9 I1=20/13; // Current through 8 ohm resistor
10 disp(' Current through 8 ohm resistor (I1) = '+
    string(I1)+' Amp');
11
12
13
14
15 // p 74 3.18

```

---

#### Scilab code Exa 3.19 Voltage

```

1
2
3
4           // Examble 3.19
5
6           // From the diagram (3.34a) Apply KVL
           // to loop-2 i.e (For I )
7           // Will get { -2I-3I+6-1(I+5-4)= 0 }
8           // Using loop-circuit analysis
9
10          I=5/6;           // Current in loop-2
11          V=3*I;          // Unknown voltage.
12          disp(' Unknown voltage V = '+string(V)+' Volt ');
13
14
15
16          // p 74           3.19

```

---

### Scilab code Exa 3.20 Current

```

1
2
3           // Examble 3.20
4
5           // From the diagram (3.38) Apply KVL
           // to all the 3 loop.
6           // Loop-1      19I1-12I2+0I3==
           // 60.....( i
7           // Loop-2      -12I1+18I2-6I3=
           // 0.....( ii
8           // Loop-3      0I1-6I2+18I3=
           // 0.....( iii
9
10          // By using matrix form will get A*X =
           // B formate

```

```

11
12 delta=[19 -12 0 ; -12 18 -6 ; 0 -6 18 ];           //
    value of A
13 d=det(delta);                                     //
    Determinant of A
14
15 delta1=[60 -12 0 ; 0 18 -6 ; 0 -6 18 ];           //
    value of A1 (when 1st colomn is replace by B)
16 d1=det(delta1);                                  //
    Determinant of A1
17
18 Is=d1/d;                                          //
    Current drawn from source (Is=I1)
19 disp(' Current drawn from source (Is) = '+string(Is
    )+' Amp');
20
21
22
23
24
25 // p 79      3.20

```

---

### Scilab code Exa 3.21 Current

```

1
2
3 // Examble 3.21
4
5 // From the diagram (3.39) Apply KVL
  to all the 3 loop.
6 // Loop-1      7I1-4I2+0I3=-
  67.....( i
7 // Loop-2      -4I1+15I2-6I3=
  -152.....( ii
8 // Loop-3      0I1-6I2+13I3=

```

```

9
10          74.....( iii
           // By using matrix form will get A*X =
           B formate
11
12 delta=[7 -4 0 ; -4 15 -6 ; 0 -6 13 ];           //
           value of A
13 d=det(delta);                                   //
           Determinant of A
14
15 delta1=[7 -4 67 ; -4 15 -152 ; 0 -6 74 ];       //
           value of A1 (when 3rd colomn is replace by B)
16 d1=det(delta1);                                 //
           Determinant of A1
17
18 I3=d1/d;                                         //
           Current through 7 ohm resistor (I3)
19 disp(' Current through 7 ohm resistor = '+string(I3)
        +' Amp');
20
21
22
23
24
25          // p 79      3.21

```

---

### Scilab code Exa 3.22 Voltage

```

1
2          // Examble 3.22
3
4          // From the diagram (3.40b) Apply KCL
           to node a
5          // will get { (va-0)/2+ (va-vb)/3 = 5
           }.....(1

```

```

6           // Similarly apply KCL at node b
7           // will get { (vb-va)/3+ vb-0)/4 = -6
              }.....(2
8
9           // After solving these 2 equation
              will have
10
11 Va=2.44;           // Voltage at node a
12 Vb=-8.89;         // Voltage at node b
13 Vab=Va-Vb;        // Voltage across 3 ohm
                    resistor
14 disp(' Voltage across 3 ohm resistor = '+string(Vab)
        +' Volt');
15
16
17
18
19           // p 80           3.22

```

---

### Scilab code Exa 3.23 Current

```

1
2           // Exa 3.23
3
4           // From the diagram (3.41) Apply KCL
              to node
5           // will get { (v1-0)/12+ (v1-60)/3+ (
              v1-0)/4 = 5 }
6           // After solving above equation we
              get V1= 18 V
7
8 V1=18;           // Voltage at node 1
9 I1=(V1-0)/12;   // Current through 12 ohm
                    resistor (I1)
10 disp(' Current through 12 ohm resistor = '+string(I1)

```

```

    )+ ' Amp ');
11
12
13
14
15          // p 81          3.23

```

---

**Scilab code Exa 3.24 Current**

```

1
2
3          // Exa 3.24
4
5          // From the diagram (3.42) Node
           // voltages are
6          // Have {  $v_a - v_b + 0v_c = 6$ 
           // }.....(1
7          // Apply KCL at Super node
8          // will get {  $0.33v_a + 0.25v_b - 0.25v_c =$ 
           // 2 }.....(2
9          // Apply KCL at node c
10         // will get {  $0v_a - 0.25v_b + 4.5v_c = -7$ 
           // }.....(3
11
12         // By using matrix form will get  $A \cdot X =$ 
           // B formate
13
14 delta=[1 -1 0 ; 0.33 0.25 -0.25 ; 0 -0.25 0.45];
           // value of A
15 d=det(delta);
           // Determinant of A
16
17 delta1=[1 6 0 ; 0.33 2 -0.25 ; 0 -7 0.45];
           // value of A1 (when 2nd column is replace by B)
18 d1=det(delta1);

```

```

    // Determinant of A1
19
20 delta2=[1 -1 6 ; 0.33 0.25 2 ; 0 -0.25 -7];
    // value of A2 (when 3rd column is replace by B)
21 d2=det(delta2);
    // Determinant of A2
22
23 Vb=d1/d;
    // Voltage at node-b
24 Vc=d2/d;
    // Voltage at node-c
25
26 I=(Vb-Vc)/4;
    // Current through 4 ohm resistor (I)
27 disp(' Current through 4 ohm resistor = '+string(I)+
    ' Amp');
28
29
30
31
    // p 82          3.24

```

---

### Scilab code Exa 3.25 Voltage

```

1
2          // Examble 3.25
3
4          // From the diagram (3.43b) Apply KCL
           // to node a
5          // will get { (va-6)/1+ (va-0)/5 =4-5
           // }
6
7 Va=(6-1)/1.2;          // Voltage at node a
8
9          // by using voltage divider rule
10

```



```

11 V=Va*(3/(2+3)); // Voltage across 3
    ohm resistor
12 disp(' Voltage across 3 ohm resistor = '+string(V)+'
    Volt ');
13
14
15
16
17
18 // p 82 3.25

```

---

#### Scilab code Exa 2.26 Current

```

1
2
3 // Exa 3.26
4
5 // Reffer Diagram (3.44 a)
6 // First of all convert all resistor
    in to conductor
7 // From the obtained diagram (3.44 c)
    Apply KCL to node 1 & 2
8 // Node-1 0.7S1-0.2S2=
    3.....( i
9 // Node-2 -0.2S1-1.2S2=
    2.....( ii
10
11 // By using matrix form will get A*X =
    B formate
12
13 delta=[0.7 -0.2 ; -0.2 1.2 ]; // value of A
14 d=det(delta); //
    Determinant of A
15
16 delta1=[3 -0.2 ; 2 1.2 ]; // value of

```

```

    A1 (when 1st colomn is replace by B)
17 d1=det(delta1); //
    Determinant of A1
18
19 delta2=[0.7 3 ; -0.2 2 ]; // value of
    A2 (when 2nd colomn is replace by B)
20 d2=det(delta2); //
    Determinant of A2
21
22 V1=d1/d; // Voltage at
    node-1
23 V2=d2/d; // Voltage at
    node-2
24
25 I=(V1-V2)/5; // Current
    through 5 ohm resistor (I)
26 disp(' Current through 5 ohm resistor = '+string(I)+
    ' Amp');
27
28
29
30
31 // p 84 3.26

```

---

### Scilab code Exa 2.27 Current

```

1
2
3 // Examble 3.27
4
5 // From the diagram (3.45)
    Apply KCL to the circuit
6 // will get  $(V-10)/2 + (V-0)/4$ 
     $+(V-8)/6 = 0$ 
7 // Using nodal analysis

```

```
8           // hence we can get V= 6.91
9 V=6.91;           // Voltage at the node
10 I=V/(1+3);       // Current (I)
11 disp(' Current (I) = '+string(I)+' Amp');
12
13
14
15
16           // p 84           3.27
```

---

# Chapter 4

## Network Theorems

Scilab code Exa 4.1 Current

```
1
2                                     // Exa 4.1
3
4                                     // Reffer the diagram (4.2 a)
5                                     // Using Superpositon theorem
6
7 I=-0.5;                               // Source current
8 I1=I*(0.3/(0.1+0.3));                 // When 0.5-A Current
   source is on { by voltage divider }
9
10 V=80*10^-3;                          // Voltage source
11 I2=(V/(0.1+0.3));                    // When 80-mV voltage
   source is on { by ohm's law }
12
13 i=I1+I2;                              // Current in the
   circuit { by Superpositon theorem }
14 disp(' Current in the circuit = '+string(i)+' Amp');
15
16
17
18
```

19  
20

// p 105

4.1

---

### Scilab code Exa 4.2 Current

```
1
2
3           // Exa 4.2
4
5           // Reffer the diagram (4.3)
6           // Using Superpositon theorem
7
8 V=10;           // Voltage source
9 I1=(V/(50+150)); // When 10-V voltage
   source is on { by ohm's law }
10
11 i1=40;           // Source current
12 I2=i1*(150/(50+150)); // When 40-A Current
   source is on { by current divider }
13
14 i2=-120;           // Source current
15 I3=i2*(50/(50+150)); // When (-120)-A
   Current source is on { by current divider }
16
17
18 I=I1+I2+I3;           // Current in the
   circuit { by Superpositon theorem }
19 disp(' Current in the circuit = '+string(I)+' Amp');
20
21
22
23
24
25           // p 106           4.2
```

---

### Scilab code Exa 4.3 Voltage

```
1
2
3           // Example 4.3
4
5           // From the diagram 4.5
6           // Using super position theorem
7           // 4-A current source is active
8
9  i=4/{1+(2+3)};           // Current
10  R=3;                     // Resistance of 3 Ohms
11  V4=i*R;                  // Voltage across 3 Ohms
    resistance in Case-1
12
13           // 5-A current source is active
14  i5=5;                    // 5-A current source
15  V5=(-i5)*{1/[1+(2+3)]*3}; // Voltage across 3 Ohms
    resistance in Case-2
16
17           // 6-V voltage source is active
18  i6=6;                    // 6-A current source
19  V6=i6*{3/[1+(2+3)]};    // Voltage across 3 Ohms
    resistance in Case-3
20
21  V=V4+V5+V6;             // Voltage across 3 Ohms
    resistance
22  disp(' Voltage across 3 Ohms resistance is = '+
    string(V)+' Volt');
23
24
25
26
27           // p 106           4.3
```

---

### Scilab code Exa 4.4 Current

```
1
2
3           // Exa 4.4
4
5           // From the diagram (4.6 a)
6           // Using Superpositon theorem
7
8 V=10;           // Voltage source
9 I1=(V/(2+4+6)); // When 10-V voltage
    source is on { by ohm's law }
10
11           // we have to find Is=
    ?
12           // When Is-A Current
    source is on
13           // will have { I2=
    -(2/3)Is }
14           // given that I1+I2= 0
15           // there for 5/6 -
    (2/3)Is= 0
16 Is=(5*3)/(6*2); // Source current
17 disp(' The value of source current (Is) = '+string(
    Is)+' Amp');
18
19
20
21
22
23           // p 108           4.4
```

---

### Scilab code Exa 4.5 Voltage

```
1
2                                     // Exa 4.5
3
4                                     // From the diagram (4.8)
5                                     // Using thevenin's equivalent
                                     theorem
6
7 V1=50;                               // Voltage source
   V1
8 V2=10;                               // Voltage source
   V2
9 I1=(V1-V2)/(10+10+20);               // Current
   through the ckt ( when Current source is off )
10
11 i=1.5;                              // Current source
   i
12 I2=i*(10/(10+(10+20)));             // Current through
   the ckt ( when Current source is active )
13 I=I1+I2;                            // Addition of I1
   & I2
14 Vth= I*20;                          // Thevenin's
   voltage at 20 Ohms R
15
16 Rth=(20*(10+10))/(20+(10+10));      // Thevenin's
   resistance
17
18 V1=Vth*(5/(5+10));                  // Voltage across
   R1
19 disp(' Voltage across olad resistor (R1) = '+string(
   V1)+' Volt ');
20
21
22
23
24
25
```



**Scilab code Exa 4.6 Voltage**

```

1
2                                     // Exa 4.6
3
4                                     // From the diagram (3.24a)
5                                     // Using thevenin's equivalent
                                     // theorem
6
7 Vth=5;                               // Thevenin's
   voltage ==> { by Circuit reduction }
8
9 Rth=3;                               // Thevenin's
   resistance ==> { by Circuit reduction }
10
11 V1=Vth*(3/(3+3));                   // Voltage across
   R1
12 disp(' Voltage across load resistor (R1) = '+string(
   V1)+' Volt');
13
14
15
16
17
18
19                                     // p 111           4.6

```

**Scilab code Exa 4.7 Current**

```

1
2                                     // Exa 4.7

```

```

3
4           // From the diagram (4.11a)
5
6           // Using Nortan's
           // equivalent theorem
7
8 R1=5;           // Resistance R1
9 R2=10;         // Resistance R2
10 V1=10;        // Voltage source V1
11 I1=V1/R1;     // Current I1
12
13 V2=5;         // Voltage source V2
14 I2=V2/R2;     // Current I2
15 IN=I1+I2;     // Nortan's current
16
17 RN=(R1*R2)/(R1+R2); // Nortan's resistance
18
19 Rl=5;         // Load resistance
20 Il=IN*(RN/(RN+Rl)); // Load current
21 disp(' Load current (Il) = '+string(Il)+' Amp');
22
23
24
25           // p 113           4.7

```

---

#### Scilab code Exa 4.8 Power

```

1
2           // Examble 4.8
3
4 Voc=12.6;     // Voltage of car battery
5 Isc=300;     // Short-circuit current
6 Ro=Voc/Isc;  // O/p resistance
7
8           // { P=Vht^2/4Rth } , but

```

```

9 Pavl=Voc^2/(4*Ro);           // Available power
10 disp(' Available power is = '+string(Pavl)+ ' Watt')
    ;
11
12
13
14
15
16 // p 114                      4.8

```

---

#### Scilab code Exa 4.9 Power

```

1
2 // Exa 4.9
3
4 n=8; // No.Of dry cells
5 E=1.5; // Emf of cell
6 Voc=n*E; // open-circuit Voltage
    of battery
7 r=0.75; // Internal resistance
8 Ro=r*n; // O/p resistance
9
10 // ==> { P=Vht^2/4Rth } , but here Vth
    = Voc & Rth= Ro
11
12 Pavl=Voc^2/(4*Ro); // Available power
13 disp(' Available power is = '+string(Pavl)+ ' Watt')
    ;
14
15
16
17
18
19 // p 115                      4.9

```

---

Scilab code Exa 4.10 Voltage And Power

```
1
2           // Examle 4.10
3
4           // From Diagram 4.12
5
6 P=25;           // Power
7 Rl=8;           // Load
8           resistance
9 Vth=P*4*Rl;     // Thevenin's
10           equivalent voltage
11
12           // If Load is Short-ckt (RL=0)
13 Vo=0;           // Voltage
14 IL=1;           // load current
15 Po1=Vo*IL;     // O/p power
16
17           // If Load is Open-ckt ( RL=infinity )
18 IL1=0;          // Load current
19 Vo1=1;          // Voltage
20 Po2=Vo1*IL1;   // O/p power
21
22 x=[0 2 4 6 8 16 32 ];           // Diffrent value
23           of RL
24 y=[0 16 22.22 24.49 25 22.22 16 ] // Value of Power
25
26 plot2d(x,y);           // To plot graph
27 xlabel('RL (in Ohms )---->'); // For X-Label
28 ylabel('Po (in W ---->') // For Y-Label
29
30           // View p 115           4.10
```

---

Scilab code Exa 4.11 Current And Resistance

```
1
2                                     // Examle 4.11
3
4                                     // From the diagram (4.14)
5
6 Req=2+{(12*4)/(12+4)}+4;           // Equivalent
   resistance (for 4.14a )
7 v=36;                               // Voltage
   source
8 i=v/Req;                             // Current
   supply by the voltage source
9 I=i*(12/(12+4));                    // Current in
   branch B ==> { by current divider }
10 disp(' Current in branch B = '+string(I)+' Amp');
11
12 Req1=3+{(12*6)/(12+6)}+1;          // Equivalent
   resistance (for 4.14b )
13 i1=v/Req1;                          // Current
   supply by the voltage source
14 I1=i1*(12/(12+6));                  // Current in
   branch A ==> { by current divider }
15 disp(' Current in branch A = '+string(I1)+' Amp');
16
17 Rtr=v/I;                             // Transfer
   resistance
18 disp(' Transfer resistance from Branch A to B = '+
   string(Rtr)+' Ohm');
19
20
21
22                                     // p 117           4.11
```

---

# Chapter 5

## Electromagnetism

Scilab code Exa 5.1 Current

```
1
2
3           // Example 5.1
4
5 B=20*10^-3; // Megnetic Field intensity
6 m=4*%pi*10^-7; // Permeability of free Space
7 n=20*100; // No.Of Turns per meter
8 I=B/(m*n);
9 disp(' Necessary Current is = '+string(round(I))+
      ' Amp');
10
11
12
13 // p 187 5.1
```

---

Scilab code Exa 5.2 Megnetic Field Strength

```
1
```

```

2
3
4           // Example 5.2
5
6 l=4;           // Layers of Solenoid
7 w=350;        // turns Winding
8 s=0.5;        // Length of Solenoid
9 n=(l*w)/s;    // No.Of turns
10 I=6;         // Current in the Solenoid
11 mo=4*pi*10^-7; // Permeability of free Space
12 B=mo*n*I;    // Formula for Megnetic Field at
               the centre
13 disp('(a) Megnitude of field near the Centre of
        Solenoid = '+string(B)+' Tesla');
14 B1=B/2;      // Formula for Megnetic Field at
               the end
15 disp('(b) Megnitude of field at the end of Solenoid
        = '+string(B1)+' Tesla');
16 disp('(c) Megnetic Field outside the solenoid is
        Negligible');
17
18
19
20           // p 188 5.2

```

---

### Scilab code Exa 5.3 Force

```

1
2
3           // Example 5.3
4
5 mo=4*pi*10^-7; // Permeability of free Space
6 i1=80;         // Current in 1st Wire
7 i2=30;         // Current in 2nd Wire
8 r=2;          // Distance between 2 wires

```

```

9
10 F=(mo*i1*i2)/(2*%pi*r);
11 disp(' Force between 2 wires = '+string(F)+' N/m');
12
13
14
15
16
17 // p 192 5.3

```

---

#### Scilab code Exa 5.4 Force

```

1
2
3
4 // Example 5.4
5
6 mo=4*%pi*10^-7; // Permeability of free Space
7 i1=4; // Current in 1st Wire
8 i2=6; // Current in 2nd Wire
9 r=0.03; // Distance between 2 wires
10
11 F=(mo*i1*i2)/(2*%pi*r);
12 l=0.15; // Section of wire
13 Fnet=F*l;
14 disp(' Force on 15 cm of wire B is = '+string(Fnet)+'
15 ' N');
16
17
18
19
20 // p 192 5.4

```

---



### Scilab code Exa 5.5 Voltage

```
1
2
3
4           // Example 5.5
5
6 B=0.5;           // Megnetic Field
7 l=0.2;           // Length of conductor
8 v=5;             // velocity Conductor
9 Q1=0;            // Angle of Motion in case 1
10 Q2=90;           // Angle of Motion in case 2
11 Q3=30;           // Angle of Motion in case 3
12
13 e1=B*l*v*sind(Q1);
14 disp(' emf of conductor when move Parallel to
      Megnetic field = '+string(e1)+' Volt ');
15 e2=B*l*v*sind(Q2);
16 disp(' emf of conductor when move Perpendicular to
      Megnetic field = '+string(e2)+' Volt ');
17 e3=B*l*v*sind(Q3);
18 disp(' emf of conductor when move at an Angle 30 to
      Megnetic field = '+string(e3)+' Volt ');
19
20
21
22
23
24           // p 198           5.5
```

---

### Scilab code Exa 5.6 Voltage

```

1
2
3
4
5           // Example 5.6
6
7 B=38*10^-6;           // Megnetic Field
8 l=52;                 // Length of conductor
9 Q=90;                 // Angle of Motion in case 1
10 v=(1100*1000)/3600; // velocity in m/s
11 e=B*l*v*sind(Q);    // Formula of emf
12 disp(' emf Generated between wing-tips = '+string(e)
        +' Volt ');
13
14
15
16
17
18           // p 198           5.6

```

---

### Scilab code Exa 5.7 Voltage

```

1
2
3
4
5
6           // Example 5.7
7
8           // We know that Area of Ring is (A
           // =Pi*R*R)
9           // i.e A=%pi*R*R*(Q/2%pi)=0.5*R*
           // R*Q;
10          // Hance by using Faraday's Law
11          // e= dQ/dt= d(BA)/dt.

```

```

12             // 0.5*B*R*R*(dq/dt) .
13
14 B=1;
15 R=1;
16 f=50;
17 e=0.5*B*R*R*f*2*%pi;    // by using Faraday's Law
18
19 disp(' emf Developed between Centre & ring = '+
      string(round(e))+ ' Volt ');
20
21
22             // p 198             5.7

```

---

#### Scilab code Exa 5.8 Voltage Time And Force

```

1
2
3             // Example 5.8
4
5
6 B=0.5;           // Megnetic Field
7 l1=0.03;        // Length of conductor
8 v=0.01;         // velocity in m/s
9 e1=B*l1*v;     // Formula of emf
10 disp('(a) The induced emf is = '+string(e1)+' Volt')
    ;
11 l2=0.1;        // Length
12 t1=l2/v;
13 disp(' Time for which the induced Voltage lasts is =
      '+string(t1)+' Second');
14
15 e2=B*l2*v;     // Formula of emf
16 disp(' (b) The induced emf is = '+string(e2)+' Volt'
      ');
17 t2=l1/v;

```

```

18 disp(' Time for which the induced Voltage lasts is =
      '+string(t2)+' Second');
19 disp(' (c) Because of the gap, No Current can flow.
      there for no force Required to Pull the coil.');
```

$$R = 0.001;$$

```

20 R=0.001;
21 F1=(B*B*l1*l1*v)/R;           // Formula of Force
22 disp(' (d.1) Force Required to pull the loop 1 = '+
      string(F1)+' N');
```

$$F2 = (B*B*l2*l2*v)/R;$$

```

23 F2=(B*B*l2*l2*v)/R;           // Formula of Force
24 disp(' (d.2) Force Required to pull the loop 1 = '+
      string(F2)+' N');
```

```

25
26
27           //           p 199           5.8
```

---

# Chapter 6

## Magnetic Circuits

Scilab code Exa 6.1 Megnetic Field Strength And Flux

```
1
2           // Example 6.1
3
4 N=200;           // No.Of turns
5 I=4;            // Current of a Coil
6 l=.06;          // circumference of Coil
7 H=(N*I)/l;     // Formula of Megnetic Field
   Strength
8 disp('(a) The Megnetic Field Strength = '+string(H)+
   ' A/m');
9 mo=4*pi*10^-7; // Permeability of free Space
10 mr=1;          // Permeability of coil
11 B=mr*mo*H;    // Formula of Flux Density
12 disp('(b) The Flux Density is = '+string(B)+' Tesla'
   );
13 A=500*10^-6;  // Area of Coil
14 Q=B*A;        // Total Flux
15 disp('(c) The total Flux is = '+string(Q)+' Wb');
16
17
18
```

**Scilab code Exa 6.2** Megnetomotive Force

```
1
2
3           // Example 6.2
4
5 Q=0.015;           // Flux
6 A=200*10^-4;       // Area of Conductor
7 mo=4*pi*10^-7;    // Permeability of free Space
8 B=Q/A;             // Megnetic Flux Density
9 H=B/mo;            // Megnetic Field Strength
10 l=2.5*10^-3;      // Air Gap
11 F=H*l;            // Formula of Magnetomotive Force
    (mmf)
12
13 disp(' Magnetomotive Force (mmf) is = '+string(round
    (F))+ ' At ');
14
15
16
17
18           // p 212 6.2
```

---

**Scilab code Exa 6.3** Reluctance And Current

```
1
2
3
4           // Example 6.3
5
6 Q=800*10^-6;       // Flux
```

```

7 A=500*10^-6; // Area of Coil
8 mo=4*pi*10^-7; // Permeability of free Space
9 mr=380; // Permeability of of Coil
10 l=0.4; // circumference of Coil
11 R=1/(mr*mo*A); // Formula of Reluctance
12 disp(' Reluctance of Ring is = '+string(R)+' A/Wb');
13 F=Q*R; // Formula of Magnetomotive Force
    (mmf)
14 N=200; // No.Of turns
15 I=F/N; // Formula of Magnetising Current
16 disp(' Magnetising Current is = '+string(I)+' At');
17
18
19
20 // p 212 6.3

```

---

#### Scilab code Exa 6.4 Current

```

1
2
3 // Example 6.4
4
5 B=0.9; // Megnetic Flux Density
6 N=4000; // No.Of turns
7 mo=4*pi*10^-7; // Permeability of free Space
8 Hc=820; // Megnetic Field Strength for
    Core
9 lc=0.22; // Length of Circuit
10 Ac=50*10^-6; // Area of Circuit
11 Fc=Hc*lc; // Magnetomotive Force (mmf) for
    Core
12 lg=0.001; // Length of Air Gap
13 Ag=50*10^-6; // Area of Megnetic Circuit
14 Hg=B/mo; // Megnetic Field Strength for
    Air Gap

```

```
15 Fg=Hg*lg;           // Magnetomotive Force (mmf) for
    Air Gap
16 F=Fc+Fg;           // Total Magnetomotive Force (mmf
    )
17 I=F/N;             // Formula of Magnetising Current
18 disp(' Magnetising Current is = '+string(I)+' Amp');
19
20
21
22
23           // p 215      6.4
```

---



# Chapter 7

## Self And Mutual Inductances

Scilab code Exa 7.1 Voltage

```
1
2
3           // Example 7.1
4
5 L=4;           // Induction of a Coil
6 di=10-4;      // Decrease in Current
7 dt=0.1;       // time Required to Decrease
   Current
8 e=L*(di/dt);  // Formula of Self induction
9 disp(' emf induced in a Coil is = '+string(e)+' Volt
   ');
10
11
12
13           // p 228 7.1
```

---

Scilab code Exa 7.2 Inductor And Voltage

```

1
2
3
4           // Example 7.2
5
6 N=150;           // turns of Coil
7 Q=0.01;         // Flux of Coil
8 I=10;           // Current in Coil
9 L=N*(Q/I);      // Induction of a Coil
10 di=10-(-10);   // Decrease in Current
11 dt=0.01;        // time Required to Decrease
    Current
12 e=L*(di/dt);    // Formula of Self induction
13 disp(' Induction of a Coil = '+string(L)+' H');
14 disp(' emf induced in a Coil is = '+string(e)+' Volt
    ');
15
16
17
18           // p 228      7.2

```

---

### Scilab code Exa 7.3 Inductor And Voltage

```

1
2
3
4
5           // Example 7.3
6
7 N=100;           // turns of Coil
8 dQ=0.4-(-0.4); // Flux of Coil
9 di=10-(-10);    // Decrease in Current
10 L=N*(dQ/di)*10^-3; // Induction of a Coil
11 disp(' (a) induction of a Coil is = '+string(L)+' H'
    ');

```

```

12 dt=0.01;           // time Required to Decrease
    Current
13 e=L*(di/dt);      // Formula of emf (using Self
    induction)
14 disp('(b) emf induced in a Coil is = '+string(e)+'
    Volt');
15
16
17
18 // p 229      7.3

```

---

#### Scilab code Exa 7.4 Inductor And Energy

```

1
2
3 // Example 7.4
4
5 r=0.75*10^-2;     // Radius of Solenoid
6 A=%pi*r*r;       // area of Solenoid
7 N=900;           // No, of turns
8 l=0.3;           // Length of Solenoid
9 mo=4*pi*10^-7;   // Permeability of free Space
10 L=(N*N*mo*A)/l; // Formula of Induction of a Coil
11 I=5;            // Current of Coil
12 disp(' Induction of a Coil = '+string(L)+' H');
13 w=0.5*L*I*I;    // Energy Store
14 disp(' Energy Stored is = '+string(w)+' J');
15
16
17
18 // p 229      7.4

```

---

#### Scilab code Exa 7.5 Megnetic Field Strength And Voltage

```

1
2           // Example 7.5
3
4 r=1*10^-2;           // Radius of rod
5 A=%pi*r*r;          // area of rod
6 N=3000;              // No.of turns
7 I=0.5;               // Current in the rod
8 l=0.2;               // Diameter of rod
9 B=1.2;               // Megnetic Flux Density
10 H=(N*I)/l;          // Megnetic Field Strength
11 m=B/H;              // Permeability of rod
12 disp(' (a) Permeability of iron = '+string(m)+' Tm/A
        ');
13 mo=4*pi*10^-7;      // Permeability of free Space
14 mr=m/mo;            // relative Permeability
15 disp(' (b) Relative Permeability of iron = '+string(
        round(mr)));
16 Q=B*A;              // Flux
17 dQ=Q*0.9;           // Chenge in Flux
18 L=(N*Q)/I;          // Formula of Induction of a
        Coil
19 disp(' (c) Induction of a Coil = '+string(L)+' H');
20 di=0.01;
21 e=N*(dQ/di)         // Formula of emf (using Self
        induction)
22 disp(' (d) Voltage in a Coil = '+string(e)+' Volt');
23
24
25
26           // p 229      7.5

```

---

### Scilab code Exa 7.6 Voltage

```

1
2

```

```

3                                     // Example 7.6
4
5 i=1;                               // Current in A Coil
6 R=3;                               // R of Coil
7 L=0.1*10^-3;                       // Inductance of Coil
8 di=10000;                          // Decrease in Current
9 dt=1;                               // time Required to Decrease
    Current
10 V=(i*R)+L*(di/dt);                // Formula Of Potential
    Difference
11 disp(' Potential Difference Across the Terminal is =
    '+string(V)+' Volt ');
12
13
14
15
16 // p 230      7.6

```

---

### Scilab code Exa 7.7 Inductor And Voltage

```

1
2                                     // Example 7.7
3
4 k=1;                               // Constant
5 N1=2000;                           // turns of Solenoid
6 N2=500;                            // turns of Coil
7 mo=4*%pi*10^-7;                   // Permeability of free Space
8 A=30*10^-4;                       // Area of aCoil
9 l=0.7;                             // Length of Solenoid
10 z=k*N1*N2*mo*A;                  // alphabet for simplicity
11 M=z/l;                            // Formula of Mutual
    Inductance
12 disp('(a) Mutual induction of a Coil = '+string(M)+'
    H');
13 dit=260;                          // Rate of Change of Current

```

```

14 e=M*dit; // Formula of emf (using
    Mutual induction)
15 disp('(b) emf induced in a Coil is = '+string(e)+'
    Volt')
16
17
18
19
20 // p232 7.7

```

---

#### Scilab code Exa 7.8 Inductor

```

1
2 // Example 7.8
3
4 N2=1700; // turns of Coil 1
5 Q2=0.8*10^-3; // total Megnetic Flux
6 I2=6; // Current in A Coil 2
7 L2=N2*(Q2/I2); // Formula for (Self
    Inductance of Coil 1)
8 disp('(a) Self Induction of a Coil 2 = '+string(L2)+'
    H');
9 N1=600; // turns of Coil 2
10 L1=L2*(N1^2/N2^2); // Formula for (Self
    Inductance of Coil 2)
11 disp('(b) Self Induction of a Coil 1 = '+string(L1)+'
    H');
12 Q21=0.5*10^-3; // Megnetic Flux in 1st
    Coil
13 k=Q21/Q2; // Constant
14 disp(' (c) Perposnality Constant (k) = '+string(k));
15 M=k*sqrt(L1*L2); // Mutual Inductance of
    Coil 1 & 2
16 disp('(d) Mutual induction of a Coil = '+string(M)+'
    H');

```

17  
18  
19  
20 // p 233 7.8

---

### Scilab code Exa 7.9 Inductor

```
1
2
3 // Example 7.9
4
5 N2=800; // turns of Coil 2
6 N1=1200; // turns of Coil 1
7 Q2=0.15*10^-3; // Megnetic Flux in Coil 2
8 Q1=0.25*10^-3; // Megnetic Flux in Coil 1
9 I2=5; // Current in A Coil 2
10 I1=5; // Current in A Coil 1
11
12 L1=N1*(Q1/I1); // Formula for (Self
    Inductance of Coil 1)
13 disp('(a) Self Induction of a Coil 1 = '+string(L1)+
    ' H');
14
15 L2=N2*(Q2/I2); // Formula for (Self
    Inductance of Coil 2)
16 disp('(b) Self Induction of a Coil 2 = '+string(L2)+
    ' H');
17
18 k=0.6; // Coefficient of Coupling
    Constant
19 Q12=k*Q1; // Formula for (Megnetic
    Flux in 2nd Coil)
20 M=N2*(Q2/I1); // Formula for (Mutual
    Inductance of Coils)
21 disp('(c) Mutual induction of a Coil = '+string(M)+'
```

```

    H');
22
23 k1=M/sqrt(L1*L2);           // Mutual Inductance of
    Coil 1 & 2
24 disp('(d) Coefficient of Coupling between the Coil =
    '+string(k1)+' H');
25
26
27
28 // p 233      7.9

```

---

#### Scilab code Exa 7.10 Inductor

```

1
2
3 // Example 7.10
4
5 La=1.4;           // Inductance of 2 Similar
    Coupled Coil in Series
6 Lo=0.6;           // Inductance of 2 Similar
    Coupled Coil in Opposing
7 M=(La-Lo)/4;     // Formula for (Mutual
    Inductance of Coils)
8 disp('(a) Mutual induction of a Coil = '+string(M)+'
    mH');
9
10 // Since La= L1+L2+2M      but (M=0.2
    mH)
11 // there for L1= L2= 5 mh
12
13 L1=0.5*10^-3;   // Self Inductance of
    Coil 1
14 L2=0.5*10^-3;   // Self Inductance of
    Coil 2
15 k=(M*10^-3)/sqrt(L1*L2); // Mutual Inductance of

```



```

    Coil 1 & 2
16 disp('(b) Coefficient of Coupling between the Coils
    = '+string(k));
17
18
19
20
21          // p136      7.10

```

---

#### Scilab code Exa 7.11 Inductor

```

1
2
3          // Example 7.11
4
5          // Net Induction When in Same
          // Direction i.e  $1.8 = L_1 + L_2 + 2M$ 
6          // Net Induction When in Opposite i.e
          //  $0.8 = L_1 + L_2 - 2M$ 
7          // by Solving 2 equation we get  $M =$ 
          // 0.25
8 k=0.6;
9 M=0.25;
10 disp('(a) Mutual induction of a Coil = '+string(M)+'
    H');
11          // by Adding Eq 1 & 2 will get  $L_1$ 
          //  $+L_2 = 1.3$  H
12          // we know that  $k = M / (L_1 * L_2)$ 
13 L1L2=M^2/k^2; // using above Formula
14          // By using L1L2 & L1+L2
15 L12=1.3; // L1+L2
16 L1_L2=sqrt(L12^2-4*L1L2); // Value of  $L_1 - L_2$ 
17
18          // by using L1+L2 & L1-L2 will get
19

```

```

20 L1=1.149;
21 L2=0.151;
22 disp('(b.1) Self Induction of a Coil 1 = '+string(L1
    )+' H');
23 disp('(b.2) Self Induction of a Coil 2 = '+string(L2
    )+' H');
24
25
26
27 // p 237 7.11

```

---

#### Scilab code Exa 7.12 Inductor

```

1
2
3 // Example 7.12
4
5 k=0.433; // Coefficient of
    Coupling Constant
6 L1=8; //Self Inductance of
    Coil 1
7 L2=6; //Self Inductance of
    Coil 2
8 M=k*sqrt(L1*L2); // Mutual Inductance of
    Coil 1 & 2
9
10 Lpa=(L1*L2-M^2)/(L1+L2-2*M); // Mutual Induction
    assists Self Induction
11 disp('(a) Mutual Induction assists Self Induction =
    '+string(Lpa)+' H');
12
13 Lpo=(L1*L2-M^2)/(L1+L2+2*M); // Mutual Induction
    Opposes Self Induction
14 disp('(b) Mutual Induction Opposes Self Induction =
    '+string(Lpo)+' H');

```

15  
16  
17  
18  
19  
20

// p 239 7.12

---

# Chapter 8

## DC Transients

Scilab code Exa 8.1 Voltage

```
1
2           // Example 8.1
3
4           // From diagram 8.3
5
6           // Equivalent resistance i.e Req= 20+
           (20||10)
7
8 Req= 20+{(20*10)/(20+10)};           // Equivalent
           resistance
9 V=24;                               // Supply voltage
10 I=V/Req;                            // Supply current
11 R=20;                                // Resistance
12 R1=20+10;                            // Total
           Resistance [ from Fig 8.3b ]
13 I1=I*{20/(20+10)};                 // Current through
           inductor
14 io=I1;                               // Open-ckt
           current
15 disp(' Open-ckt current = '+string(io)+' Amp');
16
```

```

17 Vr=-io*R;                                // Voltage across
    20 Ohms resistor
18 disp(' Voltage across 20 Ohms resistor = '+string(Vr
    )+' Volt');
19
20 // Voltage across inductor is given by i.e
    [ e=L*{io*(R/L)} ]
21 // that is [ e= io*R ]
22
23 e=io*R1;                                // Voltage across
    inductor
24 disp(' Voltage across inductor = '+string(e)+' Volt'
    );
25
26
27
28
29 // p 276                                8.1

```

---

### Scilab code Exa 8.2 Current And Power

```

1
2 // Example 8.2
3
4
5 R=0.8; // Resistance
6 L=1.6; // Inductor
7 t1=L/R; // Time
8
9 // Instantaneous current is ( it= Io*e(-
    t/2) )
10
11 Io=20/exp (0.5); // The current ( at t= -1 & i=
    20A )
12 disp(' The value of current at t=0 i(0) = '+string(

```

```

    Io)+' Amp');
13
14 i1=Io*exp (-0.5);    // Current through inductor at
    t= 1S
15 i=7.36;             // i1=7.357 we have taken as (
    i=7.36 )
16 p1=i*i*R;          // Power absorbed by Resistor
17 disp(' Power absorbed by inductor at t= 1S P(1) = '+
    string(-p1)+' Watt');
18
19             // We know that w=0.5*L*it ^2;  w= 100 J
20
21 it=sqrt(200/1.6);   // Flow of current
22 t=log (Io/it)*2;   // Time required to store
    Energy 100J
23 disp(' Time required to store Energy 100J = '+string
    (t)+' Second');
24
25
26
27             //           p 277           8.2

```

---

### Scilab code Exa 8.3 Current And Time

```

1
2
3             // Example 8.3
4
5 R=10;           // Resistance
6 L=14;          // Inductor
7 t1=L/R;        // Time
8
9 V=140;         // Voltage
10 Io=V/R;       // Steady State current
11 t2=0.4;       // Time

```

```

12 i=Io*(1-exp (-t2/t1));      // Value of current at t
    = 0.4
13 disp(' Value of current at (t=0.4) = '+string(i)+'
    Amp');
14
15          // ==> We have formula  it=Io*exp (-t/
    t1) .
16 it=8;                          // Current of 8 Amp
17 t=-log(it/14)*t1;              // Time taken to rech at
    i=8 A
18 disp('Time taken to rech at i=8 A = '+string(t)+'
    Second');
19
20
21
22
23          //      p 279          8.3

```

---

#### Scilab code Exa 8.4 Current

```

1
2          // Example 8.4
3
4          // From the diagram 4.5
5
6 V1=20;                          // Source
    voltage
7 R=80;                            // Series
    resistance
8 io1=V1/R;                        // Steay state
    current
9 disp(' Steay state current (at t=0- ) = '+string(io1)
    )+' Amp');
10
11          // Because current in inducor can't charge

```

```

instantaneously
12
13 disp(' Steay state current (at t=0+ ) = '+string(io1
    )+' Amp');
14
15 V2=40; // Source
    voltage
16 Io2=(V1+V2)/R; // Steay state
    current at t= infinity
17 disp(' Steay state current (at t= infinity ) = '+
    string(Io2)+' Amp');
18
19 L=40*10^-3; // Inductor
20 t1=L/R; // Time
    COnstant
21 t=0.001; // Time of 1
    ms
22 // By the formula ==> i(1 ms)= io1*(io1-
    Io2)*(1-e-(t/t1))
23
24 Ims=io1+(Io2-io1)*(1-exp (-t/t1)); // Steay state
    current (at t=1ms)
25 disp(' Steay state current (at t= 1ms ) = '+string(
    Ims)+' Amp');
26
27
28
29 // p 279 8.4

```

---

#### Scilab code Exa 8.5 Current

```

1
2 // Example 8.5
3
4 // From the diagram 4.6

```



```

5
6 V=20; // Source Voltage
7 Io=V/(25+5); // Current iL(0-)
8 disp('Current iL(0-) is = '+string(Io)+' Amp');
9
10 R1=30; // Resistance of 30 Ohms
11 i2=V/R1; // Current i2(0-)
12 disp('Current i2(0-) is = '+string(i2)+' Amp');
13
14 // Because current in inducor can't charge
    // instantaneously.
15 disp('Current iL(0+) is = '+string(i2)+' Amp');
16
17 R12=60; // Resistance of 60
    Ohms
18 R3=30; // Resistance of 30
    Ohms
19 R45=30; // Resistance of 30
    Ohms
20 Req=R45+[(R12*R3)/(R12+R3)]; // Equivalent
    Resistance
21 L=2; // Inductor
22 t=L/Req; // Time constant
23 t1=0.02; // Current of 20 mA
24 I1=0.667*exp(-t1/t); // Inductor current
    ( iL(t)= Io*e-t1/t )
25 disp('Inductor current iL(t) is = '+string(I1)+' Amp
    ');
26
27 // ==> [ By using Current divider ]
28 I2=-I1*(R12/(R12+R3)); // Inductor current at(
    t=20 mA)
29 disp('Inductor current at( t=20 mA) is = '+string(I2
    )+' Amp');
30
31
32 // p 280 8.5

```

### Scilab code Exa 8.6 Voltage And Current

```
1
2
3
4 // Exa 8.6
5
6 Vo=3; // Supply voltage
7 vo=0; // Voltage at V(o+) {
   Because instantly capacitor can't charge }
8 disp(' Voltage across capacitor at V(o+) = '+string(
   vo)+' Volt ');
9
10 R=1500; // Resistance
11 Io=Vo/R; // Current of capacitor
12 io=Io; // Current of capacitor at i
   (o+)
13 disp(' Current across capacitor at i(o+) = '+string(
   io)+' Amp ');
14
15 C=5*10^-6; // Capacitor
16 t=R*C; // Time constant
17 disp(' Time constant = '+string(t)+' Second ');
18
19 t1=15*10^-3; // Time instant ==> {
   v=Vo*(1-e-(t1/t)) }
20 v=Vo*(1-0.135); // Voltage at Time t1 {
   e-(t1/t)=0.135 }
21 disp(' Voltage across capacitor at ( t=15 mS ) = '+
   string(v)+' Volt ');
22
23 i=Io*0.135; // Current at Time t1 ==>
   { i=Io*e-(t1/t) }
24 disp(' Current of capacitor at ( t=15 mS ) = '+
```

```

    string(i)+' Amp');
25
26
27
28
29
30
31 // p 284      8.6

```

---

### Scilab code Exa 8.7 Voltage And Current

```

1
2
3 // Exa 8.7
4
5 Vo=3; // Supply voltage
6 vo=Vo; // Voltage at V(o+)
7 vio=Vo; // Voltage at V(o-)
8 disp(' Voltage across capacitor at V(o+) = '+string(
    vo)+' Volt');
9
10 R=100; // Resistance
11 Io=Vo/R; // Current of capacitor
12 io=-Io; // Current of capacitor at i
    (o+)
13 disp(' Current across capacitor at i(o+) = '+string(
    io)+' Amp');
14
15 C=5*10^-6; // Capacitor
16 t=R*C; // Time constant
17 disp(' Time constant = '+string(t)+' Second');
18
19 t1=1.2*10^-3; // Time instant ==> {
    v=Vo*e-(t1/t) }
20 v=Vo*0.0907; // Voltage at Time t1 {

```

```

    e-(t1/t)=0.0907 }
21 disp(' Voltage across capacitor at ( t=1.2 mS ) = '+
    string(v)+' Volt');
22
23 i=-Io*0.0907;           // Current at Time t1 ==> {
    i=-Io*e-(t1/t) }
24 disp(' Current of capacitor at ( t=1.2 mS ) = '+
    string(i)+' Amp');
25
26
27
28
29
30
31                                     // p 285      8.7

```

---

#### Scilab code Exa 8.8 Current

```

1
2           // Example 8.8
3
4           // From the diagram 8.15
5
6 R1=1000;           // Resistance of 1
    kilo-Ohms
7 R2=10000;         // Resistance of 10
    kilo-Ohms
8 R3=1000;           // Resistance of 1
    kilo-Ohms
9 Rth=[(R1+R2)*R3]/(R1+R2+R3); // Equivalent
    resistance
10 C=10*10^-6;      // capacitor
11 t=Rth*C;          // Time constant
12 V=30;             // Source voltage
13 Vc=V*(R1/(R1+R2)); // Voltage across

```

```

    the capacitor
14
15         // Apply KVL to outer loop
16         // we get  $30 - I_o * R_1 - 15 = 0$ 
17  $I_o = 15 / R_1$ ;                                     // Current in the
    outer loop
18  $I_{in} = V / (R_1 + R_2 + R_3)$ ;                       // Open=ckt current
19
20         // We know that  $\implies i(t) = I_{in} + [I_o - I_{in}] * e(-$ 
     $t / \tau)$ 
21  $\tau = 0.001$ ;                                       // Assume  $\tau = 1$  mS
22  $i(t) = I_{in} + [I_o - I_{in}] * \exp(-t / \tau)$ ;    // Current  $i(t)$ 
23 disp(' Current  $i(t)$  is = ' + string( $i(t)$ ) + ' Amp   oR    $i(t)$ 
    =  $2.5 + (15 - 2.5) * e(-t / 9.17\text{ms})$  mA');
24
25
26
27
28                                     // p 287                               8.8

```

---

## Chapter 9

# Alternating Voltage And Current

Scilab code Exa 9.1 Voltage And Angle

```
1
2           // Example 9.1
3
4           // Given v= 20 sinwt
5 Q=asind(10/20); // Angle
6 disp('(a) The Angle at which (v=10v) is = '+string(Q
   )+' Digree ');
7 disp('(b.1) The maximum value is (Vm)= 20 Volt ');
8 disp('(b.2) This Occurs twice in a cycle i.e at( wt =
   90 or 270) ');
9
10
11
12           // p 305           9.1
```

---

Scilab code Exa 9.2 Voltage Time And Frequency

```

1
2           // Example 9.2
3
4           // Given v=0.04 sin(2000t
5           // +60)V
6 w=2000;           // Angular Velocity
7 disp(' The Angular Velocity is = '+string(w)+' rad/s
8           ');
9 f=w/(2*%pi);           // frequency
10 disp(' Frequency is = '+string(f)+' Hz');
11
12 v=0.04*sind(2000*160*10^-6*(180/%pi)+60);           //
13           Voltage at (t=160 us)
14 disp(' Voltage at (t=160 us) = '+string(v*1000)+' mV
15           ');
16 T=1/f;           // Time Period
17 t=(60/360)*T;           // Time represent y 60
18           phase Angle
19 disp(' Time represent y 60 phase Angle = '+string(t
20           *1000)+' mS');
21
22
23
24           // p 305 9.2

```

---

### Scilab code Exa 9.3 Voltage

```

1
2

```

```

3           // Example 9.3
4
5 vm=20/2;           // Maximum value of Voltage
6 T=2*5*10^-3;      // Timwe Period
7 f=1/T;            // Frequency
8 w=2*%pi*f;        // Angular Frequency
9 disp('Angular Frequency is = '+string(w)+' rad/s');
10 disp('instantaneous value of Voltage is v= 10 sin
      (628.3t+Q)');
11
12           // at (t=0 v= -3.6 V)   i.e v=10sinQ
13
14 Q=asind(-0.36);   // Angle at (t=0) ( ==> in Book
      Q=-158.9 given Which is wrong)
15 v= 10*sind(628.3*0.012*(180/%pi)-Q);
16 disp('the Voltage at (t=12 mS) = '+string(-v)+' Volt
      ');
17
18
19
20
21           // p306      9.3

```

---

#### Scilab code Exa 9.4 Current And Time

```

1
2
3           // Example 9.4
4
5 f=60;             // Frequency
6 w=2*%pi*f;       // Angular Frequency
7 disp(' Angular Frequency is = '+string(w)+' rad/s');
8
9 disp(' instantaneous value of Voltage is i= 12 sin
      (377t)A');

```



```

10
11 i= 12*sind(377*(1/360)*(180/%pi)); // Formula of
    Current
12 disp(' The Value of Current After (t=1/360 s) = '+
    string(i)+' Amp');
13
14 i1=9.6; // Current
15 t={asind(i1/12)*%pi}/(377*180); // formula of
    Time Derived from Current Eq
16 disp(' Time Required to Rech at (t=9.6) = '+string(t
    *1000)+' mS');
17
18
19
20
21 // p306 9.4

```

---

#### Scilab code Exa 9.5 Time

```

1
2 // Example 9.5
3
4 // Given I1=4 Sin(100*pi*t+30)
5 // Given I2= 6 sin(100*pi*t)
6 f=50; // Frequency
7 w=2*pi*f; // Angular Frequency
8 T=1/f; // Time Period
9 t=20*10^-3*(30/360); // Time for 30 Digree
    Revolution
10 disp('Time for 30 Digree Revolution = '+string(t
    *1000)+' mS');
11 disp('The Phasor i1 Leads the Phasor i2 by 30 Digree
    or (t=1.67 mS)');
12
13

```

```
14
15
16          // p 312          9.5
```

---

### Scilab code Exa 9.6 Power

```
1
2
3          // Example 9.6
4
5 R=10;          // Resistance
6 i=4+%i*3;     // Current
7 I=sqrt(4^2+3^2); // Absolute Value of Current
8 Ir=4;         // Real Component of Current
9 Ii=3;         // Imaginary Component of Current
10 Q=atand(3/4); // Phase Angle
11 Pr=Ir^2*R;   // Power Due to Real Component
12 disp('Power Due to Real Component is = '+string(Pr)+
      ' Watt');
13
14 Pi=Ii^2*R;   // Power Due to Imaginary
      Component
15 disp('Power Due to Imaginary Component is = '+string
      (Pi)+' Watt');
16
17 P=I^2*R;     // total PowerConsumed
18 disp('total Power Consumed is = '+string(P)+' Watt')
      ;
19
20
21
22          // p 316          9.6
```

---

### Scilab code Exa 9.7 Current

```
1
2
3           // Example 9.7
4
5 I1=10+%i*0;           // Sinusoidal Current
   I1
6 I2=10+(%i*10*sqrt(3)); // Sinusoidal Current
   I2
7 I=I1+I2;             // Resultant Current
8 disp(' resultant Current is = '+string(I)+' Amp OR
   ('+string(abs(I))+' <'+string(atan2(imag(I),real
   (I)))+ ' Amp )');
9
10
11
12
13
14           // p 318 9.7
```

---

### Scilab code Exa 9.8 Current

```
1
2
3           // Example 9.8
4
5 I1=10+%i*0;           // Current i1=14.14 sin(wt
   ) A
6 I2=10+%i*17.32;      // Current i2=28.28 sin(wt
   +60) A
7 I=I1+I2;             // Summation of 2 Current
8 disp(' Summation of 2 Current is = '+string(I)+' Amp
   or 37.42<40.9 ');
9
```

```

10          // I= 20+i17.32    i.e I= 37.42<40.9
11
12 disp(' Expration for Sum of 2 Current i= 37.42 Sin(
      wt+40.9)A');
13 Im=37.42;          // Absolute Value of I
14 i=Im/sqrt(2);     // RMS value I
15 disp(' Rms Value of sum is = '+string(i)+' Amp');
16
17
18
19
20          // p 318    9.8

```

---

#### Scilab code Exa 9.9 Current

```

1
2          // Example 9.9
3
4 I1=3.535+%i*0;     // Rectangular form RMS
      of I1 i.e I1= 5/1.14<0
5 I2=3.061+%i*1.768; // Rectangular form RMS
      of I2 i.e I2= 5/1.14<30
6 I3=-1.768-%i*3.061; // Rectangular form RMS
      of I3 i.e I3= 5/1.14<-120
7 I=I1+I2+I3;       // Resultant of Current
8 disp(' Resultant Rms Value of Cuttent = '+string(I)+
      ' Amp OR ('+string(abs(I))+ ' <'+string(atan2(
      imag(I),real(I)))+ ' Amp )');
9
10
11
12
13
14          // p 318    9.9

```

---

### Scilab code Exa 9.10 Current

```
1
2
3           // Example 9.10
4
5
6           // Given  $i = 10 + 10\sin\omega t$  A
7           // Since it is Unsymmetrical
           // waveform
8           // Average can be found over
           // 1 cycle
9           // i.e Average Value of
           // Current is  $i = 10$  Amp
10  I1=10;           // Dc Current 10 Amp
11  I2=10/1.414;    // Sinusoidal Current  $10/\sqrt{2}$ 
           // (2)
12  Irms=sqrt(I1^2+I2^2); // Rms Value of resultant
           // Current
13  disp(' Average value of Resultant Current = '+string
           // (I1)+' Amp');
14  disp(' Rms value of Resultant Current = '+string(
           // Irms)+' Amp');
15
16
17
18
19
20           // p 319      9.10
```

---

### Scilab code Exa 9.11 Voltage

```

1
2
3           // Example 9.11
4
5 T=8*10^-3;           // Time period
6 A01=10*10^-3;       // Area between t= 0-1
7 A13=-5*2*10^-3;    // Area between t= 1-3
8 A34=20*10^-3;      // Area between t= 3-4
9 A45=0*10^-3;       // Area between t= 4-5
10 A58=5*3*10^-3;    // Area between t= 5-8
11 A=A01+A13+A34+A45+A58; // Total Area of waveform
12 V=A/T;             // Average value of
    waveform
13 disp(' Average value of waveform = '+string(V)+'
    Volt ');
14
15
16
17
18
19
20           // p 230      9.11

```

---

### Scilab code Exa 9.12 Voltage

```

1
2
3           // Example 9.12
4
5 T=20*10^-3;         // Time period
6 A0_10=40*100*10^-3; // Area between t= 0-10
7 A10_20=100*10*10^-3; // Area between t=
    10-20
8 A=A0_10+A10_20;    // Total Area of
    waveform

```

```

9 V=A/T; // Average value of
  waveform
10 disp(' Average value of waveform = '+string(V)+'
  Volt ');
11
12 v=sqrt(V); // Rms value
13 disp(' Rms value of waveform = '+string(v)+' Volt ');
14
15
16
17
18
19 // p 230 9.12

```

---

#### Scilab code Exa 9.13 Current And Power Factor

```

1
2 // Example 9.13
3
4 T=3; // Time period
5 A1=10; //Current under Area between t=
  0-2
6 A2=0; //Current under Area between t=
  2-3
7
8 Irms=sqrt((A1*A1*2+A2*A2)/3); // Rms value
9 disp(' Rms value of waveform = '+string(Irms)+' Amp'
  );
10
11 Iav=(A1*2+A2*1)/3; // Average Value
12 disp(' Average value of waveform = '+string(Iav)+'
  Amp ');
13
14 F=Irms/Iav; // Form Factor
15 disp(' Form Factor of waveform = '+string(F));

```

```
16
17
18
19 // p 321 9.13
```

---

**Scilab code Exa 9.14** Voltage And Power Factor

```
1
2
3 // Example 9.14
4
5
6 T=5*10^-3; // Time period
7 Vm=10; // Peak Value
8
9 Vav=Vm/2; // Average Value
10 disp(' Average value of waveform = '+string(Vav)+'
    Volt ');
11
12 Vrms=Vm/sqrt(3); // Rms value of Saw-tooth
    waveform
13 disp(' Rms value of waveform = '+string(Vrms)+' Volt
    ');
14
15 F=Vrms/Vav; // Form Factor
16 disp(' Form Factor of waveform = '+string(F));
17
18 Pf=Vm/Vrms; // Peak Factor
19 disp(' Peak Factor of waveform = '+string(Pf));
20
21
22
23
24 // p 321 9.14
```

---



### Scilab code Exa 9.15 Power And Power Factor

```
1
2           // Example 9.15
3
4           // Given  $v = 55 \sin(\omega t)V$  &  $i =$ 
5           //  $6.1 \sin(\omega t - \pi/5)A$ 
6           // Phase Angle
7           // Peak Value of
8           // Voltage
9           // Peak Value of
10          // Current
11          // Rms value of Voltage
12          // Rms value of Current
13          // Average Value of
14          // power
15          // Average value of Power = '+string(Pav)+' Watt
16          ');
17          // Apparent Value of
18          // power
19          // Apparent value of Power = '+string(Pa)+' VA')
20          ');
21          // Instant Power at ( $\omega t$ 
22          // = 0.3)
23          // Instant Power at ( $\omega t = 0.3$ ) = '+string(P)+' VA
24          ');
25          // Power Factor
26          // Power Factor = '+string(pf*100)+' %');
27
28
29
```

24

25

// p 323 9.15

---

# Chapter 10

## AC Circuits

Scilab code Exa 10.1 Current Power And Power Factor

```
1
2           // Example 10.1
3
4           // From Diagram 10.2 a
5
6 Vm=141+%i*0;           // Peak value of Voltage
7 V=Vm/1.414;           // Rms value of Voltage
8 v=100+%i*0;           // Here will have V=99.70,
   but we took v=100
9 R=3;                   // Resistance
10 wL=0.0127*100*%pi;    // Reactance
11 Z=R+%i*wL;           // Impedence
12 I=v/Z;                // Current
13 disp(' The value of current = '+string(I)+' Amp OR
   '+string(abs(I))+'<'+string(atan2(imag(I),real
   (I)))+ ' Amp');
14
15           // Study state current is I=20A & Q=53.1
   Lagging.
16 disp(' Expression for instantaneous current ==> [
   28.28 sin(100%pi*t -53.1)A ] ');
```

```

17
18 P=abs(v)*abs(20)*cosd(53.1);           // Average power
    ==> (I=20.032 ,so take I=20 )
19 disp(' Average power is = '+string(P)+' Watt');
20
21 pf=cosd(53.1);                         // Power factor
22 disp(' Power factor is = '+string(pf)+' Lagging');
23
24
25
26
27                                     // p 342           10.1

```

---

#### Scilab code Exa 10.2 Current Power And Power Factor

```

1
2
3                                     // Example 10.2
4
5 P=750;                               // Rated Power
6 V=230;                               // Supply Voltage
7 f=50;                                // Frequency
8 Vr=100                               // Rated Voltage
9 I=P/Vr;                              // Rated Current
10 Vc=sqrt(V^2-Vr^2);                  // Voltage across Capacitor
11 Xc=Vc/I;                            // Capacitive Reactance
12 C=1/(2*pi*f*Xc);                    // Capacitance
13 disp(' Required Capacitance = '+string(C)+' F');
14
15 Q=acosd(Vr/V);                       // Phase Angle
16 disp(' Phase Angle = '+string(Q)+' Degree');
17
18 pf=cosd(Q);                           // Power Factor
19 disp(' Power Factor = '+string(pf)+' Leading');
20

```

```

21 Pa=V*I; // Apparent power
22 disp(' Apparent value of Power = '+string(Pa)+' VA')
   ;
23
24 Pr=V*I*sind(Q); // Reactive Power
25 disp(' Reactive Power = '+string(round(Pr))+' VAR');
26
27
28
29 // p 344 10.2

```

---

### Scilab code Exa 10.3 Resistance Voltage And Power

```

1
2
3 // Example 10.3
4
5 R=120; // Resistance
6 Xc=250; // Capacitive Reactance
7 Q=-64.4; // Phase Angle
8 I=0.9+%i*0; // Current
9 Z=R-%i*Xc; // Impedance
10 disp(' The Impedance is = '+string(Z)+' or ( '+
      string(abs(Z))+' <'+string(atan2(imag(Z),real(Z)))+'
      )+' Amp )');
11
12 pf=cosd(Q); // Power Factor
13 disp(' Power Factor = '+string(pf)+' Leading');
14
15 V=I*Z; // Supply Voltage
16 disp(' Supply Voltage = '+string(V)+' or ( '+string
      (abs(V))+' <'+string(atan2(imag(V),real(V)))+'
      Amp )');
17 v=249.6; // Peak value of Voltage
18

```

```

19 Vr=I*R; // Voltage at Resistor
20 disp(' Voltage across Resistor = '+string(Vr)+' Volt
    ');
21
22 Vc=I*Xc; // Voltage across
    Capacitor
23 disp(' Voltage across Capacitor = '+string(Vc)+' or
    ('+string(abs(Vc))+' < -90 Amp )');
24 Pa=v*I; // Apparent power
25 disp(' Apparent value of Power = '+string(Pa)+' VA')
    ;
26
27 Pac=v*I*cosd(Q); // Active Power
28 disp(' Active Power = '+string(Pac)+' Watt');
29
30 Pr=v*I*sind(Q); // Reactive Power
31 disp(' Reactive Power = '+string(-Pr)+' VAR');
32
33
34
35 // p 345 10.3

```

---

#### Scilab code Exa 10.4 Resistance Power And Power Factor

```

1
2
3 // Example 10.4
4
5 // Given V= 160+i120 & I= -4+
    i10
6 Vi= 160+%i*120; // Sinusoidal Voltage i.e
    200<36.87
7 Ii= -4+%i*10; // Sinusoidal Current i.e
    10.77<111.8
8 Z=Vi/Ii; // Impedance

```

```

 9 Q=-74.93;           // Phase Angle
10 V=200;             // peak Value of Voltage
11 I=10.77;          // peak Value of Current
12 disp(' Impedance = '+string(Z)+' Ohms');
13
14 pf=cosd(Q);        // Power Fector
15 disp(' Power Factor = '+string(pf)+' Leading');
16 disp(' the Circuit is Capacitive , Becuase Imaginary
    part of impedance is negative .');
17
18 Pa=V*I*cosd(Q);    // Active Power
19 disp(' Active Power = '+string(Pa)+' Watt');
20
21 Pr=V*I*sind(Q);    // Reactive Power
22 disp(' Reactive Power = '+string(-Pr)+' VAR');
23
24
25
26
27
28 // p 348 10.4

```

---

### Scilab code Exa 10.5 Reluctance And Inductor

```

1
2 // Example 10.5
3
4
5 // Given Z=R+iXl; i.e Z= 10+i10
6 R=10; // Resistance
7 Xl=10; // Inductance
8 f=50; // Frequency
9 L=Xl/(2*%pi*f); // Value of Inductor
10 disp(' The Value of Resistor is = '+string(R)+' Ohm'
    );

```

```

11 disp(' The Value of Inductor is = '+string(L)+' H');
12
13
14
15 // p 348 10.5

```

---

### Scilab code Exa 10.6 Resistance And Capacitor

```

1
2 // Example 10.6
3
4 // Given  $Z=R+iX$ ; i.e  $Z= 10-i10$ 
5
6 R1=10; // Resistance
7 X1=10; // Inductance
8 f=50; // Frequency
9 Z= 10-%i*10; // Impedance
10 Y=1/Z; // Admitance
11 disp(' The Admitance of Circuit is = '+string(Y)+' S
    ');
12 G=0.05; // here  $G=1/R$ 
13 B=0.05; // here  $B= 1/C$ 
14 R=1/G; // Resistance
15 disp(' The Resistance of Circuit is = '+string(R)+'
    Ohm');
16
17 C=B/(2*%pi*f); // Capacitance
18 disp(' The Capacitance of Circuit is = '+string(C)+'
    F');
19
20
21
22 // p 348 10.6

```

---



### Scilab code Exa 10.7 Resistance Power And Power Factor

```
1
2
3           // Example 10.7
4
5 L=0.15;           // Inductance
6 w=100*%pi;       // Angular Frequency
7 C=100*10^-6;     // Capacitance
8 R=12;            // Resistance
9 V=100;           // Voltage
10 Xl=w*L;         // Inductive reactance
11 Xc=1/(w*C);     // capacitive
    reactance
12 Z=R+%i*(Xl-Xc); // Impedance
13 disp(' The Value of Impedance is = '+string(Z)+' or
    ('+string(abs(Z))+ ' <'+string(atan2(imag(Z),
    real(Z)))+ ' Amp )');
14 r=12;           // peak Value of
    impedance
15
16 I=V/Z;          // Current
17 disp(' The Value of Current is = '+string(I)+' or
    ('+string(abs(I))+ ' <'+string(atan2(imag(I),real(
    I)))+ ' Amp )');
18 i=5.15;         // peak Value of
    Current
19
20 Q=atan2(15.3/12); // Phase Angle
21 disp(' Phase Angle = '+string(-Q)+' Degree');
22
23 Vr=i*r;         // Voltage at Vr
24 disp(' Voltage at Vr = '+string(Vr)+' Volt');
25
```

```

26 Vc=i*Xc; // Voltage at Vc
27 disp(' Voltage at Vc = '+string(Vc)+' Volt');
28
29 Vl=i*Xl; //Voltage at Vl
30 disp(' Voltage at Vl = '+string(Vl)+' Volt');
31
32 pf=cosd(Q); // Power Fector
33 disp(' Power Factor = '+string(pf)+' Lagging');
34
35 Pa=V*i; // Apparent power
36 disp(' Apparent value of Power = '+string(Pa)+' VA')
    ;
37
38 Pav=V*i*pf; // Average Value of
    power
39 disp(' Average value of Power = '+string(Pav)+' Watt
    ');
40
41
42
43
44 // p 349 10.7

```

---

# Chapter 11

## Resonance in AC Circuits

Scilab code Exa 11.1 Frequency And Voltage

```
1
2           // Example 11.1
3
4 L=0.15;           // Inductor
5 C=100*10^-6;     // Capacitor
6 fo=1/{2*%pi*sqrt(L*C)}; // Resonance frequency
7 disp(' Resonance frequency (fo) = '+string(fo)+' Hz'
      );
8
9 R=12;           // Circuit resistance
10 V=100;         // Source voltage
11 Io=V/R;        // Maximum current by
      source
12 disp(' Maximum current by source = '+string(Io)+'
      Amp');
13
14 r1=R^2/(2*L^2); // for easy
      calculation
15 r2=(1/(L*C));  // for easy
      calculation
16 fc=(1/6.28)*sqrt(r2-r1); // Frequency for
```

```

    maximum capacitor voltage
17 disp(' Frequency for maximum capacitor voltage = '+
    string(fc)+' Hz');
18
19
20 r3=(R^2*C^2)/2;           // for easy
    calculation
21 fl=1/{2*%pi*sqrt((L*C)-r3)}; // Frequency for
    maximum capacitor voltage
22 disp(' Frequency for maximum capacitor voltage = '+
    string(fo)+' Hz');
23
24 Xl=2*%pi*fo*L;           // Inductive
    reactance
25 disp(' Inductive reactance = '+string(Xl)+' Ohms');
26
27 Xc=1/(2*%pi*fo*C);       // Inductive reactance
28 disp(' Capacitive reactance = '+string(Xc)+' Ohms');
29
30 Q=Xl/R;                   // Quality factor
31 disp(' Quality factor = '+string(Q));
32
33 VLC=Q*V;                  // Voltage drop across
    the elements
34 disp(' Voltage drop across the elements = '+string(
    VLC)+' Volt');
35
36
37
38 // p 378                  11.1

```

---

### Scilab code Exa 11.2 Capacitor Voltage And Q Factor

```

1
2 // Example 11.2

```

```

3
4 L=0.5;           // Inductance
5 V=100;          // Supply Voltage
6 R=4;           // Resistance
7 f=50;          // Frequency
8 C=1/(4*pi^2*f^2*L); // Capacitance
9 disp('Capacitance is = '+string(C*10^6)+' uF');
10
11 I=V/R;         // Current at Resonance
    Frequency
12 disp(' Current at Resonance Frequency = '+string(I)+
    ' Amp');
13
14 wo=2*pi*f;     // Angular Frequency
15 Xl=157;        // Inductive Reactance
16 Vc=I*Xl;       // Voltage across
    Capacitor
17 disp(' Voltage across Capacitor = '+string(Vc)+'
    Volt');
18
19 Vl=Vc;         // Voltage across
    Inductance
20 disp(' Voltage across Inductance = '+string(Vl)+'
    Volt');
21
22
23 Q=(wo*L)/R;    // Q-Factor
24 disp(' Q-Factor is = '+string(Q));
25
26
27
28
29
30 // p 378      11.2

```

---

### Scilab code Exa 11.3 Inductor Current And Voltage

```
1
2           // Example 11.3
3
4
5 V=0.85;           // Supply Voltage
6 f=175*10^3;      // Frequency
7 C=320*10^-12;   // Capacitance
8
9 L=1/(4*3.14^2*f^2*C); // Inductance
10 disp('Inductance is = '+string(L*10^3)+' mH');
11
12 Xl=2*3.14*f*L;  // Inductive reactance
13 Q=50;           // Q-Factor
14 R=Xl/Q;         // Resistance
15
16 I=V/R;          // circuit current
17 disp(' Circuit current is = '+string(I*1000)+' mA');
18
19 Vc=Q*V;         // Voltage across
   Capacitor
20 disp(' Voltage across Capacitor = '+string(Vc)+'
   Volt');
21
22
23
24
25           // p379 11.3
```

---

### Scilab code Exa 11.4 Capacitor Current And Energy

```
1
2           // Example 11.4
3
```

```

4 L=1*10^-3;           // Inductance
5 V=120;               // Supply Voltage
6 R=2;                 // Resistance
7 f=5*10^3;           // Frequency
8 C=1/(4*pi^2*f^2*L); // Capacitance
9 disp('Capacitance is = '+string(C*10^9)+' nF');
10
11 I=V/R;              // Current at Resonance
    Frequency
12 disp(' Current at Resonance Frequency = '+string(I)+
    ' Amp');
13
14 Emax=L*I^2;         // Maximum Instantaneous
    Energy
15 disp(' The Maximum Instantaneous Energy = '+string(
    Emax)+' J');
16
17
18
19
20
21 // p 379           11.4

```

---

### Scilab code Exa 11.5 Frequency And Q Factor

```

1
2
3 // Example 11.5
4
5 R1=0.51;           // Resistance -1
6 R2=1.3;           // Resistance -2
7 R3=0.24;          // Resistance -3
8 Req=R1+R2+R3;     // Equivalent
    Resistance
9 L1=32*10^-3;      // Inductance -1

```

```

10 L2=15*10^-3;           // Inductance-2
11 Leq=L1+L2;           // Equivalent
    Inductance
12 C1=62*10^-6;         // Capacitance-1
13 C2=25*10^-6;         // Capacitance-2
14 Ceq=(C1*C2)/(C1+C2); // Equivalent
    Capacitance
15
16 fo=1/(2*pi*sqrt(Leq*Ceq)); // Resonance
    Frequency
17 disp(' Resonance Frequency is = '+string(round(fo))+
    ' Hz');
18
19 Q=(1/Req)*sqrt(Leq/Ceq); // Over all Q-
    Factor
20 disp(' Over all Q-Factor is = '+string(round(Q)));
21
22 wo=2*pi*fo;
23 Q1=(wo*L1)/R1;         // Q-Factor of
    Coil-1
24 disp(' Q-Factor of Coil-1 is = '+string(Q1));
25
26 Q2=(wo*L2)/R2;         // Q-Factor of Coil
    -2
27 disp(' Q-Factor of Coil-2 is = '+string(Q2));
28
29
30
31
32 // p 380      11.5

```

---

### Scilab code Exa 11.6 Frequence

```

1
2 // Example 11.6

```



```

3
4 f=150*10^3;           // Frequency
5 Bw=75*10^3;          // Band width
6 Q=f/Bw;              // Q-Factor
7 disp(' Q-Factor is = '+string(Q));
8           // since Q < 10   there for we need
           // to solve by Equation
9           // 75= f2-f1   &   150= root(f1*f2)
10          // will get Eq ( f1^2+ 75f1- 22500= 0
           // ) by Eliminating f2
11          // by factorization we have f1=(
           // 117.1kHz or -192.1kHz )
12 f1=117.1;
13 f2=75+f1;
14 disp(' The half Power Frequencies are f1= '+string(
           f1)+' kHz   &   f2= '+string(f2)+' kHz ');
15
16
17
18          //   p 382           11.6

```

---

### Scilab code Exa 11.7 Resistance Current And Capacitor

```

1
2           // Example 11.7
3
4 V=230;           // Supply Voltage
5 L=200*10^-6;    // Inductance
6 R=20;           // Resistance
7 f=1*10^6;       // Frequency
8 Xl=2*%pi*f*L;   // Indctive reactance
9 C=1/(4*%pi^2*f^2*L); // Capacitance
10 disp(' Required Capacitance = '+string(C*10^12)+' pF
           ');
11

```

```

12 Q=Xl/R; // Q-Factor
13 disp(' Q-Factor is = '+string(Q));
14
15 Zo=L/(C*R); // dynamic Impedance
16 disp(' Dynamic Impedance is = '+string(Zo)+' Ohm');
17 Zs=8000; // Soures Resistance
18 Z=Zo+Zs; // Total Resistance
19
20 I=V/Z; // Total Line Current
21 disp(' Total Line Current is = '+string(I*1000)+' mA
    ');
22
23
24
25 // p 388 11.7

```

---

### Scilab code Exa 11.8 Frequence And Q Factor

```

1
2
3 // Example 11.8
4
5 L=0.24; // Inductance
6 C=3*10^-6; // Capacitance
7 R=150; // Resistance
8 f=1/(2*%pi*sqrt(L*C)); // Frequency
9 fo=f*sqrt(1-R^2*(C/L)); // Resonance Frequency
10 disp(' Resonance Frequency = '+string(fo)+' Hz');
11
12 Xl=2*%pi*fo*L; // Indctive reactance
13 Q=Xl/R; // Q-Factor
14 disp(' Q-Factor is = '+string(Q));
15
16 Bw=fo/Q; // Band width
17 disp(' Band width is = '+string(Bw)+' Hz');

```

18  
19  
20  
21  
22

// p 387 11.8

---

# Chapter 12

## Three Phase Circuits And System

Scilab code Exa 12.1 Current

```
1
2                                     // Example 12.1
3
4                                     // Given Z= 32+i24
5 R=32;                               // Real Part of Z
6 X=24;                               // Imaginary Part of Z
7 z=R+%i*X;                           // Impedance
8 Z=abs(z);                            // Absolute value of Z
9 V1=400;                              // Supply Voltage
10 Vph1=V1/1.732;                       // Voltage in Y-Connection
11 Iph1=Vph1/Z;                         // Current in Y-Connection
12 I11=Iph1;                            // Load Current in Y-
    Connection
13 disp(' Current Drawn ( for Y-Connection ) = '+string
    (I11)+' Amp');
14 Vph2=V1;                             // Voltage in Delta-Connection
15 Iph2=Vph2/Z;                         // Current in Delta-Connection
16 I12=1.732*Iph2;                      // Load Current in Delta-
    Connection
```

```

17 disp(' Current Drawn (for Delta-Connection ) = '+
      string(I12)+' Amp');
18
19
20
21
22 // p 409      12.1

```

---

### Scilab code Exa 12.2 Current

```

1
2
3 // Example 12.2
4
5 V1=415; // Supply Voltage
6 Vph=V1/sqrt(3); // Phase Voltage
7 p1=10000; // Load of 10-kW
8 p2=8000; // Load of 8-kW
9 p3=5000; // Load of 5-kW
10
11 IR=p1/Vph; // Current by ( 10-kW Load )
12 disp(' Current by ( 10-kW Load ) = '+string(IR)+'
      Amp');
13
14 IY=p2/Vph; // Current by ( 8-kW Load )
15 disp(' Current by ( 8-kW Load ) = '+string(IY)+' Amp
      ');
16
17 IB=p3/Vph; // nCurrent by ( 5-kW Load )
18 disp(' Current by ( 5-kW Load ) = '+string(IB)+' Amp
      ');
19
20 IH=IY*cosd(30)-IB*cosd(30); // Horizontal
      Current
21 IV=IR-IY*sind(30)-IB*sind(30); // Vertical

```

```

    Current
22 IN=sqrt(IH^2+IV^2);           // Current in
    Neutral Conductor
23 disp(' Current in Neutral Conductor = '+string(IN)+'
    Amp');
24
25
26
27
28 // p 410 12.2

```

---

### Scilab code Exa 12.3 Current

```

1
2 // Example 12.3
3
4 Z1=100;           // Impedence Z1 in Delta-
    connection load
5 R2=20;           // Resistance R2 in Delta-
    connection load
6 f=50;           // Frequency
7 L2=0.191;       // Inductance
8 X2=2*pi*f*L2;   // Reactance X2 in Delta-
    connection load
9 Z2=sqrt(R2^2+X2^2); // Impedence Z2 in Delta-
    connection load
10 Q2=atand(60/20); // Phase angle
11 C3=30*10^-6;    // Capacitor
12 Z3=1/(2*pi*f*C3); // Impedence Z3 in Delta-
    connection load
13 Q3=90;          // Leading phase angle
14 I1=415/Z1;      // Phase current I1 in loads RY
15 disp(' Phase current I1 in loads RY = '+string(I1)+'
    Amp');
16

```

```

17 I2=415/Z2;           // Phase current I2 in loads YB
18 disp(' Phase current I2 in loads YB = '+string(I2)+'
    Amp');
19
20 I3=415/Z3;           // Phase current I3 in loads BR
21 disp(' Phase current I3 in loads BR = '+string(I3)+'
    Amp');
22
23 IR=sqrt(I1^2+I3^2+(2*I1*I3*cosd(30)));           //
    Current in the liner conductor R
24 disp(' Current in the liner conductor R = '+string(
    IR)+' Amp');
25
26 QY=Q2-60;           // Phase difference between I2-
    I1
27 IY=sqrt(I1^2+I2^2+(2*I1*I2*cosd(QY)));           //
    Current in the liner conductor Y
28 disp(' Current in the liner conductor Y = '+string(
    IY)+' Amp');
29
30 QB=180-QY-30;           // Phase difference between I2-
    I3
31 IB=sqrt(I2^2+I3^2+(2*I2*I3*cosd(QB)));           //
    Current in the liner conductor B
32 disp(' Current in the liner conductor B = '+string(
    IB)+' Amp');
33
34
35
36
37 // p 411           12.3

```

---

Scilab code Exa 12.4 Current Power And Power Factor

1

```

2           // Example 12.4
3
4           // ==> For star-connection
5 disp(' ** For star-connection ** ');
6 V1=400;           // Voltage at load
7 Vph=V1/1.732;    // Phase voltage
8 Zph=sqrt(20^2+15^2); // Impedence per phase
9 Il=Vph/Zph;     // Line current
10 disp(' The line current (Il) = '+string(Il)+' Amp');
11
12 Rph=20;         // Resistance per phase
13 CosQ=Rph/Zph;  // Power factor
14 disp(' Power factor = '+string(CosQ)+' Lagging');
15
16 P=1.732*V1*Il*CosQ; // Total active power
17 disp(' Total active power = '+string(P/1000)+' kW');
18
19           // ==> For Delta-connection
20 disp(' ** For Delta-connection ** ');
21 Vph1=V1;       // Phase voltage
22 Iph=Vph1/Zph;  // Phase current
23 IL=1.732*Iph;  // Load current
24 disp(' The Load current (IL) = '+string(IL)+' Amp');
25
26 disp(' Power factor = '+string(CosQ)+' Lagging');
27
28 P1=1.732*V1*IL*CosQ; // Total active power
29 disp(' Total active power = '+string(P1/1000)+' kW')
30     ;
31
32           // p 412           12.4

```

---

Scilab code Exa 12.5 Power And Power Factor



```

1
2           // Example 12.5
3
4 p1=3000;           // Load of 3-kW
5 p2=1500;           // Load of 1.5-
   kW
6 P=p1+p2;           // Total Load
7 disp(' Total Power Consumed = '+string(P)+' Watt');
8
9 Q=atand(1.732*(p1-p2)/(p1+p2)); // Power Factor
   Angle
10 pf=cosd(Q);        // Power Factor
11 disp(' Power Factor is = '+string(pf));
12
13
14
15
16           // p 417           12.5

```

---

### Scilab code Exa 12.6 Current Power And Power Factor

```

1
2           // Example 12.6
3
4 V1=415             // Supply
   Voltage
5 p1=5200;           // Load of 5.2-
   kW
6 p2=-1700;          // Load of 1.7-
   kW
7
8 P=p1+p2;           // Total Load
9 disp(' Total Power Consumed = '+string(P)+' Watt');
10
11 Q=atand(1.732*(p1-p2)/(p1+p2)); // Power Factor

```

```

    Angle
12
13 pf=cosd(Q); // Power Factor
14 disp(' Power Factor is = '+string(pf));
15
16 // P= root(3)*Vl
    *I1*cos(Q)
17 I1=P/(1.732*Vl*pf);
18 disp(' Line Current is = '+string(I1)+' Amp');
19
20
21
22
23 // p 417 12.6

```

---

# Chapter 13

## Transformers

Scilab code Exa 13.1 Megnetic Flux And Voltage

```
1
2
3           // Example 13.1
4
5 E=6400;           // Supply Voltage
6 f=50;            // Frequency
7 N1=480;          // No.Of turns in
   Primary Coil
8 N2=20;           // No.Of turns in
   Secondary Coil
9
10 Qm=E/(4.44*f*N1); // The Peak Value
   of Flux
11 disp(' The Peak Value of Flux = '+string(Qm)+' Wb');
12
13 E1=4.44*f*N2*Qm; // Voltage
   induced in Secondary winding
14 disp(' Voltage induced in Secondary winding = '+
   string(E1)+' Volt ');
15
16
```

```

17
18
19
20
21          // p 487          13.1

```

---

**Scilab code Exa 13.2** Flux Density Current And Voltage

```

1
2          // Example 13.2
3
4  E1=230;          // Supply Voltage
5  f=50;           // Frequency
6  N1=30;          // No.Of turns in
   Primary Coil
7  N2=350;         // No.Of turns in
   Secondary Coil
8  A=250*10^-4;   // Area of the
   Core
9
10 Qm=E1/(4.44*f*N1); // The Peak Value
   of Flux
11 Bm=Qm/A;       // The Peak Value
   of Flux Density
12 disp(' The Peak Value of Flux Density = '+string(Bm)
   + ' Tesla ');
13
14 E2=E1*(N2/N1); // Voltage
   induced in Secondary winding
15 disp(' Voltage induced in Secondary winding = '+
   string(E2/1000)+' kV');
16
17 I2=100;         // Current in
   Secondary Coil
18 I1=I2*(N2/N1); // Primary

```

```

    Current
19 disp(' Primary Current is = '+string(I1/1000)+' kA '
    );
20
21
22
23
24 // p 490      13.2

```

---

### Scilab code Exa 13.3 Turns Ratio

```

1
2
3 // Example 13.3
4
5 R1=800; // Load Resistance
6 Req=50; // O/P Resistance
7 K=sqrt(R1/Req); // Ratio Constant
8 N21=K; // urns ratio of
    Transformer
9 disp(' Turns ratio of Transformer (N2/N1) = '+string
    (N21));
10
11
12
13
14
15 // p 490      13.3

```

---

### Scilab code Exa 13.4 Current

```

1
2 // Example 13.4'

```

```

3
4                                     // From the circuit Diagram Ip=
                                     30<0/{20+i20+2^2*(2-i10)}
5
6 Ip= 30/{20+%i*20+2^2*(2-%i*10)};    // Phase Current
7
8 I1=2*Ip;                             // Load current
9 disp(' The Load current is I1 = '+string(I1)+' Amp
      or ('+string(abs(I1))+' <'+string(atan2(imag(I1)
      ,real(I1))))+' Amp ');
10
11
12
13
14
15
16
17                                     // p 491      13.4

```

---

### Scilab code Exa 13.5 Power

```

1
2                                     // Example 13.5
3
4 f=50;                               // Frequency
5 N1=30;                               // No.Of turns in
   Primary Coil
6 N2=66;                               // No.Of turns in
   Secondary Coil
7 A=0.015;                             // Area of the
   Core
8 Z1=4;                                // Load Impedance
9 Bm=1.1;                               // The Peak Value
   of Flux Density
10 Qm=Bm*A;                             // The Peak Value

```

```

    of Flux
11
12 V2=4.44*f*N2*Qm;           // O/P Voltage
13 I2=V2/Z1;                 // O/P current
14 Ova=V2*I2;                // Output Volt-
    Amperes
15 disp(' Output Volt-Ampere is = '+string(Ova/1000)+'
    kVA');
16
17
18
19
20
21 // p 491           13.5

```

---

#### Scilab code Exa 13.6 Turns

```

1
2 // Example 13.6
3
4 f=50; // Frequency
5 A=9*10^-4; // Area of the
    Core
6 Bm=1; // The Peak Value
    of Flux Density
7 Qm=Bm*A; // The Peak Value
    of Flux
8
9 E3=6; // Voltage in
    Tertiary winding
10 N3=E3/(4.44*f*Qm); // No.Of Turns in
    Tertiary winding
11 disp(' No.Of Turns in Tertiary winding = '+string(
    round(N3*2)) + ' turns');
12

```

```

13
14 E1=230; // Voltage in
    Primary winding
15 N03=round(N3); // Round figure
16 N1=(N03*E1)/E3; // No.Of Turns
    in Primary winding
17 disp(' No.Of Turns in Primary winding = '+string(
    round(N1)) +' turns ');
18
19
20 E1=230;
21 E2=110; // Voltage in
    Secondary winding
22 N2=(N03*E2)/E3; // No.Of Turns
    in Secondary winding
23 disp(' No.Of Turns in Secondary winding = '+string(
    round(N2)) +' turns ');
24
25
26
27
28
29 // p 491 13.6

```

---

### Scilab code Exa 13.7 Current And Power Factor

```

1
2
3 // Example 13.7
4
5 VA=350; // VA rating
6 V1=230; // I/p Voltage
7 Io=VA/V1; // I/p Current
8 Pi=110; // I/p power
9 // Core Loss = I/p power at

```



```

10                                     no load
11                                     // Pi= V1*Io*cosQ
11 pf=Pi/VA;                           // Power factor
12 disp(' Power factor at no load = '+string(pf));
13
14 Iw=Io*pf;                            // Loss component of no-load
   Current
15 disp(' Loss component of no-load Current = '+string(
   Iw)+' Amp');
16
17 Im=sqrt(Io^2-Iw^2);                  // Magnetising component of
   no-load Current
18 disp(' Magnetising component of no-load Current = '+
   string(Im)+' Amp');
19
20
21
22                                     // p 493          13.7

```

---

### Scilab code Exa 13.8 Power

```

1
2
3                                     // Example 13.8
4
5                                     // We Know that Pi= Ph+ Pe=(
   Af+ Bf^2 )
6                                     // there for at 60Hz    100=
   60A+ 3600B
7                                     //                at 40Hz    60 =
   40A+ 1600B
8                                     // After Solving Equation We
   have
9 A=1.167;                            // Alphabet for Simlicity
10 B=0.00834;                          // Alphabet for Simlicity

```

```

11 f=50; // Frequency
12 Ph=A*f; // Hysteresis Loss
13 disp('Hysteresis Loss ( at 50 Hz ) = '+string(Ph)+'
      Watt');
14
15 Pe=B*f^2; // Eddy-Current Loss
16 disp('Eddy-Current Loss ( at 50 Hz ) = '+string(Pe)+'
      Watt');
17
18
19
20
21
22
23 // p 495 13.8

```

---

### Scilab code Exa 13.9 Current And Power Factor

```

1
2 // Example 13.9
3
4 pf1=0.2; // Power factor at 5 A
5 pf2=0.8; // Power factor at 120 A
6 Q1=acosd(pf1); // Angle for 0.2 Power factor
7 Q2=acosd(pf2); // Angle for 0.8 Power factor
8 V2=110; // Voltage in Secondary
   winding
9 V1=440; // Voltage in Primary winding
10 k=V2/V1; // Ratio Constant
11 I2=120; // Current in Secondary
   winding
12 i1=k*I2; // Current in primary winding
13 io=5; // No load Current
14 I1=23.99-%i*18; // Current in primary winding
   in complex form

```

```

15 Io=1-%i*4.899;           // No load Current in complex
    form
16
17 I=I1+Io;                 // Primary Current
18 disp(' Primary Current = '+string(I)+' Amp or '+
    string(abs(I))+'<'+string(atan2(imag(I),real(I)))
    +' Amp');
19
20 pf=cosd(-42.49);        // Primary Power factor
21 disp(' Primary Power factor = '+string(pf));
22
23
24
25
26          /// p 498          13.9

```

---

#### Scilab code Exa 13.10 Resistance And Power

```

1
2           // Example 13.10
3
4 kVA=50000;           // Single Phase supply
5 V1=4400;             // Voltage in primary winding
6 V2=220;             // Voltage in Secondary
    winding
7 R1=3.45;            // primary Resistance
8 R2=0.009;          // Secondary Resistance
9 X1=5.2;            // primary Reactance
10 X2=0.015;         // Secondary Reactance
11 I1=kVA/V1;        // primary Current
12 I2=kVA/V2;        // Secondary Current
13 k=V2/V1;          // Turns constant
14
15 Re1=R1+(R2/k^2);   // Equivalent Resistance
    referred to Primary

```

```

16 disp(' Equivalent Resistance referred to Primary = '
      +string(Re1)+' Ohm');
17
18 Re2=k^2*R1+R2;           // Equivalent Resistance
      referred to Secondary
19 disp(' Equivalent Resistance referred to Secondary =
      '+string(Re2)+' Ohm');
20
21 Xe1=X1+(X2/k^2);        // Equivalent Impedance
      referred to Primary
22 disp(' Equivalent Impedance referred to Primary = '+
      string(Xe1)+' Ohm');
23
24 Xe2=k^2*X1+X2;         // Equivalent Reactance
      referred to Secondary
25 disp(' Equivalent Reactance referred to Secondary =
      '+string(Xe2)+' Ohm');
26
27 Ze1=sqrt(Re1^2+Xe1^2);  // Equivalent Impedance
      referred to Primary
28 disp(' Equivalent Impedance referred to Primary = '+
      string(Ze1)+' Ohm');
29
30 Ze2=sqrt(Re2^2+Xe2^2);  // Equivalent Impedance
      referred to Secondary
31 disp(' Equivalent Impedance referred to Secondary =
      '+string(Ze2)+' Ohm');
32
33 i2=227.27;              // Round off value of I2
34 i1=11.36;               // Round off value of I1
35 r1=3.45;                // Round off value of R1
36 r2=0.009;              // Round off value of R2
37
38 P=i1^2*r1+round(i2)^2*r2; // Total Copper loss
39 disp(' Total Copper loss = '+string(round(P))+' Watt
      ');
40
41 re1=7.05;               // Round off value of Re1

```

```

42 P1=i1^2*re1;           // Total Copper loss By
    Equivalent Re1
43 disp(' Total Copper loss By Equivalent Re1 = '+
    string(P1)+' Watt');
44
45 re2=0.0176;           // Round off value of Re2
46 P2=i2^2*re2;           // Total Copper loss By
    Equivalent Re2
47 disp(' Total Copper loss By Equivalent Re2 = '+
    string(round(P2))+' Watt');
48
49
50
51           // p 503           13.10

```

---

### Scilab code Exa 13.11 Regulation

```

1
2           // Example 13.11
3
4 R1=10;           // Resistance of 10
    Ohms
5 R2=0.02;           // Resistance of 0.02
    Ohms
6 Xe=35           // Reactance of
    primary coil
7 n1=250;           // No.Of turns in
    Primary coil
8 n2=6600;           // No.Of turns in 2ry
    coil
9 k=n1/n2;           // Turns ratio
10 P=40000;           // Single-Phase power
11 I2=P/n1;           // Full-load current
12 Re2=k^2*R1+R2;           // Resistance Re2
13 Xe2=k^2*Xe;           // Reactance Xe2

```

```

14 SinQ=0; // SinQ=0
15 CosQ=1; // Power factor
16 Reg={(I2*Re2*cosQ)+(I2*Xe2*sinQ)}/n1; //
    % Regulation.
17 disp(' % Regulation (pf=1) = '+string(Reg*100)+' %')
    ;
18
19 CosQ1=0.8; // Leading Power
    factor
20 SinQ1=sqrt(1-CosQ1^2); // SinQ=0.6 +ve
21
22 Reg1={(I2*Re2*cosQ1)+(I2*Xe2*sinQ1)}/n1; //
    % Regulation.
23 disp(' % Regulation (pf=0.8) = '+string(Reg1*100)+'
    %');
24
25 SinQ2=-sqrt(1-CosQ1^2); // SinQ=0.6 -ve
26
27 Reg2={(I2*0.0343*cosQ1)+(I2*Xe2*sinQ2)}/n1;
    // % Regulation.
28 disp(' % Regulation for (pf=0.8) = '+string(Reg2
    *100)+' %');
29
30
31
32 // p 506 // 13.11

```

---

### Scilab code Exa 13.12 Efficiency And Power

```

1
2 // Example 13.12
3
4 // We know that  $E=4.44*f*N*Q_m$ 
5
6 Qm=0.06; // Megnetic flux

```

```

7 f=50; // Frequency
8 E2=250; // Voltage
9 N2=E2/(4.44*f*Qm); // No.Of of turns in 2
    ry coil
10 disp(' No.Of turns (N2) = '+string(round(N2))+
    turns ');
11
12 E1=5000; // Voltage
13 N1=(E1/E2)*19; // No.Of turns in 1ry
    coil
14 disp(' No.Of turns (N1) = '+string(N1)+' turns ');
15
16 kVA=150*10^3; // kVA Rating
17 pf=1; // Power factor
18 Po=0.5*kVA*pf; // O/p power
19 Cfl=1800; // Full-load Copper
    losses
20 Pc=0.5*0.5*Cfl; // Copper losses
21 Pi=1500; // Iron losses
22 n=Po/(Po+Pc+Pi); // Efficiency
23 disp(' Efficiency at half kVA = '+string(n*100)+' %'
    );
24
25 pf1=0.8; // Power factor
26 Po1=kVA*pf1; // O/p power
27 Pc1=1800; // Copper losses
28 n1=Po1/(Po1+Pc1+Pi); // Efficiency
29 disp(' Efficiency at Full-load & at(pf=0.8) = '+
    string(n1*100)+' %');
30
31 // We know that x^2 x 1800= 1500
32 x=sqrt(1500/1800); // Value of x
33 kVA1=kVA*x; // kVA Load for
    Maximum efficiency
34 disp(' kVA Load for Maximum efficiency = '+string(
    round(kVA1/1000))+ ' kVA');
35
36

```

---

**Scilab code Exa 13.13 Efficiency**

```

1
2           // Example 13.13
3
4           // For 80-kW load at pf=1 (for 6 hours)
5 t=6;           // Time in Hours
6 p=80;         // Power in kW
7 Eo=p*t;       // O/p energy
8 pf=1;         // Power factor
9 kVA=p/pf;     // kVA rating
10 kVAo=200;    // kVA at full-load
11 Pc1=3.02;    // Copper losses at full-
    load
12 Pc=(kVA/kVAo)^2*Pc1; // Copper losses
13 Pi=1.6;      // Iron losses
14 Pl=Pc+Pi;    // Total losses
15 Tloss=Pl*6; // Total losses in 6 hours
16
17           // For 160-kW load at pf=0.8 (for 8
    hours)
18 p1=160;     // Power in kW
19 E1=p1*8;    // O/p energy
20 pf1=0.8;    // Power factor
21 kVA1=p/pf;  // kVA rating
22 Pc11=3.02;  // Copper losses at full-
    load
23 Pc1=Pc11;   // Copper losses
24 Pl1=Pc1+Pi; // Total losses
25 Tloss1=Pl1*8; // Total losses in 6
    hours
26
27           // For No-load (for 10 hours)

```



```

28 E2=0; // O/p Energy
29 Pc2=0; // Copper losses
30 P12=Pc2+Pi; // Total losses
31 Tloss2=P12*10; // Total losses in 10
    hours
32 Wo=Eo+E1+E2; // Total O/P energy
33 W1=Tloss+Tloss1+Tloss2; // Total energy losses
34 n=Wo/(Wo+W1); // All-Day efficiency
35 disp('All-Day efficiency = '+string(n*100)+' %');
36
37
38 // p 510 13.13
39
40 // For 160-kW load at pf=1 (for
41 t=6; // Time in Hours

```

---

#### Scilab code Exa 13.14 Power

```

1
2 // Example 13.14
3
4
5 kVA=12000; // Single Phase supply
6 V1=120; // Voltage in primary winding
7 I2=kVA/V1; // Current in Secondary
    winding
8 I1=I2; // Current in primary winding
9 V2=240; // Voltage in Secondary
    winding
10 Pi=V2*I2; // I/p apparent power
11 disp(' I/p apparent power = '+string(Pi/1000)+' kVA'
    );
12
13 Po=V1*I1*2; // O/p apparent power
14 disp(' O/p apparent power = '+string(Po/1000)+' kVA'

```

```

    );
15
16
17
18
19
20          //      p 511      13.14

```

---

### Scilab code Exa 13.15 Voltage

```

1
2
3          // Example 13.15
4
5  V11=3300;          // The supply voltage
6  Vph1=V11/1.732;   // Primary phase voltage
7  N1=840;           // No.Of Turns in Primary
   winding
8  N2=72;            // No.Of Turns in secondary
   winding
9  Vph2=Vph1*(N2/N1); // Secondary phase voltage
10 V12=Vph2;         // Secondary line voltage
11 disp(' Secondary line voltage on No load for (star/
   delta) = '+string(V12)+' Volt');
12
13 vph1=V11;          // Primary phase voltage
14 vph2=vph1*(N2/N1); // Secondary phase voltage
15 v12=vph2*1.732;   // Secondary line voltage
16 disp(' Secondary line voltage on No load for (delta/
   star) = '+string(round(v12))+' Volt');
17
18
19
20
21

```

```

22
23
24          //      p 514          13.15

```

---

### Scilab code Exa 13.16 Current And Resistance

```

1
2          // Example 13.16
3
4  V1=200;          // Supply voltage
5  Wo=120;         // Wattmeter reading
6  Iw=Wo/V1;      // Core loss current
7  disp(' Core-loss current (Iw) = '+string(Iw)+' Amp')
8  ;
9  Io=1.3;        // Open-ckt current
10 Im=sqrt(Io^2-Iw^2); // Megnetising current
11 disp(' Megnetising current (Im) = '+string(Im)+' Amp
12      ');
13 Ro=V1/Iw;      // Resistance
14 Xo=V1/1.15;    // Reactance
15 disp(' Equivalent resistance of exciting circuit = '
16      '+string(round(Ro))+ ' Ohms');
17
18 V2=400;        // Supply voltage
19 k=V1/V2;       // Transformation Ratio
20 kVA=12000;     // kVA rating
21 Ifl=kVA/V2;    // Full-load current
22 Wsc=200;       // Short-ckt power
23 Re1=Wsc/Ifl^2; // Equivalent resistance
24      at full-load
25 Vsc=22;        // Short-ckt voltage

```

```

25 Ze1=Vsc/If1;           // Equivalent impedance
    at full-load
26 Xe1=sqrt(Ze1^2-Re1^2); // Short-ckt reactance
27 Re2=k^2*Re1;          // Equivalent resistance
    of low voltage winding
28 disp(' Equivalent resistance of low voltage winding
    = '+string(Re2)+' Ohms');
29
30 Xe2=k^2*Xe1;          // Equivalent reactance of
    low voltage winding
31 disp(' Equivalent reactance of low voltage winding =
    '+string(Xe2)+' Ohms');
32
33
34 // p 516                13.16

```

---

# Chapter 14

## Alternators And Synchronous Motors

Scilab code Exa 14.1 Speed

```
1
2           // Example 14.1
3
4 F=60;           // Frequency
5 P=6;           // No.Of poles
6 ns=(120*F)/P;  // Speed Of rotation
7 disp('Speed Of rotation Is = '+string(ns)+' Rpm');
8 F1=20;         // Decreased frequency
9 P1=(120*F1)/ns; // Number Of poles
10 disp('Number Of poles = '+string(P1));
11
12
13
14
15
16           // p 546 Ex14.1
```

---

### Scilab code Exa 14.2 Distribution Factor

```
1
2                                     // Example 14.2
3
4  alfa=20;                            // Slot angle
5  q1=120/20;                          // No.Of slots for group p
6  sa=sind((q1*alfa)/2);
7  sb=sind(alfa/2);
8  kd1=sa/(q1*sb);                      // Three phase Winding (with
    120 phase group)
9  disp('(a) A Three phase Winding (with 120 phase
    group) = '+string(kd1));
10 q2=60/20;                            // No.Of slots for group q
11 sa1=sind((q2*alfa)/2);
12 kd2=sa1/(q2*sb);                     // TThree phase Winding (
    with 60 phase group)
13 disp('(b) A Three phase Winding (with 60 phase group
    ) = '+string(kd2));
14
15
16
17
18                                     // p 554 Ex 14.2
```

---

### Scilab code Exa 14.3 Speed Emf And Voltage

```
1
2                                     // Example 14.3
3
4  f=50;                                // Frequency
5  p=20;                                // No.Of poles
6  Ns=(120*f)/p;                        // Speed Of rotation
7  disp('(a) Speed of Rotation is = '+string(Ns)+' rpm '
    );
```

```

8 p1=180/20; // No.Of slots per pole
9 Q=180/p1; // Slot angle
10 q1=p1/3; // No.Of slots per pole
    for group q
11 sa=sind((q1*Q)/2);
12 sb=sind(Q/2);
13 kd=sa/(q1*sb); // Generated emf per phase
14 disp('(b) Generated emf per phase = '+string(kd)+'
    Volt');
15
16 g=0.025; // Flux per poles
17 T=240; // No.Of turns per phase
18 kp=1;
19 E=(4.44*f*g*kp*T*0.96); // Rms value of emf per
    phase
20 E1=sqrt(3)*E; // Line emf
21 disp('(b) Generated emf per phase = '+string(E)+'
    Volt');
22 disp('(c) Line emf = '+string(E1)+' Volt');
23
24
25 // p 554 14.3

```

---

#### Scilab code Exa 14.4 Voltage Regulation

```

1
2
3 // Example 14.4'
4
5 I=15.7; // Phase current
6 Vt=22*10^3/sqrt(3); // Phase voltage
7 Zs=0.16; // Impedance
8 V=12.7; // Terminal Voltage per
    phase on full load
9 Vz=I*Zs; // Voltage drop per

```

```

    phase on full load
10 OC=0.014; // Star winding
    resistence
11 OG=0.16; // Synchronous
    impedance
12 Q=acosd(OC/OG); // Phase angle
13 pf1=0.8; // Lagging power factor
14 q1=acosd(pf1); // Lagging angle
15 alfa1=Q-q1; // Resultant angle
16 Cos1=cosd(alfa1); // power factor for
    Resultant
17 E1=(sqrt(V*V+Vz*Vz+2*V*Vz*Cos1));
18 Er1=(E1-V)/V; // the Voltage
    Regulation (0.8 Lagging)
19 disp('(a) the Voltage Regulation (0.8 Lagging) is =
    '+string(Er1*100)+' per Cent');
20
21 pf2=1; // Leading power factor
22 q2=acosd(pf2); // Leading angle
23 alfa2=Q-q2; // Resultant angle
24 Cos2=cosd(alfa2); // power factor for
    Resultant
25 E2=(sqrt(V*V+Vz*Vz+2*V*Vz*Cos2));
26 Er2=(E2-V)/V; // the Voltage
    Regulation (1 Lagging)
27 disp('(b) the Voltage Regulation (1 Lagging) is = '+
    string(Er2*100)+' per Cent');
28
29 alfa3=Q+q1; // Resultant angle
30 Cos3=cosd(alfa3); // power factor for
    Resultant
31 E3=(sqrt(V*V+Vz*Vz+2*V*Vz*Cos3));
32 Er3=(E3-V)/V; // the Voltage
    Regulation (0.8 Leading)
33 disp('(c) the Voltage Regulation (0.8 Leading) is =
    '+string(Er3*100)+' per Cent');
34
35 // p 560 14.4

```



---

### Scilab code Exa 14.5 Voltage Regulation

```
1
2
3           // Example 14.5
4
5 I=100;           // Full-rated short-
   circuit current
6 V=3.3*10^3/sqrt(3); // Three phase
   voltage
7 R=0.9;           // Remature
   resistance
8 Zs=5.196;        // Impedance
9 Vz=I*Zs;         // Voltage drop per
   phase on full load
10 Q=acosd(R/Zs); // Phase angle
11 pf1=0.8;        // Lagging power
   factor
12 q1=acosd(pf1); // Lagging angle
13 alfa1=Q-q1;     // Resultant angle
14 Cos1=cosd(alfa1); // power factor for
   Resultant
15 E1=(sqrt(V*V+Vz*Vz+2*V*Vz*Cos1));
16 Er1=(E1-V)/V;   // the Voltage
   Regulation (0.8 Lagging)
17 disp('(a) the Voltage Regulation (0.8 Lagging) is =
   '+string(Er1*100)+' per Cent');
18 alfa3=Q+q1;     // Resultant angle
19 Cos3=cosd(alfa3); // power factor for
   Resultant
20 E3=(sqrt(V*V+Vz*Vz+2*V*Vz*Cos3));
21 Er3=(E3-V)/V;   // the Voltage
   Regulation (0.8 Leading)
22 disp('(b) the Voltage Regulation (0.8 Leading) is =
```

```

    '+string(Er3*100)+' per Cent ');
23
24
25
26
27          // p 563          14.5

```

---

### Scilab code Exa 14.6 Emf And Angle

```

1
2
3          // Example 14.6
4
5 po=9000;          // O/p power
6 n=0.9;          // Efficiency of
   motor
7 pi=po/n;          // I/p power
8 X=3;          // Reactance
9 V1=400;          // Phase voltage
10 R=0.4;          // Resistance
11 Cos1=0.8;          // Leading power
   factor
12 I=pi/(sqrt(3)*V1*cos1);          // I/p current per
   phase
13 q1=acosd(0.8);          // Leading angle
14 Zs=sqrt(R*R+X*X);          // Impedance
15 Q=atand(X/R);          // Phase angle
16 V=400/sqrt(3);          // Supply voltage
   per phase
17 Er=I*Zs;          // Voltage drop
   per phase across the synchronous impedance
18
19 E=(sqrt(V*V+Er*Er+2*V*Er*cosd(180-Q-q1)));
20 E1=sqrt(3)*E;          // Exitation emf
21 disp(' Exitation emf = '+string(E1)+' volt ');

```

```

22
23 Qr=asind((Er*sind(Q+q1))/E); // Angle of rotor
24 disp(' Angle of rotor = '+string(Qr)+' Digree');
25
26
27
28 // p 568 14.6

```

---

### Scilab code Exa 14.7 Emf

```

1
2
3 // Example 14.7
4
5 Zph=24*(12/3); // The No.Of conductors
   in series
6 T=Zph/2; // No.Of turns per phase
7 p1=24/4; // No.Of slots/pole
8 Q=180/p1; // Slot angle
9 q1=p1/3; // No.Of slots/pole for
   group q
10 sa=sind((q1*Q)/2); // Distribution factor (
   Numerator part )
11 sb=sind(Q/2); // Distribution factor (
   denominator part )
12 kd=sa/(q1*sb); // Distribution factor
13 p=4; // No.Of poles
14 Ns=1500; // Speed
15 g=0.1; // Flux per pole
16 f=(p*Ns)/120; // Pitch factor
17 kp=1; // Constant
18 E=(4.44*f*g*kp*T*kd); // Generated emf per
   phase
19 E1=sqrt(3)*E; // line emf (at
   alternator 1500 rpm)

```

```

20 disp(' line emf (at alternator 1500 rpm) = '+string(
    round(E1))+ ' Volt ');
21
22
23
24
25
26 // p 572    14.7

```

---

#### Scilab code Exa 14.8 Emf

```

1
2 // Example 14.8
3
4 Q=30; // Angle between 2 slots
5 q1=6; // No.Of coils
6 sa=sind((q1*Q)/2); // Distribution factor (
    Numerator part )
7 sb=sind(Q/2); // Distribution factor (
    denominator part )
8 kd=sa/(q1*sb); // Distribution factor
9 Vc=6*10; // Voltage induced in 6
    coils
10 Er=kd*Vc; // Net emf induced in
    Six coils
11 disp(' Net emf induced in Six coils = '+string(Er)+'
    Volt ');
12
13
14
15
16
17 // p 573    14.8

```

---

### Scilab code Exa 14.9 Current Power And Torque

```
1
2
3           // Example 11.9
4
5 f=50;           // Frequency
6 N=120;         // Speed
7 p=(120*f)/N;   // Number Of poles
8 disp('(a) The No.of Poles = '+string(p));
9
10 Pf=1;         // Power fector
11 Va=100*10^6;  // VA-Rating
12 Rt=Va*Pf;     // kW-Rating
13 disp('(b) The kW rating = '+string(Rt)+' Watt');
14
15 V1=11*10^3;   // Star-connected voltage
16 I1=Va/(sqrt(3)*V1); // Current rating (I1)
17 disp('(c) The Current rating (I1) = '+string(round(
    I1))+ ' Amp');
18
19 po=100*10^6;  // Power
20 n=0.97;       // Efficiency of motor
21 Pi=po/n;     // I/P Power (Pi)
22 disp('(d) The I/P Power (Pi) = '+string(Pi)+' Watt')
    ;
23
24 t=Pi/(2*3.14*N*0.0166); // Prime Torque
25 disp('(e) The Prime Torque = '+string(t)+' Nm');
26
27
28
29           // p 573           14.9
```

---

# Chapter 15

## Induction Motors

Scilab code Exa 15.1 Speed And Frequency

```
1
2
3           // Examle 15.1
4
5 p=6;           // No.Of poles
6 f=50;         // Frequency
7 Ns=(120*f)/p; // Synchronous speed
8 disp('(a) The Synchronous Speed (Ns) = '+string(Ns)+
      ' rpm ');
9
10 s1=0.01;      // Slip (s=1 %)
11 N1=Ns*(1-s1); // he No Load Speed (N)
12 disp('(b) The No Load Speed (N) = '+string(N1)+' rpm
      ');
13
14 s2=0.03;      // Slip (s=3 %)
15 N2=Ns*(1-s2); // The Full Load Speed
16 disp('(c) The Full Load Speed (N) = '+string(N2)+'
      rpm ');
17
18 s=1;          // Slip (s=100 %)
```

```

19 fr1=s*f; // The Frequency of Rotor
   (at s=1 )
20 disp('(d) The Frequency of Rotor (at s=1 ) = '+
   string(fr1)+' Hz');
21
22 fr2=s2*f; // The Frequency of Rotor
   (at s=0.03 )
23 disp('(e) The Frequency of Rotor (at s=0.03 ) = '+
   string(fr2)+' Hz');
24
25
26
27
28 // p 593 15.1

```

---

### Scilab code Exa 15.2 Speed And Frequency

```

1
2 // Example 15.2
3
4 p=12; // No.Of poles
5 f=50; // Frequency
6 Ns=(120*f)/p; // Synchronous speed
7 disp(' The Synchronous Speed (Ns) = '+string(Ns)+'
   rpm ');
8
9 N=485; // Speed of Motor
10 s=(Ns-N)/Ns; // Slip
11 fr=s*f; // The Frequency of Rotor
   ( fr )
12 disp(' The Frequency of Rotor ( fr ) = '+string(fr)+'
   Hz ');
13
14
15

```

16  
17 // p 593 15.2

---

### Scilab code Exa 15.3 Speed

```
1
2
3 // Example 15.3
4
5 p=6; // No.Of poles
6 f=50; // Frequency
7 Ns=(120*f)/p; // Synchronous speed
8 disp(' The Synchronous Speed (Ns) = '+string(Ns)+'
rpm');
9
10 fr=2; // Frequency of rotor at
full-load
11 s=fr/f; // Slip at full-load
12 disp(' the Full Load Slip (s) = '+string(s*100)+' %'
);
13
14 N=Ns*(1-s); // The Speed of Rotor (fr)
15 disp(' The Speed of Rotor (fr) = '+string(N)+' rpm')
;
16
17
18
19
20 // p 594 15.3
```

---

### Scilab code Exa 15.4 Speed And Frequency

1



```

2
3           // Examle 15.4
4
5 p=4;           // No.Of poles
6 f=50;         // Frequency
7 Ns=(120*f)/p; // Synchronous speed
8 disp(' The Synchronous Speed (Ns) = '+string(Ns)+'
      rpm ');
9
10 s1=0.04;     // Slip
11 N1=Ns*(1-s1); // The Speed of Rotor
12 disp('(b) The Speed of Rotor (at s=0.04) = '+string(
      N1)+' rpm ');
13
14 N=600;       // Speed Of rotation
15 s=(Ns-N)/Ns; // When speed is (600 rmp
      ) Then Slip
16 fr=s*f;     // The Frequence of Rotor
      (fr)
17 disp('(d) The Frequence of Rotor (fr) = '+string(fr)
      +' Hz ');
18
19
20
21
22           // p 594           15.4

```

---

### Scilab code Exa 15.5 Current

```

1
2           // Examle 15.5
3
4
5 R2=0.05;     // Resistance
6 s=0.04;     // Slip

```

```

7 X20=0.1; // Standstill reactance
8 E1=100; // Voltage
9 E20=E1/1.732; // Induced emf per
    phase
10 Z2=sqrt(R2^2+(s*X20)^2); // Impedance
11 E2=s*E20; // Emf with (s= 0.04)
12
13 I2=E2/Z2; // Rotor current for (s
    =0.04)
14 disp(' Rotor current for (s=0.04) = '+string(round(
    I2))+ ' Amp');
15
16 CosQ2=E2/Z2; // CosQ2=E2/Z2 = 0.998
    ==> ,here take ( 0.99 )
17 Q2=acosd(0.99); // Phase difference for
    (s= 0.04)
18 disp(' Phase difference between rotor voltage &
    current for (s=0.04) = '+string(Q2)+' Digree');
19
20 s1=1;
21 E21=s1*E20; // Induced emf per
    phase for s=1
22 Z21=sqrt(R2^2+(s1*X20)^2); // Impedance ==> Z21
    = 57.73 ,but take (57.5)
23 I21=57.5/Z21; // Rotor current for (s
    =1)
24 disp(' Rotor current for (s=1) = '+string(round(I21)
    )+' Amp');
25
26 Q21=acosd(R2/Z21); // Rotor current for (s
    =1)
27 disp(' Phase difference between rotor voltage &
    current for (s=1) = '+string(Q21)+' Digree');
28
29
30
31
32 // p 597 15.5

```

---

### Scilab code Exa 15.6 Power And Speed

```
1
2                               // Examle 15.6
3
4 po=5*746;                    // O/p power
5 n=0.875;                     // Efficiency of motor at no
  load
6 pin=round(po/n);            // I/p power
7 p1=pin-po;                   // Total losses
8 pm=0.05*p1;                  // Mechanical losses
9 pe=p1-pm;                    // Electrical losses
10 pd=po+pm;                    // Devlopment power
11 disp(' Development power = '+string(pd)+' Watt');
12
13 f=50;                         // Frequency
14 p=4;                          // No.Of poles
15 Ns=(120*f)/p;                 // Synchronous speed
16 N=1470;                       // No.Of Revolution in rmp
17 s=(Ns-N)/Ns;                  // The Slip
18
19 pg=pd/(1-s);                  // Air-gap power
20 disp(' Air-gap power = '+string(pg)+' Watt');
21
22 pr=s*pg;                       // Rotor copper loss
23 disp(' Rotor copper loss = '+string(pr)+' Watt');
24
25 ps=pin-pg;                     // Stator loss
26 disp(' Stator loss = '+string(ps)+' Watt');
27
28
29
30                               // p 598    15.6
```

---

### Scilab code Exa 15.7 Current Power And Speed

```
1
2
3           // Exa 15.7
4
5 v1=400/1.732;           // Phase
   voltage
6 s=0.02;                 // Slip
7 p=4;                    // No. Of
   poles
8 f=50;                   //
   Frequency
9 R2=0.332;               //
   Resistance R2
10 X2=0.464;              //
   Reactance X2
11 Ns=(120*f)/p;         //
   Synchronous speed
12 N=Ns*(1-s);           // Rotor
   speed
13 disp(' The rotor speed is = '+string(N)+' rmp');
14
15 V1=231+%i*0;          // Supply
   voltage
16 Xg=26.3;               //
   Reactance Xg
17 X1=1.106;              //
   Reactance X1
18 R1=0.641;             //
   Resistance R1
19 Vth={V1*(%i*Xg)}/(R1+%i*(X1+Xg)); //
   Thevenin's voltage
20 Zth={%i*Xg*(R1+%i*X1)}/(R1+%i*(X1+Xg)); //
```

```

    Thevenin 's impedance
21 R1={(1-s)/s}*R2; //
    Mechanical load
22
23 I1=Vth/(Zth+R2+%i*X2+R1); // stator
    current
24 disp(' Stator current = '+string(I1)+' Amp or ('+
    string(abs(I1))+ ' <'+string(atan(imag(I1),real(
    I1)))+ ' Amp )');
25
26
27 Q=atan(imag(I1),real(I1)); // Power
    factor angle
28 pf=cosd(Q); // Power
    factor
29 disp(' Power factor is = '+string(pf)+' Lagging');
30
31 RL=340; //
    Rotational losses
32 po=(3*12.84^2*R1)-RL; // O/p
    power ==> ( taken I1=12.84 )
33 disp(' O/p power = '+string(abs(po))+ ' Watt');
34
35 pin=3*V1*12.82*0.998; // I/p
    power ==> ( taken I1=12.82 & pf= 0.998)
36 disp(' I/p power = '+string(abs(pin))+ ' Watt');
37
38 n=po/pin; //
    Efficiency of motor
39 disp(' Efficiency of motor = '+string(abs(n*100))+ '
    %');
40
41
42
43
44
45 // p 603 15.7

```

### Scilab code Exa 15.8 Resistance

```
1
2
3                                     // Exa 15.8
4
5 f=50;                               // Frequency
6 p=6;                                 // No.Of poles
7 Ns=(120*f)/p;                       // Synchronous speed
8 N=940;                               // No.Of Revolution in rmp
9
10 s=(Ns-N)/Ns;                        // The Slip
11 disp(' The Slip is = '+string(s));
12
13 R2=0.1;                              // Rotor resistance per phase
14 X20=R2/s;                            // Standing rotor reactance
15 disp(' Standing rotor reactance = '+string(X20)+'
      Ohm');
16
17
18
19
20
21                                     // p 608      15.8
```

---

# Chapter 16

## DC Machines

Scilab code Exa 16.1 Voltage Current And Power

```
1
2           // Example 16.1
3
4           // ==> When Lap-wound .
5
6  disp('* With the Armature Lap-wound, & Parallel
   pahts A=8 ');
7  Z=480;           // No.Of conductor
8  A=8;            // No.Of poles
9  e=2.1;          // Average emf in each conductor
10 E=e*(Z/A);      // Terminal voltage on No load
11 disp(' Terminal voltage on No load = '+string(E)+'
   Volt');
12 If=200;         // Full-load current per conductor
13 I1=If*A;        // O/p current on full-load
14 disp(' O/p current on full-load = '+string(I1)+'
   Amp');
15 Po=I1*E;        // Total power on full-load
16 disp(' Total power generated on full-load = '+
   string(Po/1000)+' kW');
17
```

```

18          // ==> When Wave-wound .
19
20 disp('* With the Armature Wave-wound, & Parallel
      pahts A=2 ');
21 A1=2;          // No.Of poles
22 E1=e*(Z/A1);  // Terminal voltage on No load
23 disp(' Terminal voltage on No load = '+string(E1)+'
      Volt ');
24 I11=If*A1;    // O/p current on full-load
25 disp(' O/p current on full-load = '+string(I11)+'
      Amp');
26 Po1=I11*E1;  // Total power on full-load
27 disp(' Total power generated on full-load = '+
      string(Po1/1000)+' kW');
28
29
30
31
32          // p 631      16.1

```

---

### Scilab code Exa 16.2 Emf

```

1
2          // Example 16.2
3
4 s=65;          // No.Of slots
5 nc=12;        // Couductor per slot
6 z=s*nc;       // Impedance
7 p=4;          // No.Of poles
8 Q=0.02;       // Megnetic flux
9 N=1200;       // Speed of motor
10 E=(Q*z*N*p)/(60*p); // Total emf Induced
11 disp('Total emf Induced = '+string(E)+' Volt ');
12
13

```



14  
15

// p 633 16.2

---

### Scilab code Exa 16.3 Emf

```
1
2           // Examle 16.3
3
4
5 E1=180;           // Induced emf
6 N1=500;           // Speed of mechine N1=500
7 N2=600;           // Speed of mechine N1=600
8 E2=(N2/N1)*E1;   // Emf When Machine runs at
   (600 rpm)
9 disp('Emf When Machine runs at (600 rpm)= '+string(
   E2)+' Volt ');
10
11
12
13           //      633      16.3
```

---

### Scilab code Exa 16.4 Speed And increase in flux

```
1
2           // Examle 16.4
3
4 E1=220;           // Induced emf at N=750 rpm
5 E2=250;           // Induced emf (i.e E=250)
6 N1=750;           // Speed of mechine at E1
   =220
7 N2=(E2/E1)*N1;   // Speed at Constant emf E2
   =250
```

```

8 disp('Speed at Constant emf = '+string(round(N2))+
      rpm');
9
10          // Using formula { Q2/Q1= E2/E1 x N1/
            N2 }
11
12 e=(E2*N1);          // Numerator of above
      formula
13 n=(E1*600);        // Dinominator of above
      formula { by taking N2= 600 }
14 E=e/n;            // Induced emf
15 inc=(E-1.00)*100; // % increment in Flux
16 disp(' % increment in Flux = '+string(round(inc))+
      %');
17
18
19
20
21
22          // p 633          16.4

```

---

#### Scilab code Exa 16.5 Voltage

```

1
2
3          // Exa 16.5
4
5 V=440;          // Supply Voltage
6 Rsh=110;        // Resistance of Shunt field
7 Ish=V/Rsh;     // Current through Shunt field
8 Ra=0.02;       // Resistance of Armature
      winding
9 Il=496;        // Generator current
10 Ia=Il+Ish;    // Armeture Current (Ia)
11 disp('Armeture Current (Ia) = '+string(Ia)+' Amp');

```

```

12
13 Eg=V+(Ia*Ra);          // generated emf (Eg)
14 disp('Generated emf (Eg) = '+string(Eg)+' Volt ');
15
16
17
18          //          p 638      16.5

```

---

### Scilab code Exa 16.6 Voltage And Current

```

1
2          // Exa 16.6
3
4 p=60;          // Power supply
5 v=200;        // supply voltage
6 I1=p/v;      // current through each lamp
7 I1=100*I1;   // Shunt field Current (I1)
8 disp('Shunt field Current (I1) = '+string(I1)+' Amp'
9       ');
10 Rsh=50;      // Resistance
11 Ish=v/Rsh;   // Shunt field Current
12 Ia=I1+Ish;   // Armature Current (Ia)
13 disp('Armature Current (Ia) = '+string(Ia)+' Amp');
14
15 a=4;         // No.Of paraller path
16 Ic=Ia/a;    // Current per path (Ic)
17 disp(' Current per path (Ic) = '+string(Ic)+' Amp');
18
19 Ra=0.2;     // Armature resistance
20 dro=2;     // Brush-drop
21 Eg=v+(Ia*Ra)+dro; // Generated emf (Eg)
22 disp('generated emf (Eg) = '+string(Eg)+' Volt ');
23
24

```

25  
26

// 638 16.6

---

### Scilab code Exa 16.7 Emf

```
1
2           // Exa 16.7
3
4 I1=100;           // Series field current
5 Rse=0.1;         // Resistance series field
6 Vse=Rse*I1;     // Voltage drop across
   series field (Vse)
7 disp('Voltage drop across series field (Vse) = '+
   string(Vse)+' Volt');
8
9 V=250;           // Supply voltage
10 Vsh=V+Vse;     // Voltage drop across
   Shunt field (Vsh)
11 disp('Voltage drop across Shunt field (Vsh) = '+
   string(Vsh)+' Volt');
12
13 Rsh=130;        // Resistance
14 Ish=Vsh/Rsh;   // Shunt field Current (Ish)
   )
15 disp(' Shunt field Current (Ish) = '+string(Ish)+'
   Amp');
16
17 Ia=I1+Ish;     // Armature Current (Ia)
18 disp('Armature Current (Ia) = '+string(Ia)+' Amp');
19
20 Ra=0.1;        // Armature resistance
21 dro=2;         // Brush-drop
22 Eg=V+Vse+(Ia*Ra)+dro; // Generated emf (Eg)
23 disp('Generated emf (Eg) = '+string(Eg)+' Volt');
24
```

25  
26  
27 // p 638 16.7

---

Scilab code Exa 16.8 Voltage Efficiency And Power

```
1
2 // Exa 16.8
3
4 po=30000; // o/p power
5 v=200; // Voltage
6 I1=po/v; // Load Current (I1)
7 disp(' Load Current (I1) = '+string(I1)+' Amp');
8
9 Rsh=50; // Shunt field
// resistance R1
10 Ish=v/Rsh; // Shunt field Current
11 Ia=I1+Ish; // Armature Current (Ia)
// )
12 Ra=0.05; // Shunt field
// resistance R2
13 Eg=v+(Ia*Ra); // Generated emf (Eg)
14 disp('Generated emf (Eg) = '+string(Eg)+' Volt');
15
16 Cu=Ish^2*Rsh+Ia^2*Ra; // The copper Losses (
// Cu)
17 disp('The copper Losses (Cu) = '+string(Cu)+' W');
18
19 e=po*100/(1000+po+Cu); // The Efficiency (e)
20 disp('The Efficiency (e) = '+string(e)+' %');
21
22
23
24 // p 641 16.8
```

---

### Scilab code Exa 16.9 Current And Resistance

```
1
2           // Exa 16.9
3
4
5 Vo=210;           // Supply voltage
6 Il=195;           // Full-load current
7 Po=Vo*Il;        // O/p power
8 n=0.9;            // Efficiency
9 Pin=Po/n;        // I/p power
10 Tl=Pin-Po;       // Total loss
11 Rsh=52.5;        // Shunt field resistance
12 Ish=Vo/Rsh;     // Shunt field current
13 Ia=Il+Ish;      // Armeture Current (Ia)
14 Cl=Ish^2*Rsh;   // Shunt field copper loss
15 Hl=710;         // Stray losses
16 CL=Cl+Hl        // Constant loss
17 Al=4550-CL;     // Armature copper loss
18 Ra=Al/Ia^2;     // Armature resistance
19 disp('Armature resistance = '+string(Ra)+' Ohms');
20
21           // ==> for maximum efficiency (Ia^2*RA= Pc
22           // = 1550 )
23 Ia1=sqrt(CL/0.0757); // Armeture Current for
24           // maximum efficiency ==>{Ra=0.0757557 ,but here we
25           // have Ra=0.0757}
26 Ia1=Ia1-Ish;    // Load current
27 disp(' Load current (IL) = '+string(IL)+' Amp');
28
29
```

30  
31

// p 642 16.9

---

### Scilab code Exa 16.10 Turns

```
1
2           // Exa 16.10
3
4 i1=4;           // No load current
5 i2=6;           // Full-load current
6 n=1500;        // No.Of turns per poles
7 At1=i1*n;      // Amper Turns per pole on
   No Load
8 disp(' Amper Turns per pole on No Load = '+string(
   At1)+' At');
9
10 At2=i2*n;      // Amper Turns per pole on
   Full Load
11 disp(' Amper Turns per pole on Full Load = '+string(
   At2)+' At');
12
13 At=At2-At1;    // Amper Turns per pole of
   seires winding
14 disp(' Amper Turns per pole of seires winding = '+
   string(At)+' At');
15
16 Nse=At/100;    // Full Load Current
17 disp(' Full Load Current = '+string(Nse));
18
19
20
21
22
23           // p 647 16.10
```

---

### Scilab code Exa 16.11 Voltage

```
1
2
3           // Exemple 16.11
4
5 V=250;           // Supply voltage
6 Rsh=250;        // Field winding resistance
7 Ish=V/Rsh;      // The shunt field current (
   Ish)
8 disp(' The Shunt field current (Ish) = '+string(Ish)
   +' Amp');
9 I1=41;          // Full-load current
10 Ia=I1-Ish;     // Armature current
11 disp(' The Armature current current (Ia) = '+string(
   Ia)+' Amp');
12 Ra=0.1;        // Armature resistance
13 Eb=V-(Ia*Ra); // back emf
14 disp(' The back emf (Eb) = '+string(Eb)+' Volt ');
15
16
17
18
19           // p 649           16.11
```

---

### Scilab code Exa 16.12 Speed

```
1
2
3           // Exemple 16.12
4
5 V=440;          // Supply voltage
```



```

6 Ia=50; // Armature currenrt
7 Ra=0.28; // Armature resistance
8 a=2; // No.Of paraller path
9 Q=0.023; // Megnetic flux per pole
10 z=888; // Impedence
11 p=4; // No.Of poles
12 Eb=V-(Ia*Ra); // Back emf (Eb)
13 disp(' Back emf (Eb) = '+string(Eb)+' Volt ');
14
15 N=(60*a*Eb)/(Q*z*p); // Speed of the moter
16 disp(' Speed of the moter = '+string(round(N))+ ' rms
    ');
17
18
19
20
21 // p 649 16.12

```

---

### Scilab code Exa 16.13 Speed

```

1
2 // Examble 16.13
3
4 At=900; // Speed of motor
5 V=460; // Supply voltage
6 kQ=V/At; // Original Flux
7 disp(' Original Flux = '+string(kQ));
8
9 V1=200; // Chenged Supply voltage
10 N=V1/(0.7*kQ); // Speed of Motor When
    Supply (200 V)
11 disp(' Speed of Motor When Supply (200 V) = '+string
    (round(N))+ ' rpm ');
12
13

```

14  
15  
16  
17 // p 649 16.13

---

### Scilab code Exa 16.14 Speed And Torque

```
1
2 // Exa 16.14
3
4 V=480;
5 Ia=110; // Armature current
6 Ra=0.2; // Armature resistance
7 a=6; // No. Of parallel path
8 p=6; // No. Of poles
9 Q=0.05; // Magnetic flux per pole
10 z=864; // Impedance
11 Eb=V-(Ia*Ra); // Generated emf (Eb)
12 disp('Generated emf (Eb) = '+string(Eb)+' Volt');
13
14 N=(60*a*Eb)/(Q*z*p); // Speed of the motor
15 disp(' Speed of the motor = '+string(round(N))+ ' rms
16 ');
17 // ==> Using Formula {  $t_d = \frac{Qz}{2\pi} \times \frac{p}{A} \times I_a$  }
18
19 x=(Q*z)/(2*pi); // for simplicity
20 td=(p/a)*Ia*(x); // Total Torque (Td)
21 disp(' Total Torque (Td) = '+string(round(td))+ ' Nm
22 ');
23
24
25
```

26  
27

// p 650            16.14

---

### Scilab code Exa 16.15 Power

```
1
2
3                    // Example 16.15
4
5 t=2000;            // Torque
6 N=900;            // Speed
7 Ploss=8000;       // Power loss
8 Pin=(2*pi*t*N)/60; // Input Power (Pin)
9 disp(' Input Power (Pin) '+string(Pin/1000)+' kW');
10
11 Pd=Pin-Ploss;     // Power Generated in
    Armature (Pd)
12 disp(' Power Generated in Armature (Pd) = '+string(
    Pd/1000)+' kW');
13
14
15
16                    // p 651            16.15
```

---

### Scilab code Exa 16.16 Speed

```
1
2                    // Example 16.16
3
4 V=230;            // Supply voltage
5 Ia=110;           // Current
6 Ra=0.12;          // Resistance
7 Rse=0.03;         // Series field resistance
```

```

8 E1=V-Ia*(Ra+Rse);      // Emf Generated
9
10          // But for the Given machine ( E1= QZNP
           // /60A= kQ1N1 )
11
12 N1=600;                // No.Of turns
13 Q1=0.024;             // Megnetic flux
14 k=E1/(Q1*N1);        // Constant
15
16 Ia1=50;               // Current of 50A
17 E2=V-[Ia1*(Ra+Rse)]; // Emf Generated
18
19          // We know that E2=k*Q2*N2
20
21 Q2=0.016;             // Megnetic flux
22 N2=E2/(k*Q2);        // New speed
23 disp(' The new speed is = '+string(round(N2))+ ' rpm '
       ');
24
25
26
27
28          // p 653          16.16

```

---

#### Scilab code Exa 16.17 Current

```

1
2          // Example 16.17
3
4 Ra=0.2;                // Resistance
5 V=250;                // Supply voltage
6 Eb=0;                // Voltage at rest
7 Ia=(V-Eb)/Ra;        // Current drawn by the
           machine at Eb=200
8 disp(' Current drawn by the machine at (Eb=0) = '+

```

```

    string(Ia)+' Amp');
9
10 Eb1=200;           // Voltage at Eb=200
11 Ia1=(V-Eb1)/Ra;   // Current drawn by the
    machine at Eb=200
12 disp(' Current drawn by the machine at (Eb=200) = '+
    string(Ia1)+' Amp');
13
14 Eb2=250;           // Voltage at Eb=250
15 Ia2=(V-Eb2)/Ra;   // Current drawn by the
    machine at Eb=250
16 disp(' Current drawn by the machine at (Eb=250) = '+
    string(Ia2)+' Amp');
17
18 Eb3=-250;          // Voltage at Eb=-250
19 Ia3=(V-Eb3)/Ra;   // Current drawn by the
    machine at Eb=-250
20 disp(' Current drawn by the machine at (Eb=-250) = '
    +string(Ia3)+' Amp');
21
22
23
24
25
26 // p 653           16.17

```

---

### Scilab code Exa 16.18 Speed And Torque

```

1
2 // Exa 16.18
3
4 V=480;           // Supply voltage
5 Ia=110;          // Armature current
6 Ra=0.18;         // Series field
    resistance R1

```

```

7 Rse=0.02; // Series field
  resistance R2
8 Eb=V-Ia*(Ra+Rse); // Generated emf
9 disp(' Generated emf = '+string(Eb)+' Voltage');
10
11 a=6; // No.Of paraller path
12 Q=0.05; // Megnetic flux
13 z=864; // Conductor
14 p=6; // No.Of poles
15 N=(60*a*Eb)/(Q*z*p); // Speed of a Motor
16 disp(' Speed of a Motor = '+string(round(N))+ ' rpm');
  ;
17
18 Td=(60*Eb*Ia)/(2*pi*N); // The Torque Develop by
  Armeture
19 disp(' The Torque Develop by Armeture = '+string(
  round(Td))+ ' Nm');
20
21
22
23 // p 654 16.18

```

---

#### Scilab code Exa 16.19 Resistance

```

1
2
3 // Examble 16.19
4
5 V=220; // Supply voltage
6 Ia=22; // Armature currennt
7 Ra=0.45; // Armature resistance
8 E1=V-(Ia*Ra); // Generated emf
9 disp(' Generated emf = '+string(E1)+' Voltage');
10
11 N1=700; // Speed of motor in Shunt

```

```

12 N2=450; // Speed of motor in Series
13 E2=(N2*E1)/N1; // Emf of Shunt motor
14 disp(' Emf of Shunt motor = '+string(E2)+' voltage')
    ;
15
16 Va=Ia*Ra; // Armature voltage
17 R=(V-(E2+Va))/Ia; // Resistance with Armature
18 disp(' Resistance with Armature = '+string(R)+' ohms
    ');
19
20
21
22 // p 654 16.19

```

---

#### Scilab code Exa 16.20 Speed

```

1
2
3 // Examle 16.20
4
5 V=230; // Supplt voltage
6 Ia1=40; // Armature currenrt Ia1
7 Ra=0.2; // Armature resistance
8 Rse=0.1; // Series field resistance
9 E1=V-Ia1*(Ra+Rse); // Back emfat (24 A)
10 disp(' Back emfat (24 A) = '+string(E1)+' Voltage');
11
12 Ia2=20; // Armature currenrt Ia2
13 E2=V-Ia2*(Ra+Rse); // Back emfat (20 A)
14 disp(' Back emfat (20 A) = '+string(E2)+' Voltage');
15
16 N1=1000; // Speed of a Motor at I=
    40A
17 N2=(E2*N1)/(E1*0.6); // Speed of a Motor
18 disp(' Speed of a Motor = '+string(round(N2))+ ' rpm')

```

);

19  
20  
21  
22  
23

// p 654 16.20

---



# Chapter 17

## Fractional Horse Power Motors

Scilab code Exa 17.1 Slip And Efficiency

```
1
2                                     // Exa 17.1
3
4 f=50;                               // Frequency
5 p=4;                                 // No.Of poles
6 Ns=(120*f)/p;                       // Synchronous speed
7 N=1410;                              // No.Of Revolution in rpm
8 I=2.9;                               // I/p current
9 V=230;                               // Supply voltage
10 CosQ=0.71;                          // Power factor
11 s=(Ns-N)/Ns;                        // The Slip
12 disp(' The Slip is = '+string(s*100)+' %');
13
14 po=375;                              // O/p power
15 pin=V*I*CosQ;                       // I/p power
16 eff=po/pin;                          // Efficiency
17 disp(' The efficiency is = '+string(eff*100)+' %');
18
19
20
21
```

22  
23  
24

// p 683 17.1

---

### Scilab code Exa 17.2 Current Phase Angle And Power Factor

```
1
2           // Examble 17.2
3
4
5 zm=(5+%i*12);           // Impedence of main-
   Winding
6 za=(12+%i*5);           // Impedence of starting-
   Winding
7 V=230+%i*0;             // Supply voltage
8 Im=V/zm;                 // Current in main-Winding
9 disp(' The Current in main-Winding = '+string(Im)+'
   Amp or ('+string(abs(Im))+' <'+string(atan2(
   imag(Im),real(Im))))+' Amp )');
10
11 Ia=V/za;                 // Current in starting-
   Winding
12 disp(' The Current in starting-Winding = '+string(Ia)
   )+' Amp or ('+string(abs(Ia))+' <'+string(atan2(
   imag(Ia),real(Ia))))+' Amp )');
13
14 I1=Im+Ia;                 // The line Current
15 disp(' The line Current = '+string(I1)+' Amp or ('
   +string(abs(I1))+' <'+string(atan2(imag(I1),real(
   I1))))+' Amp )');
16
17 Qa=-22.62;               // Phase angle of starting-
   winding
18 Qm=-67.38;               // Phase angle of main-
   winding
```

```

19 Q=Qa-Qm; // The phase displacement (
    Q)
20 disp(' The phase displacement (Q) = '+string(Q)+' i
    .e = '+string(round(Q))+' Digree');
21
22 pf=cosd(round(Q)); // The Power factor
23 disp(' The Power factor is = '+string(pf)+' lagging'
    );
24
25
26
27 // p 683 17.2

```

---

### Scilab code Exa 17.3 Capacitor

```

1
2 // Exa 17.3
3
4 Xm=20; // Inductive reactance of
    Main-winding
5 Rm=2; // Main-winding resistance
6 Ra=25; // Auxilliary-winding
    resistance
7 f=50; // Frequency
8 Xa=5; // Inductive reactance of
    Auxilliary-winding
9 Qm=atand(Xm/Rm); // Angle of Main-winding
10 Qa=Qm-90; // Angle of Auxilliary-
    winding
11 Xc=Xa-(tand(Qa)*Ra); // Capacitive reactance
12 C=1/(2*pi*f*7.495); //Capacitor (C) ==> { Xc
    = 7.5 ,but taking Xc= 7.495 }
13 disp('The value of Capacitor (C) = '+string(C)+' F')
    ;
14

```

```
15
16
17
18 // p 684 17.3
```

---

#### Scilab code Exa 17.4 Revolution Steps And Speed

```
1
2 // Exa 17.4
3
4 b=2.5; // Step Angle
5 r=360/b; // Resolution (r)
6 disp('Resolution (r) = '+string(r)+' steps per
7 revolution ');
8 n=r*25; // No.Of step Required for (25
9 Rev)
10 disp('No.Of step Required for (25 Rev) = '+string(n)
11 ');
12 s=(b*n)/360; // Shaft Speed (s)
13 disp('Shaft Speed (s) = '+string(s)+' rps ');
14
15
16
17 // p 689 17.4
```

---

#### Scilab code Exa 17.5 No of Rotors And Stators

```
1
2 // Exa 17.5
3
```

```

4 b=15; // Step Angle
5 m=3; // No. Oh phase
6 Nr=360/(m*b); // Number of rotors
7 disp('No. Of Rotors = '+string(abs(Nr)));
8
9 Ns1=(Nr*360)/((b*Nr)-360); // No. Of Stator When
   (Ns > Nr)
10 disp('No. Of Stator When (Ns > Nr) = '+string(abs(Ns1
   )));
11
12 Ns2=(Nr*360)/((b*Nr)+360); // No. Of Stator When
   (Ns < Nr)
13 disp('No. Of Stator When (Ns < Nr) = '+string(Ns2));
14
15
16
17 // p 690 17.5

```

---

#### Scilab code Exa 17.6 No of Rotors And Stators Theeth

```

1
2
3 // Exa 17.6
4
5 // ==> Given 4 Stack VR stepper motor
6
7 m=4; // No. Oh phase
8 b=1.8; // Step Angle
9 Nr=360/(b*m); // Number of rotors
10 disp('Number of rotors = '+string(Nr));
11
12
13
14 // p 692 17.6

```

---

# Chapter 18

## Electrical Measuring Instruments

Scilab code Exa 18.1 Torque

```
1
2           // Exa 18.1
3
4 I=0.015;           // Current in a coil
5 B=0.2;            // Megnetic flux density
6 l=0.02;           // Length of megnetic field
7 n1=42;            // No.Of turns N1
8 r=0.0125;         // radius of coil
9 n2=43;            // No.Of turns N2
10 F1=I*B*l*n1;     // The force on(42-
    Conductors)
11 disp('The force on(42-Conductors) = '+string(F1)+' N
    ');
12
13 F2=I*B*l*n2;     // The force on(43-
    Conductors)
14 disp('The force on(43-Conductors) = '+string(F2)+' N
    ');
15
```

```

16 Tr=(F1+F2)*r;           // Total Torque (Td)
17 disp ('Total Torque (Td) = '+string(Tr)+' Nm');
18
19
20
21
22 // p 756           18.1

```

---

#### Scilab code Exa 18.2 Resistance

```

1
2 // Examle 18.2
3
4 Ifs=10*10^-3;           // Maximum current
5 Im=100*10^-6;           // Full-scale diflection
   current
6 Rm=100;                 // Internal resistance
7 Ish=Ifs-Im;             // Shunt Current (Ish)
8 disp ('Shunt Current (Ish) = '+ string(Ish)+' Amp');
9
10 Rsh=(Im*Rm)/Ish;        // Shunt Current (Rsh)
11 disp ('Shunt Current (Rsh) = '+ string(Rsh)+' ohms');
12
13
14
15 // p 762           18.2

```

---

#### Scilab code Exa 18.4 Resistance

```

1
2 // Examle 18.4
3
4 Im=50*10^-6;           // Current sensitivity

```

```

5 Rm=100; // Internal resistance
6 Vf=50; // volt-meter range
7 Rs=(Vf/Im)-Rm; // The Value of Resister
  (Rs)
8 disp('The Value of Resister (Rs) = '+string(Rs
  /1000)+' kilo-ohms');
9
10
11
12
13 // p 767 18.4

```

---

#### Scilab code Exa 18.5 Resistance And Multiplying Factor

```

1
2 // Examle 18.5
3
4 Im=50*10^-6; // Current sensitivity
5 Rm=1000; // Internal resistance
6 Vf=50; // volt-meter range
7 Rs=(Vf/Im)-Rm; // The Value of Resister (
  Rs)
8 disp('The Value of Resister (Rs) = '+string(Rs
  /1000)+' kilo-ohms');
9
10 n=Vf/(Im*Rm); // The Voltage Multiplying
  Factor (N)
11 disp('The Voltage Multiplying Factor (N) = '+string(
  n));
12
13
14
15 // p 767 18.5

```

---



### Scilab code Exa 18.6 Voltage And Error

```
1
2           // Exa 18.6
3
4 s=1000;           // Sensitivity of
   Volt-meter A
5 r=50;           // Load resistance
6 Vt=50;         // Range of volt-
   meter
7 Ri1=s*r;       // Internal
   resistance of Volt-meter A
8 V1=150*{25000/(100000+25000)}; // Voltage in 1st
   Meter
9 disp('Voltage in 1st Meter (V) = '+string(V1)+' Volt
   ');
10
11 s1=20000;      // Sensitivity of
   Volt-meter B
12 Ri2=s1*r;     // Internal
   resistance of Volt-meter B
13 V2=150*{47600/(100000+47600)}; // Voltage in 2nd
   Meter
14 disp('Voltage in 2nd Meter (V) = '+string(V2)+' Volt
   ');
15
16 Er1=(Vt-V1)*100/Vt; // % Error in 1st
   meter
17 disp('% Error in 1st meter = '+string(Er1)+' %');
18
19 Er2=(Vt-48.36)*100/Vt; // % Error in 2nd
   meter ==> { V2=48.3739, but taking V2= 48.36 }
20 disp('% Error in 2nd meter = '+string(Er2)+' %');
21
```

```
22
23
24
25 // p 770 18.6
```

---

### Scilab code Exa 18.7 Angle of Deflection

```
1
2 // Exemple 18.7
3
4 k=60/20; // Derived from { Q= k x I
   }
5 i=12; // Current
6 Q1=k*i; // Diflection for Spring-
   Control Current
7 disp('Diflection for Spring-Control Current = '+
   string(Q1)+' Digree');
8
9 k1=sind(60)/20; // Derived from { SinQ= k x
   I }
10 Q2=asind(k1*12); // Diflection for Gravity-
   Control Current
11 disp('Diflection for Gravity-Control Current = '+
   string(Q2)+' Digree');
12
13
14
15 // 775 18.7
```

---

### Scilab code Exa 18.8 Deflection in the Torque

```
1
2
```

```

3           // Examle 18.8
4
5 w=0.005;           // Controling weigth
6 l=0.024;           // Distance
7 td=1.05*10^-4;    // Deflecting torque
8 k=asind(td/(w*l)); // Diflection in Digree (
   @)
9 disp('Diflection in Digree (@) = '+string(round(k))
   +' Digree ');
10
11
12
13           // p 776           18.8

```

---

#### Scilab code Exa 18.9 Angle of Deflection

```

1
2           // Examle 18.9
3
4 i1=10;           // Current I1
5 i2=5;           // Current I2
6 Q=90;           // Deflection due to
   10 Amp
7 Q1=(i2/i1)^2*Q; // Diflection for
   Spring-Control Current
8 disp('Diflection for Spring-Control Current = '+
   string(Q1)+' Digree ');
9
10           // Using formula ==> { Q2= Sin [(i2/i1)^2*
   sin(Q)] }
11
12 Q2=asind((i2/i1)^2*sind(Q)); // Diflection for
   Gravity-Control Current
13 disp('Diflection for Gravity-Control Current = '+
   string(Q2)+' Digree ');

```

---

Scilab code Exa 18.10 Current

```
1
2
3           // Exa 18.10
4
5 w=0.004;           // width of the coil
6 l=0.005;           // Length of the coil
7 A=w*l;             // Area of the coil
8 B=0.1;             // Megnetic flux density
9 n=80;              // No.Of turns
10 tc=0.5*60*10^-6;  // Controlling torque
11 td=3*10^-3;       // Deflecting torque
12 I=tc/(B*n*A);     // Current
13 disp('Current (I) = '+string(I)+' Amp');
14
15
16
17           // p 777           18.10
```

---