Scilab Textbook Companion for Grob's Basic Electronics by M. E. Schultz¹

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Book Description

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

Scilab numbering policy used in this document and the relation to the above book. Example (Solved example) Example (Solved example) Equation (Particular equation of the above book) Equation (Particular equation of the above book) Appendix to Example (Scilab Code that is an Appednix to a particular Example of the above book)

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

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

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

Contents

List of Scilab Codes

Chapter 1

Chapter Introduction to Powers of 10

Chapter 2

Chapter Introduction to Powers of 10

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```
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_1
4 clc; clear;
5 // Express the following numbers in scientific c notation:(a) 3900 (b) 0.0000056.
6
7 disp ('To express 3900 in scientific notation, write the number as a number between 1 and 10, which is 3.9 in this case, times a power of 10.')
8 disp ('Therefore 3900 = 3.9*10^3 in scientific')
9
10 disp ('To express 0.0000056 in scientific notation, write the number as a number between 1 and 10, which is 5.6 in this case, times a power of 10.')
11 disp ('Therefore 0.0000056 = 5.6*10^-6 in scientific')
```

Scilab code Exa 0.1 Example 1

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_1
4 clc; clear;
5 // Express the following numbers in scientific c notation:(a) 3900 (b) 0.0000056.
6
7 disp ('To express 3900 in scientific notation, write the number as a number between 1 and 10, which is 3.9 in this case, times a power of 10.')
8 disp ('Therefore 3900 = 3.9*10^3 in scientific')
9
10 disp ('To express 0.0000056 in scientific notation, write the number as a number between 1 and 10, which is 5.6 in this case, times a power of 10.')
11 disp ('Therefore 0.0000056 = 5.6*10^-6 in scientific')
```

Scilab code Exa 0.2 Example 2

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_2
4 clc; clear;
5 // Express the following numbers in scientific notation: (a) 235,000 (b) 364,000,000 (c) 0.000756 (d) 0.00000000000016.
6
7 disp ('To express 235,000 in scientific notation, write the number as a number between 1 and 10,
```

```
which is 2.35 in this case, times a power of 10.
8 disp ('Therefore 235,000 = 2.35*10^5 in scientific')
10 disp ('To express 364,000,000 in scientific notation
      , write the number as a number between 1 and 10,
     which is 3.64 in this case, times a power of 10.
11 disp ('Therefore 364,000,000 = 3.64*10^8 in
     scientific')
12
13 disp ('To express 0.000756 in scientific notation,
     write the number as a number between 1 and 10,
     which is 7.56 in this case, times a power of 10.
14 disp ('Therefore 0.000756 = 7.56*10^{-4} in scientific
      ')
15
16 disp ('To express 0.0000000000016 in scientific
     notation, write the number as a number between 1
     and 10, which is 1.6 in this case, times a power
     of 10.')
17 disp ('Therefore 0.0000000000016 = 1.6*10^-13 in
      scientific')
```

Scilab code Exa 0.2 Example 2

```
1  // Grob's Basic Electronics 11e
2  // Chapter No. I
3  // Example No. I_2
4  clc; clear;
5  // Express the following numbers in scientific notation: (a) 235,000 (b) 364,000,000 (c) 0.000756 (d) 0.00000000000016.
```

```
7 disp ('To express 235,000 in scientific notation,
      write the number as a number between 1 and 10,
     which is 2.35 in this case, times a power of 10.
8 disp ('Therefore 235,000 = 2.35*10^5 in scientific')
10 disp ('To express 364,000,000 in scientific notation
      , write the number as a number between 1 and 10,
     which is 3.64 in this case, times a power of 10.
11 disp ('Therefore 364,000,000 = 3.64*10^8 in
      scientific')
12
13 disp ('To express 0.000756 in scientific notation,
     write the number as a number between 1 and 10,
     which is 7.56 in this case, times a power of 10.
14 disp ('Therefore 0.000756 = 7.56*10^-4 in scientific
15
16 disp ('To express 0.0000000000016 in scientific
     notation, write the number as a number between 1
     and 10, which is 1.6 in this case, times a power
     of 10.')
17 disp ('Therefore 0.0000000000016 = 1.6*10^-13 in
     scientific')
```

Scilab code Exa 0.3 Example 3

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_3
4 clc; clear;
5 // Convert the following numbers written in scientific notation into decimal notation: (a)
```

Scilab code Exa 0.3 Example 3

Scilab code Exa 0.4 Example 4

```
Scilab code Exa 0.4 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>4</sub>
4 clc; clear;
5 // Express the following numbers in engineering
     notation: (a) 27,000 (b) 0.00047.
7 disp ('To express the number 27,000 in engineering
     notation, it must be written as a number between
     1 and 1000 times a power of 10 which is a
     multiple of 3.')
8 disp ('Therefore 27000 = 27*10^3 in engineering')
10 disp ('To express the number 0.00047 in engineering
     notation, it must be written as a number between
     1 and 1000 times a power of 10 which is a
     multiple of 3.')
11 disp ('Therefore 0.00047 = 470*10^{-6} in engineering'
     )
  Example 4
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_{-}4
4 clc; clear;
5 // Express the following numbers in engineering
     notation: (a) 27,000 (b) 0.00047.
6
```

```
7 disp ('To express the number 27,000 in engineering
    notation, it must be written as a number between
    1 and 1000 times a power of 10 which is a
    multiple of 3.')
8 disp ('Therefore 27000 = 27*10^3 in engineering')
9
10 disp ('To express the number 0.00047 in engineering
    notation, it must be written as a number between
    1 and 1000 times a power of 10 which is a
    multiple of 3.')
11 disp ('Therefore 0.00047 = 470*10^-6 in engineering')
```

Scilab code Exa 0.5 Example 5

2 // Chapter No. I

```
Scilab code Exa 0.15 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_5
4 clc; clear;
5 // Express the resistance of 1,000,000-Ohms using the appropriate metric prefix from Table I 2.
6
7 disp ('First, express 1,000,000-Ohms in engineering notation: 1,000,000-Ohms = 1.0*10^6-Ohms')
8 disp ('Next, replace 10^6 with its corresponding metric prefix. i.e mega (M)')
9 disp ('Therefore 1,000,000-Ohms = 1.0*10^6-Ohms = 1-MOhms')
Example 5
1 // Grob's Basic Electronics 11e
```

Scilab code Exa 0.6 Example 6

```
Scilab code Exa 0.16 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_6
4 clc; clear;
5 // Express the voltage value of 0.015-V using the
     appropriate metric prefix from Table I 2.
7 disp ('First, express 0.015-V in engineering
     notation: 0.015 - V = 0.015 - V')
8 disp ('Next, replace 10^-3 with its corresponding
     metric prefix. i.e milli (m)')
9 disp ('Therefore 0.015 - V = 0.015 - V = 15 - mV')
  Example 6
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_6
4 clc; clear;
```

```
5 // Express the voltage value of 0.015-V using the
    appropriate metric prefix from Table I 2.
6
7 disp ('First, express 0.015-V in engineering
    notation: 0.015-V = 0.015-V')
8 disp ('Next, replace 10^-3 with its corresponding
    metric prefix. i.e milli (m)')
9 disp ('Therefore 0.015-V = 0.015-V = 15-mV')
```

Scilab code Exa 0.7 Example 7

```
Scilab code Exa 0.17 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_7
4 clc; clear;
5 // Express the power value of 250-W using the
     appropriate metric prefix from Table I 2.
7 disp ('In this case, it is not necessary to use any
     of the metric prefixes listed in Table I 2. The
      reason is that 250-W cannot be expressed as a
     number between 1 and 1000 times a power of 10
     which is a multiple of 3.')
8 disp ('250 W cannot be expressed in engineering
     notation. The closest we can come is 0.25*10^3-W,
      which is not representative of engineering
     notation. Although 10<sup>3</sup> can be replaced with the
     metric prefix kilo (k)')
9 disp ('It is usually preferable to express the power
      as 250-W and not as 0.25-kW.')
  Example 7
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>-</sub>7
4 clc; clear;
5 // Express the power value of 250-W using the
     appropriate metric prefix from Table I 2.
7 disp ('In this case, it is not necessary to use any
     of the metric prefixes listed in Table I
      reason is that 250-W cannot be expressed as a
     number between 1 and 1000 times a power of 10
     which is a multiple of 3.')
8 disp ('250 W cannot be expressed in engineering
     notation. The closest we can come is 0.25*10^3-W,
      which is not representative of engineering
     notation. Although 10<sup>3</sup> can be replaced with the
     metric prefix kilo (k)')
9 disp ('It is usually preferable to express the power
      as 250-W and not as 0.25-kW.')
```

Scilab code Exa 0.8 Scilab code Exa 0.8 Example 8 Example 8

```
// Grob's Basic Electronics 11e
// Chapter No. I
// Example No. I_8
clc; clear;
// Make the following conversions: (a) convert 25 mA
to uA (b) convert 2700 kOhms to MOhms.

disp ('To convert 25 mA to uA, recall that the
metric prefix milli (m) corresponds to 10^3 and
that metric prefix micro (u) corresponds to 10^6.
Since 10^6 is less than 10^3 by a factor of 1000
```

```
(10<sup>3</sup>), the numerical part of the expression
      must be increased by a factor of 1000 (10<sup>3</sup>).
8 disp ('Therefore, 25 \text{ mA} = 25*10^{-3} \text{ A} = 25,000*10^{-6}
      A = 25,000 \text{ uA}.
9
10 disp ('To convert 2700 kOhms to MOhms, recall that
      the metric prefix kilo (k) corresponds to 10<sup>3</sup>
      and that the metric prefix mega (M) corresponds
      to 10<sup>6</sup>. Since 10<sup>6</sup> is larger than 10<sup>3</sup> by a
       factor of 1000 (10<sup>3</sup>), the numerical part of the
      expression must be decreased by a factor of 1000
      (10^3).
11 disp ('2700 kOhms = 2700*10^3 Ohms = 2.7*10^6 Ohms =
        2.7 MOhms. ')
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>-8</sub>
4 clc; clear;
5 // Make the following conversions: (a) convert 25 mA
        to uA (b) convert 2700 kOhms to MOhms.
7 disp ('To convert 25 mA to uA, recall that the
       metric prefix milli (m) corresponds to 10<sup>3</sup> and
      that metric prefix micro (u) corresponds to 10<sup>6</sup>.
        Since 10<sup>6</sup> is less than 10<sup>3</sup> by a factor of 1000
        (10<sup>3</sup>), the numerical part of the expression
      must be increased by a factor of 1000 (10<sup>3</sup>).
8 disp ('Therefore, 25 \text{ mA} = 25*10^{\circ}-3 \text{ A} = 25,000*10^{\circ}-6
      A = 25,000 \text{ uA}.
9
10 disp ('To convert 2700 kOhms to MOhms, recall that
      the metric prefix kilo (k) corresponds to 10<sup>3</sup>
      and that the metric prefix mega (M) corresponds
      to 10<sup>6</sup>. Since 10<sup>6</sup> is larger than 10<sup>3</sup> by a
       factor of 1000 (10<sup>3</sup>), the numerical part of the
       expression must be decreased by a factor of 1000
```

```
(10^3).')  
11 disp ('2700 kOhms = 2700*10^3 Ohms = 2.7*10^6 Ohms = 2.7 MOhms.')
```

Scilab code Exa 0.9 Example 9

```
Scilab code Exa 0.19 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_9
4 clc; clear;
5 // Add 170*10^3 and 23*10^4. Express the final
      answer in scientific notation.
7 // Given data
9 A = 170*10^3;
                       // Variable 1
                       // Variable 2
10 B = 23*10^4;
11
12 \quad C = A + B;
13 disp (C, 'The addition of 170*10^3 and 23*10^4 is')
14 disp ('i.e 4.0*10^5')
   Example 9
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_9
4 clc; clear;
5 // Add 170*10^3 and 23*10^4. Express the final
      answer in scientific notation.
7 // Given data
```

```
9 A = 170*10^3;  // Variable 1

10 B = 23*10^4;  // Variable 2

11

12 C = A+B;

13 disp (C, 'The addition of 170*10^3 and 23*10^4 is')

14 disp ('i.e 4.0*10^5')
```

Scilab code Exa 0.10 Example 10

```
Scilab code Exa 0.10 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_10
4 clc; clear;
5 // Substract 250*10^3 and 1.5*10^6. Express the
      final answer in scientific notation.
7 // Given data
8
9 A = 1.5*10^6;
050*10^3;
                       // Variable 1
// Variable 2
10 B = 250*10^3;
11
12 \quad C = A - B;
13 disp (C, 'The substraction of 250*10^3 and 1.5*10^6
      is')
14 disp ('i.e 1.25*10^6')
   Example 10
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>-</sub>10
4 clc; clear;
```

Scilab code Exa 0.11 Scilab code Exa 0.11 Example 11

Scilab code Exa 0.12 Example 12

```
Scilab code Exa 0.12 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_12
4 clc; clear;
5 // Divide 5.0*10^7 by 2.0*10^4. Express the final answer in scientific notation.
6
7 // Given data
8
9 A = 5.0*10^7; // Variable 1
10 B = 2.0*10^4; // Variable 2
11
12 C = A/B;
```

```
13 disp (C, 'The division of 5.0*10^7 by 2.0*10^4 is')
14 disp ('i.e 2.5*10^3')
   Example 12
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>1</sub>12
4 clc; clear;
5 // Divide 5.0*10^7 by 2.0*10^4. Express the final
     answer in scientific notation.
7 // Given data
                      // Variable 1
9 A = 5.0*10^7;
10 B = 2.0*10^4;
                      // Variable 2
11
12 \quad C = A/B;
13 disp (C, 'The division of 5.0*10^7 by 2.0*10^4 is')
14 disp ('i.e 2.5*10^3')
```

Scilab code Exa 0.13 Scilab code Exa 0.13 Example 13 Example 13

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_13
4 clc; clear;
5 // Find the reciprocals for the following powers of 10: (a) 10^5 (b) 10^-3.
6
7 // Given data
8
9 A = 10^5; // Variable 1
```

```
10 B = 10^-3; // Variable 2
11
12 \ C = 1/A;
13 disp (C, 'The reciprocal of 10<sup>5</sup> is')
14 disp ('i.e 10^-5')
15
16 D = 1/B;
17 disp (D, 'The reciprocal of 10-3 is')
18 disp ('i.e 10<sup>3</sup>')
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>-</sub>13
4 clc; clear;
5 // Find the reciprocals for the following powers of
      10: (a) 10^5 (b) 10^-3.
7 // Given data
                     // Variable 1
9 A = 10^5;
               // Variable 2
10 B = 10^{-3};
11
12 C = 1/A;
13 disp (C, 'The reciprocal of 10<sup>5</sup> is')
14 disp ('i.e 10^-5')
15
16 D = 1/B;
17 disp (D, 'The reciprocal of 10-3 is')
18 disp ('i.e 10<sup>3</sup>')
```

Scilab code Exa 0.14 Example 14

```
Scilab code Exa 0.14 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_14
4 clc; clear;
5 // Square 3.0*10^4. Express the answer in scientific
       notation.
6
7 // Given data
                  // Variable 1
9 A = 3.0*10^4;
10
11 B = A*A;
12 disp (B, 'The square of 3.0*10^4 is')
13 disp ('i.e 9.0*10^8')
  Example 14
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>-</sub>14
4 clc; clear;
5 // Square 3.0*10^4. Express the answer in scientific
       notation.
7 // Given data
9 A = 3.0*10^4; // Variable 1
10
11 B = A*A;
12 disp (B, 'The square of 3.0*10^4 is')
13 disp ('i.e 9.0*10^8')
```

Scilab code Exa 0.15 Example 15

```
Scilab code Exa 0.15 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>-</sub>15
4 clc; clear;
5 // Find the squareroot of 4*10^6. Express the answer
       in scientific notation.
6
7 // Given data
9 A = 4*10^6; // Variable 1
10
11 B = sqrt(A);
12 disp (B, 'The squareroot of 4*10^6 is')
13 disp ('i.e 2*10^3')
   Example 15
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>-</sub>15
4 clc; clear;
5 // Find the squareroot of 4*10<sup>6</sup>. Express the answer
       in scientific notation.
7 // Given data
9 A = 4*10^6; // Variable 1
10
11 B = sqrt(A);
12 disp (B, 'The squareroot of 4*10^6 is')
13 disp ('i.e 2*10^3')
```

Scilab code Exa 0.16 Example 16

```
Scilab code Exa 0.16 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>-</sub>16
4 clc; clear;
5 // Find the squareroot of 90*10^5. Express the
      answer in scientific notation.
6
7 // Given data
9 A = 90*10^5; // Variable 1
10
11 B = sqrt(A);
12 disp (B, 'The squareroot of 90*10<sup>5</sup> is')
13 disp ('i.e 3.0*10^3')
   Example 16
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>-</sub>16
4 clc; clear;
5 // Find the squareroot of 90*10<sup>5</sup>. Express the
      answer in scientific notation.
7 // Given data
9 A = 90*10^5; // Variable 1
10
11 B = sqrt(A);
12 disp (B, 'The squareroot of 90*10^5 is')
13 disp ('i.e 3.0*10^3')
```

Scilab code Exa 0.17 Example 17

```
Scilab code Exa 0.117 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_17
4 clc; clear;
5 // Show the keystrokes for multiplying 40*10^{-3} by
      5*10^{6}.
6
7 // Given data
                       // Variable 1
// Variable 2
9 A = 40*10^{-3};

10 B = 5*10^{6};
11
12 C = A*B;
13 disp (C, 'The multiplication of 40*10^{-3} by 5*10^{6} is
14 disp ('i.e 200.000*10^03 OR 200E03')
   Example 17
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I<sub>-</sub>17
4 clc; clear;
5 // Show the keystrokes for multiplying 40*10^{-3} by
      5*10^{6}.
7 // Given data
                       // Variable 1
9 A = 40*10^{-3};

10 B = 5*10^{6};
                       // Variable 2
11
12 C = A*B;
13 disp (C, 'The multiplication of 40*10^{-3} by 5*10^{6} is
14 disp ('i.e 200.000*10^03 OR 200E03')
```

Chapter 3
Chapter 01 Electricity

Chapter 4

Chapter 01 Electricity

Scilab code Exa 1.1 Scilab code Exa 1.1 Example 18 Example 18

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_1
4 clc; clear;
5 // A neutral dielectric has added to it 1.25*10^18
     electrons. What is its charge in coulombs?
7 // Given data
9 \text{ ec} = 1.25*10^18;
                           // Electron charge
     =1.25*10^18 electrons
11 disp ("This number of electrons is double the charge
      of 1 C.")
12 disp ('Therefore, -Q = 2 Columbs')
1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_1
```

```
4 clc; clear;
5 // A neutral dielectric has added to it 1.25*10^18
        electrons. What is its charge in coulombs?
6
7 // Given data
8
9 ec = 1.25*10^18; // Electron charge
        =1.25*10^18 electrons
10
11 disp ("This number of electrons is double the charge of 1 C.")
12 disp ('Therefore, -Q = 2 Columbs')
```

Scilab code Exa 1.2 Example 19

```
// Grob's Basic Electronics 11e
// Chapter No. 01
// Example No. 1_2
clc; clear;
// A dielectric has a positive charge of 12.5*10^18
    protons. What is its charge in coulombs?

// Given data
ec = 12.5*10^18;  // Electron charge
    =12.5*10^18 electrons

disp ("This number of electrons is double the charge of 1 C and posotive.")
disp ('Therefore, +Q = 2 Columbs')
```

Scilab code Exa 1.3 Scilab code Exa 1.3 Example 20 Example 20

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_3
4 clc; clear;
5 // A dielectric with +Q of 2 C has 12.5*10^18
        electrons added. What is its charge then?
6
7 // Given data
8
9 ec = 12.5*10^18; // Electron charge
        =12.5*10^18 electrons
10
11 disp ("The 2-C of negative charge added by the electron cancles the 2-C of positive charge, making the dielectric neutral.")
```

```
12 disp ('Therefore, Q = 0')
1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_3
4 clc; clear;
\frac{5}{4} A dielectric with +Q of 2 C has \frac{12.5*10^{18}}{18}
      electrons added. What is its charge then?
7 // Given data
9 \text{ ec} = 12.5*10^18;
                             // Electron charge
      =12.5*10^18 electrons
10
11 disp ("The 2-C of negative charge added by the
      electron cancles the 2-C of positive charge,
      making the dielectric neutral.")
12 disp ('Therefore, Q = 0')
```

Scilab code Exa 1.4 Example 21

```
Scilab code Exa 1.4 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_4
4 clc; clear;
5 // A neutral dielectric has 12.5*10^18 electrons removed. What is its charge?
6
7 // Given data
8
9 ec = 12.5*10^18; // Electron charge = 12.5*10^18 electrons
```

```
10
11 disp ('The 2-C of electron charge removed allows an
      excess of 12.5*10^18 protons. Since the proton
     and electron have exactly the same amount of
      charge, ')
12 disp ('now the dielectric has a positive charge of +
     Q = 2 Columbs. ')
   Example 21
1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1<sub>4</sub>
4 clc; clear;
5 // A neutral dielectric has 12.5*10^18 electrons
     removed. What is its charge?
7 // Given data
                            // Electron charge
9 \text{ ec} = 12.5*10^18;
      =12.5*10^18 electrons
10
11 disp ('The 2-C of electron charge removed allows an
      excess of 12.5*10^18 protons. Since the proton
     and electron have exactly the same amount of
      charge, ')
12 disp ('now the dielectric has a positive charge of +
     Q = 2 Columbs. ')
```

Scilab code Exa 1.5 Example 22

```
Scilab code Exa 1.5 // Grob's Basic Electronics 11e
2 // Chapter No. 01
```

```
3 // Example No. 1<sub>-5</sub>
4 clc; clear;
5 // What is the output voltage of a battery that
      expends 3.6 J of energy in moving 0.5C of charge?
7 // Given data
9 W = 3.6; // Work=3.6 Jouls
10 Q = 0.5; // Charge=0.5 Columb
11
12 V = W/Q;
13 disp (V, 'The Output Voltage of a Battery in Volts')
   Example 22
1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_5
4 clc; clear;
5 // What is the output voltage of a battery that
      expends 3.6 J of energy in moving 0.5C of charge?
7 // Given data
9 W = 3.6; // Work=3.6 Jouls
10 Q = 0.5; // Charge=0.5 Columb
11
12 V = W/Q;
13 disp (V, 'The Output Voltage of a Battery in Volts')
```

Scilab code Exa 1.6 Scilab code Exa 1.6 Example 23 Example 23

```
1 // Grob's Basic Electronics 11e
```

```
2 // Chapter No. 01
3 // Example No. 1_6
4 clc; clear;
5 //The charge of 12 C moves past a given point every
     second. How much is the intensity of charge flow?
7 // Given data
                  // Charge=12 Columb
9 Q = 12;
                  // Time=1 Sec i.e every second
10 T = 1;
11
12 I = Q/T;
13 disp (I, 'The Intensity of Charge Flow in Amps')
1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_6
4 clc; clear;
5 //The charge of 12 C moves past a given point every
     second. How much is the intensity of charge flow?
7 // Given data
9 Q = 12; // \text{Charge}=12 \text{ Columb}
                // Time=1 Sec i.e every second
10 T = 1;
11
12 I = Q/T;
13 disp (I, 'The Intensity of Charge Flow in Amps')
```

Scilab code Exa 1.7 Example 24

Scilab code Exa 117 // Grob's Basic Electronics 11e

```
2 // Chapter No. 01
3 // Example No. 1_7
4 clc; clear;
5 // The charge of 5 C moves past a given point in 1 s
      . How much is the current?
7 // Given data
            // Charge=5 Columb
9 Q = 5;
                 // Time=1 Sec
10 T = 1;
11
12 I = Q/T;
13 disp (I, 'The Current in Amps')
   Example 24
1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_7
4 clc; clear;
5 // The charge of 5 C moves past a given point in 1 s
      . How much is the current?
7 // Given data
9 Q = 5;  // Charge=5 Columb
10 T = 1;  // Time=1 Sec
11
12 I = Q/T;
13 disp (I, 'The Current in Amps')
```

Scilab code Exa 1.8 Example 25

```
Scilab code Exa 1.8 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_8
4 clc; clear;
5 // Calculate the resistance for the following
     conductance values: (a) 0.05 S (b) 0.1 S
6
7 // Given data
                  // G1=0.05 Siemins
9 G1 = 0.05;
10 G2 = 0.1; // G1=0.1 Siemins
11
12 R1 = 1/G1;
13 disp (R1, 'The Resistance for Conductance value 0.05
     S in Ohms')
14
15 R2 = 1/G2;
16 disp (R2, 'The Resistance for Conductance value 0.1 S
      in Ohms')
  Example 25
1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_8
4 clc; clear;
5 // Calculate the resistance for the following
     conductance values: (a) 0.05 S (b) 0.1 S
7 // Given data
9 G1 = 0.05;
                  // G1=0.05 Siemins
10 G2 = 0.1; // G1=0.1 Siemins
11
12 R1 = 1/G1;
13 disp (R1, 'The Resistance for Conductance value 0.05
     S in Ohms')
14
```

Scilab code Exa 1.9 Example 26

```
Scilab code Exa 1.19 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_9
4 clc; clear;
5 // Calculate the conductance for the following
      resistance values: (a) 1 kOhms (b) 5 kOhms
  // Given data
                    // R1=1k Ohms
9 R1 = 1*10^3;
10 R2 = 5*10^3;
                     // R2=5k Ohms
11
12 G1 = 1/R1;
13 disp (G1, 'The Conductance for Resistance value 1
     kOhms in Siemens')
14 disp ('OR 1 mS')
15
16 \text{ G2} = 1/R2;
17 disp (G2, 'The Conductance for Resistance value 5
     kOhms in Siemens')
18 disp ('OR 200 uS')
   Example 26
1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_9
```

```
4 clc; clear;
5 //Calculate the conductance for the following
    resistance values: (a) 1 kOhms (b) 5 kOhms
6
7 // Given data
8
9 R1 = 1*10^3; // R1=1k Ohms
10 R2 = 5*10^3; // R2=5k Ohms
11
12 G1 = 1/R1;
13 disp (G1, 'The Conductance for Resistance value 1
    kOhms in Siemens')
14 disp ('OR 1 mS')
15
16 G2 = 1/R2;
17 disp (G2, 'The Conductance for Resistance value 5
    kOhms in Siemens')
18 disp ('OR 200 uS')
```

Chapter 5
Chapter 02 Resistors

Chapter 6

Chapter 02 Resistors

Scilab code Exa 2.1 Example 27

```
Scilab code Exa 21 // Grob's Basic Electronics 11e
2 // Chapter No. 02
3 // Example No. 2_1
4 clc; clear;
5 // What is the resistance indicated by the five-band
      color code in Fig. 2 10? Also, what ohmic
    range is permissible for the specified tolerance?
7 disp ('The first stripe is orange for the number 3,
     the second stripe is blue for the number 6, and
     the third stripe is green for the number 5.
     Therefore, the first three digits of the
     resistance are 3, 6, and 5, respectively. The
     fourth stripe, which is the multiplier, is black,
      which means add no zeros. The fifth stripe,
     which indicates the resistor tolerance, is green
     for +-0.5\%.
8
```

```
9 disp ('Therefore R = 365 Ohms +-0.5\%. The
     permissible ohmic range is calculated as
     365*0.005 = +-1.825 Ohms, or 363.175 to 366.825
     Ohms.')
  Example 27
1 // Grob's Basic Electronics 11e
2 // Chapter No. 02
3 // Example No. 2_1
4 clc; clear;
5 // What is the resistance indicated by the five-band
      color code in Fig. 2 10? Also, what ohmic
     range is permissible for the specified tolerance?
7 disp ('The first stripe is orange for the number 3,
     the second stripe is blue for the number 6, and
     the third stripe is green for the number 5.
     Therefore, the first three digits of the
     resistance are 3, 6, and 5, respectively. The
     fourth stripe, which is the multiplier, is black,
     which means add no zeros. The fifth stripe,
     which indicates the resistor tolerance, is green
     for +-0.5\%. ')
9 disp ('Therefore R=365 Ohms +-0.5\%. The
     permissible ohmic range is calculated as
     365*0.005 = +-1.825 Ohms, or 363.175 to 366.825
```

Scilab code Exa 2.2 Example 28

Ohms.')

Scilab code Exa 212 // Grob's Basic Electronics 11e

```
2 // Chapter No. 02
3 // Example No. 2<sub>2</sub>
4 clc; clear;
5 // Determine the resistance of the chip resistor in
     Fig. 2 13.
7 disp('The first two digits are 5 and 6, giving 56 as
      the first two numbers in the resistance value.
     The third digit, 2, is the multiplier, which
     means add 2 zeros to 56 for, ')
9 disp ('Resistance of 5600 Ohms or 5.6 kOhms.')
  Example 28
1 // Grob's Basic Electronics 11e
2 // Chapter No. 02
3 // Example No. 2_2
4 clc; clear;
5 // Determine the resistance of the chip resistor in
     Fig. 2 13.
7 disp('The first two digits are 5 and 6, giving 56 as
      the first two numbers in the resistance value.
     The third digit, 2, is the multiplier, which
     means add 2 zeros to 56 for, ')
8
9 disp ('Resistance of 5600 Ohms or 5.6 kOhms.')
```

Chapter 7
Chapter 03 Ohms Law

Chapter 8

Chapter 03 Ohms Law

Scilab code Exa 3.1 Example 29

```
Scilab code Exa 311 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_1
4 clc; clear;
5 // A heater with the resistance of 8 Ohms is
     connected across the 120-V power line. How much
      is current I?
7 // Given data
                  // Voltage of Power line=120 Volts
9 V = 120;
                   // Heater Resistance=8 Ohms
10 R = 8;
11
12 I = V/R;
13 disp (I, 'The Current I in Amps')
   Example 29
```

```
// Grob's Basic Electronics 11e
// Chapter No. 03
// Example No. 3_1

clc; clear;
// A heater with the resistance of 8 Ohms is connected across the 120-V power line. How much is current I?

// Given data
// Voltage of Power line=120 Volts
R = 8; // Heater Resistance=8 Ohms

I = V/R;
disp (I, 'The Current I in Amps')
```

Scilab code Exa 3.2 Example 30

```
Scilab code Exa 3.2 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_2
4 clc; clear;
5 // A small lightbulb with a resistance of 2400 Ohms
    is connected across the 120-V power line. How
    much is current I?
6
7 // Given data
8
9 V = 120; // Voltage of Power line=120 Volts
10 R = 2400; // Lightbulb Resistance=2400 Ohms
11
12 I = V/R;
13 disp (I, 'The Current I in Amps')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_2
4 clc; clear;
5 // A small lightbulb with a resistance of 2400 Ohms
    is connected across the 120-V power line. How
    much is current I?
6
7 // Given data
8
9 V = 120; // Voltage of Power line=120 Volts
10 R = 2400; // Lightbulb Resistance=2400 Ohms
11
12 I = V/R;
13 disp (I, 'The Current I in Amps')
```

Scilab code Exa 3.3 Example 31

```
Scilab code Exa 313 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_3
4 clc; clear;
5 // If a 12-Ohms resistor is carrying a current of 2.5 A, how much is its voltage?
6
7 // Given data
8
9 I = 2.5; // Current=2.5 Amps
10 R = 12; // Resistance=12 Ohms
11
```

```
12 V = I*R;
13 disp (V, 'The Voltage in Volts')
  Example 31
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_3
4 clc; clear;
5 // If a 12-Ohms resistor is carrying a current of
     2.5 A, how much is its voltage?
  // Given data
                   // Current=2.5 Amps
9 I = 2.5;
10 R = 12;
                   // Resistance=12 Ohms
11
12 V = I * R;
13 disp (V, 'The Voltage in Volts')
```

Scilab code Exa 3.4 Example 32

```
Scilab code Exa 34 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_4
4 clc; clear;
5 // How much is the resistance of a lightbulb if it draws 0.16 A from a 12-V battery?
6
7 // Given data
8
9 V = 12; // Voltage of Battery=12 Volts
```

```
// Current drawn form Battery = 0.16
10 I = 0.16;
      Amps
11
12 R = V/I
13 disp (R, 'The Resistance in Ohms')
   Example 32
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3<sub>4</sub>
4 clc; clear;
5 // How much is the resistance of a lightbulb if it
      draws 0.16 A from a 12-V battery?
  // Given data
8
                     // Voltage of Battery=12 Volts
9 V = 12;
10 I = 0.16;
                    // Current drawn form Battery = 0.16
      Amps
11
12 R = V/I
13 disp (R, 'The Resistance in Ohms')
```

Scilab code Exa 3.5 Example 33

```
7 // Given data
9 I = 8*10^-3;
                        // Current flowing through
     Resistor=8m Amps
10 R = 5*10^3;
                        // Resistance=5k Ohms
11
12 V = I * R;
13 disp (V, 'The Voltage in Volts')
   Example 33
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_5
4 clc; clear;
5 // The I of 8 mA flows through a 5-kOhms Resistor.
     How much is the IR voltage?
7 // Given data
9 I = 8*10^-3;
                        // Current flowing through
      Resistor=8m Amps
10 R = 5*10^3;
                        // Resistance=5k Ohms
11
12 V = I * R;
13 disp (V, 'The Voltage in Volts')
```

Scilab code Exa 3.6 Example 34

```
Scilab code Exa 3.6 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_6
4 clc; clear;
```

```
5 // How much current is produced by 60 V across 12
     kOhms?
7 // Given data
9 V = 60;
                  // Voltage=60 Volts
10 R = 12*10^3; // Resistance=12k Ohms
11
12 I = V/R;
13 disp (I, 'The Current I in Amps')
14 disp ('i.e 5 mAmps')
  Example 34
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_6
4 clc; clear;
5 // How much current is produced by 60 V across 12
     kOhms?
7 // Given data
                 // Voltage=60 Volts
9 V = 60;
10 R = 12*10^3; // Resistance=12k Ohms
11
12 I = V/R;
13 disp (I, 'The Current I in Amps')
14 disp ('i.e 5 mAmps')
```

Scilab code Exa 3.7 Example 35

Scilab code Exa 317 // Grob's Basic Electronics 11e

```
2 // Chapter No. 03
3 // Example No. 3_7
4 clc; clear;
5 // A toaster takes 10 A from the 120-V power line.
     How much power is used?
7 // Given data
                   // Voltage of Power line=120 Volts
9 V = 120;
                   // Current drawn from Powerline=10
10 I = 10;
     Amps
11
12 P = V * I;
13 disp (P, 'The Power used in Watts')
14 disp ('OR 1.2 kW')
  Example 35
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_7
4 clc; clear;
5 // A toaster takes 10 A from the 120-V power line.
     How much power is used?
7 // Given data
9 V = 120;
                   // Voltage of Power line=120 Volts
                   // Current drawn from Powerline=10
10 I = 10;
     Amps
11
12 P = V * I;
13 disp (P, 'The Power used in Watts')
14 disp ('OR 1.2 kW')
```

Scilab code Exa 3.8 Example 36

```
Scilab code Exa 3.8 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_8
4 clc; clear;
5 // How much current flows in the filament of a 300-W
       bulb connected to the 120-V power line?
  // Given Data
                   // Voltage of Power line=120 Volts
9 V = 120;
                   // Power of Bulb=300 Watts
10 P = 300;
11
12 I = P/V;
13 disp (I, 'The Current I in Amps')
   Example 36
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_8
4 clc; clear;
5 // How much current flows in the filament of a 300-W
       bulb connected to the 120-V power line?
7 // Given Data
8
9 V = 120;
                   // Voltage of Power line=120 Volts
10 P = 300;
                   // Power of Bulb=300 Watts
11
12 I = P/V;
```

Scilab code Exa 3.9 Example 37

```
Scilab code Exa 3.19 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_9
4 clc; clear;
5 // How much current flows in the filament of a 60-W
     bulb connected to the 120-V power line?
  // Given Data
9 V = 120;
                   // Voltage of Power line=120 Volts
10 P = 60;
                   // Power of Bulb=60 Watts
11
12 I = P/V;
13 disp (I, 'The Current I in Amps')
14 disp ('OR 500 mA')
  Example 37
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_9
4 clc; clear;
5 // How much current flows in the filament of a 60-W
     bulb connected to the 120-V power line?
7 // Given Data
                // Voltage of Power line=120 Volts
9 V = 120;
10 P = 60;
                  // Power of Bulb=60 Watts
```

```
11
12 I = P/V;
13 disp (I, 'The Current I in Amps')
14 disp ('OR 500 mA')
```

Scilab code Exa 3.10 Example 38

```
Scilab code Exa 3.10 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_10
4 clear; clc;
5 // Assuming that the cost of electricity is 6 cent
      per kWh, how much will it cost to light a 100-W
      lightbulb for 30 days?
6
7 h = 24*30; // Total hours = 24 \text{ hrs } * 30 \text{ days}
9 \text{ kWh} = 0.1*\text{h}; // 100W=0.1\text{kW}
10
11 Cost = kWh*0.06; // 6 cent = $0.06
12
13 disp (Cost, 'Cost in $')
   Example 38
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_10
4 clear; clc;
5 // Asuming that the cost of electricity is 6 cent
      per kWh, how much will it cost to light a 100-W
      lightbulb for 30 days?
6
```

```
7 h = 24*30; // Total hours = 24 hrs * 30 days
8
9 kWh = 0.1*h; // 100W=0.1kW
10
11 Cost = kWh*0.06; // 6 cent = $0.06
12
13 disp (Cost, 'Cost in $')
```

Scilab code Exa 3.11 Example 39

```
Scilab code Exa 3.11 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_11
4 clc; clear;
5 // Calculate the power in a circuit where the source
      of 100 V produces 2 A in a 50 Ohms Resistor.
  // Given data
9 I = 2;
                   // Current=2 Amps
                   // Resistance=50 Ohms
10 R = 50;
                   // Voltage Source=100 Volts
11 V = 100;
12
13 P = I*I*R;
14 disp (P, 'The Power in Watts')
  Example 39
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_11
4 clc; clear;
```

Scilab code Exa 3.12 Example 40

```
Scilab code Exa 3.12 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_12
4 clc; clear;
5 // Calculate the power in a circuit where the source
      of 100 V produces 4 A in a 25 Ohms Resistor.
7 // Given data
9 I = 4;
                  // Current=4 Amps
                  // Resistance=25 Ohms
10 R = 25;
11 V = 100; // Voltage Source=100 Volts
12
13 P = I*I*R;
14 disp (P, 'The Power in Watts')
   Example 40
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_12
4 clc; clear;
5 // Calculate the power in a circuit where the source
      of 100 V produces 4 A in a 25 Ohms Resistor.
6
  // Given data
                   // Current=4 Amps
9 I = 4;
                   // Resistance=25 Ohms
10 R = 25;
                   // Voltage Source=100 Volts
11 V = 100;
12
13 P = I*I*R;
14 disp (P, 'The Power in Watts')
```

Scilab code Exa 3.13 Example 41

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_13
4 clc; clear;
5 // How much current is needed for a 600-W, 120-V toaster?
6
7 // Given data
8
9 V = 120; // Applied Voltage=120 Volts
10 P = 600; // Power of toaster=600 Watts
11
12 I = P/V;
13 disp (I, 'The Current I in Amps')
```

Scilab code Exa 3.14 Example 42

13 disp (R, 'The Resistance in Ohms') Example 42

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_14
4 clc; clear;
5 // How much is the resistance of a 600-W, 120-V toaster?
6
7 // Given data
8
9 V = 120; // Applied Voltage=120 Volts
10 P = 600; // Power of toaster=600 Watts
11
12 R = (V*V)/P;
13 disp (R, 'The Resistance in Ohms')
```

Scilab code Exa 3.15 Example 43

```
Scilab code Exa 3.15 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_15
4 clc; clear;
5 // How much current is needed for a 24 Ohms Resistor that dissipates 600 W?
6
7 // Given data
8
9 R = 24; // Resistance=24 Ohms
10 P = 600; // Power=600 Watts
11
```

```
12 I = sqrt(P/R);
13 disp (I, 'The Current I in Amps')
   Example 43
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_{-}15
4 clc; clear;
5 // How much current is needed for a 24 Ohms Resistor
      that dissipates 600 W?
7 // Given data
9 R = 24;
                   // Resistance=24 Ohms
10 P = 600;
                   // Power=600 Watts
11
12 I = sqrt(P/R);
13 disp (I, 'The Current I in Amps')
```

Scilab code Exa 3.16 Example 44

```
Scilab code Exa 3.16 // Grob's Basic Electronics 11e

2 // Chapter No. 03

3 // Example No. 3_16

4 clc; clear;

5 // Determine the required resistance and appropriate wattage rating of a resistor to meet the following requirements: The resistor must have a 30-V IR drop when its current is 20 mA. The resistors available have the following wattage ratings: 1 8 , 1 4 , 1 2 , 1, and 2 W.
```

```
7 // Given data
                   // Current=20m Amps
9 I = 20*10^{-3};
                   // Voltage Drop=30 Volts
10 \ V = 30;
11
12 R = V/I;
13 disp (R, 'The Resistor value in Ohms')
14 disp ('i.e 1.5 kOhms')
15
16 P = I*I*R;
17 disp (P, 'The Power in Watts')
18 disp ('OR 600 mW')
  Example 44
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_16
4 clc; clear;
5 // Determine the required resistance and appropriate
      wattage rating of a resistor to meet the
     following requirements: The resistor must have a
     30-V IR drop when its current is 20 mA. The
      resistors available have the following wattage
     ratings: 1 8, 1 4, 1 2, 1, and 2 W.
7 // Given data
9 I = 20*10^-3; // Current=20m Amps
                   // Voltage Drop=30 Volts
10 V = 30;
11
12 R = V/I;
13 disp (R, 'The Resistor value in Ohms')
14 disp ('i.e 1.5 kOhms')
15
16 P = I*I*R;
17 disp (P, 'The Power in Watts')
18 disp ('OR 600 mW')
```

Scilab code Exa 3.17 Example 45

```
Scilab code Exa 3.117 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_17
4 clc; clear;
5 // Determine the required resistance and appropriate
     wattage rating of a carbonfilm resistor to meet
     the following requirements: The resistor must
     have a 225-V IR drop when its current is 150 uA.
     The resistors available have the following
     wattage ratings: 1 8, 1 4, 1 2, 1, and 2 W.
7 // Given data
9 I = 150*10^-6; // Current=150 uAmps
                    // Voltage Drop=225 Volts
10 V = 225;
11
12 R = V/I;
13 disp (R, 'The Resistor value in Ohms')
14 disp ('i.e 1.5 MOhms')
15
16 P = I*I*R;
17 disp (P, 'The Power in Watts')
18 disp ('i.e 33.75 mW')
  Example 45
1 // Grob's Basic Electronics 11e
2 // Chapter No. 03
3 // Example No. 3_17
```

```
4 clc; clear;
5 // Determine the required resistance and appropriate
     wattage rating of a carbonfilm resistor to meet
     the following requirements: The resistor must
     have a 225-V IR drop when its current is 150 uA.
     The resistors available have the following
     wattage ratings: 1 8, 1 4, 1 2, 1, and 2 W.
7 // Given data
9 I = 150*10^-6; // Current=150 uAmps
                   // Voltage Drop=225 Volts
10 V = 225;
11
12 R = V/I;
13 disp (R, 'The Resistor value in Ohms')
14 disp ('i.e 1.5 MOhms')
15
16 P = I*I*R;
17 disp (P, 'The Power in Watts')
18 disp ('i.e 33.75 mW')
```

Chapter 9
Chapter 04 Series Circuits

Chapter 10

Chapter 04 Series Circuits

Scilab code Exa 4.1 Example 46

```
Scilab code Exa 4.11 // Grob's Basic Electronics 11e
2 // Chapter No. 04
3 // Example No. 4_1
4 clc; clear;
5 // Two resistances R1 and R2 of 5 Ohms each and R3
      of 10 Ohms are in series. How much is Rt?
  // Given data
9 R1 = 5;
               // Resistor 1=5 Ohms
               // Resistor 2=5 Ohms
10 R2 = 5;
11 R3 = 10;
               // Resistor 3=10 Ohms
12
13 \text{ Rt} = R1 + R2 + R3;
14 disp (Rt, 'The Combined Series Resistance in Ohms')
   Example 46
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 04
3 // Example No. 4_1
4 clc; clear;
5 // Two resistances R1 and R2 of 5 Ohms each and R3
      of 10 Ohms are in series. How much is Rt?
7 // Given data
               // Resistor 1=5 Ohms
9 R1 = 5;
               // Resistor 2=5 Ohms
10 R2 = 5;
11 R3 = 10;
               // Resistor 3=10 Ohms
12
13 \text{ Rt} = R1+R2+R3;
14 disp (Rt, 'The Combined Series Resistance in Ohms')
```

Scilab code Exa 4.2 Example 47

```
Scilab code Exa 4.2 // Grob's Basic Electronics 11e
2 // Chapter No. 04
3 // Example No. 4_2
4 clc; clear;
5 //With 80 V applied across the series string, how much is the current in R3?
6
7 // Given data
8
9 Rt = 20; // Total Resistance=20 Ohms
10 Vt = 80; // Applied Voltage=80 Volts
11
12 I = Vt/Rt;
13 disp (I, 'The Current in Resistor R3 connected in Series in Amps')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 04
3 // Example No. 4_2
4 clc; clear;
5 //With 80 V applied across the series string, how much is the current in R3?
6
7 // Given data
8
9 Rt = 20; // Total Resistance=20 Ohms
10 Vt = 80; // Applied Voltage=80 Volts
11
12 I = Vt/Rt;
13 disp (I, 'The Current in Resistor R3 connected in Series in Amps')
```

Scilab code Exa 4.3 Example 48

```
Scilab code Exa 4.3 // Grob's Basic Electronics 11e

2 // Chapter No. 04

3 // Example No. 4_3

4 clc; clear;

5 // Solve for Rt, I and the individual resistor voltage drops at R1, R2, R3.

6 
7 // Given data

8 
9 R1 = 10; // Resistor 1=10 Ohms

10 R2 = 20; // Resistor 2=20 Ohms

11 R3 = 30; // Resistor 3=30 Ohms
```

```
// Applied Voltage=12 Volts
12 \text{ Vt} = 12;
13
14 \text{ Rt} = R1 + R2 + R3;
15 disp (Rt, 'The combined series resistance in Ohms')
16
17 I = Vt/Rt;
18 disp (I, 'The current in Amps')
19 disp ('i.e 200 mA')
20
21 V1 = I*R1
22 disp (V1, 'The Voltage Drop of Resistor R1 in Volts')
23
24 \ V2 = I*R2
25 disp (V2, 'The Voltage Drop of Resistor R2 in Volts')
26
27 \text{ V3} = I*R3
28 disp (V3, 'The Voltage Drop of Resistor R3 in Volts')
   Example 48
1 // Grob's Basic Electronics 11e
2 // Chapter No. 04
3 // Example No. 4_3
4 clc; clear;
5 // Solve for Rt, I and the individual resistor
      voltage drops at R1, R2, R3.
6
7 // Given data
                 // Resistor 1=10 Ohms
9 R1 = 10;
10 R2 = 20;
                 // Resistor 2=20 Ohms
                 // Resistor 3=30 Ohms
11 R3 = 30;
12 \text{ Vt} = 12;
                 // Applied Voltage=12 Volts
13
14 \text{ Rt} = R1+R2+R3;
15 disp (Rt, 'The combined series resistance in Ohms')
16
17 I = Vt/Rt;
```

Scilab code Exa 4.4 Example 49

```
Scilab code Exa 4.4 // Grob's Basic Electronics 11e
2 // Chapter No. 04
3 // Example No. 4_4
4 clc; clear;
5 // A voltage source produces an IR drop of 40 V
      across a 20 Ohms R1, 60 V across a 30 Ohms R2,
     and 180 V across a 90 Ohms R3, all in series.
      According to Kirchhoff s voltage law, how much
      is the applied voltage Vt?
7 // Given data
                // Voltage drop at R1=40 Volts
9 V1 = 40;
                // Voltage drop at R2=60 Volts
10 \ V2 = 60;
             // Voltage drop at R3=180 Volts
11 \quad V3 = 180;
12
13 \text{ Vt} = V1 + V2 + V3;
14 disp (Vt, 'The Applied Voltage Vt in Volts')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 04
\frac{3}{4} // Example No. 4_4
4 clc; clear;
5 // A voltage source produces an IR drop of 40 V
      across a 20 Ohms R1, 60 V across a 30 Ohms R2,
      and 180 V across a 90 Ohms R3, all in series.
      According to Kirchhoff s voltage law, how much
      is the applied voltage Vt?
6
7 // Given data
9 V1 = 40;
                 // Voltage drop at R1=40 Volts
                // Voltage drop at R2=60 Volts
10 \ V2 = 60;
                // Voltage drop at R3=180 Volts
11 \quad V3 = 180;
12
13 \text{ Vt} = V1 + V2 + V3;
14 disp (Vt, 'The Applied Voltage Vt in Volts')
```

Scilab code Exa 4.5 Example 50

```
Scilab code Exa 4.5 // Grob's Basic Electronics 11e
2 // Chapter No. 04
3 // Example No. 4.5
4 clc; clear;
5 // An applied Vt of 120 V produces IR drops across two series resistors R 1 and R 2 If the voltage drop across R1 is 40 V, how much is the voltage drop across R2?
```

```
7 // Given data
                 // Voltage drop at R1=40 Volts
9 V1 = 40;
                // Applied Voltage=120 Volts
10 \text{ Vt} = 120;
11
12 \ V2 = Vt - V1;
13 disp (V2, 'The Voltage Drop across Resistor R2 in
      Volts')
   Example 50
1 // Grob's Basic Electronics 11e
2 // Chapter No. 04
3 // Example No. 4_5
4 clc; clear;
5 // An applied Vt of 120 V produces IR drops across
      two series resistors R 1 and R 2 If the voltage
      drop across R1 is 40 V, how much is the voltage
      drop across R2?
7 // Given data
                 // Voltage drop at R1=40 Volts
9 V1 = 40;
                // Applied Voltage=120 Volts
10 \text{ Vt} = 120;
11
12 \quad V2 = Vt - V1;
13 disp (V2, 'The Voltage Drop across Resistor R2 in
      Volts')
```

Scilab code Exa 4.6 Example 51

```
Scilab code Exa 4.6 // Grob's Basic Electronics 11e
2 // Chapter No. 04
```

```
3 // Example No. 4_6
4 clc; clear;
5 // Assume that the series circuit in Fig. 4
       failed. A technician troubleshooting the circuit
       used a voltmeter to record the following
      resistor voltage drops. V1=0 V; V2=0 V; V3=24 V;
      V4=0 V. Based on these voltmeter readings, which
      component is defective and what type of defect is
       it? (Assume that only one component is defective
      .)
6
  // Given data
                  // Resistor 1=150 Ohms
9 R1 = 150;
                  // Resistor 2=120 Ohms
10 R2 = 120;
                  // Resistor 3=180 Ohms
11 R3 = 180;
12 R4 = 150;
                  // Resistor 4=150 Ohms
13 \text{ Vt} = 24;
                  // Applied Voltage=24 Volts
14
15 \text{ Rt} = R1 + R2 + R3 + R4;
16
17 I = Vt/Rt;
18
19 \ V1 = I*R1
  disp (V1, 'The Voltage Drop of Resistor R1 in Volts')
20
21
22 \ V2 = I*R2
  disp (V2, 'The Voltage Drop of Resistor R2 in Volts')
23
24
25 \text{ V3} = \text{I} * \text{R3}
  disp (V3, 'The Voltage Drop of Resistor R3 in Volts')
26
27
28 \ V4 = I*R4
29 disp (V4, 'The Voltage Drop of Resistor R4 in Volts')
31 disp ('The Resistor R3 is defective since it is open
       circuit and drops all the voltage arround it')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 04
\frac{3}{4} Example No. 4_6
4 clc; clear;
5 // Assume that the series circuit in Fig. 4
       failed. A technician troubleshooting the circuit
       used a voltmeter to record the following
      resistor voltage drops. V1=0 V; V2=0 V; V3=24 V;
      V4=0 V. Based on these voltmeter readings, which
      component is defective and what type of defect is
       it? (Assume that only one component is defective
      .)
6
7
  // Given data
9 R1 = 150;
                  // Resistor 1=150 Ohms
                  // Resistor 2=120 Ohms
10 R2 = 120;
                  // Resistor 3=180 Ohms
11 R3 = 180;
                  // Resistor 4=150 Ohms
12 R4 = 150;
                  // Applied Voltage=24 Volts
13 \text{ Vt} = 24;
14
15 \text{ Rt} = R1+R2+R3+R4;
16
17 I = Vt/Rt;
18
19 \ V1 = I*R1
  disp (V1, 'The Voltage Drop of Resistor R1 in Volts')
20
21
22 \ V2 = I*R2
23 disp (V2, 'The Voltage Drop of Resistor R2 in Volts')
24
25 \ V3 = I*R3
26 disp (V3, 'The Voltage Drop of Resistor R3 in Volts')
27
28 \text{ V4} = \text{I} * \text{R4}
```

Scilab code Exa 4.7 Example 52

```
Scilab code Exa 417 // Grob's Basic Electronics 11e
2 // Chapter No. 04
3 // Example No. 4_7
4 clc; clear;
5 // Assume that the series circuit has failed. A
      technician troubleshooting the circuit used a
      voltmeter to record the following resistor
      voltage drops: V1 8 V; V2 6.4 V; V3 9.6 V; V4
     V. Based on the voltmeter readings, which
     component is defective and what type of defect is
       it? (Assume that only one component is defective
      .)
6
  // Given data
                 // Resistor 1=150 Ohms
9 R1 = 150;
                 // Resistor 2=120 Ohms
10 R2 = 120;
                 // Resistor 3=180 Ohms
11 R3 = 180;
                 // Resistor 4=150 Ohms
12 R4 = 150;
                 // Applied Voltage=24 Volts
13 \text{ Vt} = 24;
14
15 disp ('Calculated from the Circuit')
16
17 \text{ Rt} = R1+R2+R3+R4;
18
```

```
19 I = Vt/Rt;
20
21 \ V1 = I*R1
22 disp (V1, 'The Voltage Drop of Resistor R1 in Volts')
23
24 \ V2 = I*R2
25 disp (V2, 'The Voltage Drop of Resistor R2 in Volts')
26
27 \text{ V3} = \text{I} * \text{R3}
28 disp (V3, 'The Voltage Drop of Resistor R3 in Volts')
29
30 \ V4 = I*R4
31 disp (V4, 'The Voltage Drop of Resistor R4 in Volts')
32
33 disp ('The normal values for V1, V2, V3, and V4
      are 6 V, 4.8 V, 7.2 V, and 6 V, respectively.
      Comparing the calculated values with those
      measured reveals that V1 , V2 , and V3 have
      increased from their normal values. This
      indicates that the current has increased, which
      is why we have a larger voltage drop across these
       resistors. The measured value of 0 V for V4
     shows a significant drop from its normal value
      of 6 V. The only way this resistor can have 0 V,
     when all other resistors show an increase in
      voltage, is if R4 is shorted. Then V4=I*R4=I*0(
     Ohms = 0 V.
```

Example 52

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 04
3 // Example No. 4_7
4 clc; clear;
5 // Assume that the series circuit has failed. A technician troubleshooting the circuit used a voltmeter to record the following resistor voltage drops: V1 8 V; V2 6.4 V; V3 9.6 V; V4 0
```

```
V. Based on the voltmeter readings, which
     component is defective and what type of defect is
       it? (Assume that only one component is defective
      .)
6
7
  // Given data
8
9 R1 = 150;
                  // Resistor 1=150 Ohms
                  // Resistor 2=120 Ohms
10 R2 = 120;
                  // Resistor 3=180 Ohms
11 R3 = 180;
                  // Resistor 4=150 Ohms
12 R4 = 150;
                  // Applied Voltage=24 Volts
13 \text{ Vt} = 24;
14
15 disp ('Calculated from the Circuit')
16
17 \text{ Rt} = R1+R2+R3+R4;
18
19 I = Vt/Rt;
20
21 V1 = I*R1
22 disp (V1, 'The Voltage Drop of Resistor R1 in Volts')
23
24 \ V2 = I*R2
25 disp (V2, 'The Voltage Drop of Resistor R2 in Volts')
26
27 \text{ V3} = I*R3
28 disp (V3, 'The Voltage Drop of Resistor R3 in Volts')
29
30 \ V4 = I*R4
31 disp (V4, 'The Voltage Drop of Resistor R4 in Volts')
32
33 disp ('The normal values for V1, V2, V3, and V4
      are 6 V, 4.8 V, 7.2 V, and 6 V, respectively.
      Comparing the calculated values with those
      measured reveals that V1 , V2 , and V3 have
      increased from their normal values. This
      indicates that the current has increased, which
      is why we have a larger voltage drop across these
```

resistors. The measured value of 0 V for V4 shows a significant drop from its normal value of 6 V. The only way this resistor can have 0 V, when all other resistors show an increase in voltage, is if R4 is shorted. Then V4=I*R4=I*0(Ohms)=0 V.')

Chapter 11
Chapter 05 Parallel Circuits

Chapter 12

Chapter 05 Parallel Circuits

Scilab code Exa 5.1 Example 53

```
Scilab code Exa 5.11 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_1
4 clc; clear;
5 // Solve for branch currents I1 and I2.
7 R1 = 1*10^3;
                    // Resistor 1=1*10^3 Ohms
                    // Resistor 2=600 Ohms
8 R2 = 600;
9 \text{ Va} = 15;
                   // Applied Voltage=15 Volts
10
11 I1 = Va/R1;
12 disp (I1, 'The Current Resistor R1 in Amps')
13 disp ('i.e 15 mAmps')
14
15 I2 = Va/R2;
16 disp (I2, 'The Current Resistor R2 in Amps')
17 disp ('i.e 25 mAmps')
   Example 53
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_1
4 clc; clear;
5 // Solve for branch currents I1 and I2.
7 R1 = 1*10^3;
                   // Resistor 1=1*10^3 Ohms
  R2 = 600;
                   // Resistor 2=600 Ohms
                   // Applied Voltage=15 Volts
  Va = 15;
10
11 I1 = Va/R1;
12 disp (I1, 'The Current Resistor R1 in Amps')
13 disp ('i.e 15 mAmps')
14
15 I2 = Va/R2;
16 disp (I2, 'The Current Resistor R2 in Amps')
17 disp ('i.e 25 mAmps')
```

Scilab code Exa 5.2 Example 54

```
Scilab code Exa 5.2 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_2
4 clc; clear;
5 // An R1 of 20 Ohms, an R2 of 40 Ohms, and an R3 of 60 Ohms are connected in parallel across the 120-V power line. Using Kirchhoff s current law, determine the total current It.
6
7 // Given data
8
9 R1 = 20; // Resistor 1=20 Ohms
```

```
10 R2 = 40;
                  // Resistor 2=40 Ohms
                  // Resistor 3=60 Ohms
11 R3 = 60;
12 \text{ Va} = 120;
                  // Applied Voltage=120 Volts
13
14 I1 = Va/R1;
15 I2 = Va/R2;
16 	 I3 = Va/R3;
17
18 \text{ It} = I1 + I2 + I3
19 disp (It, 'The Total Current in the Mainline in Amps'
      )
   Example 54
1 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_2
4 clc; clear;
5 // An R1 of 20 Ohms, an R2 of 40 Ohms, and an R3 of
      60 Ohms are connected in parallel across the 120-
      V power line. Using Kirchhoff s current law,
      determine the total current It.
6
7 // Given data
9 R1 = 20;
                  // Resistor 1=20 Ohms
                  // Resistor 2=40 Ohms
10 R2 = 40;
                  // Resistor 3=60 Ohms
11 R3 = 60;
                  // Applied Voltage=120 Volts
12 \text{ Va} = 120;
13
14 I1 = Va/R1;
15 I2 = Va/R2;
16 	 I3 = Va/R3;
17
18 \text{ It} = I1 + I2 + I3
19 disp (It, 'The Total Current in the Mainline in Amps'
      )
```

Scilab code Exa 5.3 Example 55

```
Scilab code Exa 5.3 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_3
4 clc; clear;
5 // Two branches R1 and R2 across the 120-V power
     line draw a total line current It of 15 A. The R1
      branch takes 10 A. How much is the current I2 in
      the R2 branch?
  // Given data
                  // Current in R1 branch=10 Amps
9 I1 = 10;
10 \text{ It} = 15;
                   // Total Current=15 Amps
11
12 I2 = It-I1;
13 disp (I2, 'The Current in R2 branch in Amps')
  Example 55
1 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_3
4 clc; clear;
5 // Two branches R1 and R2 across the 120-V power
     line draw a total line current It of 15 A. The R1
      branch takes 10 A. How much is the current I2 in
      the R2 branch?
7 // Given data
```

Scilab code Exa 5.4 Example 56

```
Scilab code Exa 54 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5<sub>4</sub>
4 clc; clear;
5 // Three parallel branch currents are 0.1 A, 500 mA,
       and 800 A. Using Kirchhoff s current law,
      calculate It.
6
  // Given data
10 \text{ I1} = 0.1;
                            // Branch Current 1=0.1 Amps
                            // Branch Current 2=500m Amps
  I2 = 0.5;
12 \quad I3 = 800*10^-6;
                            // Branch Current 3=800u Amps
13
14 \text{ It} = I1+I2+I3;
15 disp (It, 'The Total Current in Amps')
16 disp ('i.e 600.8 mAmps')
   Example 56
1 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_4
4 clc; clear;
```

```
5 // Three parallel branch currents are 0.1 A, 500 mA,
      and 800 A. Using Kirchhoff s current law,
      calculate It.
6
7
8 // Given data
                          // Branch Current 1=0.1 Amps
10 	 I1 = 0.1;
                          // Branch Current 2=500m Amps
11 	 I2 = 0.5;
12 	 I3 = 800*10^-6;
                          // Branch Current 3=800u Amps
13
14 \text{ It} = I1+I2+I3;
15 disp (It, 'The Total Current in Amps')
16 disp ('i.e 600.8 mAmps')
```

Scilab code Exa 5.5 Example 57

```
Scilab code Exa 5.5 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_5
4 clc; clear;
5 // Two branches, each with a 5-A current, are
     connected across a 90-V source. How much is the
     equivalent resistance Req?
6
7 // Given data
9 	ext{ I1 = 5};
            // Branch Current 1=5 Amps
            // Branch Current 2=5 Amps
10 	 I2 = 5;
11 Va = 90; // Applied Voltage=90 Volts
12
13 \text{ It} = I1+I2;
```

```
14 \text{ Req} = Va/It;
15 disp (Req, 'The Equivalent Resistance Req in Ohms')
   Example 57
1 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_5
4 clc; clear;
5 // Two branches, each with a 5-A current, are
      connected across a 90-V source. How much is the
      equivalent resistance Req?
7 // Given data
                 // Branch Current 1=5 Amps
9 	ext{ I1 = 5};
                 // Branch Current 2=5 Amps
10 	 I2 = 5;
11 Va = 90;
                // Applied Voltage=90 Volts
12
13 \text{ It} = I1 + I2;
14 \text{ Req} = Va/It;
15 disp (Req, 'The Equivalent Resistance Req in Ohms')
```

Scilab code Exa 5.6 Example 58

```
Scilab code Exa 516 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_6
4 clc; clear;
5 // What Rx in parallel with 40 Ohms will provide an Req of 24 Ohms?
6
7 // Given data
```

```
8
9 R = 40;
                  // Resistance=40 Ohms
                   // Equivalent Resistance=24 Ohms
10 \text{ Req} = 24;
11
12 Rx = (R*Req)/(R-Req);
13 disp (Rx, 'The Value of Rx in Ohms')
   Example 58
1 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_6
4 clc; clear;
5 // What Rx in parallel with 40 Ohms will provide an
     Req of 24 Ohms?
6
7 // Given data
                   // Resistance=40 Ohms
9 R = 40;
10 \text{ Req} = 24;
                    // Equivalent Resistance=24 Ohms
11
12 Rx = (R*Req)/(R-Req);
13 disp (Rx, 'The Value of Rx in Ohms')
```

Scilab code Exa 5.7 Example 59

```
Scilab code Exa 517 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_7
4 clc; clear;
5 // What R in parallel with 50 kOhms will provide an Req of 25 kOhms
```

```
7 // Given data
9 R1 = 50*10^3;
                        // R1=50k Ohms
10 \text{ Req} = 25*10^3;
                           // \text{Req} = 25 \text{k Ohms}
11
12 R = (R1*Req)/(R1-Req);
13 disp (R, 'The value of R in Ohms')
14 disp ('i.e 50 kOhms')
   Example 59
1 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_7
4 clc; clear;
5 // What R in parallel with 50 kOhms will provide an
      Req of 25 kOhms
  // Given data
8
9 R1 = 50*10^3;
                          // R1=50k Ohms
10 \text{ Req} = 25*10^3;
                          // \text{Req} = 25 \text{k} \text{ Ohms}
11
12 R = (R1*Req)/(R1-Req);
13 disp (R, 'The value of R in Ohms')
14 disp ('i.e 50 kOhms')
```

Scilab code Exa 5.8 Example 60

```
Scilab code Exa 5.18 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_8
4 clc; clear;
```

5 // In Fig. 5 18a , suppose that the ammeter M1 reads 16-A instead of 20-A as it should. What could be wrong with the circuit?

7 disp ('Notice that the current I3 is supposed to be 4-A. If R3 is open, this explains why M1 reads a current that is 4-A less than its normal value.

To confi rm that R3 is open; open S1 and disconnect the top lead of R2 from point E. North

disconnect the top lead of R3 from point E. Next place an ammeter between the top of R3 and point E. Now, close S1. If I3 measures 0-A, you know that R3 is open. If I3 measures 4-A, you know that one of the other branches is drawing less current than it should. In this case, the next step would be to measure each of the remaining branch currents to find the defective component.')

Example 60

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 05
3 // Example No. 5_8
4 clc; clear;
5 // In Fig. 5 18a, suppose that the ammeter M1 reads 16-A instead of 20-A as it should. What could be wrong with the circuit?
```

7 disp ('Notice that the current I3 is supposed to be 4-A. If R3 is open, this explains why M1 reads a current that is 4-A less than its normal value. To confi rm that R3 is open; open S1 and disconnect the top lead of R3 from point E. Next place an ammeter between the top of R3 and point E. Now, close S1. If I3 measures 0-A, you know that R3 is open. If I3 measures 4-A, you know that one of the other branches is drawing less current than it should. In this case, the next

step would be to measure each of the remaining branch currents to find the defective component.'

Chapter 06 Series Parallel Circuits

Chapter 06 Series Parallel Circuits

Scilab code Exa 6.1 Example 61

```
Scilab code Exa 61 // Grob's Basic Electronics 11e
2 // Chapter No. 06
3 // Example No. 6_1
4 clc; clear;
5 // The Current in M1 reads 0 A with the standard
      resistor RS adjusted to 5642 Ohms. What is the
      value of the unknown resistor Rx?
7 // Given data
                       // Standard Resistor=5642 Ohms
9 \text{ Rs} = 5642;
                       // Resistor 1=1k Ohms
10 R1 = 1*10^3;
                        // Resistor 2=10k Ohms
11 R2 = 10*10^3;
12
13 Rx = Rs*(R1/R2);
14 disp (Rx, 'The Unknown Resistance Rx in Ohms')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 06
3 // Example No. 6_1
4 clc; clear;
5 // The Current in M1 reads 0 A with the standard
      resistor RS adjusted to 5642 Ohms. What is the
      value of the unknown resistor Rx?
  // Given data
9 \text{ Rs} = 5642;
                        // Standard Resistor = 5642 Ohms
                       // Resistor 1=1k Ohms
10 R1 = 1*10^3;
                       // Resistor 2=10k Ohms
11 R2 = 10*10^3;
12
13 Rx = Rs*(R1/R2);
14 disp (Rx, 'The Unknown Resistance Rx in Ohms')
```

Scilab code Exa 6.2 Example 62

```
Scilab code Exa 6.12 // Grob's Basic Electronics 11e
2 // Chapter No. 06
3 // Example No. 6_2
4 clc; clear;
5 // what is the maximum unknown resistance Rx that can be measured for the ratio arm values shown?
6
7 // Given data
8
9 Rsmax = 9999; // Standard Resistor(max)=9999
Ohms
```

```
10 R1 = 1*10^3; // Resistor 1=1k Ohms
11 R2 = 10*10^3; // Resistor 2=10k Ohms
12
13 Rxmax = Rsmax*(R1/R2);
14 disp (Rxmax, 'The Unknown Resistance Rx(max) in Ohms'
  Example 62
1 // Grob's Basic Electronics 11e
2 // Chapter No. 06
3 // Example No. 6_2
4 clc; clear;
5 // what is the maximum unknown resistance Rx that
     can be measured for the ratio arm values shown?
6
7 // Given data
9 Rsmax = 9999; // Standard Resistor (max) = 9999
     Ohms
12
13 Rxmax = Rsmax*(R1/R2);
14 disp (Rxmax, 'The Unknown Resistance Rx(max) in Ohms'
     )
```

Scilab code Exa 6.3 Example 63

```
Scilab code Exa 6.13 // Grob's Basic Electronics 11e
2 // Chapter No. 06
3 // Example No. 6_3
4 clc; clear;
```

```
5 // Assume that the series-parallel circuit in Fig. 6
        15a has failed. A technician troubleshooting
      the circuit has measured the following voltages:
     V1 = 10.8 \text{ V}; VAB = 9 \text{ V}; V4 = 16.2 \text{ V}. These
      voltage readings are shown in Fig. 6 15b. Based
       on the voltmeter readings shown, which component
       is defective and what type of defect does it
      have?
7 // Given data
                   // Voltage at R1=10.8 Volts
9 V1 = 10.8;
                   // Voltage at point (AB)=9 Volts
10 \text{ Vab} = 9;
                  // Voltage at R4=16.2 Volts
11 \quad V4 = 16.2;
                   // Resistor 1=120 Ohms
12 R1 = 120;
13
14 disp ('If we consider the resistance between points
     A and B as a single resistance, the circuit can
     be analyzed as if it were a simple series circuit
      . Notice that V1 and V4 have decreased from their
      normal values of 12-V and 18-V, respectively,
      whereas the voltage VAB across R2 and R3 has
      increased from 6-V to 9-V.')
15 disp ('Since the voltages V1 and V4 have decreased
      and the voltage VAB has increased, the defective
     component must be either R2 or R3 across points A
       and B.')
16
17 	ext{ It} = V1/R1;
18 Rab = Vab/It;
19 disp (Rab, 'The Resistance R(AB) in Ohms')
20
21 disp ('Notice that the value of RAB is the same as
      that of R2. This means, of course, that R3 must
      be open.')
22 disp ('Another approach to finding which resistor is
       open would be to open the switch S1 and measure
      the resistance across points A and B. This
```

measurement would show that the resistance RAB equals 100 Ohms, again indicating that the resistor R3 must be open.')

Example 63

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 06
3 // Example No. 6_3
4 clc; clear;
5 // Assume that the series-parallel circuit in Fig. 6
        15a has failed. A technician troubleshooting
      the circuit has measured the following voltages:
     V1 = 10.8 \text{ V}; VAB = 9 \text{ V}; V4 = 16.2 \text{ V}. These
      voltage readings are shown in Fig. 6 15b. Based
      on the voltmeter readings shown, which component
       is defective and what type of defect does it
     have?
6
7 // Given data
                   // Voltage at R1=10.8 Volts
9 V1 = 10.8;
                   // Voltage at point (AB)=9 Volts
10 \text{ Vab} = 9;
                   // Voltage at R4=16.2 Volts
11 \quad V4 = 16.2;
                   // Resistor 1=120 Ohms
12 R1 = 120;
13
14 disp ('If we consider the resistance between points
     A and B as a single resistance, the circuit can
     be analyzed as if it were a simple series circuit
      . Notice that V1 and V4 have decreased from their
       normal values of 12-V and 18-V, respectively,
      whereas the voltage VAB across R2 and R3 has
      increased from 6-V to 9-V.')
15 disp ('Since the voltages V1 and V4 have decreased
      and the voltage VAB has increased, the defective
      component must be either R2 or R3 across points A
       and B. ')
16
```

```
17  It = V1/R1;
18  Rab = Vab/It;
19  disp (Rab, 'The Resistance R(AB) in Ohms')
20
21  disp ('Notice that the value of RAB is the same as that of R2. This means, of course, that R3 must be open.')
22  disp ('Another approach to finding which resistor is open would be to open the switch S1 and measure the resistance across points A and B. This measurement would show that the resistance RAB equals 100 Ohms, again indicating that the resistor R3 must be open.')
```

Scilab code Exa 6.4 Example 64

```
// Voltage at point (AB)=0 Volts
10 \text{ Vab} = 0;
                   // Voltage at R4=21.6 Volts
11 \quad V4 = 21.6;
                   // Resistor 1=120 Ohms
12 R1 = 120;
13
14 disp ('Since the voltages V1 and V4 have both
     increased, and the voltage VAB has decreased, the
      defective component must be either R2 or R3
      across points A and B. Because the voltage VAB is
      0 V, either R2 or R3 must be shorted.')
15 disp ('But how can we find out which resistor is
     shorted? One way would be to measure the currents
      I2 and I3. The shorted component is the one with
      all the current.')
16 disp ('Another way to find out which resistor is
     shorted would be to open the switch S1 and
     measure the resistance across points A and B.
     Disconnect one lead of either R2 or R3 from point
      A while observing the ohmmeter. If removing the
     top lead of R3 from point A still shows a reading
      of O Ohms, then you know that R2 must be shorted
      . Similarly, if removing the top lead of R2 from
      point A (with R3 still connected at point A)
      still produces a reading of 0 Ohms, then you know
      that R3 is shorted.')
```

Example 64

```
have?
6
  // Given data
9 V1 = 14.4;
                   // Voltage at R1=14.4 Volts
10 \text{ Vab} = 0;
                   // Voltage at point (AB)=0 Volts
                   // Voltage at R4=21.6 Volts
11 \quad V4 = 21.6;
12 R1 = 120;
                   // Resistor 1=120 Ohms
13
14 disp ('Since the voltages V1 and V4 have both
     increased, and the voltage VAB has decreased, the
      defective component must be either R2 or R3
      across points A and B. Because the voltage VAB is
      0 V, either R2 or R3 must be shorted.')
15 disp ('But how can we find out which resistor is
      shorted? One way would be to measure the currents
      I2 and I3. The shorted component is the one with
      all the current.')
16 disp ('Another way to find out which resistor is
      shorted would be to open the switch S1 and
     measure the resistance across points A and B.
     Disconnect one lead of either R2 or R3 from point
      A while observing the ohmmeter. If removing the
     top lead of R3 from point A still shows a reading
      of O Ohms, then you know that R2 must be shorted
      . Similarly, if removing the top lead of R2 from
      point A (with R3 still connected at point A)
      still produces a reading of 0 Ohms, then you know
      that R3 is shorted.')
```

Chapter 07 Voltage and Current Dividers

Chapter 07 Voltage and Current Dividers

Scilab code Exa 7.1 Example 65

```
Scilab code Exa711\ //\ {\rm Grob}'s Basic Electronics 11e
2 // Chapter No. 07
3 // Example No. 7_1
4 clc; clear;
5 // Three 50 Ohms resistors R1, R2 and R3 are in
      series across an applied voltage of 180 V. How
     much is the IR voltage drop across each resistor?
7 // Given data
9 R1 = 50*10^3;
                        // Resistor 1=50k Ohms
                        // Resistor 2=50k Ohms
10 R2 = 50*10^3;
                        // Resistor 3=50k Ohms
11 R3 = 50*10^3;
                        // Applied Voltage=180 Volts
12 \text{ Vt} = 180;
13
                        // R = R1 = R2 = R3
14 R = R1
```

```
15 \text{ Rt} = R1 + R2 + R3;
16 V = Vt*(R/Rt);
17 disp (V, 'The Voltage Drop across each Resistor in
      Volts')
   Example 65
1 // Grob's Basic Electronics 11e
2 // Chapter No. 07
3 // Example No. 7_1
4 clc; clear;
5 // Three 50 Ohms resistors R1, R2 and R3 are in
      series across an applied voltage of 180 V. How
      much is the IR voltage drop across each resistor?
7 // Given data
9 R1 = 50*10^3;
                         // Resistor 1=50k Ohms
                        // Resistor 2=50k Ohms
10 R2 = 50*10^3;
                        // Resistor 3=50k Ohms
11 R3 = 50*10^3;
                        // Applied Voltage=180 Volts
12 \text{ Vt} = 180;
13
14 R = R1
                         // R = R1 = R2 = R3
15 \text{ Rt} = R1+R2+R3;
16 V = Vt*(R/Rt);
17 disp (V, 'The Voltage Drop across each Resistor in
      Volts')
```

Chapter 08 Analog and Digital Multimeters

Chapter 08 Analog and Digital Multimeters

Scilab code Exa 8.1 Example 66

```
Scilab code Exa 8.11 // Grob's Basic Electronics 11e
2 // Chapter No. 08
3 // Example No. 8_1
4 clc; clear;
5 // A shunt extends the range of a 50-uA meter
    movement to 1 mA. How much is the current through
    the shunt at full-scale deflection?
6
7 // Given data
8
9 It = 1*10^-3; // Total Current=1 mAmps
10 Im = 50*10^-6; // Current (cause of meter
    movement)=50 uAmps
11
12 Is = It-Im;
13 disp (Is,'The Current through Shunt at Full Scale
```

```
Deflection in Amps')
14 disp ('i.e 950 uAmps')
   Example 66
1 // Grob's Basic Electronics 11e
2 // Chapter No. 08
3 // Example No. 8_1
4 clc; clear;
5 // A shunt extends the range of a 50-uA meter
     movement to 1 mA. How much is the current through
       the shunt at full-scale deflection?
7 // Given data
                        // Total Current=1 mAmps
9 \text{ It} = 1*10^-3;
10 \text{ Im} = 50*10^-6;
                        // Current (cause of meter
     movement) = 50 uAmps
11
12 Is = It-Im;
13 disp (Is, 'The Current through Shunt at Full Scale
      Deflection in Amps')
14 disp ('i.e 950 uAmps')
```

Scilab code Exa 8.2 Example 67

```
Scilab code Exa 8.2 // Grob's Basic Electronics 11e

2 // Chapter No. 08

3 // Example No. 8_2

4 clc; clear;

5 // A 50 uA meter movement has an Rm of 1000 Ohms.

What Rs is needed to extend the range to 500 uA?
```

```
7 // Given data
                          // Total Current=500u Amps
9 	ext{ It = } 500*10^-6;
                          // Current (cause of meter
10 \text{ Im} = 50*10^-6;
      movement) = 50 uAmps
11 \text{ rm} = 1000;
                          // Resistance of moving coil
      =1000 Ohms
12
13 Is = It-Im;
14 \text{ Vm} = \text{Im}*\text{rm};
15
16 \text{ Rs} = Vm/Is;
17 disp (Rs, 'The Shunt Resistance Rs needed to extend
      the range to 500 uA in Ohms')
   Example 67
1 // Grob's Basic Electronics 11e
2 // Chapter No. 08
3 // Example No. 8_2
4 clc; clear;
5 // A 50 uA meter movement has an Rm of 1000 Ohms.
      What Rs is needed to extend the range to 500 uA?
7 // Given data
                         // Total Current=500u Amps
9 It = 500*10^-6;
                          // Current (cause of meter
10 \text{ Im} = 50*10^-6;
      movement) = 50 uAmps
11 \text{ rm} = 1000;
                          // Resistance of moving coil
      =1000 Ohms
12
13 Is = It-Im;
14 \text{ Vm} = \text{Im}*\text{rm};
15
16 \text{ Rs} = Vm/Is;
17 disp (Rs, 'The Shunt Resistance Rs needed to extend
      the range to 500 uA in Ohms')
```

Chapter 19
Chapter 09 Kirchhoffs Laws

Chapter 09 Kirchhoffs Laws

Scilab code Exa 9.1 Example 68

```
Scilab code Exa 9.1 // Grob's Basic Electronics 11e
2 // Chapter No. 09
3 // Example No. 9_1
4 clc; clear;
5 // Apply Kirchhoff s current law to solve for the
     unknown current, I3.
7 // Given data
                 // Branch 1 Current=2.5 Amps
9 	ext{ I1 = 2.5};
                 // Branch 2 Current=8 Amps
10 	 I2 = 8;
11 \quad I4 = 6;
                 // Branch 3 Current=6 Amps
12 	 I5 = 9;
                 // Branch 4 Current=9 Amps
13
14 // I1+I2+I3-I4-I5 = 0 Sum of all currents at node is
      ZERO
15 // I1+I2+I3 = I4+I5 Total Incomming Current = Total
      Outgoing Current
```

```
16
17 \quad I3 = I4 + I5 - I1 - I2;
18 disp (I3, 'The Branch 3 Current I3 in Amps')
   Example 68
1 // Grob's Basic Electronics 11e
2 // Chapter No. 09
3 // Example No. 9_1
4 clc; clear;
5 // Apply Kirchhoff s current law to solve for the
      unknown current, I3.
7 // Given data
                  // Branch 1 Current=2.5 Amps
9 	 I1 = 2.5;
                  // Branch 2 Current=8 Amps
10 	 I2 = 8;
11 \quad I4 = 6;
                  // Branch 3 Current=6 Amps
12 	 15 = 9;
                  // Branch 4 Current=9 Amps
13
14 // I1+I2+I3-I4-I5 = 0 Sum of all currents at node is
      ZERO
15 // I1+I2+I3 = I4+I5 Total Incomming Current = Total
      Outgoing Current
16
17 \quad I3 = I4 + I5 - I1 - I2;
18 disp (I3, 'The Branch 3 Current I3 in Amps')
```

Scilab code Exa 9.2 Example 69

```
Scilab code Exa 9.12 // Grob's Basic Electronics 11e
2 // Chapter No. 09
3 // Example No. 9_2
```

```
4 clc; clear;
5 // Apply Kirchhoff s voltage law to solve for the
       voltages V(AG) \& V(BG).
7 // Given data
                      // Source Voltage 1=18 Volts
9 V1 = 18;
10 \quad V2 = 18;
                       // Source Voltage 2=18 Volts
                      // Resistor 10=120 Ohms
11 R1 = 120;
                      // Resistor 2=100 Ohms
12 R2 = 100;
13 R3 = 180;
                      // Resistor 3=180 Ohms
14
15 \text{ Vt} = V1 + V2;
16 \text{ Rt} = R1+R2+R3;
17
18 I = Vt/Rt;
19
20 \text{ VR1} = I*R1;
21 \text{ VR2} = I*R2;
22 \text{ VR3} = I*R3;
23
  // V1+V2-VR1-VR2-VR3=0 Sum of all Voltages in loop
      is ZERO
25 // V1+V2 = VR1+VR2+VR3 Total Applied Voltage = Total
        Dropped Voltage in Resistors
26
27 \text{ Vt} = \text{VR1} + \text{VR2} + \text{VR3};
28
29 \text{ VAG} = \text{VR2} + \text{VR3} - \text{V2};
30 disp (VAG, 'The Voltage V(AG) in Volts')
31
32 \text{ VBG} = V1 - VR1 - VR2;
33 disp (VBG, 'The Voltage V(BG) in Volts')
   Example 69
1 // Grob's Basic Electronics 11e
2 // Chapter No. 09
```

```
3 // Example No. 9<sub>-2</sub>
4 clc; clear;
5 // Apply Kirchhoff s voltage law to solve for the
       voltages V(AG) & V(BG).
7 // Given data
9 V1 = 18;
                       // Source Voltage 1=18 Volts
                       // Source Voltage 2=18 Volts
10 \quad V2 = 18;
                       // Resistor 10=120 Ohms
11 R1 = 120;
12 R2 = 100;
                       // Resistor 2=100 Ohms
                       // Resistor 3=180 Ohms
13 R3 = 180;
14
15 \text{ Vt} = V1 + V2;
16 \text{ Rt} = R1 + R2 + R3;
17
18 I = Vt/Rt;
19
20 \text{ VR1} = I*R1;
21 \text{ VR2} = I*R2;
22 \text{ VR3} = I*R3;
23
24 // V1+V2-VR1-VR2-VR3=0 Sum of all Voltages in loop
       is ZERO
25 // V1+V2 = VR1+VR2+VR3 Total Applied Voltage = Total
        Dropped Voltage in Resistors
26
27 \text{ Vt} = \text{VR1} + \text{VR2} + \text{VR3};
28
29 \text{ VAG} = \text{VR2} + \text{VR3} - \text{V2};
30 disp (VAG, 'The Voltage V(AG) in Volts')
31
32 \text{ VBG} = \text{V1-VR1-VR2};
33 disp (VBG, 'The Voltage V(BG) in Volts')
```

Chapter 11 Conductors and Insulators

Chapter 11 Conductors and Insulators

Scilab code Exa 11.1 Example 70

```
Scilab code Exa 111  // Grob's Basic Electronics 11e
2  // Chapter No. 11
3  // Example No. 11_1
4  clc; clear;
5  // What is the area in circular mils of a wire with a diameter of 0.005 in.?
6
7  // Given data
8
9  Din = 0.005;  // Diameter in Inches=0.005 in.
10  Dmil = 5;  // Diameter in Mils=5 mil.
11
12  // 0.005 in. = 5 mil
13  // Therefore: Din == Dmil
14
15  A = Dmil*Dmil;
```

16 disp (A, 'The Circular Area in cmils')

```
Example 70
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 11
3 // Example No. 11_1
4 clc; clear;
5 // What is the area in circular mils of a wire with
      a diameter of 0.005 in.?
  // Given data
9 \text{ Din} = 0.005;
                         // Diameter in Inches = 0.005 in.
10 \text{ Dmil} = 5;
                         // Diameter in Mils=5 mil.
11
12 // 0.005 \text{ in.} = 5 \text{ mil}
13 // Therefore: Din = Dmil
15 A = Dmil*Dmil;
16 disp (A, 'The Circular Area in cmils')
```

Scilab code Exa 11.2 Example 71

```
Scilab code Exa 11.2 // Grob's Basic Electronics 11e
2 // Chapter No. 11
3 // Example No. 11_2
4 clc; clear;
5 // A stranded wire is made up of 16 individual
    strands of No. 27 gage wire. What is its
    equivalent gage size in solid wire?
6
7 // Given data
```

```
8
                  // No. of strands=16
9 N = 16;
10 \text{ A27} = 201.5
                   // Circular area of No. 27 Guage
      wire = 201.5 cmils
11
12 \quad A = N*A27;
13 disp (A, 'The Total Area in cmils')
14
15 disp ('The Circular Area of 3224 cmils corresponds
      very closely to the cmil area of No. 15 gage wire
      . Therefore, 16 strands of No. 27 gage wire is
      roughly equivalent to No. 15 gage solid wire.')
   Example 71
1 // Grob's Basic Electronics 11e
2 // Chapter No. 11
3 // Example No. 11<sub>-2</sub>
4 clc; clear;
5 // A stranded wire is made up of 16 individual
      strands of No. 27 gage wire. What is its
      equivalent gage size in solid wire?
7 // Given data
9 N = 16;
                   // No. of strands=16
                   // Circular area of No. 27 Guage
10 \quad A27 = 201.5
      wire =201.5 cmils
11
12 A = N*A27;
13 disp (A, 'The Total Area in cmils')
14
15 disp ('The Circular Area of 3224 cmils corresponds
      very closely to the cmil area of No. 15 gage wire
      . Therefore, 16 strands of No. 27 gage wire is
      roughly equivalent to No. 15 gage solid wire.')
```

Scilab code Exa 11.3 Example 72

```
Scilab code Exa 11.3 // Grob's Basic Electronics 11e
2 // Chapter No. 11
3 // Example No. 11_3
4 clc; clear;
5 // How much is the resistance of 100 ft of No. 20
      gage copper wire?
7 // Given data
                        // roh or specific resistance
9 \text{ roh} = 10.4;
      =10.4 (for Copper)
                       // Lenght=100 feet
10 \ 1 = 100;
                   // Area of No. 20 Gage=1022 cmil
11 A = 1022;
12
13 R = roh*(1/A);
14 disp (R, 'The Resistance of 100 ft of No. 20 gage
     Copper Wire in Ohms')
15 disp ('i.e 1.02 Ohms')
   Example 72
1 // Grob's Basic Electronics 11e
2 // Chapter No. 11
3 // Example No. 11<sub>-</sub>3
4 clc; clear;
5 // How much is the resistance of 100 ft of No. 20
      gage copper wire?
7 // Given data
```

Scilab code Exa 11.4 Example 73

```
Scilab code Exa 114 // Grob's Basic Electronics 11e
2 // Chapter No. 11
3 // Example No. 11_4
4 clc; clear;
5 // How much is the resistance of 100 ft of No. 23
     gage copper wire?
7 // Given data
                       // roh or specific resistance
9 \text{ roh} = 10.4;
     =10.4 (for Copper)
                  // Lenght=100 feet
10 1 = 100;
11 A = 509.5;
                       // Area of No. 23 Gage=509.5
     cmil
12
13 R = roh*(1/A);
14 disp (R, 'The Resistance of 100 ft of No. 20 gage
     Copper Wire in Ohms')
  Example 73
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 11
3 // Example No. 11_4
4 clc; clear;
5 // How much is the resistance of 100 ft of No. 23
     gage copper wire?
6
7 // Given data
9 \text{ roh} = 10.4;
                      // roh or specific resistance
     =10.4 (for Copper)
               // Lenght=100 feet
10 1 = 100;
                 // Area of No. 23 Gage=509.5
11 A = 509.5;
     cmil
12
13 R = roh*(1/A);
14 disp (R, 'The Resistance of 100 ft of No. 20 gage
     Copper Wire in Ohms')
```

Scilab code Exa 11.5 Example 74

```
// Lenght=100 feet
10 \ 1 = 0.2*10^-2;
                     // Area=1 sqcm
11 A = 1*10^-2;
12
13 R = roh*(1/A);
14 disp (R, 'The Resistance of a Slab of Germanium in
     Ohms')
   Example 74
1 // Grob's Basic Electronics 11e
2 // Chapter No. 11
3 // Example No. 11_{-5}
4 clc; clear;
5 // How much is the resistance of a slab of germanium
       0.2 cm long with a crosssectional area of 1 sqcm
7 // Given data
9 \text{ roh} = 55;
                      // roh or specific resistance=55 (
      for Germanium)
10 \quad 1 = 0.2*10^-2;
                      // Lenght=100 feet
                     // Area=1 sqcm
11 A = 1*10^-2;
12
13 R = roh*(1/A);
14 disp (R, 'The Resistance of a Slab of Germanium in
     Ohms')
```

Scilab code Exa 11.6 Example 75

```
Scilab code Exa 11.16 // Grob's Basic Electronics 11e
2 // Chapter No. 11
```

```
3 // Example No. 11_6
4 clc; clear;
5 // A tungsten wire has a 14-Ohms R at 20 C.
      Calculate its resistance at 120 C.
7 // Given data
  Tmax = 120;
                           // \text{ Temp(max)} = 120 \text{ degree}
      Centigrates
  Tmin = 20;
10
                           // \text{Temp(min)} = 20 \text{ degree}
      Centigrates
                           // Wire Resistance=14 Ohms
11 \text{ Ro} = 14;
12 \text{ alpha} = 0.005;
                          // Aplha=0.005 (for Tungsten)
13
14 delta = Tmax-Tmin;
16 Rt = Ro+Ro*(alpha*delta);
17 disp (Rt, 'The Resistance at 120 C in Ohms')
   Example 75
1 // Grob's Basic Electronics 11e
2 // Chapter No. 11
3 // Example No. 11_6
4 clc; clear;
5 // A tungsten wire has a 14-Ohms R at 20 C.
      Calculate its resistance at 120 C.
7 // Given data
  Tmax = 120;
                           // \text{ Temp(max)} = 120 \text{ degree}
      Centigrates
10 \text{ Tmin} = 20;
                           // \text{Temp(min)} = 20 \text{ degree}
      Centigrates
                          // Wire Resistance=14 Ohms
11 \text{ Ro} = 14;
12 \text{ alpha} = 0.005;
                          // Aplha=0.005 (for Tungsten)
13
14 delta = Tmax-Tmin;
```

```
15

16 Rt = Ro+Ro*(alpha*delta);

17 disp (Rt, 'The Resistance at 120 C in Ohms')
```

Chapter 14
Chapter 12 Battries

Chapter 12 Battries

Scilab code Exa 12.1 Example 76

```
Scilab code Exa 121 // Grob's Basic Electronics 11e
2 // Chapter No. 12
3 // Example No. 12_1
4 clc; clear;
5 // Calculate ri if the output of a generator drops
      from 100 V with zero load current to 80 V when Il
       is 2 A.
7 // Given data
9 \text{ VoO} = 100;
                   // Vo at zero load current=100 Volts
                   // Vo at 2 A load current=80 Volts
10 \text{ Vol} = 80;
                    // Load current=2 Amps
11 	 I1 = 2;
12
13 Ri = (Vo0-Vo1)/I1;
14 disp (Ri, 'The Resistance ri in Ohms')
   Example 76
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 12
3 // Example No. 12_1
4 clc; clear;
5 // Calculate ri if the output of a generator drops
     from 100 V with zero load current to 80 V when Il
       is 2 A.
7 // Given data
                   // Vo at zero load current=100 Volts
9 \text{ VoO} = 100;
                  // Vo at 2 A load current=80 Volts
10 \text{ Vol} = 80;
                   // Load current=2 Amps
11 	 I1 = 2;
12
13 Ri = (Vo0-Vo1)/I1;
14 disp (Ri, 'The Resistance ri in Ohms')
```

Chapter 16
Chapter 13 Magnetism

Chapter 13 Magnetism

Scilab code Exa 13.1 Example 77

```
Scilab code Exa 1311 // Grob's Basic Electronics 11e
2 // Chapter No. 13
3 // Example No. 13_1
4 clc; clear;
5 // Make the following conversions: (a) 25,000 Mx to
     Wb; (b) 0.005 Wb to Mx.
7 // Given data
9 A = 25000;
                        // A=25000 Maxwell
                        // B=0.005 Wabers
10 B = 0.005;
10 D - 0.005;
11 C = 1*10^8;
                     // Conversion Factor
12
13 Wb = A*(1/C);
14 disp (Wb, 'The 25000 Maxwell in Wabers is')
15 disp ('i.e 250*10^{-}-6 Wb or 250 \text{ uWb'})
17 Mx = B*C;
```

```
18 disp (Mx, 'The 0.005 Wabers in Maxwell is')
19 disp ('i.e 5.0*10^5 Mx')
   Example 77
1 // Grob's Basic Electronics 11e
2 // Chapter No. 13
3 // Example No. 13_1
4 clc; clear;
5 // Make the following conversions: (a) 25,000 Mx to
     Wb; (b) 0.005 Wb to Mx.
7 // Given data
                        // A=25000 Maxwell
9 A = 25000;
                        // B=0.005 Wabers
10 B = 0.005;
11 C = 1*10^8;
                        // Conversion Factor
12
13 Wb = A*(1/C);
14 disp (Wb, 'The 25000 Maxwell in Wabers is')
15 disp ('i.e 250*10^{-}-6 Wb or 250 \text{ uWb'})
16
17 Mx = B*C;
18 disp (Mx, 'The 0.005 Wabers in Maxwell is')
19 disp ('i.e 5.0*10^5 Mx')
```

Scilab code Exa 13.2 Example 78

```
Scilab code Exa 13.2 // Grob's Basic Electronics 11e
2 // Chapter No. 13
3 // Example No. 13_2
4 clc; clear;
```

```
5 // With a flux of 10,000 Mx through a perpendicular
      area of 5 sqcm, what is the flux density in gauss
6
7 // Given data
          // Area=5 sqcm
10 flux = 10000; // \text{ Total Flux} = 10000 \text{ Mx}
11
12 B = flux/A;
13 disp (B, 'The Flux Density in Guass (G)')
   Example 78
1 // Grob's Basic Electronics 11e
2 // Chapter No. 13
3 // Example No. 13_2
4 clc; clear;
5 // With a flux of 10,000 Mx through a perpendicular
      area of 5 sqcm, what is the flux density in gauss
7 // Given data
9 A = 5; // Area=5 sqcm
10 flux = 10000; // Total Flux=10000 Mx
11
12 B = flux/A;
13 disp (B, 'The Flux Density in Guass (G)')
```

Scilab code Exa 13.3 Example 79

Scilab code Exa 1313 // Grob's Basic Electronics 11e

```
2 // Chapter No. 13
3 // Example No. 13<sub>-</sub>3
4 clc; clear;
5 // With a flux of 400 uWb through an area of 0.0005
     sqm, what is the flux density B in tesla units?
7 // Given data
11
12 B = flux/A;
13 disp (B, 'The Flux Density in Tesla (T)')
   Example 79
1 // Grob's Basic Electronics 11e
2 // Chapter No. 13
3 // Example No. 13_3
4 clc; clear;
5 // With a flux of 400 uWb through an area of 0.0005
     sqm, what is the flux density B in tesla units?
7 // Given data
9 A = 0.0005; // Area=0.0005 sqm
10 flux = 400*10^-6; // Total Flux=400 uWb
11
12 B = flux/A;
13 disp (B, 'The Flux Density in Tesla (T)')
```

Scilab code Exa 13.4 Example 80

```
Scilab code Exa 134 // Grob's Basic Electronics 11e
2 // Chapter No. 13
3 // Example No. 13_4
4 clc; clear;
5 // Make the following conversions: (a) 0.003 T to G;
      (b) 15,000 G to T.
6
  // Given data
                       // A=0.003 Tesla
9 A = 0.003;
                       // B=15000 Guass
10 B = 15000;
11 C = 1*10^4;
                       // Conversion Factor
12
13 G = A*C;
14 disp (G, 'The 0.003 Tesla in Guass is')
16 T = B*(1/C);
17 disp (T, 'The 15,000 Guass in Tesla is')
   Example 80
1 // Grob's Basic Electronics 11e
2 // Chapter No. 13
3 // Example No. 13_4
4 clc; clear;
5 // Make the following conversions: (a) 0.003 T to G;
      (b) 15,000 G to T.
7 // Given data
9 A = 0.003;
                       // A=0.003 Tesla
                       // B=15000 Guass
10 B = 15000;
11 C = 1*10^4; // Conversion Factor
12
13 G = A*C;
14 disp (G, 'The 0.003 Tesla in Guass is')
15
16 T = B*(1/C);
```

 disp (T, The 15,000 Guass in Tesla is)

Chapter 18
Chapter 14 Electromagnetism

Chapter 14 Electromagnetism

Scilab code Exa 14.1 Example 81

```
// Grob's Basic Electronics 11e
// Chapter No. 14
// Example No. 14_1
clc; clear;
// Calculate the ampere-turns of mmf for a coil with 2000 turns and a 5-mA current.

// Given data
// Given data
// Current=5 mAmps
N = 2000; // No. of Turns=2000
// No. of Turns=2000
// Simple Company of Magneto-Motive Force (mmf) in A.t')
```

Scilab code Exa 14.2 Example 82

```
Scilab code Exa 14.12 // Grob's Basic Electronics 11e
2 // Chapter No. 14
3 // Example No. 14_2
4 clc; clear;
5 // A coil with 4 A is to provide a magnetizing force of 600 A t. How many turns are necessary?
6
7 // Given data
8
9 I = 4; // Current=4 Amps
10 mmf = 600; // Magnetizing Force=600 A.t
11
12 N = mmf/I;
13 disp (N, 'The Turns necessary are')
```

Example 82

```
// Grob's Basic Electronics 11e
// Chapter No. 14
// Example No. 14_2
clc; clear;
// A coil with 4 A is to provide a magnetizing force of 600 A t. How many turns are necessary?

// Given data
// Current=4 Amps
mmf = 600; // Magnetizing Force=600 A.t
// N = mmf/I;
disp (N,'The Turns necessary are')
```

Scilab code Exa 14.3 Example 83

```
Scilab code Exa 14.3 // Grob's Basic Electronics 11e
2 // Chapter No. 14
3 // Example No. 14_3
4 clc; clear;
5 // A coil with 400 turns must provide 800 A t of magnetizing force. How much current is necessary?
6
7 // Given data
8
9 mmf = 800; // Magnetizing Force=800 A.t
10 N = 400; // No. of Turns=400
11
12 I = mmf/N;
13 disp (I, 'The Current necessary in Amps')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 14
3 // Example No. 14_3
4 clc; clear;
5 // A coil with 400 turns must provide 800 A t of magnetizing force. How much current is necessary?
6 
7 // Given data
8 
9 mmf = 800; // Magnetizing Force=800 A.t
10 N = 400; // No. of Turns=400
11
12 I = mmf/N;
13 disp (I, 'The Current necessary in Amps')
```

Scilab code Exa 14.4 Example 84

```
Scilab code Exa 1414 // Grob's Basic Electronics 11e
2 // Chapter No. 14
3 // Example No. 14_4
4 clc; clear;
5 // The wire in a solenoid of 250 turns has a
    resistance of 3 Ohms. (a) How much is the current
    when the coil is connected to a 6-V battery? (b)
    Calculate the ampereturns of mmf.
6
7 // Given data
8
9 V = 6; // Voltage=6 Volts
10 R = 3; // Resistance=3 Ohms
```

```
// No. of Turns=250
11 N = 250;
12
13 I = V/R;
14 disp (I, 'The Current necessary when a wire is
      connected to 6-V Battery in Amps')
15
16 \text{ mmf} = I * N;
17 disp (mmf, 'The Amps-Turn (A.t) of Magneto-Motive
      Force (mmf) in A.t')
   Example 84
1 // Grob's Basic Electronics 11e
2 // Chapter No. 14
3 // Example No. 14_4
4 clc; clear;
5 // The wire in a solenoid of 250 turns has a
      resistance of 3 Ohms. (a) How much is the current
      when the coil is connected to a 6-V battery? (b)
      Calculate the ampereturns of mmf.
7 // Given data
9 V = 6;
                       // Voltage=6 Volts
10 R = 3;
                       // Resistance=3 Ohms
                       // No. of Turns=250
11 N = 250;
12
13 I = V/R;
14 disp (I, 'The Current necessary when a wire is
      connected to 6-V Battery in Amps')
15
16 \text{ mmf} = I * N;
17 disp (mmf, 'The Amps-Turn (A.t) of Magneto-Motive
      Force (mmf) in A.t')
```

Scilab code Exa 14.5 Example 85

```
Scilab code Exa 14.5 // Grob's Basic Electronics 11e
2 // Chapter No. 14
3 // Example No. 14_5
4 clc; clear;
5 // A magnetic material has a ur of 500. Calculate
      the absolute u as B/H (a) in CGS units and (b) in
       SI units.
7 // Given data
                      // ur = 500
9 \text{ ur} = 500;
                      // uo for CGS Units=1
10 \text{ uoa} = 1;
  uob = 1.26*10^-6; // uo for SI Units=1.26 u
12
13 ua = ur*uoa;
14 disp (ua, 'The Absolute u as B/H in CGS in (G/Oe)')
15
16 \text{ ub} = \text{ur}*\text{uob};
  disp (ub, 'The Absolute u as B/H in SI in (T/(A.t/m))
  disp ('i.e 630*10^{-6} \text{ T/(A.t/m)}')
   Example 85
1 // Grob's Basic Electronics 11e
2 // Chapter No. 14
3 // Example No. 14_5
4 clc; clear;
5 // A magnetic material has a ur of 500. Calculate
      the absolute u as B/H (a) in CGS units and (b) in
```

Scilab code Exa 14.6 Example 86

```
Scilab code Exa 1416 // Grob's Basic Electronics 11e
2 // Chapter No. 14
3 // Example No. 14_6
4 clc; clear;
5 // u = 630*10^-6 in SI units, calculate the flux density B that will be produced by the field intensity H equal to 1000 A.t/m.
6
7 // Given data
8
9 u = 630*10^-6; // u=630 micro T/(A.t/m)
10 H = 1000; // H=1000 A.t/m
11
12 B = u*H;
13 disp (B, 'The Flux density in Tesla')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 14
3 // Example No. 14_6
4 clc; clear;
5 // u = 630*10^-6 in SI units, calculate the flux density B that will be produced by the field intensity H equal to 1000 A.t/m.
6
7 // Given data
8
9 u = 630*10^-6; // u=630 micro T/(A.t/m)
10 H = 1000; // H=1000 A.t/m
11
12 B = u*H;
13 disp (B, 'The Flux density in Tesla')
```

Chapter 15 Alternating Voltage and Current

Chapter 15 Alternating Voltage and Current

Scilab code Exa 15.1 Example 87

```
Scilab code Exa 1511 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_1
4 clc; clear;
5 // A sine wave of voltage varies from zero to a
     maximum of 100 V. How much is the voltage at the
     instant of 30
                    of the cycle? 45 ? 90 ? 270
7 // Given data
                   // Vm=100 Volts
9 \text{ Vm} = 100;
10 t1 = 30;
                   // Theta 1=30
                 // Theta 2=45
11 t2 = 45;
                  // Theta 3=90
12 t3 = 90;
13 	 t4 = 270;
                   // Theta 4=270.
14
```

```
15 \text{ v1} = \text{Vm*sind(t1)};
16 disp (v1, 'The Voltage at 30 in Volts')
17
18 \text{ v2} = \text{Vm*sind(t2)};
19 disp (v2, 'The Voltage at 45 in Volts')
20
21 \text{ v3} = \text{Vm*sind(t3)};
22 disp (v3, 'The Voltage at 90 in Volts')
23
24 \text{ v4} = \text{Vm*sind(t4)};
25 disp (v4, 'The Voltage at 270 in Volts')
   Example 87
1 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_1
4 clc; clear;
5 // A sine wave of voltage varies from zero to a
      maximum of 100 V. How much is the voltage at the
      instant of 30 of the cycle? 45 ? 90 ? 270
7 // Given data
                      // Vm=100 Volts
9 \text{ Vm} = 100;
10 t1 = 30;
                      // Theta 1=30
                     // Theta 2=45
11 t2 = 45;
12 t3 = 90;
                      // Theta 3=90
13 	 t4 = 270;
                      // Theta 4=270
14
15 \text{ v1} = \text{Vm*sind(t1)};
16 disp (v1, 'The Voltage at 30
                                     in Volts')
17
18 \text{ v2} = \text{Vm*sind(t2)};
19 disp (v2, 'The Voltage at 45
                                      in Volts')
20
21 \text{ v3} = \text{Vm*sind(t3)};
22 disp (v3, 'The Voltage at 90
                                      in Volts')
```

```
23

24 v4 = Vm*sind(t4);

25 disp (v4, 'The Voltage at 270 in Volts')
```

Scilab code Exa 15.2 Example 88

```
Scilab code Exa 15.2 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_2
4 clc; clear;
5 // An alternating current varies through one
      complete cycle in 1 1000 s. Calculate the
      period and frequency.
7 // Given data
                      // One Complete Cycle=1
9 \text{ tc} = 1/1000;
                                                      1000
      sec.
10
11 T = tc;
12 disp (T, 'The Time period in Seconds')
13 disp ('i.e 1/1000 \text{ sec}')
14
15 f = 1/tc;
16 disp (f, 'The Frequency in Hertz')
17 disp ('OR 1 kHz')
   Example 88
1 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_2
4 clc; clear;
```

```
5 // An alternating current varies through one
     complete cycle in 1
                          1000 s. Calculate the
     period and frequency.
7 // Given data
9 tc = 1/1000; // One Complete Cycle=1
                                                    1000
      sec.
10
11 T = tc;
12 disp (T, 'The Time period in Seconds')
13 disp ('i.e 1/1000 \text{ sec}')
14
15 f = 1/tc;
16 disp (f, 'The Frequency in Hertz')
17 disp ('OR 1 kHz')
```

Scilab code Exa 15.3 Example 89

```
12 t1 = 1/f1;
13 disp (t1, 'The Time period in Seconds of 1 MHz freq.'
14 disp ('i.e 1*10^-6 sec = 1 usec')
15
16 	 t2 = 1/f2;
17 disp (t2, 'The Time period in Seconds of 2 MHz freq.'
18 disp ('i.e 0.5*10^{-6} sec = 0.5 usec')
   Example 89
1 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_3
4 clc; clear;
5 // Calculate the period for the two frequencies of 1
      MHz and 2 MHz. Calculate the period for the two
      frequencies of 1 MHz and 2 MHz.
7 // Given data
                        // Freq=1 MHz
9 	 f1 = 1*10^6;
                        // Freq=2 MHz
10 	ext{ f2} = 2*10^6;
11
12 t1 = 1/f1;
13 disp (t1, 'The Time period in Seconds of 1 MHz freq.'
14 disp ('i.e 1*10^{-6} sec = 1 usec')
15
16 	 t2 = 1/f2;
17 disp (t2, 'The Time period in Seconds of 2 MHz freq.'
18 disp ('i.e 0.5*10^{-6} sec = 0.5 usec')
```

Scilab code Exa 15.4 Scilab code Exa 15.4 Example 90 Example 90

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_4
4 clc; clear;
5 // Calculate lamda for a radio wave witf f of 30 GHz
7 // Given data
9 c = 3*10^10; // Speed of light = 3*10^10 cm/s
                // Freq=30 GHz
10 f = 30*10^9;
11
12 \ 1 = c/f;
13 disp (1, 'The Lamda or Wavelenght in cm')
1 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_4
4 clc; clear;
5 // Calculate lamda for a radio wave witf f of 30 GHz
  // Given data
9 c = 3*10^10;

10 f = 30*10^9;
                   // Speed of light = 3*10^10 \text{ cm/s}
                        // Freq=30 GHz
11
12 \ 1 = c/f;
13 disp (1, 'The Lamda or Wavelenght in cm')
```

Scilab code Exa 15.5 Example 91

```
Scilab code Exa 15.15 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_5
4 clc; clear;
5 // The length of a TV antenna is lamda/2 for radio
      waves with f of 60 MHz. What is the antenna
      length in centimeters and feet?
7 // Given data
9 c = 3*10^10;
                    // Speed of light = 3*10^10 \text{ cm/s}
                    // Freq=60 MHz
10 f = 60*10^6;
                    // 2.54 cm = 1 in
11 \text{ in = } 2.54;
                    '/ 12 in = 1 ft
12 	 ft = 12;
13
14 \ 11 = c/f;
15 \ 1 = 11/2;
16 disp (1, 'The Height in cm')
17
18 li = 1/in
19 lf = li/ft;
20 disp (1f, 'The Height in feet')
   Example 91
1 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_5
4 clc; clear;
```

```
5 // The length of a TV antenna is lamda/2 for radio
      waves with f of 60 MHz. What is the antenna
      length in centimeters and feet?
7 // Given data
                    // Speed of light = 3*10^10 \text{ cm/s}
9 c = 3*10^10;
                     // Freq=60 MHz
10 f = 60*10^6;
                     // 2.54 \text{ cm} = 1 \text{ in}
11 \text{ in = } 2.54;
                     // 12 in = 1 ft
12 	 ft = 12;
13
14 \ 11 = c/f;
15 \ 1 = 11/2;
16 disp (1, 'The Height in cm')
17
18 li = 1/in
19 lf = li/ft;
20 disp (1f, 'The Height in feet')
```

Scilab code Exa 15.6 Example 92

```
Scilab code Exa 15.6 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_6
4 clc; clear;
5 // For the 6-m band used in amateur radio, what is the corresponding frequency?
6
7 // Given data
8
9 v = 3*10^10; // Speed of light=3*10^10 cm/s
10 l = 6*10^2; // lamda=6 meter
```

```
11
12 	 f = v/1
13 disp (f, 'The Frequency in Hertz')
14 disp ('i.e 50*10^6 Hz OR 50 MHz')
   Example 92
1 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_6
4 clc; clear;
5 // For the 6-m band used in amateur radio, what is
      the corresponding frequency?
7 // Given data
                     // Speed of light = 3*10^10 \text{ cm/s}
9 v = 3*10^10;
10 \ 1 = 6*10^2;
                    // lamda=6 meter
11
12 \, f = v/1
13 disp (f, 'The Frequency in Hertz')
14 disp ('i.e 50*10^6 Hz OR 50 MHz')
```

Scilab code Exa 15.7 Example 93

```
Scilab code Exa 1517 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_7
4 clc; clear;
5 // What is the wavelength of the sound waves produced by a loudspeaker at a frequency of 100 Hz?
```

```
7 // Given data
               // Speed of light=1130 ft/s
9 c = 1130;
10 f = 100; // \text{Freq} = 100 \text{ Hz}
11
12 \ 1 = c/f;
13 disp (1, 'The Lamda or Wavelenght in ft')
   Example 93
1 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_{-}7
4 clc; clear;
5 // What is the wavelength of the sound waves
      produced by a loudspeaker at a frequency of 100
      Hz?
7 // Given data
9 c = 1130; // Speed of light = 1130 ft/s
10 f = 100; // \text{Freq} = 100 \text{ Hz}
11
12 \ 1 = c/f;
13 disp (1, 'The Lamda or Wavelenght in ft')
```

Scilab code Exa 15.8 Example 94

```
Scilab code Exa 15.8 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_8
4 clc; clear;
```

```
5 // For ultrasonic waves at a frequency of 34.44 kHz,
       calculate the wavelength in feet and in
      centimeters.
7 // Given data
9 c = 1130; // Speed of light = 1130 ft/s
10 f = 34.44*10^3; // Freq=100 \text{ Hz}
                    // 2.54 \text{ cm} = 1 \text{ in}
11 in = 2.54;
                    // 12 in = 1 ft
12 	 ft = 12;
13
14 \ 1 = c/f;
15 disp (1, 'The Lamda or Wavelenght in ft')
16
17 \ a = 1*ft;
18
19 \ 11 = a*in;
20 disp (11, 'The Lamda or Wavelenght in cm')
21 disp ('appox 1 cm')
   Example 94
1 // Grob's Basic Electronics 11e
2 // Chapter No. 15
3 // Example No. 15_8
4 clc; clear;
5 // For ultrasonic waves at a frequency of 34.44 kHz,
       calculate the wavelength in feet and in
      centimeters.
7 // Given data
9 c = 1130; // Speed of light = 1130 \text{ ft/s}
10 f = 34.44*10^3; // Freq=100 \text{ Hz}
                    // 2.54 \text{ cm} = 1 \text{ in}
11 \text{ in = } 2.54;
              '/ 12 in = 1 ft
12 	 ft = 12;
13
14 \ 1 = c/f;
```

```
15 disp (1, 'The Lamda or Wavelenght in ft')
16
17 a = l*ft;
18
19 l1 = a*in;
20 disp (l1, 'The Lamda or Wavelenght in cm')
21 disp ('appox 1 cm')
```

Chapter 16 Capacitance

Chapter 23

Chapter 16 Capacitance

Scilab code Exa 16.1 Example 95

```
Scilab code Exa 16.11 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_1
4 clc; clear;
5 // How much charge is stored in a 2 uF capacitor connected across a 50-V supply?
6
7 // Given data
8
9 V = 50; // Voltage=50 Volts
10 C = 2*10^-6; // Capacitor=2 uFarad
11
12 Q = C*V;
13 disp (Q, 'The Charge Stored in Columb')
14 disp ('i.e 100*10^-6 Columbs')
Example 95
```

```
// Grob's Basic Electronics 11e
// Chapter No. 16
// Example No. 16_1

clc; clear;
// How much charge is stored in a 2 uF capacitor connected across a 50-V supply?

// Given data

V = 50; // Voltage=50 Volts

C = 2*10^-6; // Capacitor=2 uFarad

Q = C*V;
disp (Q, 'The Charge Stored in Columb')
disp ('i.e 100*10^-6 Columbs')
```

Scilab code Exa 16.2 Example 96

```
Scilab code Exa 16.12 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_2
4 clc; clear;
5 // How much charge is stored in a 40 uF capacitor connected across a 50-V supply?
6
7 // Given data
8
9 V = 50; // Voltage=50 Volts
10 C = 40*10^-6; // Capacitor=2 uFarad
11
12 Q = C*V;
13 disp (Q, 'The Charge Stored in Columb')
14 disp ('i.e 2000*10^-6 Columbs')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_2
4 clc; clear;
5 // How much charge is stored in a 40 uF capacitor connected across a 50-V supply?
6
7 // Given data
8
9 V = 50; // Voltage=50 Volts
10 C = 40*10^-6; // Capacitor=2 uFarad
11
12 Q = C*V;
13 disp (Q, 'The Charge Stored in Columb')
14 disp ('i.e 2000*10^-6 Columbs')
```

Scilab code Exa 16.3 Example 97

```
Scilab code Exa 16.3 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_3
4 clc; clear;
5 // A constant current of 2 uA charges a capacitor
    for 20 s. How much charge is stored? Remember I=Q
    /t or Q=I*t.
6
7 // Given data
8
9 I = 2*10^-6; // Current=2 uAmps
10 t = 20; // Time=20 Sec
```

```
11
12 \ Q = I*t
13 disp (Q, 'The Charge Stored in Columb')
14 disp ('i.e 40*10^{-}-6 Columbs OR 40 uColumb')
   Example 97
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_3
4 clc; clear;
5 // A constant current of 2 uA charges a capacitor
      for 20 s. How much charge is stored? Remember I=Q
      /t or Q=I*t.
7 // Given data
9 I = 2*10^-6;
                        // Current=2 uAmps
                        // Time=20 Sec
10 t = 20;
11
12 \ Q = I * t
13 disp (Q, 'The Charge Stored in Columb')
14 disp ('i.e 40*10^{-}-6 Columbs OR 40 uColumb')
```

Scilab code Exa 16.4 Example 98

```
7 // Given data
                    // Voltage=20 Volts
9 V = 20;
9 V = 20; // Voltage=20 Volts
10 Q = 40*10^-6; // Charge=40 uColumb
11
12 C = Q/V
13 disp (C, 'The Capacitance in Farad')
14 disp ('i.e 2 uF')
   Example 98
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_4
4 clc; clear;
5 // The voltage across the charged capacitor is 20 V.
       Calculate C.
7 // Given data
8
                    // Voltage=20 Volts
9 V = 20;
10 Q = 40*10^-6; // Charge=40 uColumb
11
12 C = Q/V
13 disp (C, 'The Capacitance in Farad')
14 disp ('i.e 2 uF')
```

Scilab code Exa 16.5 Example 99

```
Scilab code Exa 16.5 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16.5
4 clc; clear;
```

```
5 // A constant current of 5 mA charges a 10 uF
     capacitor for 1 s. How much is the voltage across
      the capacitor?
6
7 // Given data
12
13 \ Q = I*t;
14
15 V = Q/C;
16 disp (V, 'The Voltage across Capacitor in Volts')
  Example 99
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_5
4 clc; clear;
5 // A constant current of 5 mA charges a 10 uF
     capacitor for 1 s. How much is the voltage across
      the capacitor?
7 // Given data
                 // Current=5 mAmps
9 I = 5*10^-3;
                    // Time=1 Sec
10 t = 1;
11 C = 10*10^-6; // Cap=10 uFarad
12
13 \ Q = I*t;
14
15 V = Q/C;
16 disp (V, 'The Voltage across Capacitor in Volts')
```

Scilab code Exa 16.6 Example 100

```
Scilab code Exa 16.16 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_6
4 clc; clear;
5 // Calculate C for two plates, each with an area 2
     sqm, separated by 1 cm with a dielectric of air.
7 // Given data
                       // Constant = 8.85 p
9 c = 8.85*10^-12;
                       // Area=2 sqm
10 A = 2;
                       // Distance=1 cm
11 d = 1*10^-2;
12 K = 1
                       // Permeability=1
13
14 \quad C = K*c*(A/d);
15 disp (C, 'The Capacitance in Farad')
16 disp ('i.e 1700*10^--12 F OR 1770 pF')
  Example 100
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_6
4 clc; clear;
5 // Calculate C for two plates, each with an area 2
     sqm, separated by 1 cm with a dielectric of air.
7 // Given data
9 c = 8.85*10^-12; // Constant=8.85 p
```

Scilab code Exa 16.7 Example 101

```
Scilab code Exa 1617 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_7
4 clc; clear;
5 // Determine the value of cpacitance for the film
     capacitors in Fig. 16-12a and b
6
7 disp ('In Fig. 16 12a, the first two numbers are
     5 and 6, respectively, for 56 as the first two
     digits in the numerical value of the capacitance.
     The third number, 3, indicates a multiplier of
     1000, or 56*1000 = 56,000 pF. The letter J
     indicates a capacitor tolerance of +-5\%.
8 disp ('In Fig. 16 12b , the first two numbers are
    4 and 7, respectively, for 47 as the first two
     digits in the numerical value of the capacitance.
     The third number, 9, indicates a fractional
     multiplier of 0.1, or 47*0.1 = 4.7 pF. The letter
     C indicates a capacitor tolerance of +-0.25 pF.
    )
```

Example 101

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16<sub>-</sub>7
4 clc; clear;
5 // Determine the value of cpacitance for the film
     capacitors in Fig. 16-12a and b
7 disp ('In Fig. 16 12a, the first two numbers are
     5 and 6, respectively, for 56 as the first two
     digits in the numerical value of the capacitance.
     The third number, 3, indicates a multiplier of
     1000, or 56*1000 = 56,000 pF. The letter J
     indicates a capacitor tolerance of +-5\%.
8 disp ('In Fig. 16 12b , the first two numbers are
     4 and 7, respectively, for 47 as the first two
     digits in the numerical value of the capacitance.
     The third number, 9, indicates a fractional
     multiplier of 0.1, or 47*0.1 = 4.7 pF. The letter
     C indicates a capacitor tolerance of +-0.25 pF.
     )
```

Scilab code Exa 16.8 Example 102

```
Scilab code Exa 16.18 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16.8
4 clc; clear;
5 // In Fig. 16 14 , determine (a) the capacitance value and tolerance; (b) the temperature-range identification information.
6
7 disp ('(a) Since the capacitance is expressed as a decimal fraction, its value is in microfarads. In
```

this case, C=0.047 uF. The letter Z, to the right of 0.047, indicates a capacitor tolerance of +80%, -20%. Notice that the actual capacitance value can be as much as 80% above its coded value but only 20% below its coded value.')

9 disp ('(b) The alphanumeric code, Z5V, printed below the capacitance value, provides additional capacitor information. The letter Z and number 5 indicate the low and high temperatures of +10 C and +85 C, respectively. The letter V indicates that the maximum capacitance change over the specified temperature range (10 C to 85 C) is +22%, +82%. For temperature changes less than the range indicated, the percent change in capacitance will be less than that indicated.')

Example 102

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_8
4 clc; clear;
5 // In Fig. 16 14, determine (a) the capacitance
     value and tolerance; (b) the temperature-range
     identification information.
6
7 disp ('(a) Since the capacitance is expressed as a
     decimal fraction, its value is in microfarads. In
      this case, C = 0.047 uF. The letter Z, to the
     right of 0.047, indicates a capacitor tolerance
     of +80\%, -20\%. Notice that the actual capacitance
      value can be as much as 80% above its coded
     value but only 20% below its coded value.')
9 disp ('(b) The alphanumeric code, Z5V, printed below
      the capacitance value, provides additional
     capacitor information. The letter Z and number 5
```

indicate the low and high temperatures of +10 C and +85 C, respectively. The letter V indicates that the maximum capacitance change over the specified temperature range (10 C to 85 C) is +22%, +82%. For temperature changes less than the range indicated, the percent change in capacitance will be less than that indicated.')

Scilab code Exa 16.9 Scilab code Exa 16.9 Example 103 Example 103

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_9
4 clc; clear;
5 // Determine the capacitance and tolerance for the
     capacitor in Fig. 16
                          15.
7 disp ('The dots in the top row are read from left to
      right in the direction of the arrow. In the
     bottom row, they are read in the reverse order
     from right to left. The first dot at the left in
     the top row is black, indicating a mica capacitor
     . The next two color dots are blue and red, for
     62 as the first two digits in the numerical value
      of the capacitance. The next dot, at the far
     right in the bottom row, is red, indicating a
     multiplier of 100. Therefore, C = 62*100 = 6200
     pF. The next dot is gold, indicating a capacitor
     tolerance of +-5\%.
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_9
```

```
4 clc; clear;
5 // Determine the capacitance and tolerance for the
     capacitor in Fig. 16
                           15.
7 disp ('The dots in the top row are read from left to
      right in the direction of the arrow. In the
     bottom row, they are read in the reverse order
     from right to left. The first dot at the left in
     the top row is black, indicating a mica capacitor
     . The next two color dots are blue and red, for
     62 as the first two digits in the numerical value
      of the capacitance. The next dot, at the far
     right in the bottom row, is red, indicating a
     multiplier of 100. Therefore, C = 62*100 = 6200
     pF. The next dot is gold, indicating a capacitor
     tolerance of +-5\%.
```

Scilab code Exa 16.10 Example 104

of 1,000,000. Therefore the capacitance C is 47*1,000,000 = 47,000,000 pF, or 47 uF. The blue color at the left indicates a voltage rating of 35 V. And, finally, the silver dot at the very top indicates a tolerance of +-10%.

Example 104

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_10
4 clc; clear;
5 // For the tantalum capacitor shown in Fig. 16 21,
      determine the capacitance C in both pF and uF
     units. Also, determine the voltage rating and
     tolerance.
7 disp ('Moving from top to bottom, the first two
     color bands are yellow and violet, which
     represent the digits 4 and 7, respectively. The
     third color band is blue, indicating a multiplier
      of 1,000,000. Therefore the capacitance C is
     47*1,000,000 = 47,000,000 pF, or 47 uF. The blue
     color at the left indicates a voltage rating of
     35 V. And, finally, the silver dot at the very
     top indicates a tolerance of +-10\%.
```

Scilab code Exa 16.11 Example 105

```
Scilab code Exa 16.11 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_11
4 clc; clear;
```

```
5 // The high-voltage circuit for a color picture tube
       can have 30 kV across 500 pF of C . Calculate
      the stored energy.
7 // Given data
9 V = 30*10^3;  // Voltage=30 kVoltage=30 c = 500*10^-12;  // Cap=500 pFarad
                         // Voltage=30 kVolts
11
12 E = 0.5*C*V*V
13 disp (E, 'The Energy Stored in Joules')
   Example 105
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_11
4 clc; clear;
5 // The high-voltage circuit for a color picture tube
       can have 30 kV across 500 pF of C . Calculate
      the stored energy.
6
7 // Given data
9 V = 30*10^3; // Voltage=30 kVolts
10 C = 500*10^-12; // Cap=500 pFarad
11
12 E = 0.5*C*V*V
13 disp (E, 'The Energy Stored in Joules')
```

Scilab code Exa 16.12 Example 106

Scilab code Exa 16.12 // Grob's Basic Electronics 11e

```
3 // Example No. 16_12
4 clc; clear;
5 //Suppose a film capacitor, coded 393J, is being
     measured using the meter shown in Fig. 16 25.
     If the meter reads 37.6 on the 200-nF range, (a)
     What is the capacitance value in picofarad units?
      (b) Is the measured capacitance value within its
      specified tolerance?
6
7 disp ('The capacitor code, 393J, corresponds to a
     capacitance value of 39,000 \text{ pF} +-5\%.
8 disp ('(a) A reading of 37.6 on the 200-nF range
     corresponds to a capacitance of 37.6 nF. To
     convert 37.6 nF to picofarad units, move the
     decimal point three places to the right. This
     gives an answer of 37,600 pF.')
9 disp ('(b) The acceptable capacitance range is
     calculated as follows: 39,000 \text{ pF} * 0.05 = +-1950
     pF. Therefore, the measured value of capacitance
     can range anywhere from 37,050 pF to 40,950 pF
     and still be considered within tolerance.')
10
11 disp('Note that in nanofarad units, this corresponds
      to a range of 37.05 to 40.95 nF. Since the
     measured value of 37.6 nF falls within this range
     , the measured capacitance value is within
     tolerance.')
  Example 106
1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_12
4 clc; clear;
5 //Suppose a film capacitor, coded 393J, is being
     measured using the meter shown in Fig. 16 25.
     If the meter reads 37.6 on the 200-nF range, (a)
```

2 // Chapter No. 16

What is the capacitance value in picofarad units?
(b) Is the measured capacitance value within its specified tolerance?

7 disp ('The capacitor code, 393J, corresponds to a capacitance value of 39,000 pF +-5%.')

- 8 disp ('(a) A reading of 37.6 on the 200-nF range corresponds to a capacitance of 37.6 nF. To convert 37.6 nF to picofarad units, move the decimal point three places to the right. This gives an answer of 37,600 pF.')
- 9 disp ('(b) The acceptable capacitance range is calculated as follows: $39,000~\mathrm{pF}*0.05 = +-1950~\mathrm{pF}$. Therefore, the measured value of capacitance can range anywhere from $37,050~\mathrm{pF}$ to $40,950~\mathrm{pF}$ and still be considered within tolerance.')

10

11 disp('Note that in nanofarad units, this corresponds to a range of 37.05 to 40.95 nF. Since the measured value of 37.6 nF falls within this range, the measured capacitance value is within tolerance.')

Chapter 24

Chapter 17 Capacitive Reactance

Chapter 25

Chapter 17 Capacitive Reactance

Scilab code Exa 17.1 Example 107

```
16
17 \text{ Xc2} = 1/(2*\%pi*f*C2);
18 disp (Xc2, 'The Capacitive Reactance in Ohms')
19 disp ('appox 114 Ohms')
   Example 107
1 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17_1
4 clc; clear;
5 // How much is Xc for (a) 0.1 uF of C at 1400 Hz? (b)
      ) 1 uF of C at the same frequency?
7 // Given data
                        // Frequency=1400 Hz
9 f = 1400;
                        // Cap1=0.1 uF
10 \quad C1 = 0.1*10^-6;
                        // Cap2=1 uF
11 C2 = 1*10^-6;
12
13 Xc1 = 1/(2*\%pi*f*C1);
14 disp (Xc1, 'The Capacitive Reactance in Ohms')
15 disp ('appox 1140 Ohms')
16
17 \text{ Xc2} = 1/(2*\%pi*f*C2);
18 disp (Xc2, 'The Capacitive Reactance in Ohms')
19 disp ('appox 114 Ohms')
```

Scilab code Exa 17.2 Example 108

```
Scilab code Exa 1712 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17_2
```

```
4 clc; clear;
5 //How much is the Xc of a 47-pF value of C at (a) 1
     MHz? (b) 10 MHz?
6
7 // Given data
                  // Frequency1=1 MHz
9 	 f1 = 1*10^6;
10 f2 = 10*10^6; // Frequency2=10 MHz
11 C = 47*10^-12; // Cap=47 pF
12
13 // For 1 MHz
14
15 Xc1 = 1/(2*\%pi*f1*C);
16 disp (Xc1, 'The Capacitive Reactance in Ohms')
17 disp ('appox 3388 Ohms')
18
19 // For 10 MHz
20
21 \text{ Xc2} = 1/(2*\%pi*f2*C);
22 disp (Xc2, 'The Capacitive Reactance in Ohms')
   Example 108
1 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17<sub>-2</sub>
4 clc; clear;
5 //How much is the Xc of a 47-pF value of C at (a) 1
     MHz? (b) 10 MHz?
7 // Given data
9 f1 = 1*10^6; // Frequency1=1 MHz
10 f2 = 10*10^6; // Frequency2=10 MHz
11 C = 47*10^-12; // Cap=47 pF
12
13 // For 1 MHz
14
```

```
15  Xc1 = 1/(2*%pi*f1*C);
16  disp (Xc1, 'The Capacitive Reactance in Ohms')
17  disp ('appox 3388 Ohms')
18
19  // For 10 MHz
20
21  Xc2 = 1/(2*%pi*f2*C);
22  disp (Xc2, 'The Capacitive Reactance in Ohms')
```

Scilab code Exa 17.3 Example 109

```
Scilab code Exa 17.3 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17_3
4 clc; clear;
5 // What C is needed for Xc of 100 Ohms at 3.4 MHz?
7 // Given data
9 f = 3.4*10^6; // Frequency=3.4 MHz
10 Xc = 100; // Capacitive Reactance=100 Ohms
11
12 C = 1/(2*\%pi*f*Xc);
13 disp (C, 'The Capacitance in Farads')
14 disp ('appox 468 pF')
  Example 109
1 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17<sub>-</sub>3
4 clc; clear;
5 // What C is needed for Xc of 100 Ohms at 3.4 MHz?
```

```
6
7 // Given data
8
9 f = 3.4*10^6; // Frequency=3.4 MHz
10 Xc = 100; // Capacitive Reactance=100 Ohms
11
12 C = 1/(2*%pi*f*Xc);
13 disp (C, 'The Capacitance in Farads')
14 disp ('appox 468 pF')
```

Scilab code Exa 17.4 Example 110

```
Scilab code Exa 174 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17_4
4 clc; clear;
5 // At what frequency will a 10 uF capacitor have Xc
      equal to 100 Ohms?
7
  // Given data
9 Xc = 100; // Capacitive Reactance=100 Ohms
10 C = 10*10^-6; // Cap=10 uF
11
12 f = 1/(2*\%pi*C*Xc);
13 disp (f, 'The Frequency in Hertz')
14 disp ('appox 159 Hz')
   Example 110
1 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17<sub>-4</sub>
```

```
4 clc; clear;
5 // At what frequency will a 10 uF capacitor have Xc
        equal to 100 Ohms?
6
7 // Given data
8
9 Xc = 100; // Capacitive Reactance=100 Ohms
10 C = 10*10^-6; // Cap=10 uF
11
12 f = 1/(2*%pi*C*Xc);
13 disp (f, 'The Frequency in Hertz')
14 disp ('appox 159 Hz')
```

Scilab code Exa 17.5 Example 111

```
Scilab code Exa 17.5 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17<sub>-</sub>5
4 clc; clear;
5 // Calculate the instantaneous value of charging
      current ic produced by a 6 uF C when its
      potential difference is increased by 50 V in 1 s.
7 // Given data
                   // Cap=6 uF
9 C = 6*10^-6;
10 \, dv = 50;
                   // differential voltage increased by
       50 Volts
                   // differential time is 1 sec
11 dt = 1;
12
13 ic = C*(dv/dt);
14 disp (ic, 'The Instantaneous Value of Charging
      Current ic produced in Amps')
```

```
15 disp ('i.e 300 uAmps')
Example 111
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17<sub>-5</sub>
4 clc; clear;
5 // Calculate the instantaneous value of charging
      current ic produced by a 6 uF C when its
      potential difference is increased by 50 V in 1 s.
7 // Given data
9 C = 6*10^-6;
                    // Cap=6 uF
10 \, dv = 50;
                    // differential voltage increased by
       50 Volts
                   // differential time is 1 sec
11 dt = 1;
12
13 ic = C*(dv/dt);
14 disp (ic, 'The Instantaneous Value of Charging
      Current ic produced in Amps')
15 disp ('i.e 300 uAmps')
```

Scilab code Exa 17.6 Example 112

```
Scilab code Exa 17.16 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17.6
4 clc; clear;
5 // Calculate the instantaneous value of charging current ic produced by a 6 uF C when its potential difference is decreased by 50 V in 1 s.
```

```
7 // Given data
9 \text{ C} = 6*10^-6; // Cap=6 uF
                   // differential voltage decreased
10 \, dv = -50;
     by 50 Volts
11 dt = 1;
                   // differential time is 1 sec
12
13 ic = C*(dv/dt);
14 disp (ic, 'The Instantaneous Value of Discharging
      Current ic produced in Amps')
15 disp ('i.e -300 \text{ uAmps'})
   Example 112
1 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17_6
4 clc; clear;
5 // Calculate the instantaneous value of charging
      current ic produced by a 6 uF C when its
      potential difference is decreased by 50 V in 1 s.
7 // Given data
9 C = 6*10^-6; // Cap=6 uF
                   // differential voltage decreased
10 \, dv = -50;
     by 50 Volts
11 dt = 1;
                   // differential time is 1 sec
12
13 ic = C*(dv/dt);
14 disp (ic, 'The Instantaneous Value of Discharging
      Current ic produced in Amps')
15 disp ('i.e -300 \text{ uAmps'})
```

Scilab code Exa 17.7 Example 113

```
Scilab code Exa 1717 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // Example No. 17<sub>-</sub>7
4 clc; clear;
5 // Calculate ic produced by a 250-pF capacitor for a
       change of 50 V in 1 us.
7 // Given data
9 C = 250*10^-12;
                       // \text{Cap}=250 \text{ pF}
                        // differential voltage increased
10 \, dv = 50;
       by 50 Volts
                       // differectial time is 1 usec
11 dt = 1*10^-6;
12
13 ic = C*(dv/dt);
14 disp (ic, 'The Instantaneous Value of ic produced in
15 disp ('12500 uAmps or 12.5 mAmps')
   Example 113
1 // Grob's Basic Electronics 11e
2 // Chapter No. 17
\frac{3}{\sqrt{\text{Example No. } 17_7}}
4 clc; clear;
5 // Calculate ic produced by a 250-pF capacitor for a
       change of 50 V in 1 us.
7 // Given data
```

Chapter 26
Chapter 18 Capacitive Circuits

Chapter 27

Chapter 18 Capacitive Circuits

Scilab code Exa 18.1 Example 114

```
Scilab code Exa 1811 // Grob's Basic Electronics 11e
2 // Chapter No. 18
3 // Example No. 18_1
4 clear; clc;
5 // If a R=30ohms and Xc=40ohms are in series with
     100V applied, find the following: Zt, I, Vr, Vc
     and Theta z. What is the phase angle between Vc
     and Vr with respect to I? Prove that the sum of
     the series voltage drop equals the applied
      voltage Vt
6
7 // Given data
9 R = 30; // Resistance=30 Ohms
              // Capacitive Reactance=40 Ohms
10 \text{ Xc} = 40;
              // Applied Voltage=100 Volts
11 \text{ Vt} = 100;
13 R1 = R*R;
```

```
14 \text{ Xc1} = \text{Xc}*\text{Xc};
15
16 \text{ Zt} = \text{sqrt}(R1+Xc1);
17 disp (Zt, 'Zt in Ohms');
18
19 I = (Vt/Zt);
20 disp (I, 'I in Ampers');
21
22 \text{ Vr} = I*R;
23 disp (Vr, 'Voltage Across Resistor in Volts');
24
25 \text{ Vc} = I*Xc;
26 disp (Vc, 'Voltage Across Capacitive Reactance in
      Volts');
27
28 \text{ Oz} = \text{atand}(-(Xc/R))
29 disp (Oz, 'Theta z is');
30
31 // Prove that the sum of the series voltage drop
      equals the applied voltage Vt
32
33 Vt = sqrt((Vr*Vr)+(Vc*Vc));
34 disp (Vt, 'Sum of Voltage Drop is Equal to Applied
      Voltage of 100V in Volts');
   Example 114
1 // Grob's Basic Electronics 11e
2 // Chapter No. 18
3 // Example No. 18_1
4 clear; clc;
5 // If a R=30ohms and Xc=40ohms are in series with
      100V applied, find the following: Zt, I, Vr, Vc
      and Theta z. What is the phase angle between Vc
      and Vr with respect to I? Prove that the sum of
      the series voltage drop equals the applied
      voltage Vt
6
```

```
7 // Given data
                 // Resistance=30 Ohms
9 R = 30;
10 \text{ Xc} = 40;
                 // Capacitive Reactance=40 Ohms
                // Applied Voltage=100 Volts
11 \text{ Vt} = 100;
12
13 R1 = R*R;
14 \text{ Xc1} = \text{Xc}*\text{Xc};
15
16 \text{ Zt} = \text{sqrt}(R1+Xc1);
17 disp (Zt, 'Zt in Ohms');
18
19 I = (Vt/Zt);
20 disp (I, 'I in Ampers');
21
22 \text{ Vr} = I*R;
23 disp (Vr, 'Voltage Across Resistor in Volts');
24
25 \text{ Vc} = I*Xc;
26 disp (Vc, 'Voltage Across Capacitive Reactance in
      Volts');
27
28 \text{ Oz} = \text{atand}(-(Xc/R))
29 disp (Oz, 'Theta z is');
30
31 //Prove that the sum of the series voltage drop
      equals the applied voltage Vt
32
33 Vt = sqrt((Vr*Vr)+(Vc*Vc));
34 disp (Vt, 'Sum of Voltage Drop is Equal to Applied
      Voltage of 100V in Volts');
```

```
Scilab code Exa 1812 // Grob's Basic Electronics 11e
2 // Chapter No. 18
3 // Example No. 18_2
4 clc; clear;
5 // A 30-mA Ir is in parallel with another branch
      current of 40 mA for Ic. The applied voltage Va
      is 72 V. Calculate It, Zeq and Theta I.
7 // Given data
9 \text{ Ir} = 30*10^{-3};
                    // Current Ir=30 mA
10 Ic = 40*10^-3; // Current Ic=40 \text{ mA}
                    // Applied Voltage=72 Volts
11 \ Va = 72;
12
13 A = Ir*Ir;
14 B = Ic*Ic;
15
16 It = sqrt(A+B);
17 disp (It, 'The Total Current in Amps')
18 disp ('i.e 50 mAmps')
19
20 \text{ Zeq} = Va/It;
21 disp (Zeq, 'The Equivalent Impedence in Ohms')
22 disp ('i.e 1.44 kOhms')
23
24 Oi = atand (Ic/Ir);
25 disp (Oi, 'The Value of Theta I in degrees')
   Example 115
1 // Grob's Basic Electronics 11e
2 // Chapter No. 18
3 // Example No. 18<sub>2</sub>
4 clc; clear;
5 // A 30-mA Ir is in parallel with another branch
      current of 40 mA for Ic. The applied voltage Va
      is 72 V. Calculate It, Zeq and Theta I.
6
```

```
7 // Given data
9 Ir = 30*10^-3; // Current Ir=30 mA
10 Ic = 40*10^{-3}; // Current Ic=40 \text{ mA}
11 Va = 72; // Applied Voltage=72 Volts
12
13 A = Ir*Ir;
14 B = Ic*Ic;
15
16 It = sqrt(A+B);
17 disp (It, 'The Total Current in Amps')
18 disp ('i.e 50 mAmps')
19
20 \text{ Zeq} = Va/It;
21 disp (Zeq, 'The Equivalent Impedence in Ohms')
22 disp ('i.e 1.44 kOhms')
23
24 Oi = atand (Ic/Ir);
25 disp (Oi, 'The Value of Theta I in degrees')
```

Chapter 28
Chapter 19 Inductance

Chapter 29

Chapter 19 Inductance

Scilab code Exa 19.1 Example 116

```
Scilab code Exa 191 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_1
4 clc; clear;
5 // The current in an inductor changes from 12 to 16
    A in 1s. How much is the di/dt rate of current
        change in amperes per second?
6
7 // Given data
8
9 di = 4; // Differential current=16-12=4 Amps
10 dt = 1; // Differential time=1 sec
11
12 A = di/dt;
13 disp (A, 'The di/dt Rate of Current change in A/s')
    Example 116
```

```
// Grob's Basic Electronics 11e
// Chapter No. 19
// Example No. 19_1
clc; clear;
// The current in an inductor changes from 12 to 16
    A in 1s. How much is the di/dt rate of current change in amperes per second?

// Given data

di = 4; // Differential current=16-12=4 Amps
dt = 1; // Differential time=1 sec

A = di/dt;
disp (A, 'The di/dt Rate of Current change in A/s')
```

Scilab code Exa 19.2 Example 117

```
Scilab code Exa 1912 // Grob's Basic Electronics 11e
2  // Chapter No. 19
3  // Example No. 19_2
4  clc; clear;
5  // The current in an inductor changes by 50 mA in 2
    us. How much is the di/dt rate of current change
    in amperes per second?
6
7  // Given data
8
9  di = 50*10^-3;  // Differential current=50 mAmps
10  dt = 2*10^-6;  // Differential time=2 usec
11
12  A = di/dt;
13  disp (A, 'The di/dt Rate of Current change in A/s')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_2
4 clc; clear;
5 // The current in an inductor changes by 50 mA in 2
    us. How much is the di/dt rate of current change
    in amperes per second?
6
7 // Given data
8
9 di = 50*10^-3; // Differential current=50 mAmps
10 dt = 2*10^-6; // Differential time=2 usec
11
12 A = di/dt;
13 disp (A, 'The di/dt Rate of Current change in A/s')
```

Scilab code Exa 19.3 Example 118

```
11
12 L = V1/R;
13 disp (L, 'The Value of Inductance in Henry')
   Example 118
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>3
4 clc; clear;
5 // How much is the inductance of a coil that induces
       40 V when its current changes at the rate of 4 A
      /s?
6
7 // Given data
9 \text{ V1} = 40;
                // Induced voltage=40 Volts
10 R = 4
                // Current changing rate=di/dt=4 A/s
11
12 L = V1/R;
13 disp (L, 'The Value of Inductance in Henry')
```

Scilab code Exa 19.4 Example 119

```
8
9 V1 = 1000; // Induced voltage=1000 \text{ Volts}
10 di = 50*10^-3; // differential current=50 \text{ mAmps}
11 dt = 2*10^-6; // differential time=2 usec
12
13 A = di/dt;
14
15 L = V1/A;
16 disp (L, 'The Value of Inductance in Henry')
17 disp ('OR 40 mH')
   Example 119
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_4
4 clc; clear;
5 // How much is the inductance of a coil that induces
       1000 V when its current changes at the rate of
     50 mA in 2 us?
7 // Given data
8
                   // Induced voltage=1000 Volts
9 V1 = 1000;
10 di = 50*10^-3; // differential current=50 \text{ mAmps}
11 dt = 2*10^-6; // differential time=2 usec
12
13 A = di/dt;
14
15 L = V1/A;
16 disp (L, 'The Value of Inductance in Henry')
17 disp ('OR 40 mH')
```

```
Scilab code Exa 19.5 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_5
4 clc; clear;
5 // How much is the self-induced voltage across a 4-H
       inductance produced by a current change of 12 A/
      s?
7 // Given data
             // Inductor=4 H
9 L = 4;
10 R = 12;
             // current change=di/dt=12 A/s
11
12 Vl = L*R;
13 disp (V1, 'The Value of Self-Induced Voltage in Volts
      ')
   Example 120
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>5
4 clc; clear;
5 // How much is the self-induced voltage across a 4-H
       inductance produced by a current change of 12 A/
      s?
6
7 // Given data
             // Inductor=4 H
9 L = 4;
            // \text{ current change=} \text{di/dt=} 12 \text{ A/s}
10 R = 12;
11
12 V1 = L*R;
13 disp (V1, 'The Value of Self-Induced Voltage in Volts
      ')
```

Scilab code Exa 19.6 Example 121

```
Scilab code Exa 1916 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-6</sub>
4 clc; clear;
5 // The current through a 200-mH L changes from 0 to
      100 mA in 2 us. How much is Vl?
7 // Given data
                        // Inductor=200 mH
9 L = 200*10^-3;
10 \, di = 100*10^-3;
                        // differential current=100
     mAmps
                        // differectial time=2 usec
11 dt = 2*10^-6;
12
13 A = di/dt;
14
15 V1 = L*A;
16 disp (V1, 'The Value of Self-Induced Voltage in Volts
      ')
17 disp ('OR 10 kVolts')
   Example 121
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_6
4 clc; clear;
5 // The current through a 200-mH L changes from 0 to
      100~\mathrm{mA} in 2~\mathrm{us}. How much is Vl ?
6
```

Scilab code Exa 19.7 Example 122

```
Scilab code Exa 1917 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_7
4 clc; clear;
5 // A coil L1 produces 80 uWb of magnetic flux. Of
    this total flux, 60 uWb arelinked with L2. How
    much is k between L1 and L2?
6
7 // Given data
8
9 lf1 = 80*10^-6; // Magnetic flux of coil L1=80 uWb
10 lf2 = 60*10^-6; // Magnetic flux of coil L2=60 uWb
11
12 k = lf2/lf1;
13 disp (k, 'The Coefficient of Coupling k between Coil
    L1 and Coil L2 is')
```

Scilab code Exa 19.8 Example 123

```
Scilab code Exa 1918 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_8
4 clc; clear;
5 // A 10-H inductance L1 on an iron core produces 4
    Wb of magnetic flux. Another coil L2 is on the
    same core. How much is k between L1 and L2?
6
7 // Given data
8
9 lf1 = 4; // Magnetic flux of coil L1=4 Wb
```

```
10 lf2 = 4; // Magnetic flux of coil L2=4 Wb
11
12 k = lf2/lf1;
13 disp (k, 'The Coefficient of Coupling k between Coil
     L1 and Coil L2 is')
   Example 123
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-8</sub>
4 clc; clear;
5 // A 10-H inductance L1 on an iron core produces 4
     Wb of magnetic flux. Another coil L2 is on the
     same core. How much is k between L1 and L2?
6
7 // Given data
9 lf1 = 4; // Magnetic flux of coil L1=4 Wb
10 lf2 = 4; // Magnetic flux of coil L2=4 Wb
11
12 k = 1f2/1f1;
13 disp (k, 'The Coefficient of Coupling k between Coil
     L1 and Coil L2 is')
```

Scilab code Exa 19.9 Example 124

```
Scilab code Exa 19.9 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_9
4 clc; clear;
5 // Two 400-mH coils L1 and L2 have a coefficient of coupling k equal to 0.2. Calculate Lm.
```

```
7 // Given data
9 L1 = 400*10^{-3}; // L1=400 \text{ mH}
10 L2 = 400*10^{-3}; // L2=400 \text{ mH}
11 k = 0.2;
                    // Coupling coefficient = 0.2
12
13 Lm = k*sqrt(L1*L2);
14 disp (Lm, 'The mutual inductance in Henry')
15 disp ('i.e 80*10^{-3} H OR 80 mH')
   Example 124
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_9
4 clc; clear;
5 // Two 400-mH coils L1 and L2 have a coefficient of
      coupling k equal to 0.2. Calculate Lm.
7 // Given data
9 L1 = 400*10^{-3}; // L1=400 \text{ mH}
10 L2 = 400*10^{-3}; // L2=400 \text{ mH}
                    // Coupling coefficient = 0.2
11 k = 0.2;
12
13 Lm = k*sqrt(L1*L2);
14 disp (Lm, 'The mutual inductance in Henry')
15 disp ('i.e 80*10^{-3} H OR 80 mH')
```

Scilab code Exa 19.10 Example 125

Scilab code Exa 19.10 // Grob's Basic Electronics 11e

```
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>10
4 clc; clear;
5 // If the two coils had a mutual inductance LM of 40
       mH, how much would k be?
7 // Given data
9 L1 = 400*10^-3; // Coil Inductance 1=400 \text{ mH}
10 L2 = 400*10^{-3}; // Coil Inductance 2=400 \text{ mH}
11 Lm = 40*10^-3; // Mutual inductance=40 \text{ mH}
12
13 lt = sqrt(L1*L2);
14
15 k = Lm/lt;
16 disp (k, 'The Coupling Coefficient k is')
   Example 125
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>10
4 clc; clear;
5 // If the two coils had a mutual inductance LM of 40
       mH, how much would k be?
7 // Given data
9 L1 = 400*10^{-3}; // Coil Inductance 1=400 \text{ mH}
10 L2 = 400*10^-3; // Coil Inductance 2=400 \text{ mH}
11 Lm = 40*10^-3; // Mutual inductance=40 \text{ mH}
12
13 lt = sqrt(L1*L2);
14
15 k = Lm/lt;
16 disp (k, 'The Coupling Coefficient k is')
```

Scilab code Exa 19.11 Example 126

```
Scilab code Exa 19.111 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_11
4 clc; clear;
5 // A power transformer has 100 turns for Np and 600
      turns for Ns. What is the turns ratio? How much
      is the secondary voltage Vs if the primary
      voltage Vp is 120 V?
7 // Given data
                  // Turns in primary coil=100
9 \text{ np} = 100;
10 \text{ ns} = 600;
                   // Turns in secondary coil=600
11 \text{ vp} = 120;
                  // Primary voltage=120 Volts
12
13 Tr = np/ns;
14 disp (Tr, 'The Turns Ratio is')
15 disp ('OR 1:6')
16
17 vs = vp*(ns/np);
18 disp (vs, 'The Secondary Voltage in Volts')
   Example 126
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_11
4 clc; clear;
5 // A power transformer has 100 turns for Np and 600
      turns for Ns. What is the turns ratio? How much
```

```
is the secondary voltage Vs if the primary
      voltage Vp is 120 V?
6
7 // Given data
                    // Turns in primary coil=100
9 \text{ np} = 100;
                   // Turns in secondary coil=600
10 \text{ ns} = 600;
                    // Primary voltage=120 Volts
11 \text{ vp} = 120;
12
13 Tr = np/ns;
14 disp (Tr, 'The Turns Ratio is')
15 disp ('OR 1:6')
16
17 vs = vp*(ns/np);
18 disp (vs, 'The Secondary Voltage in Volts')
```

Scilab code Exa 19.12 Example 127

```
Scilab code Exa 19.12 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_12
4 clc; clear;
5 // A power transformer has 100 turns for Np and 5
    turns for Ns. What is the turns ratio? How much
    is the secondary voltage Vs with a primary
    voltage of 120 V?
6
7 // Given data
8
9 np = 100; // Turns in primary coil=100
10 ns = 5; // Turns in secondary coil=5
11 vp = 120; // Primary voltage=120 Volts
```

```
12
13 Tr = np/ns;
14 disp (Tr, 'The Turns Ratio 20:1 or')
15
16 \text{ vs} = \text{vp*(ns/np)};
17 disp (vs, 'The Secondary Voltage in Volts')
   Example 127
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>12
4 clc; clear;
5 // A power transformer has 100 turns for Np and 5
      turns for Ns. What is the turns ratio? How much
      is the secondary voltage Vs with a primary
      voltage of 120 V?
7 // Given data
                     // Turns in primary coil=100
9 \text{ np} = 100;
                    // Turns in secondary coil=5
10 \text{ ns} = 5;
                 // Primary voltage=120 Volts
11 \text{ vp} = 120;
12
13 Tr = np/ns;
14 disp (Tr, 'The Turns Ratio 20:1 or')
15
16 \text{ vs} = \text{vp*(ns/np)};
17 disp (vs, 'The Secondary Voltage in Volts')
```

Scilab code Exa 19.13 Example 128

Scilab code Exa 19.13 // Grob's Basic Electronics 11e

```
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>13
4 clc; clear;
5 // A transformer with a 1:6 turns ratio has 720 V
      across 7200 Ohms in the secondary. (a) How much
      is Is? (b) Calculate the value of Ip.
6
  // Given data
                   // Secondary voltage=720 Volts
9 \text{ vs} = 720;
                   // Secondary load=7200 Ohms
10 R1 = 7200;
                    // Turns ratio = 1:6
11 tr = 1/6;
12
13 Is = vs/Rl;
14 disp (Is, 'The Secondary Current in Amps')
15
16 Ip = Is/tr;
17 disp (Ip, 'The Primary Current in Amps')
   Example 128
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>13
4 clc; clear;
5 // A transformer with a 1:6 turns ratio has 720 V
      across 7200 Ohms in the secondary. (a) How much
      is Is? (b) Calculate the value of Ip.
7 // Given data
                  // Secondary voltage=720 Volts
9 \text{ vs} = 720;
                  // Secondary load=7200 Ohms
10 R1 = 7200;
                   // Turns ratio = 1:6
11 tr = 1/6;
13 Is = vs/Rl;
14 disp (Is, 'The Secondary Current in Amps')
15
```

Scilab code Exa 19.14 Example 129

```
Scilab code Exa 19.14 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>14
4 clc; clear;
5 // A transformer with a 20:1 voltage step-down ratio
       has 6 V across 0.6 in the secondary. (a) How
      much is Is? (b) How much is Ip?
7 // Given data
                     // Secondary voltage=6 Volts
9 \text{ vs} = 6;
                     // Secondary load = 0.6 Ohms
10 R1 = 0.6;
                     // \text{ Turns } \text{ratio} = 20:1
11 tr = 20/1;
12
13 Is = vs/Rl;
14 disp (Is, 'The Secondary Current in Amps')
15
16 	ext{ Ip = Is/tr};
17 disp (Ip, 'The Primary Current in Amps')
   Example 129
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>14
4 clc; clear;
```

```
// A transformer with a 20:1 voltage step-down ratio
    has 6 V across 0.6 in the secondary. (a) How
    much is Is? (b) How much is Ip?

// Given data

vs = 6; // Secondary voltage=6 Volts
Rl = 0.6; // Secondary load=0.6 Ohms
tr = 20/1; // Turns ratio=20:1

Is = vs/Rl;
disp (Is, 'The Secondary Current in Amps')

Ip = Is/tr;
disp (Ip, 'The Primary Current in Amps')
```

Scilab code Exa 19.15 Example 130

```
13 Ip = Is*(vs/vp);
14 disp (Ip, 'The Primary current in Amps')
15 disp ('OR 420 mAmps')
   Example 130
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_15
4 clc; clear;
5 // Calculate the primary current I P if the
      secondary current Is equals its rated value of 2
     Α.
6
7 // Given data
9 \text{ vs} = 25.2;
                    // Secondary voltage = 25.2 Volts
                   // Primary voltage=120 Volts
10 \text{ vp} = 120;
11 Is = 2;
                    // Secondary current=2 Amps
12
13 Ip = Is*(vs/vp);
14 disp (Ip, 'The Primary current in Amps')
15 disp ('OR 420 mAmps')
```

Scilab code Exa 19.16 Example 131

```
Scilab code Exa 19.16 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_16
4 clc; clear;
5 // Determine the Primary Impedence Zo
6
7 // Method 1
```

```
8 // Given data
                // Primary Voltage = 32 Volts
10 \text{ Vp} = 32;
                // Load Resistance = 8 Ohms
11 R1 = 8;
               // Turns Ratio Np/Ns = 4/1
12 \text{ TR} = 4;
13
14 Vs = Vp/TR;
15
16 Is = Vs/Rl;
17
18 Ip = ((Vs/Vp)*Is);
19
20 \text{ Zp} = \text{Vp/Ip};
21 disp (Zp, 'Primary Impedence in Ohms by Method 1');
22
  // Method 2
23
24
25 \text{ Zp} = TR*TR*R1;
26 disp (Zp, 'Primary Impedence in Ohms by Method 2');
   Example 131
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_16
4 clc; clear;
5 // Determine the Primary Impedence Zo
7 // Method 1
  // Given data
10 \text{ Vp} = 32;
               // Primary Voltage = 32 Volts
               // Load Resistance = 8 Ohms
11 R1 = 8;
               // Turns Ratio Np/Ns = 4/1
12 \text{ TR} = 4;
13
14 Vs = Vp/TR;
15
16 Is = Vs/Rl;
```

```
17
18    Ip = ((Vs/Vp)*Is);
19
20    Zp = Vp/Ip;
21    disp (Zp, 'Primary Impedence in Ohms by Method 1');
22
23    // Method 2
24
25    Zp = TR*TR*R1;
26    disp (Zp, 'Primary Impedence in Ohms by Method 2');
```

Scilab code Exa 19.17 Scilab code Exa 19.17 Example 132 Example 132

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>17
4 clc; clear;
5 // Calculate the turns ratio Np/Ns that will produce
       a reflected primary impedance Zp of (a) 75 Ohms;
       (b) 600 Ohms.
7 // Given data
9 \text{ Zs} = 300;
               // Secondary impedence=300 Ohms
               // Primary impedence=75 Ohms
10 \text{ Zp1} = 75;
               // Primary impedence=600 Ohms
11 \text{ Zp2} = 600;
12
13 tra = sqrt (Zp1/Zs);
14 disp (tra, 'The Turns ratio Np/Ns is')
15 disp ('OR 1/2')
16
17 trb = sqrt (Zp2/Zs);
18 disp (trb, 'The Turns ratio Np/Ns is 1.414/1 or')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>17
4 clc; clear;
5 // Calculate the turns ratio Np/Ns that will produce
       a reflected primary impedance Zp of (a) 75 Ohms;
       (b) 600 Ohms.
6
  // Given data
                // Secondary impedence=300 Ohms
9 \text{ Zs} = 300;
                // Primary impedence=75 Ohms
10 \text{ Zp1} = 75;
               // Primary impedence=600 Ohms
11 \text{ Zp2} = 600;
12
13 tra = sqrt (Zp1/Zs);
14 disp (tra, 'The Turns ratio Np/Ns is')
15 disp ('OR 1/2')
16
17 trb = sqrt (Zp2/Zs);
18 disp (trb, 'The Turns ratio Np/Ns is 1.414/1 or')
```

Scilab code Exa 19.18 Example 133

```
Scilab code Exa 19.18 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_18
4 clc; clear;
5 // Inductance L1 is 5 mH and L2 is 10 mH. How much is Lt?
6
7 // Given data
```

```
8
9 11 = 5*10^-3; // Inductor 1=5 mH
10 12 = 10*10^-3; // Inductor 2=10 mH
11
12 \text{ Lt} = 11+12;
13 disp (Lt, 'The Total Inductance in Henry')
14 disp ('i.e 15 mH')
   Example 133
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_{-}18
4 clc; clear;
5 // Inductance L1 is 5 mH and L2 is 10 mH. How much
     is Lt?
7 // Given data
9 11 = 5*10^-3; // Inductor 1=5 mH
10 12 = 10*10^-3; // Inductor 2=10 mH
11
12 \text{ Lt} = 11+12;
13 disp (Lt, 'The Total Inductance in Henry')
14 disp ('i.e 15 mH')
```

Scilab code Exa 19.19 Example 134

```
Scilab code Exa 19.19 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_19
4 clc; clear;
```

```
5 // Inductances L1 and L2 are each 8 mH. How much is
     Leq?
7 // Given data
9 	 11 = 8*10^-3;
                   // Inductor 1=8 mH
10 12 = 8*10^-3; // Inductor 2=8 mH
11
12 \ a = 1/11;
13 b = 1/12;
14
15 Leq = 1/(a+b);
16 disp(Leq, 'The Equivalent Inductance in Henry')
17 disp ('i.e 4 mH')
   Example 134
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>19
4 clc; clear;
5 // Inductances L1 and L2 are each 8 mH. How much is
     Leq?
7 // Given data
9 11 = 8*10^-3; // Inductor 1=8 mH
  12 = 8*10^{-3}; // Inductor 2=8 mH
11
12 \ a = 1/11;
13 b = 1/12;
14
15 Leq = 1/(a+b);
16 disp(Leq, 'The Equivalent Inductance in Henry')
17 disp ('i.e 4 mH')
```

Scilab code Exa 19.20 Example 135

```
Scilab code Exa 19.20 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>20
4 clc; clear;
5 // Two series coils, each with an L of 250 uH, have
      a total inductance of 550 uH connected series-
      aiding and 450 uH series -opposing. (a) How much
      is the mutual inductance Lm between the two coils
      ? (b) How much is the coupling coefficient k?
6
7 // Given data
                         // Coil Inductance 1=250 uH
9 	 11 = 250*10^-6;
                        // Coil Inductance 2=250 uH
10 \quad 12 = 250*10^-6;
11 Lts = 550*10^-6; // Inductance series—aiding=550
      uН
12 Lto = 450*10^-6; // Inductance series—opposing
      =450 \text{ uH}
13
14 \text{ Lm} = (\text{Lts-Lto})/4
15 disp (Lm, 'The Mutual Inductance in Henry')
16 disp ('i.e 25 uH')
17
18 	ext{ lt = sqrt(11*12);}
19
20 k = Lm/lt;
21 disp (k, 'The Coupling coefficient k is')
   Example 135
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-</sub>20
4 clc; clear;
5 // Two series coils, each with an L of 250 uH, have
      a total inductance of 550 uH connected series -
      aiding and 450 uH series -opposing. (a) How much
      is the mutual inductance Lm between the two coils
      ? (b) How much is the coupling coefficient k?
6
7 // Given data
                        // Coil Inductance 1=250 uH
9 	 11 = 250*10^-6;
                        // Coil Inductance 2=250 uH
10 \ 12 = 250*10^-6;
11 Lts = 550*10^-6;
                        // Inductance series -aiding=550
     uН
12 Lto = 450*10^-6; // Inductance series—opposing
      =450 \text{ uH}
13
14 \text{ Lm} = (\text{Lts-Lto})/4
15 disp (Lm, 'The Mutual Inductance in Henry')
16 disp ('i.e 25 uH')
17
18 	ext{ lt = sqrt(11*12);}
19
20 k = Lm/lt;
21 disp (k, 'The Coupling coefficient k is')
```

Scilab code Exa 19.21 Example 136

```
Scilab code Exa 19.21 // Grob's Basic Electronics 11e
2 // Chapter No. 19
```

```
3 // Example No. 19<sub>-21</sub>
4 clc; clear;
5 // A current of 1.2 A flows in a coil with an
      inductance of 0.4 H. How much energy is stored in
       the magnetic field?
7 // Given data
                  // Coil Inductance 1=0.4 H
9 11 = 0.4;
                  // Current=1.2 Amps
10 I = 1.2;
11
12 E = (11*I*I)/2;
13 disp (E, 'The Energy Stored in the Magnetic Field in
      Joules')
   Example 136
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19<sub>-21</sub>
4 clc; clear;
5 // A current of 1.2 A flows in a coil with an
      inductance of 0.4 H. How much energy is stored in
       the magnetic field?
7 // Given data
                  // Coil Inductance 1=0.4 H
9 11 = 0.4;
10 I = 1.2;
                  // Current=1.2 Amps
11
12 E = (11*I*I)/2;
13 disp (E, 'The Energy Stored in the Magnetic Field in
      Joules')
```

Chapter 30

Chapter 20 Inductive Reactance

Chapter 31

Chapter 20 Inductive Reactance

Scilab code Exa 20.1 Example 137

```
1  // Grob's Basic Electronics 11e
2  // Chapter No. 20
3  // Example No. 20_1
4  clc; clear;
5  // How much is Xl of a 6-mH L at 41.67 kHz?
6
7  // Given data
8
9  f = 41.67*10^3;  // Frequency=41.67 kHz
10  L = 6*10^-3;  // Inductor=6 mH
11
12  Xl = 2*%pi*f*L;
13  disp (Xl, 'The Inductive Reactance in Ohms')
```

Scilab code Exa 20.2 Example 138

```
Scilab code Exa 20.12 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20<sub>-2</sub>
4 clc; clear;
5 // Calculate the Xl of (a) a 10-H L at 60 Hz and (b)
       a 5-H L at 60 Hz.
7 // Given
              data
9 f = 60;
                // Frequency=60 Hz
10 L1 = 10;
                // Inductor 1=10 H
                // Inductor 2=5 H
11 L2 = 5;
12 \text{ pi} = 3.14
13
14 X11 = 2*pi*f*L1;
15 disp (X11, 'The Inductive Reactance in Ohms')
```

```
16
17 \text{ X}12 = 2*pi*f*L2;
18 disp (X12, 'The Inductive Reactance in Ohms')
   Example 138
1 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20_2
4 clc; clear;
5 // Calculate the XI of (a) a 10-H L at 60 Hz and (b)
       a 5-H L at 60 Hz.
6
7 // Given
              data
9 f = 60;
                // Frequency=60 Hz
                // Inductor 1=10 H
10 L1 = 10;
                // Inductor 2=5 H
11 L2 = 5;
12 \text{ pi} = 3.14
13
14 \text{ Xl1} = 2*pi*f*L1;
15 disp (X11, 'The Inductive Reactance in Ohms')
16
17 X12 = 2*pi*f*L2;
18 disp (X12, 'The Inductive Reactance in Ohms')
```

Scilab code Exa 20.3 Example 139

```
Scilab code Exa 20.3 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20_3
4 clc; clear;
```

```
5 // Calculate the XI of a 250-uH coil at (a) 1 MHz
      and (b) 10 MHz.
7 // Given data
9 	 f1 = 1*10^6;
                    // Frequency1=1 MHz
                   // Frequency2=10 MHz
10 	 f2 = 10*10^6;
11 L = 250*10^-6;
                    // Inductor=250 uH
12 \text{ pi} = 3.14;
13
14 // For 1 Mhz
15
16 \text{ Xl1} = 2*pi*f1*L;
17 disp (X11, 'The Inductive Reactance in Ohms')
18
19 // For 10 Mhz
20
21 X12 = 2*pi*f2*L;
22 disp (X12, 'The Inductive Reactance in Ohms')
   Example 139
1 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20_{-3}
4 clc; clear;
5 // Calculate the XI of a 250-uH coil at (a) 1 MHz
      and (b) 10 MHz.
7 // Given data
                    // Frequency1=1 MHz
9 	 f1 = 1*10^6;
                    // Frequency2=10 MHz
10 	 f2 = 10*10^6;
11 L = 250*10^-6;
                    // Inductor=250 uH
12 \text{ pi} = 3.14;
13
14 // For 1 Mhz
15
```

```
16 X11 = 2*pi*f1*L;
17 disp (X11, 'The Inductive Reactance in Ohms')
18
19 // For 10 Mhz
20
21 X12 = 2*pi*f2*L;
22 disp (X12, 'The Inductive Reactance in Ohms')
```

Scilab code Exa 20.4 Example 140

```
Scilab code Exa 2014 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20<sub>-4</sub>
4 clc; clear;
5 // A coil with negligible resistance has 62.8 V
      across it with 0.01 A of current. How much is X1?
7 // Given data
9 V1 = 62.8;
                   // Voltage across coil=62.8 Volts
10 	ext{ Il} = 0.01;
                   // Current in coil=0.01 Amps
11
12 X1 = V1/I1;
13 disp (X1, 'The Inductive Reactance in Ohms')
   Example 140
1 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20_4
4 clc; clear;
5 // A coil with negligible resistance has 62.8 V
      across it with 0.01 A of current. How much is X1?
```

```
6
7 // Given data
8
9 V1 = 62.8; // Voltage across coil=62.8 Volts
10 I1 = 0.01; // Current in coil=0.01 Amps
11
12 X1 = V1/I1;
13 disp (X1, 'The Inductive Reactance in Ohms')
```

Scilab code Exa 20.5 Example 141

```
Scilab code Exa 2015 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20_5
4 clc; clear;
5 // Calculate L of the coil when the frequency is
     1000 Hz.
7 // Given data
8
9 X1 = 6280;
                   // Inductive reactance=6280 Ohms
10 f = 1000;
                  // Frequency=1000 Hz
11 \text{ pi} = 3.14;
12
13 L = X1/(2*pi*f);
14 disp (L, 'The value of Inductor in Henry')
   Example 141
1 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20_5
4 clc; clear;
```

Scilab code Exa 20.6 Example 142

```
Scilab code Exa 2016 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20_6
4 clc; clear;
5 // Calculate L of a coil that has 15,700 Ohms of Xl
     at 12 MHz.
  // Given data
                   // Inductive reactance=15700 Ohms
9 X1 = 15700;
                  // Frequency=12 MHz
10 f = 12*10^6;
11 \text{ pi} = 3.14;
12
13 L = X1/(2*pi*f);
14 disp (L, 'The value of Inductor in Henry')
15 disp ('i.e Appox 208.8*10^-6 OR 208.8 uH')
   Example 142
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20_6
4 clc; clear;
5 // Calculate L of a coil that has 15,700 Ohms of Xl
     at 12 MHz.
6
7 // Given data
                  // Inductive reactance=15700 Ohms
9 X1 = 15700;
10 f = 12*10^6;
                 // Frequency=12 MHz
11 \text{ pi} = 3.14;
12
13 L = X1/(2*pi*f);
14 disp (L, 'The value of Inductor in Henry')
15 disp ('i.e Appox 208.8*10^-6 OR 208.8 uH')
```

Scilab code Exa 20.7 Example 143

```
Scilab code Exa 2017 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20_7
4 clc; clear;
5 // At what frequency will an inductance of 1 H have a reactance of 1000 ?
6
7 // Given data
8
9 X1 = 1000; // Inductive reactance=1000 Ohms
10 L = 1; // Inductor=1 H
11
12 f = X1/(2*%pi*L);
13 disp (f, 'The Frequency in Hertz')
```

```
// Grob's Basic Electronics 11e
// Chapter No. 20
// Example No. 20_7

clc; clear;
// At what frequency will an inductance of 1 H have a reactance of 1000 ?

// Given data

X1 = 1000; // Inductive reactance=1000 Ohms

L = 1; // Inductor=1 H

f = X1/(2*%pi*L);
disp (f, 'The Frequency in Hertz')
```

Chapter 32

Chapter 21 Inductive Circuits

Chapter 21 Inductive Circuits

Scilab code Exa 21.1 Example 144

```
Scilab code Exa 2111 // Grob's Basic Electronics 11e
2 // Chapter No. 21
3 // Example No. 21_1
4 clc; clear
5 // If a R=30 ohms and Xl=40 ohms are in series with
     100V applied, find the following: Zt, I, Vr, Vl
     and Theta z. What is the phase angle between Vl
     and Vr with respect to I? Prove that the sum of
     the series voltage drop equals the applied
     voltage Vt
6
7 // Given data
9 R = 30; // Resistance=30 Ohms
10 X1 = 40; // Inductive reactance=40 Ohms
11 Vt = 100; // Applied voltage=100 \text{ Volts}
12
13
```

```
14 R1 = R*R;
15 \times 11 = X1 \times X1;
16
17 Zt = sqrt(R1+X11);
18 disp (Zt, 'Zt in ohms');
19
20 I = (Vt/Zt);
21 disp (I, 'I in Ampers');
22
23 Vr = I*R;
24 disp (Vr, 'Vr in Volts');
25
26 \text{ V1} = I * X1;
27 disp (V1, 'V1 in Volts');
28
29 \text{ Oz} = \text{atand}(X1/R);
30 disp (Oz, 'Theta z in degree');
31
32 //Prove that the sum of the series voltage drop
      equals the applied voltage Vt
33
34 Vt = sqrt((Vr*Vr)+(Vl*Vl));
35 disp (Vt, 'Sum of Voltage Drop is Equal to Applied
      Voltage 100V');
   Example 144
1 // Grob's Basic Electronics 11e
2 // Chapter No. 21
3 // Example No. 21_1
4 clc; clear
5 // If a R=30 ohms and Xl=40 ohms are in series with
      100V applied, find the following: Zt, I, Vr, Vl
      and Theta z. What is the phase angle between VI
      and Vr with respect to I? Prove that the sum of
      the series voltage drop equals the applied
      voltage Vt
6
```

```
7 // Given data
                // Resistance=30 Ohms
9 R = 30;
10 X1 = 40;
                // Inductive reactance=40 Ohms
               // Applied voltage=100 Volts
11 \text{ Vt} = 100;
12
13
14 R1 = R*R;
15 \times X11 = X1 \times X1;
16
17 Zt = sqrt(R1+X11);
18 disp (Zt, 'Zt in ohms');
19
20 I = (Vt/Zt);
21 disp (I, 'I in Ampers');
22
23 Vr = I*R;
24 disp (Vr, 'Vr in Volts');
25
26 \text{ V1} = I * X1;
27 disp (V1, 'V1 in Volts');
28
29 \text{ Oz} = \text{atand}(X1/R);
30 disp (Oz, 'Theta z in degree');
31
32 //Prove that the sum of the series voltage drop
      equals the applied voltage Vt
33
34 Vt = sqrt((Vr*Vr)+(Vl*Vl));
35 disp (Vt, 'Sum of Voltage Drop is Equal to Applied
      Voltage 100V');
```

```
Scilab code Exa 21.12 // Grob's Basic Electronics 11e
2 // Chapter No. 21
3 // Example No. 21_2
4 clc; clear;
5 // What is the total Z of a 600-Ohms R in parallel
      with a 300 Ohms X1? Assume 600 V for the applied
      voltage.
  // Given data
9 R = 600;
               // Resistance=600 Ohms
10 X1 = 300;
               // Inductive reactance=300 Ohms
11 V = 600;
               // Applied voltage=600 Volts
12
13 Ir = V/R;
14 	ext{ Il} = V/X1;
15 A = Ir*Ir;
16 B = I1*I1;
17 It = sqrt(A+B);
18
19 Zeq = V/It;
20 disp(Zeq, 'The Total Impedence in Ohms')
   Example 145
1 // Grob's Basic Electronics 11e
2 // Chapter No. 21
3 // Example No. 21_{-2}
4 clc; clear;
5 // What is the total Z of a 600-Ohms R in parallel
      with a 300 Ohms X1? Assume 600 V for the applied
      voltage.
7 // Given data
9 R = 600;
               // Resistance=600 Ohms
10 X1 = 300;
               // Inductive reactance=300 Ohms
11 V = 600;
               // Applied voltage=600 Volts
```

```
12
13    Ir = V/R;
14    Il = V/Xl;
15    A = Ir*Ir;
16    B = Il*Il;
17    It = sqrt(A+B);
18
19    Zeq = V/It;
20    disp(Zeq, 'The Total Impedence in Ohms')
```

Scilab code Exa 21.3 Example 146

```
Scilab code Exa 21.3 // Grob's Basic Electronics 11e
2 // Chapter No. 21
3 // Example No. 21_{-3}
4 clc; clear;
5 // An air-core coil has an Xl of 700 Ohms and an Re
      of 2 Ohms. Calculate the value of Q for this coil
  // Given data
9 X1 = 700; // Inductive reactance=700 Ohms
               // AC effective resistance=2 Ohms
10 \text{ Re} = 2;
11
12 Q = X1/Re;
13 disp (Q, 'The Q of Coil is')
   Example 146
1 // Grob's Basic Electronics 11e
2 // Chapter No. 21
3 // Example No. 21<sub>-</sub>3
```

Scilab code Exa 21.4 Example 147

```
Scilab code Exa 214 // Grob's Basic Electronics 11e
2 // Chapter No. 21
3 // Example No. 21_4
4 clc; clear;
5 // A 200 uH coil has a Q of 40 at 0.5 MHz. Find Re.
7 // Given data
                    // L of coil=200 uHenry
9 L = 200*10^-6;
                   // Q = 40
10 \ Q = 40;
11 f = 0.5*10^6; // Frequency=0.5 MHz
12 \text{ pi} = 3.14;
13
14 X1 = 2*pi*L*f;
15
16 \text{ Re} = X1/Q;
17 disp (Re, 'The AC Effective Resistance in Ohms')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 21
3 // Example No. 21_4
4 clc; clear;
5 // A 200 uH coil has a Q of 40 at 0.5 MHz. Find Re.
7 // Given data
                  // L of coil=200 uHenry
9 L = 200*10^-6;
                   // Q = 40
10 \ Q = 40;
                   // Frequency=0.5 MHz
11 f = 0.5*10^6;
12 \text{ pi} = 3.14;
13
14 X1 = 2*pi*L*f;
16 Re = X1/Q;
17 disp (Re, 'The AC Effective Resistance in Ohms')
```

Chapter 22 RC and LR Time Constants

Chapter 22 RC and LR Time Constants

Scilab code Exa 22.1 Example 148

```
// Grob's Basic Electronics 11e
// Chapter No. 22
// Example No. 22_1

clc; clear;
// What is the time constant of a 20-H coil having 100 Ohms of series resistance?

// Given data

L = 20; // Inductor=20 Henry
R = 100; // Resistor=100 Ohms

T = L/R;
disp (T, 'The Time Constant in Seconds')
```

Scilab code Exa 22.2 Example 149

```
Scilab code Exa 2212 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_{-2}
4 clc; clear;
5 // An applied dc voltage of 10 V will produce a
     steady-state current of 100 mA in the 100-Ohms
      coil. How much is the current after 0.2 s? After
     1 s?
6
7 // Given data
            // Inductor=20 Henry
9 L = 20;
           // Resistor=100 Ohms
10 R = 100;
11 I = 100*10^-3; // Steady-state current=100 \text{ mAmps}
12
```

```
13 disp ('Since 0.2 sec is one time constant, I is 63\%
      of 100 mA')
14 I1 = 0.63*I;
15 disp (I1, 'The current at 0.2 sec time constant')
16
17 disp ('After 1 sec the current reaches its steady
     state value of 100 mAmps ')
  Example 149
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_2
4 clc; clear;
5 // An applied dc voltage of 10 V will produce a
     steady-state current of 100 mA in the 100-Ohms
      coil. How much is the current after 0.2 s? After
     1 s?
6
7 // Given data
                   // Inductor=20 Henry
9 L = 20;
10 R = 100;
                   // Resistor=100 Ohms
11 I = 100*10^-3; // Steady-state current=100 \text{ mAmps}
12
13 disp ('Since 0.2 sec is one time constant, I is 63\%
     of 100 mA')
14 I1 = 0.63*I;
15 disp (I1, 'The current at 0.2 sec time constant')
16
17 disp ('After 1 sec the current reaches its steady
     state value of 100 mAmps ')
```

```
Scilab code Exa 22.33 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22\_3
4 clc; clear;
5 // If a 1-M Ohms R is added in series with the coil,
      how much will the time constant be for the
     higher resistance RL circuit?
7 // Given data
                  // Inductor=20 Henry
9 L = 20;
10 R = 1*10^6; // Resistor=1 MOhms
11
12 T = L/R;
13 disp (T, 'The Time Constant in Seconds')
14 disp ('i.e 20 us')
  Example 150
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_3
4 clc; clear;
5 // If a 1-M Ohms R is added in series with the coil,
      how much will the time constant be for the
     higher resistance RL circuit?
6
7 // Given data
9 L = 20;
                  // Inductor=20 Henry
10 R = 1*10^6; // Resistor=1 MOhms
11
12 T = L/R;
13 disp (T, 'The Time Constant in Seconds')
14 disp ('i.e 20 us')
```

Scilab code Exa 22.4 Example 151

```
Scilab code Exa 224 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_4
4 clc; clear;
5 // What is the time constant of a 0.01-uF capacitor
     in series with a 1-M Ohmsresistance?
7 // Given data
9 \quad C = 0.01*10^-6;
                       // Capacitor=0.01 uFarad
                       // Resistor=1 MOhms
10 R = 1*10^6;
11
12 T = C*R;
13 disp (T, 'The Time Constant in Seconds')
   Example 151
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_4
4 clc; clear;
5 // What is the time constant of a 0.01-uF capacitor
     in series with a 1-M Ohmsresistance?
7 // Given data
                   // Capacitor=0.01 uFarad
9 C = 0.01*10^-6;
                       // Resistor=1 MOhms
10 R = 1*10^6;
11
12 T = C*R;
```

Scilab code Exa 22.5 Scilab code Exa 22.5 Example 152 Example 152

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22\_5
4 clc; clear;
5 // With a dc voltage of 300 V applied, how much is
      the voltage across C in Example 22 4 after 0.01
      s of charging? After 0.05 s? After 2 hours?
      After 2 days?
7 // Given data
9 C = 0.01*10^-6;
                        // Capacitor = 0.01 uFarad
                       // Resistor=1 MOhms
10 R = 1*10^6;
11 V = 300;
                        // Applied DC=300 Volts
12
13 T = C*R;
14 disp (T, 'The Time Constant in Seconds')
16 disp ('Since 0.01 sec is one time constant, the
      voltage across C then is 63% of 300 V,')
17
18 \text{ T1} = 0.63 * V;
19 disp (T1, 'The Capacitor voltage at 0.01 Sec in Volts
      ')
20
21 T2 = V
22 disp (V, 'After 5 time constants or 0.05 Sec
      Capacitor voltage in volts ')
23
```

```
24 disp ('After 2 hours or 2 days the C will be still
      charged to 300 V if the supply is still connected
      ')
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_5
4 clc; clear;
5 // With a dc voltage of 300 V applied, how much is
      the voltage across C in Example 22 4 after 0.01
      s of charging? After 0.05 s? After 2 hours?
      After 2 days?
7 // Given data
9 C = 0.01*10^-6;
                        // Capacitor = 0.01 uFarad
                       // Resistor=1 MOhms
10 R = 1*10^6;
                        // Applied DC=300 Volts
11 V = 300;
12
13 T = C*R;
14 disp (T, 'The Time Constant in Seconds')
15
16 disp ('Since 0.01 sec is one time constant, the
      voltage across C then is 63% of 300 V,')
17
18 \text{ T1} = 0.63 * V;
19 disp (T1, 'The Capacitor voltage at 0.01 Sec in Volts
      ')
20
21 T2 = V
22 disp (V, 'After 5 time constants or 0.05 Sec
      Capacitor voltage in volts ')
23
24 disp ('After 2 hours or 2 days the C will be still
      charged to 300 V if the supply is still connected
      ')
```

Scilab code Exa 22.6 Example 153

```
Scilab code Exa 2216 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_6
4 clc; clear;
5 // If the capacitor is allowed to charge to 300 V
     and then discharged, how much is the capacitor
     voltage 0.01 s after the start of discharge? The
      series resistance is the same on discharge as on
     charge.
6
7 // Given data
9 C = 0.01*10^-6; // Capacitor = 0.01 uFarad
                       // Resistor=1 MOhms
10 R = 1*10^6;
11 V = 300;
                       // Applied DC=300 Volts
12
13 disp ('In one time constant, C discharges to 37% of
     its initial voltage')
14
15 \ V1 = 0.37 * V;
16 disp (V1, 'The Capacitor voltage after 0.01 sec start
      of discharge in volts')
  Example 153
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_6
4 clc; clear;
```

```
_{5} // If the capacitor is allowed to charge to _{300} V
     and then discharged, how much is the capacitor
      voltage 0.01 s after the start of discharge? The
      series resistance is the same on discharge as on
     charge.
7 // Given data
9 C = 0.01*10^-6; // Capacitor = 0.01 uFarad
                       // Resistor=1 MOhms
10 R = 1*10^6;
11 V = 300;
                       // Applied DC=300 Volts
12
13 disp ('In one time constant, C discharges to 37% of
      its initial voltage')
14
15 V1 = 0.37*V;
16 disp (V1, 'The Capacitor voltage after 0.01 sec start
      of discharge in volts')
```

Scilab code Exa 22.7 Example 154

```
Scilab code Exa 2217 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_7
4 clc; clear;
5 // Assume the capacitor is discharging after being charged to 200 V. How much will the voltage across C be 0.01 s after the beginning of discharge? The series resistance is the same on discharge as on charge.
6 // Given data
```

```
8
9 C = 0.01*10^-6; // Capacitor = 0.01 uFarad
10 R = 1*10^6;
                       // Resistor=1 MOhms
11 \quad V = 200;
                        // Capacitor voltage=200 Volts
12
13 disp ('In one time constant, C discharges to 37% of
      its initial voltage')
14
15 \text{ V1} = 0.37 * \text{V};
16 disp (V1, 'The Capacitor voltage after 0.01 sec start
       of discharge in volts')
   Example 154
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_{-}7
4 clc; clear;
5 // Assume the capacitor is discharging after being
      charged to 200 V. How much will the voltage
      across C be 0.01 s after the beginning of
      discharge? The series resistance is the same on
      discharge as on charge.
7 // Given data
9 C = 0.01*10^-6; // Capacitor = 0.01 uFarad
                       // Resistor=1 MOhms
10 R = 1*10^6;
11 V = 200;
                       // Capacitor voltage=200 Volts
12
13 disp ('In one time constant, C discharges to 37% of
      its initial voltage')
14
15 V1 = 0.37*V;
16 disp (V1, 'The Capacitor voltage after 0.01 sec start
       of discharge in volts')
```

Scilab code Exa 22.8 Example 155

```
Scilab code Exa 22.18 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_8
4 clc; clear;
5 // If a 1-M Ohms resistance is added in series with
     the capacitor 0.01-uF and resistor 1-M Ohms in,
     how much will the time constant be?
7 // Given data
                 // Capacitor=0.01 uFarad
9 C = 0.01*10^-6;
                     // Resistor= 2 MOhms
10 R = 2*10^6;
11
12 T = C*R;
13 disp (T, 'The Time Constant in Seconds')
  Example 155
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_8
4 clc; clear;
5 // If a 1-M Ohms resistance is added in series with
     the capacitor 0.01-uF and resistor 1-M Ohms in,
     how much will the time constant be?
7 // Given data
10 R = 2*10^6;
```

```
11
12 T = C*R;
13 disp (T, 'The Time Constant in Seconds')
```

Scilab code Exa 22.9 Example 156

```
Scilab code Exa 22.9 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_9
4 clc; clear;
5 // An RC circuit has a time constant of 3 s. The
     capacitor is charged to 40 V. Then C is
      discharged. After 6 s of discharge, how much is
     Vr?
6
7 // Given data
9 RC = 3;
              // RC time constant=3 Sec
               // Discharge time=6 Sec
10 t = 6;
11 \ Vc = 40;
               // Capacitor voltage=40 Volts
12
13 A = t/RC; // constant factor
14 B = log10(Vc);
15
16 Vr = 10^{(B-(A*0.434))};
17 disp (Vr, 'The Value of Vr in Volts')
  Example 156
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_9
4 clc; clear;
```

```
5 // An RC circuit has a time constant of 3 s. The
     capacitor is charged to 40 V. Then C is
      discharged. After 6 s of discharge, how much is
     Vr?
7 // Given data
               // RC time constant=3 Sec
9 RC = 3;
               // Discharge time=6 Sec
10 t = 6;
11 \ Vc = 40;
              // Capacitor voltage=40 Volts
12
13 A = t/RC; // constant factor
14 B = log10(Vc);
15
16 Vr = 10^{(B-(A*0.434))};
17 disp (Vr, 'The Value of Vr in Volts')
```

Scilab code Exa 22.10 Scilab code Exa 22.10 Example 157 Example 157

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_10
4 clc; clear;
5 // An RC circuit has an R of 10 k Ohms and a C of
     0.05 uF. The applied voltage for charging is 36 V
      . (a) Calculate the time constant. (b) How long
      will it take C to charge to 24 V?
7 C = 0.05*10^-6;
                       // Capacitor = 0.05 uFarad
                       // Resistor=10 kOhms
8 R = 10*10^3;
9 V = 36;
                       // Applied voltage=36 Volts
10 v = 12;
                       // Voltage drops from 36 to 12
     Volts
```

```
// Specific factor
11 A = 2.3;
12
13 T = C*R;
14 disp (T, 'The Time Constant in Seconds')
15 disp ('i.e 0.5*10^{-3} Sec OR 0.5 mSec')
16
17 t = A*T*log10(V/v);
18 disp (t, 'Time required to charge Capacitor upto 24
      Volts in Seconds')
19 disp ('i.e appox 0.549*10^{-3} Sec OR 0.549 mSec')
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_10
4 clc; clear;
5 // An RC circuit has an R of 10 k Ohms and a C of
      0.05 uF. The applied voltage for charging is 36 V
      . (a) Calculate the time constant. (b) How long
      will it take C to charge to 24 V?
7 C = 0.05*10^-6;
                        // Capacitor = 0.05 uFarad
                        // Resistor=10 kOhms
8 R = 10*10^3;
                        // Applied voltage=36 Volts
9 V = 36;
10 v = 12;
                        // Voltage drops from 36 to 12
      Volts
11 A = 2.3;
                        // Specific factor
12
13 T = C*R;
14 disp (T, 'The Time Constant in Seconds')
15 disp ('i.e 0.5*10^{-3} Sec OR 0.5 mSec')
16
17 t = A*T*log10(V/v);
18 disp (t, 'Time required to charge Capacitor upto 24
      Volts in Seconds')
19 disp ('i.e appox 0.549*10^{-3} Sec OR 0.549 mSec')
```

Chapter 23 Alternating Current Circuits

Chapter 23 Alternating Current Circuits

Scilab code Exa 23.1 Example 158

```
Scilab code Exa 23.1 // Grob's Basic Electronics 11e
2 // Chapter No. 23
3 // Example No. 23_1
4 clc; clear;
5 // A 27-Ohms R is in series with 54 Ohms of Xl and
     27 Ohms of Xc. The applied voltage Vt is 50 mV.
     Calculate ZT, I, and Theta z.
7 // Given data
                  // Resistance=27 Ohms
9 R = 27;
10 \text{ X1} = 54;
                   // Inductive reactance=54 Ohms
11 Vt = 50*10^-3; // Applied voltage=100 Volts
                   // Capacitive reactance=27 Ohms
12 \text{ Xc} = 27;
13
14 nXl = Xl-Xc; // Net Inductive reactance
```

```
15 R1 = R*R;
16 \text{ nXl1} = \text{nXl*nXl};
17
18 Zt = sqrt(R1+nXl1);
19 disp (Zt, 'Total Impedence Zt in Ohms')
20
21 I = (Vt/Zt);
22 disp (I, 'Current I in Ampers')
23 disp ('i.e 1.31 mAmps')
24
25 \text{ Oz} = \text{atand}(Xc/R);
26 disp (Oz, 'Theta z in Degree')
   Example 158
1 // Grob's Basic Electronics 11e
2 // Chapter No. 23
3 // Example No. 23_1
4 clc; clear;
5 // A 27-Ohms R is in series with 54 Ohms of Xl and
      27 Ohms of Xc. The applied voltage Vt is 50 mV.
      Calculate ZT, I, and Theta z.
  // Given data
9 R = 27;
                     // Resistance=27 Ohms
                     // Inductive reactance=54 Ohms
10 X1 = 54;
                     // Applied voltage=100 Volts
11 Vt = 50*10^-3;
12 \text{ Xc} = 27;
                     // Capacitive reactance=27 Ohms
13
14 \text{ nXl} = Xl-Xc;
                     // Net Inductive reactance
15 R1 = R*R;
16 \text{ nXl1} = \text{nXl*nXl};
17
18 Zt = sqrt(R1+nX11);
19 disp (Zt, 'Total Impedence Zt in Ohms')
20
21 I = (Vt/Zt);
```

```
22 disp (I, 'Current I in Ampers')
23 disp ('i.e 1.31 mAmps')
24
25 Oz = atand(Xc/R);
26 disp (Oz, 'Theta z in Degree')
```

Scilab code Exa 23.2 Example 159

```
Scilab code Exa 2312 // Grob's Basic Electronics 11e
2 // Chapter No. 23
3 // Example No. 23_2
4 clc; clear;
5 // The following branch currents are supplied from a
       50-mV \text{ source}: Ir = 1.8 mA; Il = 2.8 mA; Ic = 1 mA.
      Calculate It, Zeq, and Theta I.
7 // Given data
9 \text{ Va} = 50*10^{-3};
                           // Applied voltage=50m Volts
                           // Ir = 1.8 mAmps
10 Ir = 1.8*10^-3;
                           // Ir = 2.8 mAmps
11 I1 = 2.8*10^{-3};
                           // Ic=1 mAmps
12 \text{ Ic} = 1*10^-3;
13
14 \text{ nI} = Il-Ic;
                           // net current
15 \text{ Ir1} = \text{Ir*Ir};
16 \text{ nI1} = \text{nI*nI};
17
18 It = sqrt(Ir1+nI1);
19 disp (It, 'The Total Current It in Amps')
20 disp ('i.e 2.55 mAmps')
21
22 \text{ Zeq} = Va/It;
```

```
23 disp (Zeq, 'The Equivalent Impedence Zeq in Ohms')
24 disp ('Appox 19.61 Ohms')
25
26 \text{ Oz} = \operatorname{atand}(-(nI/Ir));
27 disp (Oz, 'Theta z in Degree');
   Example 159
1 // Grob's Basic Electronics 11e
2 // Chapter No. 23
3 // Example No. 23_2
4 clc; clear;
5 // The following branch currents are supplied from a
       50-mV source: Ir = 1.8 \text{ mA}; Il = 2.8 \text{ mA}; Ic = 1 \text{ mA}.
      Calculate It, Zeq, and Theta I.
6
7 // Given data
                           // Applied voltage=50m Volts
9 \text{ Va} = 50*10^{-3};
                           // Ir = 1.8 mAmps
10 Ir = 1.8*10^-3;
11 Il = 2.8*10^{-3};
                           // Ir = 2.8 mAmps
12 Ic = 1*10^-3;
                           // Ic=1 mAmps
13
14 \text{ nI} = Il-Ic;
                           // net current
15 Ir1 = Ir*Ir;
16 \text{ nI1} = \text{nI*nI};
17
18 It = sqrt(Ir1+nI1);
19 disp (It, 'The Total Current It in Amps')
20 disp ('i.e 2.55 mAmps')
21
22 \text{ Zeq} = Va/It;
23 disp (Zeq, 'The Equivalent Impedence Zeq in Ohms')
24 disp ('Appox 19.61 Ohms')
25
26 \text{ Oz} = \operatorname{atand}(-(nI/Ir));
27 disp (Oz, 'Theta z in Degree');
```

Chapter 26 Chapter 25 Resonance

Chapter 25 Resonance

Scilab code Exa 25.1 Example 160

```
Scilab code Exa 25.11 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_1
4 clc; clear;
5 // Calculate the resonant frequency for an 8-H
     inductance and a 20-uF capacitance.
7 // Given data
                     // L=8 Henry
9 L = 8;
                       // C=20 uFarad
10 C = 20*10^-6;
11
12 fr = 1/(2*\%pi*sqrt(L*C));
13 disp (fr, 'The resonant frequency in Hertz')
14 disp ('Appox 12.6 Hertz')
  Example 160
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_1
4 clc; clear;
5 // Calculate the resonant frequency for an 8-H
     inductance and a 20-uF capacitance.
6
7 // Given data
9 L = 8;
                       // L=8 Henry
10 C = 20*10^-6;
                       // C=20 uFarad
11
12 fr = 1/(2*%pi*sqrt(L*C));
13 disp (fr, 'The resonant frequency in Hertz')
14 disp ('Appox 12.6 Hertz')
```

Scilab code Exa 25.2 Example 161

```
Scilab code Exa 2512 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_2
4 clc; clear;
5 // Calculate the resonant frequency for a 2-uH
    inductance and a 3-pF capacitance.
6
7 // Given data
8
9 L = 2*10^-6; // Inductor=2 uHenry
10 C = 3*10^-12; // Capacitor=3 pFarad
11 pi = 3.14;
12
13 fr = 1/(2*pi*sqrt(L*C));
```

```
14 disp (fr, 'The resonant frequency in Hertz')
15 disp ('i.e 65 MHz')
   Example 161
1 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_2
4 clc; clear;
5 // Calculate the resonant frequency for a 2-uH
     inductance and a 3-pF capacitance.
7 // Given data
9 L = 2*10^-6;
                      // Inductor=2 uHenry
                      // Capacitor=3 pFarad
10 C = 3*10^-12;
11 \text{ pi} = 3.14;
12
13 fr = 1/(2*pi*sqrt(L*C));
14 disp (fr, 'The resonant frequency in Hertz')
15 disp ('i.e 65 MHz')
```

Scilab code Exa 25.3 Example 162

```
Scilab code Exa 25.3 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_3
4 clc; clear;
5 // What value of C resonates with a 239-uH L at 1000 kHz?
6
7 // Given data
```

```
9 L = 239*10^-6; // Inductor=239 uHenry
10 fr = 1000*10^3; // Resonant frequency=1000
      kHertz
11
12 A = %pi*%pi; // pi square

13 R = fr*fr; // Resonant frequency square
15 C = 1/(4*A*B*L);
16 disp (C, 'The value of Capacitor in Farads')
17 disp ('i.e 106 pF')
   Example 162
 1 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_{-3}
4 clc; clear;
 5 // What value of C resonates with a 239-uH L at 1000
       kHz?
 6
 7 // Given data
9 L = 239*10^-6; // Inductor=239 uHenry
10 fr = 1000*10^3; // Resonant frequency=1000
      kHertz
11
14
15 C = 1/(4*A*B*L);
16 disp (C, 'The value of Capacitor in Farads')
17 disp ('i.e 106 pF')
```

```
Scilab code Exa 254 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25\_4
4 clc; clear;
5 // What value of L resonates with a 106-pF C at 1000
      kHz, equal to 1 MHz?
6
7 // Given data
                     // Capacitor=106 pFarad
9 C = 106*10^-12;
10 \text{ fr} = 1*10^6;
                        // Resonant frequency=1 MHertz
11
12 A = \%pi*\%pi;
                         // pi square
                        // Resonant frequency square
13 B = fr*fr;
14
15 C = 1/(4*A*B*C);
16 disp (C, 'The value of Inductor in Henry')
17 disp ('i.e 239 uF')
   Example 163
1 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_4
4 clc; clear;
5 // What value of L resonates with a 106-pF C at 1000
      kHz, equal to 1 MHz?
7 // Given data
9 C = 106*10^-12;
                        // Capacitor=106 pFarad
                        // Resonant frequency=1 MHertz
10 \text{ fr} = 1*10^6;
11
12 A = \%pi*\%pi;
                          // pi square
13 B = fr*fr;
                        // Resonant frequency square
14
15 C = 1/(4*A*B*C);
16 disp (C, 'The value of Inductor in Henry')
```

Scilab code Exa 25.5 Example 164

```
Scilab code Exa 25.15 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_5
4 clc; clear;
5 // A series circuit resonant at 0.4 MHz develops 100
      mV across a 250-uH L with a 2-mV input.
      Calculate Q.
6
7 // Given data
9 Vo = 100*10^-3; // Output voltage=100 \text{ mVolts}
                        // Input voltage=2 mVolts
10 Vi = 2*10^-3;
10 VI - 2 = 1

11 L = 250*10^{-6};
                        // Inductor=250 uHenry
                       // Frequency=0.4 MHertz
12 f = 0.4*10^6;
13
14 Q = Vo/Vi;
15 disp (Q, 'The Magnification factor Q is')
   Example 164
1 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_{-}5
4 clc; clear;
5 // A series circuit resonant at 0.4 MHz develops 100
      mV across a 250-uH L with a 2-mV input.
      Calculate Q.
7 // Given data
```

Scilab code Exa 25.6 Example 165

```
Scilab code Exa 2516 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_{-6}
4 clc; clear;
5 // What is the ac resistance of the coil in A series
       circuit resonant at 0.4 MHz develops 100 mV
      across a 250-uH L with a 2-mV input.
7 // Given data
9 Vo = 100*10^-3; // Output voltage=100 \text{ mVolts}
10 Vi = 2*10^-3;
                        // Input voltage=2 mVolts
11 L = 250*10^-6;
                      // Inductor=250 uHenry
                       // Frequency=0.4 MHertz
12 f = 0.4*10^6;
13 \text{ pi} = 3.14;
14
15 Q = Vo/Vi;
16 X1 = 2*pi*f*L;
17
18 \text{ rs} = X1/Q;
19 disp (rs, 'The Ac Resistance of Coil in Ohms')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_6
4 clc; clear;
5 // What is the ac resistance of the coil in A series
       circuit resonant at 0.4 MHz develops 100 mV
      across a 250-uH L with a 2-mV input.
7 // Given data
9 \text{ Vo} = 100*10^{-3};
                        // Output voltage=100 mVolts
                        // Input voltage=2 mVolts
10 Vi = 2*10^-3;
                        // Inductor=250 uHenry
11 L = 250*10^-6;
12 	 f = 0.4*10^6;
                        // Frequency=0.4 MHertz
13 \text{ pi} = 3.14;
14
15 Q = Vo/Vi;
16 X1 = 2*pi*f*L;
17
18 rs = X1/Q;
19 disp (rs, 'The Ac Resistance of Coil in Ohms')
```

Scilab code Exa 25.7 Example 166

```
Scilab code Exa 2517 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_7
4 clc; clear;
5 // In Fig. 25 9 , assume that with a 4-mVac input signal for VT, the voltage across R1 is 2 mV when
```

```
R1 is 225-kOhms. Determine Zeq and Q.
  // Given data
8
9 \text{ vin} = 4*10^-3;
                         // Input AC signal=4 mVac
10 R1 = 225*10^3;
                         // Resistance1=225 kOhms
                         // Voltage across Resistor1=2
11 \text{ vR1} = 2*10^-3;
      mVac
12 \times 1 = 1.5*10^3;
                         // Inductive Reactance=1.5 kOhms
13
14 disp ('Because they divide Vt equally')
15
16 \text{ Zeq} = R1;
17 disp (Zeq, 'The Equivalent Impedence in Ohms')
18 disp ('i.e 225 kOhms')
19
20 \ Q = Zeq/xl;
21 disp (Q, 'The Q is')
   Example 166
1 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_{-}7
4 clc; clear;
5 // In Fig. 25 9 , assume that with a 4-mVac input
      signal for VT, the voltage across R1 is 2 mV when
       R1 is 225-kOhms. Determine Zeq and Q.
7 // Given data
                         // Input AC signal=4 mVac
9 \text{ vin} = 4*10^-3;
10 R1 = 225*10^3;
                         // Resistance1=225 kOhms
11 \text{ vR1} = 2*10^-3;
                         // Voltage across Resistor1=2
      mVac
12 \times 1 = 1.5 \times 10^3;
                         // Inductive Reactance=1.5 kOhms
13
14 disp ('Because they divide Vt equally')
```

```
15
16 Zeq = R1;
17 disp (Zeq, 'The Equivalent Impedence in Ohms')
18 disp ('i.e 225 kOhms')
19
20 Q = Zeq/x1;
21 disp (Q, 'The Q is')
```

Scilab code Exa 25.8 Example 167

```
Scilab code Exa 25.18 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_8
4 clc; clear;
5 // A parallel LC circuit tuned to 200 kHz with a
     350-uH L has a measured ZEQ of 17,600. Calculate
     Q.
  // Given data
                        // Inductor=350 uHenry
9 L = 350*10^-6;
                        // Frequency=200 kHertz
10 f = 200*10^3;
                      // Equivalent Impedence=17600
11 \text{ Zeq} = 17600;
     Ohms
12
13 X1 = 2*\%pi*f*L;
14
15 Q = Zeq/X1;
16 disp (Q, 'The Magnification factor Q is')
   Example 167
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_8
4 clc; clear;
5 // A parallel LC circuit tuned to 200 kHz with a
     350-uH L has a measured ZEQ of 17,600. Calculate
     Q.
  // Given data
9 L = 350*10^-6;
                        // Inductor=350 uHenry
                       // Frequency=200 kHertz
10 f = 200*10^3;
11 \text{ Zeq} = 17600;
                       // Equivalent Impedence=17600
     Ohms
12
13 X1 = 2*\%pi*f*L;
14
15 Q = Zeq/X1;
16 disp (Q, 'The Magnification factor Q is')
```

Scilab code Exa 25.9 Example 168

```
Scilab code Exa 2519 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_9
4 clc; clear;
5 // An LC circuit resonant at 2000 kHz has a Q of 100. Find the total bandwidth delta f and the edge frequencies f1 and f2.
6
7 // Given data
```

```
9 \text{ fr} = 2000*10^3;
                           // Resonant frequency = 2000
     kHertz
                            // Magnification factor = 100
10 Q = 100;
11
12 Bw = fr/Q;
13 disp (Bw, 'The Bandwidth BW or Delta f in Hertz')
14 disp ('i.e 20 kHz')
15
16 f1 = fr-Bw/2;
17 disp (f1, 'The Edge Frequency f1 in Hertz')
18 disp ('i.e 1990 kHz')
19
20 	 f2 = fr+Bw/2;
21 disp (f2, 'The Edge Frequency f2 in Hertz')
22 disp ('i.e 2010 kHz')
   Example 168
1 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_9
4 clc; clear;
5 // An LC circuit resonant at 2000 kHz has a Q of
      100. Find the total bandwidth delta f and the
      edge frequencies f1 and f2.
7 // Given data
9 	 fr = 2000*10^3;
                           // Resonant frequency=2000
     kHertz
                            // Magnification factor=100
10 Q = 100;
11
12 Bw = fr/Q;
13 disp (Bw, 'The Bandwidth BW or Delta f in Hertz')
14 disp ('i.e 20 kHz')
15
16 f1 = fr-Bw/2;
17 disp (f1, 'The Edge Frequency f1 in Hertz')
```

```
18 disp ('i.e 1990 kHz')
19
20 f2 = fr+Bw/2;
21 disp (f2, 'The Edge Frequency f2 in Hertz')
22 disp ('i.e 2010 kHz')
```

Scilab code Exa 25.10 Example 169

```
Scilab code Exa 25.10 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_10
4 clc; clear;
5 // An LC circuit resonant at 6000 kHz has a Q of
      100. Find the total bandwidth delta f and the
      edge frequencies f1 and f2.
7 // Given data
                   // Resonant frequency=6000
9 \text{ fr} = 6000*10^3;
     kHertz
10 Q = 100;
                            // Magnification factor = 100
11
12 Bw = fr/Q;
13 disp (Bw, 'The Bandwidth BW or Delta f in Hertz')
14 disp ('i.e 60 kHz')
15
16 f1 = fr-Bw/2;
17 disp (f1, 'The Edge Frequency f1 in Hertz')
18 disp ('i.e 5970 kHz')
19
20 	 f2 = fr + Bw/2;
21 disp (f2, 'The Edge Frequency f2 in Hertz')
22 disp ('i.e 6030 kHz')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 25
3 // Example No. 25_10
4 clc; clear;
5 // An LC circuit resonant at 6000 kHz has a Q of
      100. Find the total bandwidth delta f and the
      edge frequencies f1 and f2.
7 // Given data
9 \text{ fr} = 6000*10^3;
                           // Resonant frequency = 6000
     kHertz
10 Q = 100;
                            // Magnification factor = 100
11
12 Bw = fr/Q;
13 disp (Bw, 'The Bandwidth BW or Delta f in Hertz')
14 disp ('i.e 60 kHz')
15
16 f1 = fr-Bw/2;
17 disp (f1, 'The Edge Frequency f1 in Hertz')
18 disp ('i.e 5970 kHz')
19
20 f2 = fr+Bw/2;
21 disp (f2, 'The Edge Frequency f2 in Hertz')
22 disp ('i.e 6030 kHz')
```

Chapter 27
Chapter 26 Filters

Chapter 28

Chapter 26 Filters

Scilab code Exa 26.1 Example 170

```
Scilab code Exa 26.11 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_1
4 clc; clear;
5 // Calculate (a)the cutoff frequency fc; (b)Vout at fc; (c)Theta at fc (Assume Vin = 10 Vpp for all frequencies)
6
7 // Given data
8
9 R = 10*10^3; // Resistor=10 kOhms
10 C = 0.01*10^-6; // Capacitor=0.01 uFarad
11 Vin = 10; // Input Voltage=10Vpp
12 pi = 3.14
13
14 // To calculate fc
15
16 fc = 1/(2*pi*R*C);
```

```
17 disp (fc, 'The Cutoff Frequency in Hertz')
18 disp ('i.e 1.592 kHz')
19
20 // To calculate Vout at fc
21
22 \text{ Xc} = 1/(2*pi*fc*C);
23
24 Zt = sqrt((R*R)+(Xc*Xc));
25
26 \text{ Vout} = \text{Vin}*(Xc/Zt);
27 disp (Vout, 'The Output Voltage in Vpp');
28
29 // To calculate Theta
30
31 Theta = atand(-(R/Xc));
32 disp (Theta, 'The Phase angle (Theta z) in Degree');
   Example 170
1 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_1
4 clc; clear;
5 // Calculate (a) the cutoff frequency fc; (b) Vout at
      fc; (c) Theta at fc (Assume Vin = 10 Vpp for all
      frequencies)
6
  // Given data
                         // Resistor=10 kOhms
9 R = 10*10^3;
                         // Capacitor = 0.01 uFarad
10 C = 0.01*10^-6;
                         // Input Voltage=10Vpp
11 \text{ Vin} = 10;
12 \text{ pi} = 3.14
13
14 // To calculate fc
15
16 fc = 1/(2*pi*R*C);
17 disp (fc, 'The Cutoff Frequency in Hertz')
```

```
disp ('i.e 1.592 kHz')

// To calculate Vout at fc

Xc = 1/(2*pi*fc*C);

Zt = sqrt((R*R)+(Xc*Xc));

Vout = Vin*(Xc/Zt);

disp (Vout, 'The Output Voltage in Vpp');

// To calculate Theta

Theta = atand(-(R/Xc));

disp (Theta, 'The Phase angle (Theta z) in Degree');
```

Scilab code Exa 26.2 Example 171

```
Scilab code Exa 2612 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_{-2}
4 clc; clear;
5 // Calculate (a) the cutoff frequency fc; (b) Vout at
      1 kHz; (c) Theta at 1 kHz (Assume Vin = 10 Vpp for
       all frequencies)
6
  // Given data
                        // Resistor=1 kOhms
9 R = 1*10^3;
                        // Inductor=50 mHenry
10 L = 50*10^{-3}
                        // Input Voltage=10Vpp
11 \text{ Vin} = 10;
12 f = 1*10^3;
                        // Frequency=1 kHz
```

```
13 // To calculate fc
14
15 fc = R/(2*\%pi*L);
16 disp (fc, 'The Cutoff Frequency in Hertz')
17 disp ('i.e 3.183 kHz')
18
19 // To calculate Vout at fc
20
21 X1 = 2*\%pi*f*L;
22
23 Zt = sqrt((R*R)+(X1*X1));
24
25 \text{ Vout = Vin*(R/Zt)};
26 disp (Vout, 'The Output Voltage in Vpp');
27 disp ('Appox 9.52 Volts(p-p)')
28
29 // To calculate Theta
30
31 Theta = atand(-(X1/R));
32 disp (Theta, 'The Phase angle (Theta z) in Degree');
   Example 171
1 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_{-2}
4 clc; clear;
5 // Calculate (a) the cutoff frequency fc; (b) Vout at
      1 kHz; (c) Theta at 1 kHz (Assume Vin = 10 Vpp for
       all frequencies)
  // Given data
                         // Resistor=1 kOhms
9 R = 1*10^3;
10 L = 50*10^{-3}
                         // Inductor=50 mHenry
                         // Input Voltage=10Vpp
11 \text{ Vin} = 10;
12 f = 1*10^3;
                         // Frequency=1 kHz
13 // To calculate fc
```

```
14
15 fc = R/(2*\%pi*L);
16 disp (fc, 'The Cutoff Frequency in Hertz')
17 disp ('i.e 3.183 kHz')
18
19 // To calculate Vout at fc
20
21 X1 = 2*\%pi*f*L;
22
23 Zt = sqrt((R*R)+(X1*X1));
24
25 Vout = Vin*(R/Zt);
26 disp (Vout, 'The Output Voltage in Vpp');
27 disp ('Appox 9.52 Volts(p-p)')
28
29 // To calculate Theta
30
31 Theta = atand(-(X1/R));
32 disp (Theta, 'The Phase angle (Theta z) in Degree');
```

Scilab code Exa 26.3 Example 172

```
Scilab code Exa 263 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_3
4 clc; clear;
5 // Calculate the cutoff frequency for (a) the RC high-pass filter; (b) the RL high-pass filter
6
7 // Given data
8
9 R = 1.5*10^3; // Resistor=1.5 kOhms
```

```
10 L = 100*10^-3
                        // Inductor=100 mHenry
11 C = 0.01*10^-6;
                        // Capacitor=0.01 uFarad
12
13 // To calculate fc for RC high-pass filter
14
15 fc = 1/(2*\%pi*R*C);
16 disp (fc, 'The Cutoff Frequency for RC High-Pass
      Filter in Hertz')
  disp ('i.e 10.61 kHz')
17
18
  // To calculate fc for RL high-pass filter
20
21 \text{ fc1} = R/(2*\%pi*L);
22 disp (fc1, 'The Cutoff Frequency for RL High-Pass
      Filter in Hertz')
23 disp ('Appox 2.39 kHz')
   Example 172
1 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_3
4 clc; clear;
5 // Calculate the cutoff frequency for (a) the RC
     high-pass filter; (b) the RL high-pass filter
  // Given data
9 R = 1.5*10^3;
                        // Resistor = 1.5 kOhms
                        // Inductor=100 mHenry
10 L = 100*10^{-3}
11 C = 0.01*10^-6;
                        // Capacitor=0.01 uFarad
12
13 // To calculate fc for RC high-pass filter
14
15 fc = 1/(2*\%pi*R*C);
16 disp (fc, 'The Cutoff Frequency for RC High-Pass
      Filter in Hertz')
17 disp ('i.e 10.61 kHz')
```

```
18
19 // To calculate fc for RL high-pass filter
20
21 fc1 = R/(2*%pi*L);
22 disp (fc1, 'The Cutoff Frequency for RL High-Pass Filter in Hertz')
23 disp ('Appox 2.39 kHz')
```

Scilab code Exa 26.4 Example 173

```
Scilab code Exa 26.4 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_4
4 clc; clear;
5 // Calculate the cutoff frequencies fc1 and fc2.
7 // Given data
9 R1 = 1*10^3;
                        // Resistor 1=1 kOhms
                        // Capacitor 1=1 uFarad
10 \text{ C1} = 1*10^-6;
                        // Resistor 2=100 kOhms
11 R2 = 100*10^3;
                        // Capacitor 2=0.001 uFarad
12 C2 = 0.001*10^-6;
13
14 // To calculate fc1 for RC high-pass filter
15
16 \text{ fc1} = 1/(2*\%pi*R1*C1);
17 disp (fc1, 'The Cutoff Frequency for RC High-Pass
      filter in Hertz');
18 disp ('i.e 159 Hz')
19
  // To calculate fc2 for RC high-pass filter
20
21
```

```
22 \text{ fc2} = 1/(2*\%pi*R2*C2);
23 disp (fc2, 'The Cutoff Frequency for RC High-Pass
      filter in Hertz');
24 disp ('i.e 1.59 kHz')
   Example 173
1 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_4
4 clc; clear;
5 // Calculate the cutoff frequencies fc1 and fc2.
7 // Given data
                        // Resistor 1=1 kOhms
9 R1 = 1*10^3;
                        // Capacitor 1=1 uFarad
10 C1 = 1*10^-6;
11 R2 = 100*10^3;
                        // Resistor 2=100 kOhms
                        // Capacitor 2=0.001 uFarad
12 C2 = 0.001*10^-6;
13
14 // To calculate fc1 for RC high-pass filter
15
16 \text{ fc1} = 1/(2*\%pi*R1*C1);
17 disp (fc1, 'The Cutoff Frequency for RC High-Pass
      filter in Hertz');
18 disp ('i.e 159 Hz')
19
20 // To calculate fc2 for RC high-pass filter
21
22 \text{ fc2} = 1/(2*\%pi*R2*C2);
23 disp (fc2, 'The Cutoff Frequency for RC High-Pass
      filter in Hertz');
24 disp ('i.e 1.59 kHz')
```

Scilab code Exa 26.5 Example 174

```
Scilab code Exa 26.5 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_5
4 clc; clear;
5 // Calculate the notch frequency fn if R1 is 1 kOhms
       and C1 is 0.01 uF. Also, calculate the required
      values for 2R1 and 2C1 in the low-pass filter.
7 // Given data
8
                        // Resistor 1=1 kOhms
9 R1 = 1*10^3;
10 \text{ C1} = 0.01*10^-6;
                        // Capacitor 1=0.01 uFarad
11 pi = 3.14;
12
13 // To calculate Notch frequency fn for RC low-pass
      filter
14
15 fn = 1/(4*pi*R1*C1);
16 disp (fn, 'The Notch Frequency for RC Low-Pass filter
       in Hertz');
17 disp ('i.e 7.96 kHz')
18
19 A = 2*R1;
20 disp (A, 'The Required Value of 2R1 in Ohms')
21 disp ('i.e 2 kOhms')
22
23 B = 2*C1;
24 disp (B, 'The Required Value of 2C1 in Ohms')
25 disp ('0.02 uF')
   Example 174
1 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_5
```

```
4 clc; clear;
5 // Calculate the notch frequency fn if R1 is 1 kOhms
      and C1 is 0.01 uF. Also, calculate the required
      values for 2R1 and 2C1 in the low-pass filter.
7 // Given data
8
                        // Resistor 1=1 kOhms
9 R1 = 1*10^3;
                        // Capacitor 1=0.01 uFarad
10 \text{ C1} = 0.01*10^-6;
11 \text{ pi} = 3.14;
12
13 // To calculate Notch frequency fn for RC low-pass
      filter
14
15 fn = 1/(4*pi*R1*C1);
16 disp (fn, 'The Notch Frequency for RC Low-Pass filter
       in Hertz');
17 disp ('i.e 7.96 kHz')
18
19 A = 2*R1;
20 disp (A, 'The Required Value of 2R1 in Ohms')
21 disp ('i.e 2 kOhms')
22
23 B = 2*C1;
24 disp (B, 'The Required Value of 2C1 in Ohms')
25 disp ('0.02 uF')
```

Scilab code Exa 26.6 Example 175

```
Scilab code Exa 26.6 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_6
```

```
4 clc; clear;
5 // A certain amplifier has an input power of 1 W and
      an output power of 100 W. Calculate the dB power
     gain of the amplifier.
7 // Given data
9 Pi = 1; // Input power=1 Watts
10 Po = 100; // Output power=100 Watts
11
12 N = 10*log10(Po/Pi);
13 disp (N, 'The Power Gain of Amplifier in dB')
  Example 175
1 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_6
4 clc; clear;
5 // A certain amplifier has an input power of 1 W and
      an output power of 100 W. Calculate the dB power
     gain of the amplifier.
7 // Given data
              // Input power=1 Watts
9 \text{ Pi} = 1;
              // Output power=100 Watts
10 \text{ Po} = 100;
12 N = 10*log10(Po/Pi);
13 disp (N, 'The Power Gain of Amplifier in dB')
```

Scilab code Exa 26.7 Example 176

```
Scilab code Exa 2617 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_7
4 clc; clear;
5 // The input power to a filter is 100 mW, and the
     output power is 5 mW. Calculate the attenuation,
     in decibels, offered by the filter.
7 // Given data
9 Pi = 100*10^-3;  // Input power=1 Watts
10 Po = 5*10^-3;  // Output power=100 Watts
                     // Output power=100 Watts
11
12 N = 10*log10(Po/Pi);
13 disp (N, 'The Attenuation offered by the Filter in dB
      ')
  Example 176
1 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_7
4 clc; clear;
5 // The input power to a filter is 100 mW, and the
     output power is 5 mW. Calculate the attenuation,
     in decibels, offered by the filter.
  // Given data
11
12 N = 10*log10(Po/Pi);
13 disp (N, 'The Attenuation offered by the Filter in dB
      ')
```

Scilab code Exa 26.8 Example 177

```
Scilab code Exa 26.18 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_8
4 clc; clear;
5 // Calculate the attenuation, in decibels, at the
      following frequencies: (a) 0 Hz; (b) 1.592 kHz; (
      c) 15.92 kHz. (Assume that Vin is 10 V p-p at all
       frequencies.)
6
7 // Given data
9 	 f1 = 0;
                              // Frequency 1=0 Hz
10 	 f2 = 1.592*10^3;
                              // Frequency 2=1.592 kHz (
      cutoff frequency)
11 	ext{ f3} = 15.92*10^3;
                              // Frequency 3=15.92 kHz
12 \text{ Vi} = 10;
                              // Voltage input=10 Volts (p-
      p)
13 R = 10*10^3;
                              // Resistor 1=10 kOhms
14 C = 0.01*10^-6;
                              // Capacitor 1=0.01 uFarad
15 \text{ pi} = 3.14;
16
17 \text{ Vol} = \text{Vi};
18 \text{ Vo2} = 0.707*\text{Vi};
19
20 // At 0 Hz
21
22 \text{ N1} = 20*\log 10 (Vo1/Vi);
23 disp (N1, 'The Attenuation at 0 Hz in dB')
24
25 //At 1.592 kHz (cutoff frequency)
```

```
26
27 \text{ N2} = 20*\log 10 (Vo2/Vi);
28 disp (N2, 'The Attenuation at 1.592 kHz in dB')
29
30 // At 15.92 kHz
31
32 \text{ Xc} = 1/(2*\%pi*f3*C);
33
34 \quad A = R*R;
35 B = Xc*Xc;
36
37 \text{ Zt} = \text{sqrt} (A+B);
38
39 N3 = 20*log10(Xc/Zt);
40 disp (N3, 'The Attenuation at 15.92 kHz in dB')
   Example 177
1 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_8
4 clc; clear;
5 // Calculate the attenuation, in decibels, at the
      following frequencies: (a) 0 Hz; (b) 1.592 kHz; (
      c) 15.92 kHz. (Assume that Vin is 10 V p-p at all
       frequencies.)
6
7 // Given data
9 	 f1 = 0;
                              // Frequency 1=0 Hz
10 	ext{ f2} = 1.592*10^3;
                              // Frequency 2=1.592 kHz (
      cutoff frequency)
11 	ext{ f3} = 15.92*10^3;
                              // Frequency 3=15.92 kHz
12 \text{ Vi} = 10;
                              // Voltage input=10 Volts (p-
      p)
13 R = 10*10^3;
                              // Resistor 1=10 kOhms
14 C = 0.01*10^-6;
                              // Capacitor 1=0.01 uFarad
15 \text{ pi} = 3.14;
```

```
16
17 \text{ Vol} = \text{Vi};
18 \text{ Vo2} = 0.707*\text{Vi};
19
20 // At 0 Hz
21
22 \text{ N1} = 20*\log 10 (\text{Vo1/Vi});
23 disp (N1, 'The Attenuation at 0 Hz in dB')
24
25 //At 1.592 kHz (cutoff frequency)
26
27 \text{ N2} = 20*\log 10 (Vo2/Vi);
28 disp (N2, 'The Attenuation at 1.592 kHz in dB')
29
30 // At 15.92 kHz
31
32 \text{ Xc} = 1/(2*\%pi*f3*C);
33
34 \quad A = R*R;
35 B = Xc*Xc;
36
37 \text{ Zt} = \text{sqrt} (A+B);
38
39 \text{ N3} = 20*\log 10(Xc/Zt);
40 disp (N3, 'The Attenuation at 15.92 kHz in dB')
```

Scilab code Exa 26.9 Example 178

```
Scilab code Exa 2619 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_9
4 clc; clear;
```

```
5 // From the graph in Fig. 26 23b, what is the
     attenuation in decibels at (a) 100 Hz; (b) 10 kHz
     ; (c) 50 kHz?
7 disp ('At F = 100 \text{ Hz}, N(dB) = 0 \text{ dB}, as indicated by
     point A on the graph.')
8 disp ('At F = 10 \text{ kHz}, N(dB) = -16 \text{ dB}, as indicated
     by point B on the graph.')
9 disp ('At F = 50 kHz, N(dB) = -30 dB, as indicated
     by point C on the graph.')
  Example 178
1 // Grob's Basic Electronics 11e
2 // Chapter No. 26
3 // Example No. 26_{-9}
4 clc; clear;
5 // From the graph in Fig. 26 23b, what is the
     attenuation in decibels at (a) 100 Hz; (b) 10 kHz
     ; (c) 50 \text{ kHz}?
7 disp ('At F = 100 \text{ Hz}, N(dB) = 0 \text{ dB}, as indicated by
     point A on the graph.')
8 disp ('At F = 10 \text{ kHz}, N(dB) = -16 \text{ dB}, as indicated
     by point B on the graph.')
 disp ('At F = 50 \text{ kHz}, N(dB) = -30 \text{ dB}, as indicated
     by point C on the graph.')
```

Chapter 29

Chapter 27 Diodes and Diode Applications

Chapter 30

Chapter 27 Diodes and Diode Applications

Scilab code Exa 27.1 Example 179

```
Scilab code Exa 27.11 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_{1}
4 clc; clear;
5 // For the diode curve, calculate the dc resistance,
      RF, at points A and B.
7 // Given data
9 \text{ Vf1} = 0.65;
                     // Forward votage 1=0.65 Volts
10 If1 = 11*10^-3
                    // Forward current 1=11 mAmps
                     // Forward votage 2=0.7 Volts
11 \text{ Vf2} = 0.7;
13
14 Rf1 = Vf1/If1;
15 disp (Rf1, 'The Forward Resistance at Point A in Ohms
```

```
')
16 disp ('Appox 59.1 Ohms')
17
18 Rf2 = Vf2/If2;
19 disp (Rf2, 'The Forward Resistance at Point B in Ohms
   Example 179
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_1
4 clc; clear;
5 // For the diode curve, calculate the dc resistance,
      RF, at points A and B.
6
7 // Given data
9 \text{ Vf1} = 0.65;
                         // Forward votage 1=0.65 Volts
                         // Forward current 1=11 mAmps
10 \quad \text{If1} = 11*10^{-3}
                        // Forward votage 2=0.7 Volts
11 \text{ Vf2} = 0.7;
  If 2 = 22.5*10^{-3}
                        // Forward current 2=22.5 mAmps
13
14 Rf1 = Vf1/If1;
15 disp (Rf1, 'The Forward Resistance at Point A in Ohms
16 disp ('Appox 59.1 Ohms')
17
18 Rf2 = Vf2/If2;
19 disp (Rf2, 'The Forward Resistance at Point B in Ohms
      ')
```

Scilab code Exa 27.2 Example 180

```
Scilab code Exa 27.12 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_2
4 clc; clear;
5 // A silicon diode has a forward voltage drop of 1.1
      V for a forward diode current, If, of 1 A.
     Calculate the bulk resistance, Rb.
7 // Given data
9 Vf1 = 1.1; // Forward votage 1=1.1 Volts
              // Forward current 1=1 Amps
11 Vf2 = 0.7; // Fwd. vltg. 2=0.7 Volts (min working
      vltg of diode is 0.7 V)
12 If 2 = 0 // Forward current=0 Amps
13
14 delV = Vf1-Vf2; // diff. between max. min.
     Voltages
15 \text{ delI} = \text{If1-If2};
                   // diff. between max. min.
     Currents
16
17 Rb = delV/delI;
18 disp (Rb, 'The Bulk Resistance in Ohms')
  Example 180
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_2
4 clc; clear;
5 // A silicon diode has a forward voltage drop of 1.1
      V for a forward diode current, If, of 1 A.
     Calculate the bulk resistance, Rb.
7 // Given data
9 Vf1 = 1.1; // Forward votage 1=1.1 Volts
10 If 1 = 1 // Forward current 1=1 Amps
```

```
11 Vf2 = 0.7;  // Fwd. vltg. 2=0.7 Volts (min working
      vltg of diode is 0.7 V)
12 If2 = 0  // Forward current=0 Amps
13
14 delV = Vf1-Vf2;  // diff. between max. min.
      Voltages
15 delI = If1-If2;  // diff. between max. min.
      Currents
16
17 Rb = delV/delI;
18 disp (Rb, 'The Bulk Resistance in Ohms')
```

Scilab code Exa 27.3 Example 181

```
Scilab code Exa 27.13 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_{-3}
4 clc; clear;
5 // Solve for the load voltage and current using the
      first, second, and third diode approximations.
7 // Given data
                    // Load resistance=100 Ohms
9 R1 = 100;
10 Rb = 2.5;
11 Vin = 10;
                   // Resistance=2.5 Ohms
                 // Input voltage=10 Volts
                   // Voltage = 0.7 Volts
12 \text{ Vb} = 0.7;
13
14
15 // Using first approximation
17 \text{ Vll} = \text{Vin}
```

```
18 disp (V11, 'The Load Voltage of First Approximation
      in Volts (dc)')
19
20 \text{ Ill} = \text{Vll/Rl};
21 disp (Il1, 'The Load Current of First Approximation
      in Amps')
22 disp ('i.e 100 mAmps')
23
24 // Using second approximation
25
26 \text{ Vl2} = \text{Vin-Vb}
  disp (V12, 'The Load Voltage of Second Approximation
      in Volts')
28
29 	 I12 = V12/R1;
30 disp (I12, 'The Load Current of Second Approximation
      in Amps')
31 disp ('i.e 93 mAmps')
32
33 // Using third approximation
34
35 I13 = (Vin-Vb)/(R1+Rb);
36 disp (I13, 'The Load Current of Third Approximation
      in Amps')
37 disp ('i.e 90.73 mAmps')
38
39 \text{ V13} = \text{I13*R1};
40 disp (V13, 'The Load Voltage of Third Approximation
      in Volts')
   Example 181
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_3
4 clc; clear;
5 // Solve for the load voltage and current using the
      first, second, and third diode approximations.
```

```
7 // Given data
                     // Load resistance=100 Ohms
9 R1 = 100;
10 \text{ Rb} = 2.5;
                     // Resistance=2.5 Ohms
11 \text{ Vin} = 10;
                     // Input voltage=10 Volts
                     // Voltage=0.7 Volts
12 \text{ Vb} = 0.7;
13
14
15 // Using first approximation
16
17 \text{ Vll} = \text{Vin}
18 disp (V11, 'The Load Voltage of First Approximation
      in Volts (dc)')
19
20 \text{ Ill = Vl1/Rl};
21 disp (Il1, 'The Load Current of First Approximation
      in Amps')
22 disp ('i.e 100 mAmps')
23
24 // Using second approximation
25
26 \text{ Vl2} = \text{Vin-Vb}
27 disp (V12, 'The Load Voltage of Second Approximation
      in Volts')
28
29 	 I12 = V12/R1;
30 disp (I12, 'The Load Current of Second Approximation
      in Amps')
31 disp ('i.e 93 mAmps')
32
33 // Using third approximation
34
35 \text{ Il3} = (Vin-Vb)/(Rl+Rb);
36 disp (I13, 'The Load Current of Third Approximation
      in Amps')
37 disp ('i.e 90.73 mAmps')
38
```

```
39 V13 = I13*R1;
40 disp (V13, 'The Load Voltage of Third Approximation
            in Volts')
```

Scilab code Exa 27.4 Example 182

```
Scilab code Exa 27.4 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_4
4 clc; clear;
5 // If the turns ratio Np:Ns is 3:1, calculate the
      following: Vs, Vdc, Il, Idiode, PIV for D1, and
      fout.
  // Given data
9 \text{ Vp} = 120;
                    // Primary voltage=120 Vac
                    // Turns ratio Np:Ns=3:1
10 A = 3/1;
11 B = 1/3;
                    // Turns ratio Ns:Np=1:3
                    // Load resistance=100 Ohms
12 R1 = 100;
13 \text{ fi} = 60;
                    // Input frequency=60
14
15 Vs = B*Vp;
16 disp (Vs, 'The Secondary Voltage in Volts(ac)')
17
18 Vspk = (Vs*1.414);
19
20 \ C = Vspk-0.7;
21
22 \text{ Vdc} = 0.318*C;
23 disp (Vdc, 'The DC Voltage in Volts')
24
```

```
25 	ext{ Il} = Vdc/Rl;
26 disp (Il, 'The Load Current in Amps');
27
28 Idiode = Il;
29 disp (Idiode, 'The DC Diode Current in Amps')
30
31 \text{ PIV} = \text{Vspk};
32 disp (PIV, 'The PIV for Diode-1 in Volts')
33
34 fo =fi;
35 disp (fo, 'The Output Frequency in Hertz')
   Example 182
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_4
4 clc; clear;
5 // If the turns ratio Np:Ns is 3:1, calculate the
      following: Vs, Vdc, Il, Idiode, PIV for D1, and
      fout.
7 // Given data
9 \text{ Vp} = 120;
                     // Primary voltage=120 Vac
                     // Turns ratio Np:Ns=3:1
10 A = 3/1;
                     // Turns ratio Ns:Np=1:3
11 B = 1/3;
12 R1 = 100;
                     // Load resistance=100 Ohms
                     // Input frequency=60
13 \text{ fi} = 60;
14
15 Vs = B*Vp;
16 disp (Vs, 'The Secondary Voltage in Volts(ac)')
17
18 \text{ Vspk} = (\text{Vs}*1.414);
19
20 \ C = Vspk-0.7;
21
22 \text{ Vdc} = 0.318*C;
```

```
disp (Vdc, 'The DC Voltage in Volts')

11 = Vdc/R1;

26 disp (I1, 'The Load Current in Amps');

27

28 Idiode = I1;

29 disp (Idiode, 'The DC Diode Current in Amps')

30

31 PIV = Vspk;

32 disp (PIV, 'The PIV for Diode-1 in Volts')

33

34 fo =fi;

35 disp (fo, 'The Output Frequency in Hertz')
```

Scilab code Exa 27.5 Example 183

```
Scilab code Exa 27.5 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27<sub>-</sub>5
4 clc; clear;
5 // If the turns ratio Np:Ns is 3:1, calculate the
      following: Vdc, II, Idiode, PIV for D1, and fout.
7 // Given data
                    // Primary voltage=120 Vac
9 \text{ Vp} = 120;
                    // Turns ratio Np:Ns = 3:1
10 A = 3/1;
                    // Turns ratio Ns:Np = 1:3
11 B = 1/3;
                    // Load resistance=100 Ohms
12 R1 = 100;
13
14 Vs = B*Vp;
15 Vspk = 1.414*(Vs/2);
```

```
16 \text{ Vopk} = \text{Vspk} - 0.7;
17
18 \text{ Vdc} = 0.636*\text{Vopk};
19 disp (Vdc, 'The DC Voltage in Volts')
20
21 	ext{ Il} = Vdc/Rl;
22 disp (Il, 'The Load Current in Amps')
23 disp ('i.e 175.4 mAmps')
24
25 Idiode = I1/2;
26 disp (Idiode, 'The DC Diode Current in Amps')
27 disp ('i.e 87.7 mAmps')
28
29 \ C = (Vspk*2) - 0.7;
30
31 \text{ PIV} = C;
32 disp (PIV, 'The PIV for Diode-1 in Volts')
33
34 f = 120;
35 disp (f, 'The Output Frequency in Hertz')
   Example 183
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_5
4 clc; clear;
5 // If the turns ratio Np:Ns is 3:1, calculate the
      following: Vdc, Il, Idiode, PIV for D1, and fout.
7 // Given data
9 \text{ Vp} = 120;
                     // Primary voltage=120 Vac
                     // Turns ratio Np:Ns = 3:1
10 A = 3/1;
11 B = 1/3;
                     // Turns ratio Ns:Np = 1:3
12 R1 = 100;
                     // Load resistance=100 Ohms
13
14 Vs = B*Vp;
```

```
15 Vspk = 1.414*(Vs/2);
16 Vopk = Vspk-0.7;
17
18 \text{ Vdc} = 0.636*\text{Vopk};
19 disp (Vdc, 'The DC Voltage in Volts')
20
21 	ext{ Il} = Vdc/Rl;
22 disp (Il, 'The Load Current in Amps')
23 disp ('i.e 175.4 mAmps')
24
25 Idiode = I1/2;
26 disp (Idiode, 'The DC Diode Current in Amps')
27 disp ('i.e 87.7 mAmps')
28
29 \ C = (Vspk*2) - 0.7;
30
31 \text{ PIV} = C;
32 disp (PIV, 'The PIV for Diode-1 in Volts')
33
34 	 f = 120;
35 disp (f, 'The Output Frequency in Hertz')
```

Scilab code Exa 27.6 Example 184

```
Scilab code Exa 2716 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_6
4 clc; clear;
5 // If the turns ratio Np:Ns is 3:1, calculate the following: Vdc, Il, Idiode, PIV for each diode, and fout.
```

```
7 // Given data
                    // Primary voltage=120 Vac
9 \text{ Vp} = 120;
10 A = 3/1;
                    // Turns ratio Np: Ns = 3:1
11 B = 1/3;
                    // Turns ratio Ns:Np = 1:3
12 R1 = 100;
                    // Load resistance=100 Ohms
13
14 Vs = B*Vp;
15 Vspk = 1.414*(Vs);
16 \text{ Vopk} = \text{Vspk}-1.4;
17
18 \ Vdc = 0.636*Vopk;
19 disp (Vdc, 'The DC Voltage in Volts')
20
21 	ext{ Il} = Vdc/Rl;
22 disp (Il, 'The Load Current in Amps')
23 disp ('i.e 350.8 mAmps')
24
25 Idiode = I1/2;
26 disp (Idiode, 'The DC Diode Current in Amps')
27 disp ('i.e 175.4 mAmps')
28
29 \ C = Vspk-0.7;
30
31 \text{ PIV} = C;
32 disp (PIV, 'The PIV for each Diode in Volts')
33
34 f = 120;
35 disp (f, 'The Output Frequency in Hertz')
   Example 184
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_6
4 clc; clear;
5 // If the turns ratio Np:Ns is 3:1, calculate the
      following: Vdc, Il, Idiode, PIV for each diode,
```

```
and fout.
6
  // Given data
9 \text{ Vp} = 120;
                      // Primary voltage=120 Vac
                     // Turns ratio Np:Ns = 3:1
10 A = 3/1;
                     // Turns ratio Ns:Np = 1:3
11 B = 1/3;
12 R1 = 100;
                     // Load resistance=100 Ohms
13
14 Vs = B*Vp;
15 Vspk = 1.414*(Vs);
16 \text{ Vopk} = \text{Vspk}-1.4;
17
18 \text{ Vdc} = 0.636*\text{Vopk};
19 disp (Vdc, 'The DC Voltage in Volts')
20
21 	ext{ Il} = Vdc/Rl;
22 disp (Il, 'The Load Current in Amps')
23 disp ('i.e 350.8 mAmps')
24
25 Idiode = I1/2;
26 disp (Idiode, 'The DC Diode Current in Amps')
27 disp ('i.e 175.4 mAmps')
28
29 \ C = Vspk-0.7;
30
31 \text{ PIV} = C;
32 disp (PIV, 'The PIV for each Diode in Volts')
33
34 \text{ f} = 120;
35 disp (f, 'The Output Frequency in Hertz')
```

```
Scilab code Exa 27.17 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_{-}7
4 clc; clear;
5 // Assume the transformer turns ratio Np:Ns = 4:1 in
                21 a and 2:1 in Fig. 27 22a. Compare
       Vripple and Vdc if C = 500 uF and Rl = 250.
7 // Given data
                          // Turns ratio Np:Ns=4:1
9 \text{ A1} = 4/1;
                          // Turns ratio Ns:Np=1:4
10 B1 = 1/4;
                          // Turns ratio Np: Ns=2:1
11 \quad A2 = 2/1;
                          // Turns ratio Ns:Np=1:2
12 B2 = 1/2;
                          // Primary voltage=120 Vac
13 \text{ Vp} = 120;
14 \text{ Vb} = 0.7;
                          // Charging Time of Capacitor of
15 	 t1 = 16.67*10^{-3};
       Turns ratio Np:Ns=4:1=16.67 mSec
                          // Charging Time of Capacitor of
16 	 t2 = 8.33*10^{-3};
       Turns ratio Np:Ns=4:1=8.33 mSec
                          // Load resistance=250 Ohms
17 R1 = 250;
18 C = 500*10^{-6};
                          // Capacitor=500 uFarad
19
20 // Calculations for Turns Ratio Np:Ns=4:1
21
22 \text{ Vs1} = B1*Vp;
23 \text{ Vspk1} = \text{Vs1*1.414};
24 \text{ Vopk1} = \text{Vspk1} - \text{Vb};
25 D = -t1/(R1*C);
26
27 \text{ Vrp1} = \text{Vopk1}*(1-(%e^D));
28 disp (Vrp1, 'The Ripple Voltage for Turns Ratio Np: Ns
      =4:1 in Volts (p-p)')
29 disp ('Appox 5.21 Volts(p-p)')
30
31 \text{ Vdc1} = \text{Vopk1} - (\text{Vrp1/2});
32 disp (Vdc1, 'The DC Voltage for Turns Ratio Np:Ns=4:1
       in Volts')
```

```
33 disp ('Appox 39.12 Volts')
34
35 // Calculations for Turns Ratio Np:Ns = 2:1
36
37 \text{ Vs2} = B2*Vp;
38 \ V2 = Vs2/2;
39 \text{ V2pk2} = \text{V2*1.414}
40 \text{ Vopk2} = \text{V2pk2} - \text{Vb};
41 E = -t2/(R1*C);
42
43 Vrp2 = Vopk2*(1-(%e^E));
44 disp (Vrp2, 'The Ripple Voltage for Turns Ratio Np: Ns
      =2:1 in Volts (p-p),
45 disp ('Appox 2.69 Volts(p-p)')
46
47 \text{ Vdc2} = \text{Vopk2} - (\text{Vrp2}/2);
48 disp (Vdc2, 'The DC Voltage for Turns Ratio Np:Ns=2:1
       in Volts')
49 disp ('Appox 40.38 Volts')
   Example 185
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_{-}7
4 clc; clear;
5 // Assume the transformer turns ratio Np:Ns = 4:1 in
                21 a and 2:1 in Fig. 27 22a. Compare
       Vripple and Vdc if C = 500 uF and Rl = 250.
7 // Given data
8
9 \text{ A1} = 4/1;
                          // Turns ratio Np:Ns=4:1
                          // Turns ratio Ns:Np=1:4
10 B1 = 1/4;
                          // Turns ratio Np: Ns=2:1
11 \quad A2 = 2/1;
                          // Turns ratio Ns:Np=1:2
12 B2 = 1/2;
13 \text{ Vp} = 120;
                          // Primary voltage=120 Vac
14 \text{ Vb} = 0.7;
```

```
15 t1 = 16.67*10^{-3}; // Charging Time of Capacitor of
        Turns ratio Np:Ns=4:1=16.67 mSec
                           // Charging Time of Capacitor of
16 	 t2 = 8.33*10^{-3};
        Turns ratio Np:Ns=4:1=8.33 mSec
17 R1 = 250;
                            // Load resistance=250 Ohms
18 C = 500*10^{-6};
                            // Capacitor=500 uFarad
19
20 // Calculations for Turns Ratio Np:Ns=4:1
21
22 \text{ Vs1} = \text{B1*Vp};
23 \text{ Vspk1} = \text{Vs1*1.414};
24 \text{ Vopk1} = \text{Vspk1} - \text{Vb};
25 D = -t1/(R1*C);
26
27 \text{ Vrp1} = \text{Vopk1}*(1-(\%e^D));
28 disp (Vrp1, 'The Ripple Voltage for Turns Ratio Np: Ns
       =4:1 in Volts (p-p)')
29 disp ('Appox 5.21 Volts(p-p)')
30
31 \text{ Vdc1} = \text{Vopk1} - (\text{Vrp1}/2);
32 disp (Vdc1, 'The DC Voltage for Turns Ratio Np:Ns=4:1
        in Volts')
33 disp ('Appox 39.12 Volts')
34
35 // Calculations for Turns Ratio Np:Ns = 2:1
36
37 \text{ Vs2} = B2*Vp;
38 \ V2 = Vs2/2;
39 \text{ V2pk2} = \text{V2*1.414}
40 \text{ Vopk2} = \text{V2pk2} - \text{Vb};
41 E = -t2/(R1*C);
42
43 Vrp2 = Vopk2*(1-(%e^E));
44 disp (Vrp2, 'The Ripple Voltage for Turns Ratio Np: Ns
       =2:1 in Volts (p-p)')
45 disp ('Appox 2.69 Volts(p-p)')
46
47 \text{ Vdc2} = \text{Vopk2} - (\text{Vrp2/2});
```

```
48 disp (Vdc2, 'The DC Voltage for Turns Ratio Np:Ns=2:1 in Volts')
49 disp ('Appox 40.38 Volts')
```

Scilab code Exa 27.8 Example 186

```
Scilab code Exa 27.8 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_8
4 clc; clear;
5 // Calculate the LED current.
7 // Given data
                  // Input voltage=24 Volts
9 \text{ Vin} = 24;
                  // Voltage drop at LED=2 Volts
10 Vled = 2;
11 Rs = 2.2*10^3; // Source Resistance=2.2 kOhms
12
13 Iled = (Vin-Vled)/Rs;
14 disp (Iled, 'The LED Current in Amps')
15 disp ('i.e 10 mAmps')
  Example 186
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_8
4 clc; clear;
5 // Calculate the LED current.
7 // Given data
9 Vin = 24; // Input voltage=24 Volts
```

Scilab code Exa 27.9 Scilab code Exa 27.9 Example 187 Example 187

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_9
4 clc; clear;
5 // Calculate the resistance Rs, required to provide
     an LED current of 25 mA.
7 // Given data
                        // Input voltage=24 Volts
9 \text{ Vin} = 24;
                        // Voltage drop at LED=2 Volts
10 \text{ Vled} = 2;
11 Iled = 25*10^-3;
                     // LED Current=25 mAmps
12
13 Rs = (Vin-Vled)/Iled;
14 disp (Rs, 'The Resistance Rs, Required to Provide an
     LED Current of 25 mA in Ohms')
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27\, \_9
4 clc; clear;
5 // Calculate the resistance Rs, required to provide
     an LED current of 25 mA.
6
```

Scilab code Exa 27.10 Example 188

```
Scilab code Exa 27.10 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_10
4 clc; clear;
5 // Calculate the maximum rated zener current for a 1
      W, 10 V zener.
7 // Given data
             // Power rating of zener= 1 Watts
9 \text{ Pzm} = 1;
                  // Voltage rating of zener= 10 Volts
10 \ Vz = 10;
11
12 Izm = Pzm/Vz;
13 disp (Izm, 'The Maximum Rated Current of Zener in
     Amps')
14 disp ('i.e 100 mAmps')
   Example 188
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
```

```
// Example No. 27_10
clc; clear;
// Calculate the maximum rated zener current for a 1
W, 10 V zener.

// Given data

// Given data

// Power rating of zener= 1 Watts

Vz = 10; // Voltage rating of zener= 10 Volts

Izm = Pzm/Vz;

disp (Izm, 'The Maximum Rated Current of Zener in Amps')

disp ('i.e 100 mAmps')

// Amps'
```

Scilab code Exa 27.11 Example 189

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_11
4 clc; clear;
5 // If Vz=10 V, calculate Iz.
7 // Given data
9 \text{ Vin} = 25;
                   // Input voltage=25 Volts
                    // Zener voltage=10 Volts
10 \ Vz = 10;
                   // Source Resistance=1 kOhms
11 Rs = 1*10^3;
12
13 Iz = (Vin-Vz)/Rs;
14 disp (Iz, 'The Zener Current in Amps')
15 disp ('i.e 15 mAmps')
```

Scilab code Exa 27.12 Example 190

```
Scilab code Exa 27.12 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_12
4 clc; clear;
5 // If R L increases to 250 Ohms, calculate the following: Is, Il, Iz, and Pz.
6
7 // Given data
8
9 Vin = 25; // Input voltage=25 Volts
10 Vz = 7.5; // Zener voltage=7.5 Volts
11 Rl = 250; // Load Resistance=250 Ohms
```

```
12 Is = 75*10^-3; // Source current=75 \text{ mAmps}
13
14 disp (Is, 'The Source Current in Amps')
15 disp ('i.e 75 mAmps')
16
17 Il = Vz/Rl;
18 disp (Il, 'The Load Current in Amps')
19 disp ('i.e 30 mAmps')
20
21 	ext{ Iz = Is-Il};
22 disp (Iz, 'The Zener Current in Amps')
23 disp ('i.e 45 mAmps')
24
25 \text{ Pz} = \text{Vz*Iz};
26 disp (Pz, 'The Power Dissipation of Zener in Watts')
27 disp ('i.e 337.5 mWatts')
   Example 190
 1 // Grob's Basic Electronics 11e
 2 // Chapter No. 27
 3 // Example No. 27<sub>-</sub>12
4 clc; clear;
 5 // If R L increases to 250 Ohms, calculate the
      following: Is, Il, Iz, and Pz.
 7 // Given data
9 \text{ Vin} = 25;
                    // Input voltage=25 Volts
10 \ Vz = 7.5;
                     // Zener voltage=7.5 Volts
11 R1 = 250; // Load Resistance=250 Ohms
  Is = 75*10^-3; // Source current=75 \text{ mAmps}
13
14 disp (Is, 'The Source Current in Amps')
15 disp ('i.e 75 mAmps')
16
17 Il = Vz/Rl;
18 disp (Il, 'The Load Current in Amps')
```

```
disp ('i.e 30 mAmps')

10
21    Iz = Is-I1;
22    disp (Iz, 'The Zener Current in Amps')
23    disp ('i.e 45 mAmps')

24
25    Pz = Vz*Iz;
26    disp (Pz, 'The Power Dissipation of Zener in Watts')
27    disp ('i.e 337.5 mWatts')
```

Scilab code Exa 27.13 Example 191

```
Scilab code Exa 27.13 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_13
4 clc; clear;
5 // Calculate Is, Il and Iz for (a) Rl=200 ohms; (b) Rl
      =500 ohms.
7 // Given data
9 \text{ Vin} = 16;
                    // Vin=16 Volts given
                    // Vz=10 Volts given
10 \ Vz = 10;
11 \text{ Rs} = 100;
                    // Source Resistance = 100 ohms
      given
12 Rla = 200;
                    // Load Resistance A = 200 ohms
      given
               //Load Resistance B = 500 ohms given
13 \text{ Rlb} = 500;
14
15 // For Rl 200 ohms
17 Is = (Vin-Vz)/Rs;
```

```
18 disp (Is, 'The Source Current in Amps.')
19 disp ('i.e 60 mAmps')
20
21 Ila = Vz/Rla;
22 disp (Ila, 'The Load Current for 200 ohms Load in
      Amps. ')
  disp ('i.e 50 mAmps')
23
24
25
  Iza = Is-Ila
26 disp (Iza, 'The Zener Current for 200 ohms Load in
      Amps. ')
27 disp ('i.e 10 mAmps')
28
29 // For Rl 500 ohms
30
31 	ext{ Ilb = Vz/Rlb;}
32 disp (Ilb, 'The Load Current for 500 ohms Load in
      Amps. ')
  disp ('i.e 20 mAmps')
33
34
35 Izb = Is-Ilb
36 disp (Izb, 'The Zener Current for 500 ohms load in
      Amps. ')
37 disp ('i.e 40 mAmps')
   Example 191
1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27<sub>-</sub>13
4 clc; clear;
5 // Calculate Is, Il and Iz for (a) Rl=200 ohms; (b) Rl
      =500 ohms.
  // Given data
9 \text{ Vin} = 16;
                    // Vin=16 Volts given
                    // Vz=10 Volts given
10 \ Vz = 10;
```

```
// Source Resistance = 100 ohms
11 \text{ Rs} = 100;
      given
12 Rla = 200;
                    // Load Resistance A = 200 ohms
      given
13 \text{ Rlb} = 500;
                    //Load Resistance B = 500 ohms given
14
15 // For Rl 200 ohms
16
17 Is = (Vin-Vz)/Rs;
18 disp (Is, 'The Source Current in Amps.')
19 disp ('i.e 60 mAmps')
20
21 Ila = Vz/Rla;
22 disp (Ila, 'The Load Current for 200 ohms Load in
     Amps. ')
  disp ('i.e 50 mAmps')
23
24
25 Iza = Is-Ila
26 disp (Iza, 'The Zener Current for 200 ohms Load in
     Amps. ')
27 disp ('i.e 10 mAmps')
28
29 // For Rl 500 ohms
30
31 Ilb = Vz/Rlb;
32 disp (Ilb, 'The Load Current for 500 ohms Load in
     Amps. ')
33 disp ('i.e 20 mAmps')
34
35 Izb = Is-Ilb
36 disp (Izb, 'The Zener Current for 500 ohms load in
     Amps. ')
37 disp ('i.e 40 mAmps')
```

Chapter 31

Chapter 28 Bipolar Junction Transistors

Chapter 32

Chapter 28 Bipolar Junction Transistors

Scilab code Exa 28.1 Example 192

```
Scilab code Exa 281 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_1
4 clc; clear;
5 // A transistor has the following currents: Ib is 20
    mA and Ic is 4.98 A. Calculate Ie.
6
7 // Given data
8
9 Ib = 20*10^-3; // Base current=20 mAmps
10 Ic = 4.98; // Collector current=4.98 Amps
11
12 Ie = Ic+Ib;
13 disp (Ie, 'The Emitter Current Ie in Amps')
    Example 192
```

```
// Grob's Basic Electronics 11e
// Chapter No. 28
// Example No. 28_1

clc; clear;
// A transistor has the following currents: Ib is 20 mA and Ic is 4.98 A. Calculate Ie.

formula is 4.98 Amps

formula is 4.98;
// Collector current = 4.98 Amps

formula is 4.98;
// Collector current = 4.98 Amps

formula is 4.98;
// Collector current = 4.98 Amps

formula is 4.98;
// Collector current = 4.98 Amps

formula is 4.98;
// Collector current = 4.98 Amps

formula is 4.98;
// Collector current = 4.98 Amps

formula is 4.98 A. Calculate Ie.

formula is
```

Scilab code Exa 28.2 Example 193

Scilab code Exa 28.3 Example 194

```
Scilab code Exa 28.3 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_3
4 clc; clear;
5 // A transistor has the following currents: Ie is 50
    mA, Ic is 49 mA. Calculate Ib.
6
7 // Given data
8
9 Ie = 50*10^-3; // Emitter current=50 mAmps
10 Ic = 49*10^-3; // Collector current=20 mAmps
11
```

```
12 Ib = Ie-Ic;
13 disp (Ib, 'The Base Current Ib in Amps')
14 disp ('i.e 1 mAmps')
  Example 194
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_3
4 clc; clear;
5 // A transistor has the following currents: Ie is 50
      mA, Ic is 49 mA. Calculate Ib.
7 // Given data
                    // Emitter current=50 mAmps
9 	ext{ Ie} = 50*10^-3;
10 Ic = 49*10^-3; // Collector current=20 mAmps
11
12 Ib = Ie-Ic;
13 disp (Ib, 'The Base Current Ib in Amps')
14 disp ('i.e 1 mAmps')
```

Scilab code Exa 28.4 Example 195

```
Scilab code Exa 28.4 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_4
4 clc; clear;
5 // A transistor has the following currents: Ie is 15
    mA, Ib is 60 uA. Calculate Alpha(dc).
6
7 // Given data
```

```
11
12 Ic = Ie-Ib;
13
14 \text{ Adc} = Ic/Ie;
15 disp (Adc, 'The Value of Alpha(dc) is')
  Example 195
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_4
4 clc; clear;
5 // A transistor has the following currents: Ie is 15
     mA, Ib is 60 uA. Calculate Alpha(dc).
7 // Given data
11
12 Ic = Ie-Ib;
13
14 \text{ Adc} = Ic/Ie;
15 disp (Adc, 'The Value of Alpha(dc) is')
```

Scilab code Exa 28.5 Example 196

```
Scilab code Exa 28.5 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_5
4 clc; clear;
```

```
5 // A transistor has the following currents: Ic is 10
     mA and Ib is 50 uA. Calculate Beta(dc).
7 // Given data
11
12 Bdc = Ic/Ib;
13 disp (Bdc, 'The Value of Beta(dc) is')
  Example 196
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28\_5
4 clc; clear;
5 // A transistor has the following currents: Ic is 10
     mA and Ib is 50 uA. Calculate Beta(dc).
7 // Given data
11
12 \text{ Bdc} = \text{Ic/Ib};
13 disp (Bdc, 'The Value of Beta(dc) is')
```

Scilab code Exa 28.6 Example 197

```
Scilab code Exa 28.16 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_6
```

```
4 clc; clear;
5 // A transistor has Beta(dc) of 150 and Ib of 75
     uAmps. Calculate Ic.
7 // Given data
                    // Beta (dc)=150
9 \text{ Bdc} = 150;
10 Ib = 75*10^-6; // Base current=75 uAmps
11
12 	ext{ Ic} = Bdc*Ib;
13 disp (Ic, 'The Collector Current Ic in Amps')
14 disp ('i.e 11.25 mAmps')
  Example 197
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_6
4 clc; clear;
5 // A transistor has Beta(dc) of 150 and Ib of 75
     uAmps. Calculate Ic.
7 // Given data
11
12 Ic = Bdc*Ib;
13 disp (Ic, 'The Collector Current Ic in Amps')
14 disp ('i.e 11.25 mAmps')
```

Scilab code Exa 28.7 Example 198

```
Scilab code Exa 2817 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_7
4 clc; clear;
5 // A transistor has Beta(dc) of 100. Calculate Alpha
     (dc).
6
7 // Given data
9 Bdc = 100; // Beta(dc)=100
10
11 Adc = Bdc/(1+Bdc);
12 disp (Adc, 'The Value of Alpha(dc) is')
  Example 198
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_7
4 clc; clear;
5 // A transistor has Beta(dc) of 100. Calculate Alpha
     (dc).
  // Given data
9 Bdc = 100; // Beta(dc)=100
10
11 Adc = Bdc/(1+Bdc);
12 disp (Adc, 'The Value of Alpha(dc) is')
```

Scilab code Exa 28.8 Example 199

Scilab code Exa 28.18 // Grob's Basic Electronics 11e

```
2 // Chapter No. 28
3 // Example No. 28_8
4 clc; clear;
5 // A transistor has Alpha(dc) of 0.995. Calculate
     Beta (dc).
7 // Given data
9 Adc = 0.995; // \text{Alpha}(dc) = 100
10
11 Bdc = Adc/(1-Adc);
12 disp (Bdc, 'The Value of Beta(dc) is')
  Example 199
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_8
4 clc; clear;
5 // A transistor has Alpha(dc) of 0.995. Calculate
     Beta (dc).
6
7 // Given data
9 Adc = 0.995; // \text{Alpha}(dc) = 100
10
11 Bdc = Adc/(1-Adc);
12 disp (Bdc, 'The Value of Beta(dc) is')
```

Scilab code Exa 28.9 Example 200

```
Scilab code Exa 2819 // Grob's Basic Electronics 11e
2 // Chapter No. 28
```

```
3 // Example No. 28_9
4 clc; clear;
5 // Calculate Pd if Vcc is 10 V and Ib is 50 uAmps.
      Assume Beta(dc) is 100.
7 // Given data
8
                         // Beta(dc) = 100
9 \text{ Bdc} = 100;
                         // Base current=50 uAmps
10 Ib = 50*10^-6;
                         // Supply voltage=10 Volts
11 \ Vcc = 10;
12
13 Vce = Vcc
14
15 Ic = Bdc*Ib;
16
17 \text{ Pd} = \text{Vce*Ic};
18 disp (Pd, 'The Power Dissipation in Watts')
19 disp ('i.e 50 mWatts')
   Example 200
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_9
4 clc; clear;
5 // Calculate Pd if Vcc is 10 V and Ib is 50 uAmps.
      Assume Beta (dc) is 100.
7 // Given data
9 \text{ Bdc} = 100;
                         // Beta(dc) = 100
                         // Base current=50 uAmps
10 Ib = 50*10^-6;
                         // Supply voltage=10 Volts
11 \ Vcc = 10;
12
13 Vce = Vcc
14
15 \text{ Ic} = Bdc*Ib;
16
```

```
17 Pd = Vce*Ic;
18 disp (Pd, 'The Power Dissipation in Watts')
19 disp ('i.e 50 mWatts')
```

Scilab code Exa 28.10 Example 201

```
Scilab code Exa 28.10 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_10
4 clc; clear;
5 // The transistor has a power rating of 0.5 W. If
      Vce is 20 V, calculate the maximum allowable
      collector current, Ic, that can exist without
      exceeding the transistor s power rating.
6
7 // Given data
9 \text{ Pdmax} = 0.5;
                        // Power dissipation (max) = 0.5
      Watts
10 \text{ Vce} = 20;
                        // Voltage (collector to emitter
      =20 Volts
11
12 Ic = Pdmax/Vce;
13 disp (Ic, 'The Maximum Allowable Collector Current Ic
      (max) in Amps')
14 disp ('i.e 25 mAmps')
   Example 201
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_10
4 clc; clear;
```

```
5 // The transistor has a power rating of 0.5 W. If
      Vce is 20 V, calculate the maximum allowable
      collector current, Ic, that can exist without
      exceeding the transistor s power rating.
7 // Given data
                        // Power dissipation (max) = 0.5
9 \text{ Pdmax} = 0.5;
      Watts
10 \text{ Vce} = 20;
                        // Voltage (collector to emitter
      =20 Volts
11
12 Ic = Pdmax/Vce;
13 disp (Ic, 'The Maximum Allowable Collector Current Ic
      (max) in Amps')
14 disp ('i.e 25 mAmps')
```

Scilab code Exa 28.11 Example 202

```
Scilab code Exa 28.11 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_11
4 clc; clear;
5 // Assume that a transistor has a power rating Pd(
    max) of 350 mW at an ambient temperature Ta of 25
        C. The derating factor is 2.8 mW/ C. Calculate
        the power rating at 50 C.
6
7 // Given data
8
9 f = 2.8*10^-3; // Derating factor = 2.8 mW/ C
10 Pd = 350*10^-3; // Power dissipation (max) = 350
        mWatts
```

```
// Ambient Temperature=25 C
11 \text{ Ta} = 25;
                          // Power rating at 50 C
12 \text{ Tp = } 50;
13
14 \text{ delT} = \text{Tp-Ta};
                          // Difference between max and
      min temp
15
16 delPd = delT*f;
17
18 Prat = Pd-delPd;
19 disp (Prat, 'The Power Rating at 50 C in Watts')
20 disp ('i.e 280 mWatts')
   Example 202
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_11
4 clc; clear;
5 // Assume that a transistor has a power rating Pd(
      max) of 350 mW at an ambient temperature Ta of 25
        C. The derating factor is 2.8 mW/C. Calculate
       the power rating at 50 C.
  // Given data
9 f = 2.8*10^{-3};
                          // Derating factor = 2.8 mW/ C
                          // Power dissipation (max) = 350
10 \text{ Pd} = 350*10^{-3};
      mWatts
11 \text{ Ta} = 25;
                          // Ambient Temperature=25 C
                          // Power rating at 50 C
12 \text{ Tp = } 50;
13
14 \text{ delT} = \text{Tp-Ta};
                         // Difference between max and
      min temp
15
16 \text{ delPd} = \text{delT*f};
17
18 Prat = Pd-delPd;
19 disp (Prat, 'The Power Rating at 50 C in Watts')
```

Scilab code Exa 28.12 Example 203

```
Scilab code Exa 28.112 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_12
4 clc; clear;
5 // Solve for Ib, Ic, Vce. Also, Construct a dc load
      line showing the values of Ic(sat), Vce(off), Icq
      , Vceq.
7 // Given data
8 \ \text{Vcc} = 12;
                             // Supply voltage=12 Volts
9 \text{ Vbe} = 0.7;
                             // Base-Emitter Voltage=0.7
      Volts
                             // Base Resistor=390K Ohms
10 \text{ Rb} = 390*10^3;
11 Rc = 1.5*10^3;
                             // Collector Resistor = 1.5K
      Ohms
12 B = 150;
                             // Beta(dc) = 150
13
14 Ib = (Vcc-Vbe)/Rb;
15 disp (Ib, 'The Base Current in Amps.')
16 disp ('Appox 28.97 mAmps')
17
18 Icq = B*Ib;
19 disp (Icq, 'The Collector Current in Amps');
20 disp ('Appox 4.35 mAmps')
21
22 \text{ Vceq} = \text{Vcc-(Icq*Rc)};
23 disp (Vceq, 'The Voltage Collector-Emitter in Volts'
```

```
24
25 // For DC load line
26
27 \text{ Icsat} = (Vcc/Rc);
28 Vceoff = Vcc;
29
30 Vce1=[Vceoff Vceq 0]
31 Ic1=[0 Icq Icsat]
32
33 //To plot DC load line
34
35 printf ("Q(\%f,\%f)\n", Vceq, Icq)
36 plot2d(Vce1, Ic1)
37 plot(Vceq, Icq,".r")
38 plot(0, Icq,".r")
39 plot(Vceq,0,".r")
40 plot(0, Icsat, ".b")
41 plot(Vceoff,0,".b")
42 xlabel("Vce in volt")
43 ylabel("Ic in Ampere")
44 xtitle("DC Load-line for Base-Biased Transistor
      Circuit")
   Example 203
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_12
4 clc; clear;
5 // Solve for Ib, Ic, Vce. Also, Construct a dc load
      line showing the values of Ic(sat), Vce(off), Icq
      , Vceq.
7 // Given data
                             // Supply voltage=12 Volts
8 \ \text{Vcc} = 12;
9 \text{ Vbe} = 0.7;
                             // Base-Emitter Voltage=0.7
      Volts
10 \text{ Rb} = 390*10^3;
                             // Base Resistor = 390K Ohms
```

```
// Collector Resistor = 1.5K
11 Rc = 1.5*10^3;
      Ohms
                               // Beta(dc) = 150
12 B = 150;
13
14 Ib = (Vcc-Vbe)/Rb;
15 disp (Ib, 'The Base Current in Amps.')
16 disp ('Appox 28.97 mAmps')
17
18 Icq = B*Ib;
19 disp (Icq, 'The Collector Current in Amps');
20 disp ('Appox 4.35 mAmps')
21
22 \text{ Vceq} = \text{Vcc-(Icq*Rc)};
23 disp (Vceq, 'The Voltage Collector-Emitter in Volts'
24
25 // For DC load line
26
27 \text{ Icsat} = (Vcc/Rc);
28 Vceoff = Vcc;
29
30 Vce1=[Vceoff Vceq 0]
31 Ic1=[0 Icq Icsat]
32
33 //To plot DC load line
34
35~\text{printf}\left(\text{"}Q(\,\%f\,,\%f)\,\middle\backslash\,\text{n"}\right. , Vceq , Icq)
36 plot2d(Vce1, Ic1)
37 plot(Vceq, Icq,".r")
38 plot(0, Icq,".r")
39 plot(Vceq,0,".r")
40 plot(0, Icsat, ".b")
41 plot(Vceoff,0,".b")
42 xlabel("Vce in volt")
43 ylabel("Ic in Ampere")
44 xtitle("DC Load-line for Base-Biased Transistor
      Circuit")
```

Scilab code Exa 28.13 Example 204

```
Scilab code Exa 28.13 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_13
4 clc; clear;
5 // Solve for Vb, Ve, Ic, Vc, and Vce. Also,
      calculate Ic(sat) and Vce(off). Finally,
      construct a dc load line showing the values of Ic
      (sat), Vce(off), Icq, and Vceq.
7 // Given data
9 R1 = 33*10^3;
                         // Resistor 1=33 kOhms
                        // Resistor 2=5.6 kOhms
10 R2 = 5.6*10^3;
                        // Collector resistance=1.5
11 Rc = 1.5*10^3;
      kOhms
                         // Emitter resistance=390 Ohms
12 \text{ Re} = 390;
                        // Beta (dc) = 200
13 \text{ Bdc} = 200;
                        // Supply voltage = 18 Volts
14 \ Vcc = 18;
                        // Base-Emmiter Voltage=0.7
15 \text{ Vbe} = 0.7;
      Volts
16
17 Vb = Vcc*(R2/(R1+R2));
18 disp (Vb, 'The Base Voltage in Volts')
19
20 \text{ Ve = Vb-Vbe};
21 disp (Ve, 'The Emmiter Voltage in Volts')
22
                         // Emitter current
23 Ie = Ve/Re;
24
25 Ic = Ie;
```

```
26
27 \text{ Vc} = \text{Vcc} - (\text{Ic} * \text{Rc});
28 disp (Vc, 'The Collector Voltage in Volts')
29 disp ('Appox 10.65 Volts')
30
31 Vce = Vcc-(Ic*(Rc+Re));
32 disp (Vce, 'The Collector-Emitter Voltage in Volts')
33 disp ('Appox 8.74 Volts')
34
35 \text{ Icsat} = \text{Vcc/(Rc+Re)};
36 disp (Icsat, 'The Current Ic(sat) in Amps')
37 disp ('i.e 9.52 mAmps')
38
39 Vceoff = Vcc;
40 disp (Vceoff, 'The Voltage Vce(off) in Volts')
41
42 Icq = Ic
43 Vceq = Vce
44
45 \text{ Vce1} = [\text{Vcc Vceq 0}]
46 Ic1=[0 Icq Icsat]
47
48 //To plot DC load line
49
50 printf ("Q(\%f,\%f)\n", Vceq, Icq)
51 plot2d(Vce1, Ic1)
52 plot(Vceq, Icq, ".r")
53 plot(0, Icq,".r")
54 plot(Vceq,0,".r")
55 plot(0, Icsat, ".b")
56 plot(Vceoff,0,".b")
57 xlabel("Vce in Volt")
58 ylabel("Ic in mAmps")
59 xtitle("DC Load-line for Voltage Divider-Biased
      Transistor Circuit")
   Example 204
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_13
4 clc; clear;
5 // Solve for Vb, Ve, Ic, Vc, and Vce. Also,
      calculate Ic(sat) and Vce(off). Finally,
      construct a dc load line showing the values of Ic
      (sat), Vce(off), Icq, and Vceq.
  // Given data
8
9 R1 = 33*10^3;
                         // Resistor 1=33 kOhms
                         // Resistor 2=5.6 kOhms
10 R2 = 5.6*10^3;
11 Rc = 1.5*10^3;
                         // Collector resistance=1.5
      kOhms
                         // Emitter resistance=390 Ohms
12 \text{ Re} = 390;
                         // Beta (dc) = 200
13 \text{ Bdc} = 200;
                         // Supply voltage = 18 Volts
14 \ Vcc = 18;
15 Vbe = 0.7;
                         // Base-Emmiter Voltage=0.7
      Volts
16
17 Vb = Vcc*(R2/(R1+R2));
18 disp (Vb, 'The Base Voltage in Volts')
19
20 \text{ Ve = Vb-Vbe};
21 disp (Ve, 'The Emmiter Voltage in Volts')
22
                         // Emitter current
23 Ie = Ve/Re;
24
25 Ic = Ie;
26
27 \text{ Vc} = \text{Vcc} - (\text{Ic} * \text{Rc});
28 disp (Vc, 'The Collector Voltage in Volts')
29 disp ('Appox 10.65 Volts')
30
31 Vce = Vcc-(Ic*(Rc+Re));
32 disp (Vce, 'The Collector-Emitter Voltage in Volts')
33 disp ('Appox 8.74 Volts')
```

```
34
35 \text{ Icsat} = \text{Vcc/(Rc+Re)};
36 disp (Icsat, 'The Current Ic(sat) in Amps')
37 disp ('i.e 9.52 mAmps')
38
39 Vceoff = Vcc;
40 disp (Vceoff, 'The Voltage Vce(off) in Volts')
41
42 \text{ Icq} = \text{Ic}
43 Vceq = Vce
44
45 \text{ Vce1} = [\text{Vcc Vceq 0}]
46 Ic1=[0 Icq Icsat]
47
48 //To plot DC load line
49
50 printf("Q(\%f,\%f)\n", Vceq, Icq)
51 plot2d(Vce1, Ic1)
52 plot(Vceq, Icq, ".r")
53 plot(0,Icq,".r")
54 plot(Vceq,0,".r")
55 plot(0, Icsat, ".b")
56 plot(Vceoff,0,".b")
57 xlabel("Vce in Volt")
58 ylabel("Ic in mAmps")
59 xtitle("DC Load-line for Voltage Divider-Biased
      Transistor Circuit")
```

Scilab code Exa 28.14 Example 205

```
Scilab code Exa 28.14 // Grob's Basic Electronics 11e
2 // Chapter No. 28
```

```
3 // Example No. 28<sub>-</sub>14
4 clc; clear;
5 // For the pnp transistor, solve for Vb, Ve, Ic, Vc,
       and Vce.
7 // Given data
                        // Resistor1=33 kOhms
9 R1 = 33*10^3;
                      // Resistor2 = 6.2 kOhms
10 R2 = 6.2*10^3;
                       // Collector resistance=2 kOhms
11 Rc = 2*10^3;
                       // Emitter resistance=500 Ohms
12 \text{ Re} = 500;
                       // Supply voltage=12 Volts
13 \ \text{Vcc} = 12;
                     // Base-Emmiter Voltage=0.7 Volts
14 \text{ Vbe} = 0.7;
15
16
17 Vb = -Vcc*(R2/(R1+R2));
18 disp (Vb, 'The Base Voltage in Volts')
19 disp ('Appox -1.9 Volts')
20
21 \text{ Ve = Vb-(-Vbe)};
22 disp (Ve, 'The Emitter Voltage in Volts')
23 disp ('Appox -1.2 Volts')
24
                     // Ic = le
25 Ic = -(Ve/Re);
26 disp (Ic, 'The Collector Current in Amps')
27 disp ('Appox 2.4 mAmps')
28
29 \text{ Vc} = -\text{Vcc} + (\text{Ic} * \text{Rc})
30 disp (Vc, 'The Collector Voltage in Volts')
31
32 \text{ Vce} = -\text{Vcc} + (\text{Ic} * (\text{Rc} + \text{Re}));
33 disp (Vce, 'The Collector-Emitter Voltage in Volts');
   Example 205
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_14
```

```
4 clc; clear;
5 // For the pnp transistor, solve for Vb, Ve, Ic, Vc,
       and Vce.
6
7 // Given data
9 R1 = 33*10^3;
                       // Resistor1=33 kOhms
                       // Resistor 2 = 6.2 kOhms
10 R2 = 6.2*10^3;
11 Rc = 2*10^3;
                       // Collector resistance=2 kOhms
                       // Emitter resistance=500 Ohms
12 \text{ Re} = 500;
                      // Supply voltage=12 Volts
// Base-Emmiter Voltage=0.7 Volts
13 \ \text{Vcc} = 12;
14 \text{ Vbe} = 0.7;
15
16
17 Vb = -Vcc*(R2/(R1+R2));
18 disp (Vb, 'The Base Voltage in Volts')
19 disp ('Appox -1.9 Volts')
20
21 Ve = Vb-(-Vbe);
22 disp (Ve, 'The Emitter Voltage in Volts')
23 disp ('Appox -1.2 Volts')
24
25 Ic = -(Ve/Re); // Ic = ^{\sim} Ie
26 disp (Ic, 'The Collector Current in Amps')
27 disp ('Appox 2.4 mAmps')
28
29 \text{ Vc} = -\text{Vcc} + (\text{Ic} * \text{Rc})
30 disp (Vc, 'The Collector Voltage in Volts')
31
32 \text{ Vce} = -\text{Vcc}+(\text{Ic}*(\text{Rc}+\text{Re}));
33 disp (Vce, 'The Collector-Emitter Voltage in Volts');
```

```
Scilab code Exa 28.15 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_15
4 clc; clear;
5 // Calculate Ie and Vc
7 // Given data
                    // Supply voltage at emitter=6 Volts
9 \text{ Vee} = 6;
10 \ Vcc = 15;
                    // Supply voltage at collector=15
      Volts
11 Vbe = 0.7;
                    // Base-Emmiter Voltage=0.7 Volts
                    // Collector resistance=1.5 kOhms
12 \text{ Rc} = 1.5*10^3;
13 Re = 1*10^3;
                    // Emitter resistance=1 kOhms
14
15 Ie = (Vee-Vbe)/Re;
16 disp (Ie, 'The Emitter current in Amps')
17 disp ('i.e 5.3 mAmps')
18
             // Ic =~ Ie
19 Ic = Ie;
20
21 \text{ Vc} = \text{Vcc-Ic*Rc};
22 disp (Vc, 'The Collector voltage in Volts')
   Example 206
1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28<sub>-</sub>15
4 clc; clear;
5 // Calculate Ie and Vc
7 // Given data
                    // Supply voltage at emitter=6 Volts
9 \text{ Vee} = 6;
10 \text{ Vcc} = 15;
                    // Supply voltage at collector=15
      Volts
                    // Base-Emmiter Voltage=0.7 Volts
11 Vbe = 0.7;
```

```
12 Rc = 1.5*10^3;  // Collector resistance=1.5 kOhms
13 Re = 1*10^3;  // Emitter resistance=1 kOhms
14
15 Ie = (Vee-Vbe)/Re;
16 disp (Ie, 'The Emitter current in Amps')
17 disp ('i.e 5.3 mAmps')
18
19 Ic = Ie;  // Ic = Ie
20
21 Vc = Vcc-Ic*Rc;
22 disp (Vc, 'The Collector voltage in Volts')
```

Chapter 29 Transistor Amplifiers

Chapter 29 Transistor Amplifiers

Scilab code Exa 29.1 Example 207

```
Scilab code Exa 2911 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_1
4 clc; clear;
5 // For the diode circuit, calculate the ac
      resistance, rac, for the following values of R: (
     a) 10 kOhms, (b) 5 kOhms, and (c) 1 kOhms. Use
      the second approximation of a diode.
6
7 // Given data
9 R1 = 10*10^3;
                      // Resistance 1=10 kOhms
10 R2 = 5*10^3;
                     // Resistance 2=5 kOhms
                    // Resistance 3=1 kOhms
11 R3 = 1*10^3;
12 \text{ Vdc} = 10;
                    // DC supply=10 Volts
                     // Starting voltage of diode=0.7
13 \quad V = 0.7;
```

```
Volts
14 A = 25*10^-3; // Constant
15
16 // For R=10 kOhms
17
18 \quad Id1 = (Vdc-V)/R1;
19
20 \text{ rac1} = A/Id1;
   disp (rac1, 'The Ac Resistance with R=10 kOhms in
      Ohms')
22
23 // For R=5 kOhms
24
25 \quad Id2 = (Vdc-V)/R2;
26
27 \text{ rac2} = A/Id2;
   disp (rac2, 'The Ac Resistance with R=5 kOhms in Ohms
      ')
29
30 // For R=1 kOhms
31
32 \text{ Id3} = (Vdc-V)/R3;
33
34 \text{ rac3} = A/Id3;
  disp (rac3, 'The Ac Resistance with R=1 kOhms in Ohms
35
36 disp ('Appox 2.69 Ohms')
   Example 207
1 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_1
4 clc; clear;
5 // For the diode circuit, calculate the ac
      resistance, rac, for the following values of R: (
      a) 10 kOhms, (b) 5 kOhms, and (c) 1 kOhms. Use
      the second approximation of a diode.
```

```
7 // Given data
                       // Resistance 1=10 kOhms
9 R1 = 10*10^3;
                       // Resistance 2=5 kOhms
10 R2 = 5*10^3;
11 R3 = 1*10^3;
                       // Resistance 3=1 kOhms
                       // DC supply=10 Volts
12 \text{ Vdc} = 10;
13 \quad V = 0.7;
                        // Starting voltage of diode=0.7
      Volts
14 A = 25*10^{-3};
                   // Constant
15
16 // For R=10 kOhms
17
18 \quad Id1 = (Vdc-V)/R1;
19
20 \text{ rac1} = A/Id1;
   disp (rac1, 'The Ac Resistance with R=10 kOhms in
      Ohms')
22
23 // For R=5 kOhms
24
25 \quad Id2 = (Vdc-V)/R2;
26
27 \text{ rac2} = A/Id2;
   disp (rac2, 'The Ac Resistance with R=5 kOhms in Ohms
28
      ')
29
30 // For R=1 kOhms
31
32 \text{ Id3} = (Vdc-V)/R3;
33
34 \text{ rac3} = A/Id3;
35 disp (rac3, 'The Ac Resistance with R=1 kOhms in Ohms
      ')
36 disp ('Appox 2.69 Ohms')
```

Scilab code Exa 29.2 Example 208

```
Scilab code Exa 29.2 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_2
4 clc; clear;
5 //A common-emitter amplifier circuit has an input of
       25 mVp-p and an output of 5 Vp-p. Calculate Av.
6
  // Given data
9 \text{ Vin} = 25*10^-3;
                         // Input voltage=25 mVolts(p-p)
10 \text{ Vo} = 5;
                         // Output voltage=5 Volts(p-p).
11
12 \text{ Av} = \text{Vo/Vin};
13 disp (Av, 'The Voltage Gain Av is')
   Example 208
1 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_2
4 clc; clear;
5 //A common-emitter amplifier circuit has an input of
       25 mVp-p and an output of 5 Vp-p. Calculate Av.
6
7 // Given data
9 Vin = 25*10^{-3};
                         // Input voltage=25 \text{ mVolts}(p-p)
10 \text{ Vo} = 5;
                         // Output voltage=5 Volts(p-p).
11
12 Av = Vo/Vin;
```

Scilab code Exa 29.3 Example 209

```
Scilab code Exa 29.13 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29<sub>-</sub>3
4 clc; clear;
5 // assume Av still equals 300. If vin is 5 mVp-p,
      calculate Vout.
7 // Given data
9 Vin = 5*10^-3; // Input voltage=5 mVolts(p-p)
                      // Voltage gain=300
10 \text{ Av} = 300;
11
12 Vo = Av*Vin;
13 disp (Vo, 'The Output Voltage in Volts(p-p)')
   Example 209
1 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_{-3}
4 clc; clear;
5 // assume Av still equals 300. If vin is 5 mVp-p,
      calculate Vout.
7 // Given data
9 Vin = 5*10^-3; // Input voltage=5 mVolts(p-p)
                      // Voltage gain=300
10 \text{ Av} = 300;
11
```

```
12 Vo = Av*Vin;
13 disp (Vo, 'The Output Voltage in Volts(p-p)')
```

Scilab code Exa 29.4 Example 210

```
Scilab code Exa 29.4 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_4
4 clc; clear;
5 // Assume that re varies from 3.33 Ohms to 6.67 Ohms
       as the temperature of the transistor changes.
      Calculate the variation in the voltage gain, Av.
7 // Given data
9 rl = 600; // Load resistance=600 Ohms
                  // Internal emitter resistance=6.67
10 \text{ re} = 6.67;
     Ohms
11
12 \text{ Av} = rl/re;
13 disp (Av, 'The Voltage Gain Av is')
14 disp ('Appox 90')
  Example 210
1 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_4
4 clc; clear;
5 // Assume that re varies from 3.33 Ohms to 6.67 Ohms
      as the temperature of the transistor changes.
      Calculate the variation in the voltage gain, Av.
6
```

Scilab code Exa 29.5 Example 211

```
Scilab code Exa 29.5 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29<sub>-</sub>5
4 clc; clear;
5 // Assume that r'e varies from 3.33 Ohms to 6.67
     Ohms. Calculate the minimum and maximum values
      for Av.
7 // Given data
9 \text{ rl} = 600;
                 // Load resistance=600 Ohms
10 \text{ re1} = 3.33;
                 // Internal emitter resistance = 3.33
     Ohms
11 re2 = 6.67; // Internal emitter resistance=6.67
     Ohms
12 \text{ rE} = 60;
            // Emitter resistance=60 Ohms
13
14 Av1 = r1/(re1+rE);
15 disp (Av1, "The Voltage Gain Av(max) when r'e=3.33
      Ohms is")
```

```
16
17 Av2 = r1/(re2+rE);
18 disp (Av2, 'The Voltage Gain Av(min) when r'e=6.67
     Ohms is')
19 disp ('Appox 9')
   Example 211
1 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_{-}5
4 clc; clear;
5 // Assume that r'e varies from 3.33 Ohms to 6.67
     Ohms. Calculate the minimum and maximum values
      for Av.
6
7 // Given data
                 // Load resistance=600 Ohms
9 \text{ rl} = 600;
10 \text{ re1} = 3.33;
                 // Internal emitter resistance=3.33
     Ohms
11 \text{ re2} = 6.67;
                 // Internal emitter resistance = 6.67
     Ohms
12 \text{ rE} = 60;
                 // Emitter resistance=60 Ohms
13
14 Av1 = r1/(re1+rE);
15 disp (Av1, "The Voltage Gain Av(max) when r'e=3.33
     Ohms is")
16
17 Av2 = r1/(re2+rE);
18 disp (Av2, 'The Voltage Gain Av(min) when r'e=6.67
     Ohms is')
19 disp ('Appox 9')
```

Scilab code Exa 29.6 Example 212

```
Scilab code Exa 2916 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_6
4 clc; clear;
5 // Find the exact value of Av. Also, find Vout.
7 // Given data
9 \text{ rl} = 909;
                    // Load resistance=909 Ohms
10 \text{ re} = 3.35;
                    // Internal emitter resistance = 3.35
     Ohms
11 \ Vin = 1;
                    // Input voltage=1 Volts(p-p)
12
13 Av = r1/(re+r1);
14 disp (Av, 'The Voltage Gain Av is')
15
16 Vo = Av*Vin;
17 disp (Vo, 'The Output Voltage in Volts(p-p)')
18 disp ('i.e 996 mVolts(p-p)')
   Example 212
1 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_6
4 clc; clear;
5 // Find the exact value of Av. Also, find Vout.
7 // Given data
8
                    // Load resistance=909 Ohms
9 \text{ rl} = 909;
                    // Internal emitter resistance=3.35
10 \text{ re} = 3.35;
     Ohms
                // Input voltage=1 Volts(p-p)
11 \ Vin = 1;
12
```

```
13 Av = rl/(re+rl);
14 disp (Av, 'The Voltage Gain Av is')
15
16 Vo = Av*Vin;
17 disp (Vo, 'The Output Voltage in Volts(p-p)')
18 disp ('i.e 996 mVolts(p-p)')
```

Scilab code Exa 29.7 Example 213

```
Scilab code Exa 2917 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_7
4 clc; clear;
5 // Calculate Zin.
7 // Given data
9 \text{ rl} = 909;
                         // Load resistance=909 Ohms
10 \text{ re} = 3.35;
                         // Internal emitter resistance
      =3.35 Ohms
                         // Beta=100
11 B = 100;
                         // Resistance1 = 4.7 kOhms
12 R1 = 4.7*10^3;
13 R2 = 5.6*10^3;
                         // Resistance 2 = 5.6 kOhms
14
15 Zibase = B*(re+rl);
16 A = (R1*R2)/(R1+R2);
17
18 Zin = (Zibase*A)/(A+Zibase);
19 disp (Zin, 'The Input impedence in Ohms')
20 disp ('i.e 2.48 kOhms')
   Example 213
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_7
4 clc; clear;
5 // Calculate Zin.
7 // Given data
9 \text{ rl} = 909;
                         // Load resistance=909 Ohms
                         // Internal emitter resistance
10 \text{ re} = 3.35;
      =3.35 Ohms
                         // Beta=100
11 B = 100;
                         // Resistance1=4.7 kOhms
12 R1 = 4.7*10^3;
13 R2 = 5.6*10^3;
                         // Resistance 2 = 5.6 kOhms
14
15 Zibase = B*(re+rl);
16 A = (R1*R2)/(R1+R2);
17
18 Zin = (Zibase*A)/(A+Zibase);
19 disp (Zin, 'The Input impedence in Ohms')
20 disp ('i.e 2.48 kOhms')
```

Scilab code Exa 29.8 Example 214

```
7 // Given data
                     // Resistance1=22 kOhms
9 R1 = 22*10^3;
10 R2 = 18*10^3;
                     // Resistance2=18 kOhms
                     // Generator resistance=600 Ohms
11 \text{ Rg} = 600;
12 \text{ Re} = 1.5*10^3;
                     // Emitter resistance=1.5 kOhms
                     // Load resistance=1 kOhms
13 R1 = 1*10^3;
14 \ Vcc = 20;
                     // Supply Voltage=20 Volts
                     // Voltage Base-Emitter=0.7 Volts
15 Vbe = 0.7;
                     // Beta=200
16 B = 200;
                     // Input Voltage=5 Volts(p-p)
17 \text{ vin} = 5;
18
19 // Calculate the DC quantities first:
20
21 Vb = Vcc*(R2/(R1+R2));
22 disp (Vb, 'The Base Voltage in Volts')
23
24 \text{ Ve} = \text{Vb-Vbe};
25 disp (Ve, 'The Emitter Voltage in Volts')
26
27 Ie = Ve/Re;
                     // Ic = le
28 Ic = Ie;
29 disp (Ic, 'The Collector current in Amps')
30 disp ('i.e 5.53 mAmps')
31
32 \text{ Vc} = \text{Vcc};
                     // Since the collector is tied
      directly to Vcc
33 disp (Vc, 'The Collector Voltage in Volts')
34
35 \text{ Vce} = \text{Vcc-Ve};
36 disp (Vce, 'The Collector-Emmiter Voltage in Volts')
37
38 Icsat = Vcc/Re;
39
40 \text{ Vceoff} = \text{Vcc};
41
42 // Now, calculate AC quantities:
43
```

```
44 \ a = 25*10^{-3};
45
46 \text{ re} = a/Ie;
47 disp (re, 'The AC emmiter resistance in Ohms')
48 disp ('Appox 4.52 Ohms')
49
50 b = Re*R1;
51 c = Re+R1;
52 \text{ rl} = b/c;
53
54 \text{ Av} = rl/(rl+re);
55 disp (Av, 'The Voltage gain is')
56
57 Zinbase = B*(re+rl);
58 disp (Zinbase, 'The Input Base Impedence in Ohms')
59 disp ('i.e 120.9 kOhms')
60
61 d = 1/Zinbase;
62 e = 1/R1;
63 f = 1/R2;
64
65 \text{ Zin} = (d+e+f)^-1
66 disp(Zin, 'The Input Impedence in Ohms')
67 disp ('i.e 9.15 kOhms')
68
69 vb = vin*(Zin/(Zin+Rg));
70 disp (vb, 'The AC base voltage in Volts(p-p)')
71
72 \text{ vout = } Av*vb;
73 disp(vout, 'The AC output voltage in Volts(p-p)')
74
75 \text{ Icq} = \text{Ic}
76 \text{ Vceq} = \text{Vce}
77
78 \text{ Vce1} = [\text{Vcc Vceq 0}]
79 Ic1=[0 Icq Icsat]
80
81 //To plot DC load line
```

```
82
83 printf ("Q(\%f,\%f)\n", Vceq, Icq)
84 plot2d(Vce1, Ic1)
85 plot(Vceq, Icq, ".r")
86 plot(0, Icq,".r")
87 plot(Vceq,0,".r")
88 plot(0, Icsat, ".b")
89 plot(Vceoff, 0, ".b")
90 xlabel("Vce in Volt")
91 ylabel("Ic in mAmps")
92 xtitle("DC Load-line for Emitter Follower Circuit")
   Example 214
  // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_8
4 clc; clear;
5 // Calculate the following quantities: Vb, Ve, Ic,
      Vc, Vce, r'e, Zin(base), Zin, Av, vb, and vout.
      Also, plot the dc load line.
7 // Given data
9 R1 = 22*10^3;
                    // Resistance1=22 kOhms
                    // Resistance2=18 kOhms
10 R2 = 18*10^3;
                    // Generator resistance=600 Ohms
11 \text{ Rg} = 600;
                    // Emitter resistance=1.5 kOhms
12 Re = 1.5*10^3;
13 Rl = 1*10^3;
                    // Load resistance=1 kOhms
                    // Supply Voltage=20 Volts
14 \ Vcc = 20;
                    // Voltage Base-Emitter=0.7 Volts
15 \text{ Vbe} = 0.7;
                    // Beta=200
16 B = 200;
                    // Input Voltage=5 Volts(p-p)
17 \text{ vin} = 5;
18
19 // Calculate the DC quantities first:
20
21 \text{ Vb} = \text{Vcc}*(R2/(R1+R2));
22 disp (Vb, 'The Base Voltage in Volts')
```

```
23
24 \text{ Ve} = \text{Vb-Vbe};
25 disp (Ve, 'The Emitter Voltage in Volts')
26
27 Ie = Ve/Re;
28 Ic = Ie;
                     // Ic = Te
29 disp (Ic, 'The Collector current in Amps')
30 disp ('i.e 5.53 mAmps')
31
32 \text{ Vc} = \text{Vcc};
                     // Since the collector is tied
      directly to Vcc
33 disp (Vc, 'The Collector Voltage in Volts')
34
35 \text{ Vce} = \text{Vcc-Ve};
36 disp (Vce, 'The Collector-Emmiter Voltage in Volts')
37
38 Icsat = Vcc/Re;
39
40 Vceoff = Vcc;
41
42 // Now, calculate AC quantities:
43
44 \ a = 25*10^{-3};
45
46 \text{ re} = a/Ie;
47 disp (re, 'The AC emmiter resistance in Ohms')
48 disp ('Appox 4.52 Ohms')
49
50 b = Re*R1;
51 c = Re+R1;
52 \text{ rl} = b/c;
53
54 \text{ Av} = rl/(rl+re);
55 disp (Av, 'The Voltage gain is')
57 Zinbase = B*(re+rl);
58 disp (Zinbase, 'The Input Base Impedence in Ohms')
59 disp ('i.e 120.9 kOhms')
```

```
60
61 d = 1/Zinbase;
62 e = 1/R1;
63 f = 1/R2;
64
65 \text{ Zin} = (d+e+f)^-1
66 disp(Zin, 'The Input Impedence in Ohms')
67 disp ('i.e 9.15 kOhms')
68
69 vb = vin*(Zin/(Zin+Rg));
70 disp (vb, 'The AC base voltage in Volts(p-p)')
71
72 \text{ vout = } Av*vb;
73 disp(vout, 'The AC output voltage in Volts(p-p)')
74
75 \text{ Icq} = \text{Ic}
76 \text{ Vceq} = \text{Vce}
77
78 Vce1 = [Vcc Vceq 0]
79 Ic1=[0 Icq Icsat]
80
81 //To plot DC load line
82
83 printf("Q(\%f,\%f)\n", Vceq, Icq)
84 plot2d(Vce1, Ic1)
85 plot(Vceq, Icq,".r")
86 plot(0, Icq,".r")
87 plot(Vceq,0,".r")
88 plot(0, Icsat, ".b")
89 plot (Vceoff, 0, ".b")
90 xlabel("Vce in Volt")
91 ylabel("Ic in mAmps")
92 xtitle("DC Load-line for Emitter Follower Circuit")
```

```
Scilab code Exa 2919 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_9
4 clc; clear;
5 // Calculate the following: Ie, Vcb, r'e, Av, vout
      and zin.
7 // Given data
9 \text{ Rc} = 1.5*10^3;
                    // Collector resistance=1.5
      kOhms
10 Re = 1.8*10^3;
                         // Emitter resistance=1.8 kOhms
                        // Load resistance=1.5 kOhms
11 Rl = 1.5*10^3;
                        // +ve Supply Voltage=15 Volts
12 \ Vcc = 15;
                         // -ve Supply Voltage=9 Volts
13 Vee = 9;
                         // Voltage Base-Emitter=0.7
14 \text{ Vbe} = 0.7;
      Volts
15 vin = 25*10^-3; // Input Voltage=25 \text{ mVolts}(p-p)
16
17
18 Ie = (Vee-Vbe)/Re;
19 disp (Ie, 'The Emmiter current in Amps')
20 disp ('i.e 4.61 mApms')
21
22 Ic = Ie;
                    // Ic = le
23
24 \text{ Vcb} = \text{Vcc-(Ic*Rc)};
25 disp (Vcb, 'The Collector-Base Voltage in Volts')
26 disp ('Appox 8.09 Volts')
27
28 a = 25*10^{-3};
29
30 \text{ re} = a/Ie;
31 disp (re, 'The AC emmiter resistance in Ohms')
32
```

```
33 b = Rc*R1;
34 c = Rc + R1;
35
36 \text{ rl} = b/c;
37
38 \text{ Av} = \text{rl/re};
39 disp (Av, 'The Voltage gain is')
40
41 \text{ vout = } Av*vin;
42 disp(vout, 'The AC output voltage in Volts(p-p)')
43 disp ('Appox 3.46 Volts(p-p)')
44
45 d = Re*re
46 e = Re + re
47
48 Zin = d/e;
49 disp (Zin, 'The Input Impedence in Ohms')
   Example 215
1 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_9
4 clc; clear;
5 // Calculate the following: Ie, Vcb, r'e, Av, vout
6
7 // Given data
9 \text{ Rc} = 1.5*10^3;
                          // Collector resistance=1.5
      kOhms
                          // Emitter resistance=1.8 kOhms
10 Re = 1.8*10^3;
                          // Load resistance=1.5 kOhms
11 R1 = 1.5*10^3;
                          // +ve Supply Voltage=15 Volts
12 \ Vcc = 15;
                         // -ve Supply Voltage=9 Volts
13 Vee = 9;
14 \text{ Vbe} = 0.7;
                         // Voltage Base-Emitter=0.7
      Volts
15 \text{ vin} = 25*10^-3;
                         // Input Voltage=25 mVolts(p-p)
```

```
16
17
18 Ie = (Vee-Vbe)/Re;
19 disp (Ie, 'The Emmiter current in Amps')
20 disp ('i.e 4.61 mApms')
21
                      // Ic = ^{\sim} Ie
22 Ic = Ie;
23
24 \text{ Vcb} = \text{Vcc-(Ic*Rc)};
25 disp (Vcb, 'The Collector-Base Voltage in Volts')
26 disp ('Appox 8.09 Volts')
27
28 \ a = 25*10^{-3};
29
30 \text{ re} = a/Ie;
31 disp (re, 'The AC emmiter resistance in Ohms')
32
33 b = Rc*R1;
34 c = Rc+R1;
35
36 \text{ rl} = b/c;
37
38 \text{ Av} = r1/re;
39 disp (Av, 'The Voltage gain is')
40
41 \text{ vout = } Av*vin;
42 disp(vout, 'The AC output voltage in Volts(p-p)')
43 disp ('Appox 3.46 Volts(p-p)')
45 d = Re*re
46 e = Re + re
47
48 Zin = d/e;
49 disp (Zin, 'The Input Impedence in Ohms')
```

Scilab code Exa 29.10 Example 216

```
Scilab code Exa 29.10 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29<sub>-</sub>10
4 clc; clear;
5 // Calculate the ac output voltage, vout.
7 // Given data
                          // Collector resistance=1.2
9 \text{ Rc} = 1.2*10^3;
      kOhms
10 Re = 2.2*10^3;
                           // Emitter resistance=2.2 kOhms
                          // Load resistance = 3.3 kOhms
11 Rl = 3.3*10^3;
                          // Generator Resistance=600 Ohms
12 \text{ Rg} = 600;
                          // +ve Supply Voltage=15 Volts
13 \ Vcc = 12;
                          // -ve Supply Voltage=9 Volts
14 \text{ Vee} = 12;
                          // Voltage Base-Emitter=0.7
15 Vbe = 0.7;
      Volts
16 \text{ vin} = 1;
                          // Input Voltage=1 Volts(p-p)
17
18 Ie = (Vee-Vbe)/Re;
19
20 a = 25*10^{-3};
21 \text{ re} = a/Ie;
22
23 b = Rc*R1;
24 c = Rc + R1;
25 \text{ rl} = b/c;
26
27 \text{ Av} = rl/re;
28
```

```
29 d = Re*re
30 e = Re + re
31 \text{ Zin} = d/e;
32
33 ve = vin*(Zin/(Zin+Rg));
34
35 \text{ vout} = Av*ve;
36 disp(vout, 'The AC output voltage in Volts(p-p)')
   Example 216
1 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29<sub>-</sub>10
4 clc; clear;
5 // Calculate the ac output voltage, vout.
7 // Given data
                          // Collector resistance = 1.2
9 \text{ Rc} = 1.2*10^3;
      kOhms
10 Re = 2.2*10^3;
                          // Emitter resistance = 2.2 kOhms
11 R1 = 3.3*10^3;
                          // Load resistance=3.3 kOhms
                          // Generator Resistance=600 Ohms
12 \text{ Rg} = 600;
                          // +ve Supply Voltage=15 Volts
13 \ Vcc = 12;
                          // -ve Supply Voltage=9 Volts
14 \text{ Vee} = 12;
                          // Voltage Base-Emitter=0.7
15 Vbe = 0.7;
      Volts
16 \text{ vin} = 1;
                          // Input Voltage=1 Volts(p-p)
17
18 Ie = (Vee-Vbe)/Re;
19
20 a = 25*10^{-3};
21 \text{ re} = a/Ie;
22
23 b = Rc*R1;
24 c = Rc + R1;
25 \text{ rl} = b/c;
```

```
26
27 Av = rl/re;
28
29 d = Re*re
30 e = Re+re
31 Zin = d/e;
32
33 ve = vin*(Zin/(Zin+Rg));
34
35 vout = Av*ve;
36 disp(vout, 'The AC output voltage in Volts(p-p)')
```

Chapter 30 Field Effect Transistors

Chapter 30 Field Effect Transistors

Scilab code Exa 30.1 Example 217

```
Scilab code Exa 3011 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_1
4 clear; clc;
5 // Determine Id for each value of Vgs (a) 0V; (b)
      -0.5V; (c) -1V (d) -2V (e) -3V
7 // Given Data
                         // Voltage Gate-Source 1=0 Volts
9 \text{ Vgs1} = 0;
                         // Voltage Gate-Source 2=-0.5
10 \text{ Vgs2} = -0.5;
      Volts
11 \text{ Vgs3} = -1;
                         // Voltage Gate-Source 3=-1
      Volts
12 \text{ Vgs4} = -2;
                         // Voltage Gate-Source 4=-2
      Volts
```

```
// Voltage Gate-Source 5=-3
13 \text{ Vgs5} = -3;
      Volts
14 Vgsoff = -4;
                           // Voltage Gate-Source(off)=-4
      Volts
  Idss = 10*10^{-3}
                           // Idss = 10m Amps
15
16
17 a = (1-(Vgs1/Vgsoff))
18 b = (1-(Vgs2/Vgsoff))
19 c = (1-(Vgs3/Vgsoff))
20 d = (1-(Vgs4/Vgsoff))
21 e = (1-(Vgs5/Vgsoff))
22
23 // Vgs = 0 Volts
24
25 \text{ Id1} = \text{Idss*a*a}
26 disp (Id1, 'The Value of Id for Vgs = 0 Volts in Amps
27 disp ('i.e 10 mAmps')
28
29 // \text{Vgs} = -0.5 \text{ Volts}
30
31 \text{ Id2} = \text{Idss*b*b}
32 disp (Id2, 'The Value of Id for Vgs = -0.5 Volts in
      Amps')
33 disp ('i.e 7.65 mAmps')
34
35 // \text{Vgs} = -1 \text{ Volts}
36
37 \text{ Id3} = \text{Idss*c*c}
38 disp (Id3, The Value of Id for Vgs = -1 Volts in
      Amps')
39
  disp ('i.e 5.62 mAmps')
40
41 // \text{Vgs} = -2 \text{ Volts}
42
43 \text{ Id4} = \text{Idss*d*d}
44 disp (Id4, 'The Value of Id for Vgs = -2 Volts in
      Amps')
```

```
45 disp ('i.e 2.5 mAmps')
46
  // \text{ Vgs} = -3 \text{ Volts}
47
48
49 \text{ Id5} = \text{Idss*e*e}
50 disp (Id5, The Value of Id for Vgs = -3 Volts in
      Amps')
51 disp ('i.e 0.625 mAmps')
   Example 217
1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_1
4 clear; clc;
5 // Determine Id for each value of Vgs (a) 0V; (b)
      -0.5V; (c) -1V (d) -2V (e) -3V
7
  // Given Data
                          // Voltage Gate-Source 1=0 Volts
9 \text{ Vgs1} = 0;
                          // Voltage Gate-Source 2=-0.5
10 \text{ Vgs2} = -0.5;
      Volts
11 \text{ Vgs3} = -1;
                          // Voltage Gate-Source 3=-1
      Volts
                          // Voltage Gate-Source 4=-2
12 \text{ Vgs4} = -2;
      Volts
13 \text{ Vgs5} = -3;
                          // Voltage Gate-Source 5=-3
      Volts
                          // Voltage Gate-Source(off)=-4
14 \text{ Vgsoff} = -4;
      Volts
  Idss = 10*10^-3
                          // Idss = 10m Amps
15
16
17 a = (1-(Vgs1/Vgsoff))
18 b = (1-(Vgs2/Vgsoff))
19 c = (1-(Vgs3/Vgsoff))
20 d = (1-(Vgs4/Vgsoff))
21 e = (1-(Vgs5/Vgsoff))
```

```
22
23 // \text{Vgs} = 0 \text{ Volts}
24
25 Id1 = Idss*a*a
  disp (Id1, 'The Value of Id for Vgs = 0 Volts in Amps
   disp ('i.e 10 mAmps')
27
28
   // \text{ Vgs} = -0.5 \text{ Volts}
29
30
31 \text{ Id2} = \text{Idss*b*b}
32 disp (Id2, 'The Value of Id for Vgs = -0.5 Volts in
      Amps')
33 disp ('i.e 7.65 mAmps')
34
35
   // \text{ Vgs} = -1 \text{ Volts}
36
  Id3 = Idss*c*c
   disp (Id3, 'The Value of Id for Vgs = -1 Volts in
      Amps')
39 disp ('i.e 5.62 mAmps')
40
41 // \text{Vgs} = -2 \text{ Volts}
42
43 \text{ Id4} = \text{Idss*d*d}
44 disp (Id4, 'The Value of Id for Vgs = -2 Volts in
      Amps')
   disp ('i.e 2.5 mAmps')
45
46
   // \text{ Vgs} = -3 \text{ Volts}
47
48
49 \text{ Id5} = \text{Idss*e*e}
50 disp (Id5, The Value of Id for Vgs = -3 Volts in
      Amps')
51 disp ('i.e 0.625 mAmps')
```

Scilab code Exa 30.2 Example 218

```
Scilab code Exa 30.2 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_2
4 clear; clc;
5 // Find the minimim and maximum value of Id and Vds
       if Vgs=-1.5 Volts
7 // Given Data
9 Idssmin = 2*10^-3;
                                // \operatorname{Idss}(\min) = 2m \operatorname{Amp}
10 Idssmax = 20*10^-3;
                                // \operatorname{Idss}(\max) = 20 \operatorname{m} \operatorname{Amp}
                                // Voltage Gate-Source=-1.5V
11 Vgs = -1.5;
12 Vgsoffmin = -2;
                                // Voltage Gate-Source(off)(
      \min = -2 \text{ Volts}
13 Vgsoffmax = -8;
                                // Voltage Gate-Source(off)(
      \max)=-8 Volts
14 \text{ Vdd} = 20;
                                // Supply Voltage (Drain)=20
      Volts
15 \text{ Rd} = 1*10^3;
                                // Drain Resistance=1k Ohms
16
17 a = 1-(Vgs/Vgsoffmin);
18 b = 1-(Vgs/Vgsoffmax);
19
20 // Calculation using Minimum Values
21
22 \text{ Id1} = \text{Idssmin}*a*a;
23 disp (Id1, 'The Value of Id in Amps using Minimum
       Values')
24 disp ('i.e 125 uAmps')
25
```

```
26 \text{ Vds1} = \text{Vdd-Id1*Rd};
27 disp (Vds1, 'The Value of Vds in Volts using Minimum
       Values')
28
29 // Calculation using Maximum Values
30
31 \text{ Id2} = \text{Idssmax*b*b};
32 disp (Id2, 'The Value of Id in Amps using Maximum
       Values')
33 disp ('i.e 13.2 mAmps')
34
35 \text{ Vds2} = \text{Vdd-Id2*Rd};
36 disp (Vds2, 'The Value of Vds in Volts using Maximun
       Values')
37
38 \text{ Vp} = -\text{Vgsoffmax};
39
40 \text{ Vdsp} = \text{Vp+Vgs};
41 disp (Vdsp, 'The Value of Vds(p) in Volts using
      Maximun Values')
   Example 218
1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_2
4 clear; clc;
5 // Find the minimim and maximum value of Id and Vds
       if Vgs=-1.5 Volts
7 // Given Data
9 Idssmin = 2*10^-3;
                                 // \operatorname{Idss}(\min) = 2m \operatorname{Amp}
                                 // \operatorname{Idss}(\max) = 20 \operatorname{m} \operatorname{Amp}
10 Idssmax = 20*10^-3;
                                 // Voltage Gate-Source=-1.5V
11 Vgs = -1.5;
12 Vgsoffmin = -2;
                                 // Voltage Gate-Source(off)(
      \min = -2 \text{ Volts}
                                 // Voltage Gate-Source(off)(
13 Vgsoffmax = -8;
```

```
\max)=-8 Volts
14 \text{ Vdd} = 20;
                                // Supply Voltage (Drain)=20
      Volts
15 \text{ Rd} = 1*10^3;
                                // Drain Resistance=1k Ohms
16
17 a = 1-(Vgs/Vgsoffmin);
18 b = 1-(Vgs/Vgsoffmax);
19
20 // Calculation using Minimum Values
21
22 \text{ Id1} = \text{Idssmin}*a*a;
23 disp (Id1, 'The Value of Id in Amps using Minimum
      Values')
24 disp ('i.e 125 uAmps')
25
26 \text{ Vds1} = \text{Vdd-Id1*Rd};
27 disp (Vds1, 'The Value of Vds in Volts using Minimum
      Values')
28
29 // Calculation using Maximum Values
30
31 \text{ Id2} = \text{Idssmax*b*b};
32 disp (Id2, 'The Value of Id in Amps using Maximum
      Values')
33 disp ('i.e 13.2 mAmps')
34
35 \text{ Vds2} = \text{Vdd-Id2*Rd};
36 disp (Vds2, 'The Value of Vds in Volts using Maximun
      Values')
37
38 \text{ Vp} = -\text{Vgsoffmax};
39
40 \text{ Vdsp} = \text{Vp+Vgs};
41 disp (Vdsp, 'The Value of Vds(p) in Volts using
      Maximun Values')
```

Scilab code Exa 30.3 Example 219

```
Scilab code Exa 30.3 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_3
4 clear; clc;
5 // Calculate the value of Vd
7 // Given Data
9 \text{ Vs} = 1;
                     // Voltage at Resistor Rs=1 Volts
                     // Source Resistor=200 Ohms
10 \text{ Rs} = 200;
                     // Supply Voltage (Drain)=10 Volts
11 \text{ Vdd} = 10;
                     // Drain Resistor=1k Ohms
12 \text{ Rd} = 1*10^3;
13
14 Is=Vs/Rs;
15
16 \text{ Id} = \text{Is};
17
18 Vd = Vdd - Id*Rd;
19 disp (Vd, 'The Drain Voltage Vd in Volts')
   Example 219
1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_3
4 clear; clc;
5 // Calculate the value of Vd
  // Given Data
```

Scilab code Exa 30.4 Example 220

```
Scilab code Exa 304 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_{-4}
4 clear; clc;
5 // Calculate Vg, Vs, Id, Vd.
7 // Given Data
8
                         // Resistor 1=390k Ohms
9 R1 = 390*10^3;
                         // Resistor 2=100k Ohms
10 R2 = 100*10^3;
                         // Drain Resistor=1k Ohms
11 Rd = 1*10^3;
12 \text{ Vdd} = 15;
                         // Supply Voltage (Drain)=15
      Volts
13 Vgs = -1;
                         // Voltage Gate-Source=-1 Volts
                         // Source Resistor=800 Ohms
14 \text{ Rs} = 800;
15
16 \text{ Vg} = (R2/(R1+R2))*Vdd;
17 disp (Vg, 'The Value of Vg in Volts')
```

```
18 disp ('i.e 3 Volts')
19
20 \text{ Vs} = \text{Vg-Vgs};
21 disp (Vs, 'The Value of Vs in Volts')
22 disp ('i.e 4 Volts')
23
24 Id = Vs/Rs;
25 disp (Id, 'The Value of Id in Amps.')
26 disp ('i.e 5 mAmps')
27
28 \text{ Vd} = \text{Vdd-Id*Rd}
29 disp (Vd, 'The Value of Vd in Volts')
30 disp ('Appox 10 Volts')
   Example 220
1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_4
4 clear; clc;
5 // Calculate Vg, Vs, Id, Vd.
7 // Given Data
                          // Resistor 1=390k Ohms
9 R1 = 390*10^3;
                          // Resistor 2=100k Ohms
10 R2 = 100*10^3;
                          // Drain Resistor=1k Ohms
11 \text{ Rd} = 1*10^3;
12 \text{ Vdd} = 15;
                          // Supply Voltage (Drain)=15
      Volts
                          // Voltage Gate-Source=-1 Volts
13 Vgs = -1;
14 \text{ Rs} = 800;
                          // Source Resistor=800 Ohms
15
16 \text{ Vg} = (R2/(R1+R2))*Vdd;
17 disp (Vg, 'The Value of Vg in Volts')
18 disp ('i.e 3 Volts')
19
20 \text{ Vs} = \text{Vg-Vgs};
21 disp (Vs, 'The Value of Vs in Volts')
```

```
disp ('i.e 4 Volts')

disp ('i.e 4 Volts')

disp (Id = Vs/Rs;

find the Value of Id in Amps.')

disp ('i.e 5 mAmps')

Vd = Vdd-Id*Rd

disp (Vd, 'The Value of Vd in Volts')

disp ('Appox 10 Volts')
```

Scilab code Exa 30.5 Example 221

```
Scilab code Exa 3015 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_{-}5
4 clc; clear;
5 // Calculate the value Drain Current Id and Drain
      Voltage Vd.
7 // Given Data
9 \text{ Vdd} = 15;
                          // Supply Voltage (Drain)=15
      Volts
10 \text{ Vbe} = 0.7;
                          // Voltage Base-Emitter=0.7
      Volts
                          // Emitter Resistor = 2.2 kOhms
11 Re = 2.2*10^3;
                          // Drain Resistor=1 kOhms
12 \text{ Rd} = 1*10^3;
13 \text{ Vee} = 15;
                          // Supply Voltage (Emitter)=15
      Volts
14
15
16 Ic = (Vee-Vbe)/Re;
```

```
17
18 \text{ Id} = \text{Ic};
19 disp (Id, 'The Drain Current Id in Amps')
20 disp ('i.e 6.5 mAmps')
21
22 \text{ Vd} = \text{Vdd-Id*Rd};
23 disp (Vd, 'The Drain Voltage Vd in Voltage')
   Example 221
1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_5
4 clc; clear;
  // Calculate the value Drain Current Id and Drain
       Voltage Vd.
7 // Given Data
9 \text{ Vdd} = 15;
                            // Supply Voltage (Drain)=15
       Volts
10 \text{ Vbe} = 0.7;
                            // Voltage Base-Emitter=0.7
       Volts
11 Re = 2.2*10^3;
                            // Emitter Resistor = 2.2 kOhms
                            // Drain Resistor=1 kOhms
12 \text{ Rd} = 1*10^3;
                            // Supply Voltage (Emitter)=15
13 \text{ Vee} = 15;
       Volts
14
15
16 \text{ Ic} = (\text{Vee-Vbe})/\text{Re};
17
18 \text{ Id} = \text{Ic};
19 disp (Id, 'The Drain Current Id in Amps')
20 disp ('i.e 6.5 mAmps')
21
22 \text{ Vd} = \text{Vdd-Id*Rd};
23 disp (Vd, 'The Drain Voltage Vd in Voltage')
```

Scilab code Exa 30.6 Example 222

```
Scilab code Exa 30.16 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_6
4 clear; clc;
5 // Calculate the Voltage Gain Av and Output Voltage
      Vo
7 // Given Data
9 \text{ Rd} = 1.5*10^3;
                        // Drain Resistor=1.5 kOhms
                           // Load Resistor=10 kOhms
10 Rl = 10*10^3;
10 RI = 10*10 3; // Load Resistor:
11 Idss = 10*10^{-3}; // Idss=10 \text{ mAmps}
                           // Voltage Gate-Source=-1 Volts
12 \text{ Vgs} = -1;
13 Vgsoff = -4;
                       // Voltage Gate-Source (off)=-4
      Volts
                           // Input Voltage=0.2 Volts(p-p)
14 \text{ Vin} = 0.2;
15
16 \text{ gmo} = 2*Idss/(-Vgsoff);
17
18 gm = gmo*(1-(Vgs/Vgsoff));
19
20 \text{ rl} = (Rd*R1)/(Rd+R1);
21
22 \text{ Av = gm*rl};
23 disp (Av, 'The Voltage Gain Av is')
24 disp ('Appox 4.875')
25
26 \text{ Vo} = \text{Av}*\text{Vin}
27 disp (Vo, 'The Output Voltage Vo in Volts(p-p)')
28 disp ('Appox 0.975 \text{ Volts}(p-p)')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_6
4 clear; clc;
5 // Calculate the Voltage Gain Av and Output Voltage
      Vo
7 // Given Data
9 Rd = 1.5*10^3;
                         // Drain Resistor=1.5 kOhms
                         // Load Resistor=10 kOhms
10 R1 = 10*10^3;
11 Idss = 10*10^-3;
                         // Idss=10 mAmps
                         // Voltage Gate-Source=-1 Volts
12 \text{ Vgs} = -1;
13 Vgsoff = -4;
                         // Voltage Gate-Source(off)=-4
      Volts
                         // Input Voltage = 0.2 \text{ Volts} (p-p)
14 \text{ Vin} = 0.2;
15
16 \text{ gmo} = 2*Idss/(-Vgsoff);
17
18 gm = gmo*(1-(Vgs/Vgsoff));
19
20 rl = (Rd*R1)/(Rd+R1);
21
22 \text{ Av = gm*rl};
23 disp (Av, 'The Voltage Gain Av is')
24 disp ('Appox 4.875')
25
26 \text{ Vo = Av*Vin}
27 disp (Vo, 'The Output Voltage Vo in Volts(p-p)')
28 disp ('Appox 0.975 \text{ Volts}(p-p)')
```

Scilab code Exa 30.7 Example 223

```
Scilab code Exa 30.17 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30<sub>-</sub>7
4 clc; clear;
5 // Calculate Av, Vo & Zo.
7 // Given Data
8
                          // Source Resistor = 240 Ohms
9 \text{ Rs} = 240;
                          // Load Resistor = 1.8 kOhms
10 Rl = 1.8*10^3;
11 Vgsoff = -8;
                          // Voltage Gate-Source(off)=-8
      Volts
12 Vgs = -2;
                          // Voltage Gate-Source=-2 Volts
                          // Idss=15 \text{ mAmps}.
13 \text{ Idss} = 15*10^-3
                          // Input Voltage=1 Volts(p-p)
14 \text{ Vin} = 1;
15
16 \text{ rl} = ((Rs*R1)/(Rs+R1));
17 \text{ gmo} = 2*Idss/-Vgsoff;
18 gm = gmo*(1-(Vgs/Vgsoff));
19
20 \text{ Av = gm*rl/(1+gm*rl);}
21 disp (Av, 'The Voltage Gain Av is')
22
23 \text{ Vo = Av*Vin};
24 disp (Vo, 'The Output Voltage Vo in Volts(p-p)')
25
26 A = (1/gm);
27 \quad Zo = ((Rs*A)/(Rs+A));
28 disp (Zo, 'The Output Impedence Zo in Ohms')
29 disp ('Appox 143.5 Ohms')
   Example 223
1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
```

```
3 // Example No. 30<sub>-</sub>7
4 clc; clear;
5 // Calculate Av, Vo & Zo.
7 // Given Data
                          // Source Resistor = 240 Ohms
9 \text{ Rs} = 240;
                          // Load Resistor = 1.8 kOhms
10 R1 = 1.8*10^3;
                           // Voltage Gate-Source(off)=-8
11 Vgsoff = -8;
      Volts
                          // Voltage Gate-Source=-2 Volts
12 \text{ Vgs} = -2;
                          // Idss=15 \text{ mAmps}.
13 \text{ Idss} = 15*10^{-3}
                          // Input Voltage=1 Volts(p-p)
14 \text{ Vin} = 1;
15
16 \text{ rl} = ((Rs*R1)/(Rs+R1));
17 gmo = 2*Idss/-Vgsoff;
18 gm = gmo*(1-(Vgs/Vgsoff));
19
20 \text{ Av = gm*rl/(1+gm*rl);}
21 disp (Av, 'The Voltage Gain Av is')
22
23 \text{ Vo = Av*Vin};
24 disp (Vo, 'The Output Voltage Vo in Volts(p-p)')
25
26 A = (1/gm);
27 \text{ Zo} = ((Rs*A)/(Rs+A));
28 disp (Zo, 'The Output Impedence Zo in Ohms')
29 disp ('Appox 143.5 Ohms')
```

Scilab code Exa 30.8 Example 224

Scilab code Exa 3018 // Grob's Basic Electronics 11e

```
2 // Chapter No. 30
3 // Example No. 30_{-8}
4 clear; clc;
5 // Calculate Av, Vo, Zin.
7 // Given Data
8
                          // Drain Resistor = 1.2 kOhms
9 \text{ Rd} = 1.2*10^3;
                         // Load Resistor=15 kOhms
10 R1 = 15*10^3;
                         // Transconductance = 3.75
11 \text{ gm} = 3.75*10^{-3};
      mSiemens
12 \text{ Vin} = 10*10^{-3};
                         // Input Voltage=10 mVpp
                          // Source Resistor = 200 Ohms
13 \text{ Rs} = 200;
14
15 rl = ((Rd*R1)/(Rd+R1));
17 Av = gm*rl;
18 disp (Av, 'The Voltage Gain Av is')
19
20 \text{ Vo = Av*Vin};
21 disp (Vo, 'The Output Voltage in Volts(p-p)')
22 disp ('Appox 41.6 mVolts(p-p)')
23
24 A = (1/gm);
25
26 \text{ Zi} = ((Rs*A)/(Rs+A));
27 disp (Zi, 'The Output Impedence Zi in Ohms')
28 disp ('Appox 114 Ohms')
   Example 224
1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_8
4 clear; clc;
5 // Calculate Av, Vo, Zin.
7 // Given Data
```

```
8
9 \text{ Rd} = 1.2*10^3;
                          // Drain Resistor = 1.2 kOhms
                          // Load Resistor=15 kOhms
10 Rl = 15*10^3;
                          // Transconductance=3.75
11 \text{ gm} = 3.75*10^{-3};
      mSiemens
12 Vin = 10*10^-3;
                          // Input Voltage=10 mVpp
                          // Source Resistor = 200 Ohms
13 \text{ Rs} = 200;
14
15 rl = ((Rd*R1)/(Rd+R1));
16
17 \text{ Av} = \text{gm*rl};
18 disp (Av, 'The Voltage Gain Av is')
19
20 \text{ Vo = Av*Vin};
21 disp (Vo, 'The Output Voltage in Volts(p-p)')
22 disp ('Appox 41.6 mVolts(p-p)')
23
24 A = (1/gm);
25
26 \text{ Zi} = ((Rs*A)/(Rs+A));
27 disp (Zi, 'The Output Impedence Zi in Ohms')
28 disp ('Appox 114 Ohms')
```

Scilab code Exa 30.9 Example 225

```
Scilab code Exa 30.9 // Grob's Basic Electronics 11e

2 // Chapter No. 30

3 // Example No. 30_9

4 clear; clc;

5 // Determine Id for each value of Vgs (a) 2V; (b) -2V; (c) 0V
```

```
7 // Given Data
                           // Voltage Gate-Source 1=2 Volts
8 \text{ Vgs1} = 2;
9 \text{ Vgs2} = -2;
                           // Voltage Gate-Source 2=-2
      Volts
10 \text{ Vgs3} = 0;
                           // Voltage Gate-Source 3=0 Volts
                           // Voltage Gate-Source(off)=-4
11 Vgsoff = -4;
      Volts
                           // Idss = 10m Amps
12
  Idss = 10*10^-3;
13
14 a = (1-(Vgs1/Vgsoff));
15 b = (1-(Vgs2/Vgsoff));
16 c = (1-(Vgs3/Vgsoff));
17
18 // \text{Vgs} = 2 \text{ Volts}
19
20 \text{ Id1} = \text{Idss*a*a};
21 disp (Id1, 'The Value of Id for Vgs = 2 Volts in Amps
  disp ('i.e 22.5 mAmps')
22
23
24 // \text{Vgs} = -2 \text{Volts}
25
26 \text{ Id2} = \text{Idss*b*b};
27 disp (Id2, 'The Value of Id for Vgs = -2 Volts in
      Amps')
28 disp ('i.e 2.5 mAmps')
29
30 // \text{Vgs} = 0 \text{ Volts}
31
32 \text{ Id3} = \text{Idss*c*c};
33 disp (Id3, 'The Value of Id for Vgs = 0 Volts in Amps
34 disp ('i.e 10 mAmps')
   Example 225
1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
```

```
3 // Example No. 30_9
4 clear; clc;
5 // Determine Id for each value of Vgs (a) 2V; (b) -2V
      ; (c) 0V
7 // Given Data
                          // Voltage Gate-Source 1=2 Volts
8 \text{ Vgs1} = 2;
9 \text{ Vgs2} = -2;
                          // Voltage Gate-Source 2=-2
      Volts
                          // Voltage Gate-Source 3=0 Volts
10 \text{ Vgs3} = 0;
11 Vgsoff = -4;
                          // Voltage Gate-Source(off)=-4
      Volts
12
  Idss = 10*10^-3;
                          // Idss = 10m Amps
13
14 a = (1-(Vgs1/Vgsoff));
15 b = (1-(Vgs2/Vgsoff));
16 c = (1-(Vgs3/Vgsoff));
17
18 // \text{Vgs} = 2 \text{ Volts}
19
20 \text{ Id1} = \text{Idss*a*a};
  disp (Id1, 'The Value of Id for Vgs = 2 Volts in Amps
  disp ('i.e 22.5 mAmps')
22
23
24 // \text{Vgs} = -2 \text{Volts}
25
26 \text{ Id2} = \text{Idss*b*b};
  disp (Id2, 'The Value of Id for Vgs = -2 Volts in
      Amps')
  disp ('i.e 2.5 mAmps')
28
29
30 // Vgs = 0 Volts
31
32 \text{ Id3} = \text{Idss*c*c};
33 disp (Id3, 'The Value of Id for Vgs = 0 Volts in Amps
      ')
34 disp ('i.e 10 mAmps')
```

Scilab code Exa 30.10 Example 226

```
Scilab code Exa 30.110 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_10
4 clear; clc;
5 // Calculate the value of Rd to provide an Id(on) of
       10m Amps.
6
7 // Given Data
                        // Suppy Voltage (Drain)=15 Volts
9 \text{ Vdd} = 15;
                        // Voltage Gate-Source(on)=10
10 \text{ Vgson} = 10;
      Volts
  Idon = 10*10^-3; // Drain Current(on)=10m Amps
11
12
13 Rd = (Vdd-Vgson)/Idon;
14 disp (Rd, 'The Drain Resistance in Ohms');
15
16 disp('A 470 Ohms resistor would provide the proper
      biasing voltage at the
                               gate')
   Example 226
1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_10
4 clear; clc;
5 // Calculate the value of Rd to provide an Id(on) of
       10m Amps.
6
```

Chapter 31 Power Amplifiers

Chapter 31 Power Amplifiers

Scilab code Exa 31.1 Example 227

```
Scilab code Exa 3111 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_1
4 clear; clc;
5 // Calculate the following dc quantities Icq, Vceq,
      Pd, Ic(sat) and Vce(off). Also draw the dc load
      line
7 // Given Data
                        // Resistor 1=18k Ohms
9 R1 = 18*10^3;
9 \text{ K1} = 10 * 10 3;
10 \text{ R2} = 2.7 * 10^3;
                         // Resistor 2=2.7k Ohms
                         // Supply Voltage (Collector)=20
11 \ Vcc = 20;
      Volts
12 \text{ Vbe} = 0.7;
                    // Voltage Base-Emitter=0.7
      Volts
13 Re = 240;
                         // Emitter Resistor = 240 Ohms
14 \text{ Rc} = 1*10^3;
                         // Collector Resistor=1k Ohms
```

```
15
16 \text{ Vb} = \text{Vcc}*(R2/(R1+R2));
17
18 Ve = Vb - Vbe;
19
20 //Ie = Ic;
21
22 \text{ Icq} = \text{Ve/Re};
23 disp (Icq, 'The value of Icq in Amps')
24 disp ('i.e Appox 7.91 mAmps')
25
26 \text{ Vceq} = \text{Vcc-Icq*(Rc+Re)};
27 disp (Vceq, 'The value of Vceq in Volts')
28 disp ('Appox 10.19 Volts')
29
30 \text{ Pd} = Vceq*Icq;
31 disp (Pd, 'The Power Dissipation in Watts')
32 disp ('i.e 80.6 mWatts')
33
34 \text{ Icsat} = \text{Vcc/(Rc+Re)};
35 disp (Icsat, 'The value of Ic(sat) in Amps')
36 disp ('i.e 16.1 mAmps')
37
38 Vceoff = Vcc;
39 disp (Vceoff, 'The value of Vce(off) in Volts')
40
41 // For DC load line
42
43 Vce1=[Vceoff Vceq 0]
44 Ic1=[0 Icq Icsat]
45
46 //To plot DC load line
47
48 printf ("Q(\%f,\%f)\n", Vceq, Icq)
49 plot2d(Vce1, Ic1)
50 plot(Vceq, Icq, ".r")
51 plot(0, Icq,".r")
52 plot(Vceq,0,".r")
```

```
53 plot(0, Icsat, ".b")
54 plot (Vceoff, 0, ".b")
55 xlabel("Vce in volt")
56 ylabel("Ic in Ampere")
57 xtitle("DC Load-line for Common-Emitter Class A
      Amplifier Circuit")
   Example 227
1 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_1
4 clear; clc;
5 // Calculate the following dc quantities Icq, Vceq,
      Pd, Ic(sat) and Vce(off). Also draw the dc load
      line
6
7 // Given Data
                          // Resistor 1=18k Ohms
9 R1 = 18*10^3;
                          // Resistor 2=2.7k Ohms
10 R2 = 2.7*10^3;
11 \ Vcc = 20;
                          // Supply Voltage (Collector)=20
      Volts
12 \text{ Vbe} = 0.7;
                          // Voltage Base-Emitter=0.7
      Volts
13 \text{ Re} = 240;
                          // Emitter Resistor = 240 Ohms
                          // Collector Resistor=1k Ohms
14 \text{ Rc} = 1*10^3;
15
16 \text{ Vb} = \text{Vcc}*(R2/(R1+R2));
17
18 \text{ Ve} = \text{Vb-Vbe};
19
20 //Ie = Ic;
21
22 \text{ Icq} = \text{Ve/Re};
23 disp (Icq, 'The value of Icq in Amps')
24 disp ('i.e Appox 7.91 mAmps')
```

25

```
26 \text{ Vceq} = \text{Vcc-Icq*(Rc+Re)};
27 disp (Vceq, 'The value of Vceq in Volts')
28 disp ('Appox 10.19 Volts')
29
30 \text{ Pd} = \text{Vceq*Icq};
31 disp (Pd, 'The Power Dissipation in Watts')
32 disp ('i.e 80.6 mWatts')
33
34 \text{ Icsat} = \text{Vcc/(Rc+Re)};
35 disp (Icsat, 'The value of Ic(sat) in Amps')
36 disp ('i.e 16.1 mAmps')
37
38 Vceoff = Vcc;
39 disp (Vceoff, 'The value of Vce(off) in Volts')
40
41 // For DC load line
42
43 Vce1=[Vceoff Vceq 0]
44 Ic1=[0 Icq Icsat]
45
46 //To plot DC load line
47
48 printf ("Q(\%f,\%f)\n", Vceq, Icq)
49 plot2d(Vce1, Ic1)
50 plot(Vceq, Icq, ".r")
51 plot(0, Icq,".r")
52 plot(Vceq,0,".r")
53 plot(0, Icsat, ".b")
54 plot(Vceoff,0,".b")
55 xlabel("Vce in volt")
56 ylabel("Ic in Ampere")
57 xtitle("DC Load-line for Common-Emitter Class A
      Amplifier Circuit")
```

Scilab code Exa 31.2 Example 228

```
Scilab code Exa 31.2 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_2
4 clc; clear;
5 // Claculate the following AC quantities Av, Vout,
      Pl, Pcc and percent efficiency. Also calculate
      the endpoints of ac loadline
7 // Given data
9 \text{ Icq} = 7.91*10^-3;
                              // Collector Currect (Q-point
      =7.91 mAmps
10 R1 = 1.5*10^3;
                              // Load Resistor = 1.5 kOhms
11 Rc = 1*10^3;
                              // Collector Resistor=1
      kOhms
12 Vin = 25*10^{-3};
                              // Input Voltage=25 mVolts(p
      -p
13 R1 = 18*10^3;
                              // Resistor 1=18 kOhms
                              // Resistor 2=2.7 kOhms
14 R2 = 2.7*10^3;
15 \text{ Vcc} = 20;
                              // Supply Voltage (Collector)
      =20 \text{ Volts}
                              // Voltage Colector-Emitter (
16 \text{ Vceq} = 10.19;
      Q-point)=10.19 Volts
17
18 \text{ rc} = (25*10^{-3})/\text{Icq};
19 rl = (Rc*R1)/(Rc+R1)
20
21 \text{ Av} = r1/rc;
22 disp (Av, 'The Voltage Gain Av is')
23 disp ('Appox 190')
24
25 \text{ Vout} = \text{Av*Vin};
26 disp (Vout, 'The Output Voltage in Volts')
27 disp ('Appox 4.75 Volts')
28
```

```
29 Pl = (Vout*Vout)/(8*R1);
30 disp (Pl, 'The Load Power in Watts')
31 disp ('i.e Appox 1.88 mWatts')
32
33 Ivd = Vcc/(R1+R2);
34 // Ic = Icq
35 Icc = Ivd+Icq;
36
37 \text{ Pcc} = \text{Vcc*Icc};
38 disp (Pcc, 'The Dc Input Power in Watts')
39 disp ('i.e Appox 177.4 mWatts')
40
41 efficiency = ((Pl/Pcc)*100);
42 disp (efficiency, 'The Efficiency in \% is ')
43 disp ('Appox 1%')
44
45 // Endpoints of AC load line
46
47 icsat = Icq+(Vceq/rl);
48 disp (icsat, 'The Y-axis Value of AC Load-line is ic (
      sat) in Amps')
49 disp ('i.e 24.89 mAmps')
50
51 vceoff = Vceq+Icq*rl;
52 disp (vceoff, 'The X-axis value of AC Load-line is
      vce(off) in Volts')
53
54 // For AC load line
55
56 Vce1=[vceoff Vceq 0]
57 Ic1=[0 Icq icsat]
58
59 //To plot AC load line
60
61 printf("Q(\%f, \%f)\n", Vceq, Icq)
62 plot2d(Vce1, Ic1)
63 plot(Vceq, Icq,".r")
64 plot(0, Icq, ".r")
```

```
65 plot(Vceq,0,".r")
66 plot(0,icsat,".b")
67 plot(vceoff,0,".b")
68 xlabel("Vce in volt")
69 ylabel("Ic in Ampere")
70 xtitle("AC Load-line for Common-Emitter Class A
      Amplifier Circuit")
   Example 228
1 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_2
4 clc; clear;
5 // Claculate the following AC quantities Av, Vout,
      Pl, Pcc and percent efficiency. Also calculate
      the endpoints of ac loadline
7 // Given data
9 \text{ Icq} = 7.91*10^{-3};
                             // Collector Currect(Q-point
      =7.91 mAmps
10 R1 = 1.5*10^3;
                             // Load Resistor = 1.5 kOhms
11 Rc = 1*10^3;
                             // Collector Resistor=1
      kOhms
12 \text{ Vin} = 25*10^-3;
                             // Input Voltage=25 mVolts(p
      -p)
13 R1 = 18*10^3;
                              // Resistor 1=18 kOhms
14 R2 = 2.7*10^3;
                              // Resistor 2=2.7 kOhms
15 \text{ Vcc} = 20;
                              // Supply Voltage (Collector)
      =20 \text{ Volts}
                              // Voltage Colector-Emitter (
16 \text{ Vceq} = 10.19;
      Q-point)=10.19 Volts
17
18 \text{ rc} = (25*10^{-3})/\text{Icq};
19 rl = (Rc*R1)/(Rc+R1)
20
```

21 Av = rl/rc;

```
22 disp (Av, 'The Voltage Gain Av is')
23 disp ('Appox 190')
24
25 \text{ Vout} = \text{Av*Vin};
26 disp (Vout, 'The Output Voltage in Volts')
27 disp ('Appox 4.75 Volts')
28
29 Pl = (Vout*Vout)/(8*R1);
30 disp (Pl, 'The Load Power in Watts')
31 disp ('i.e Appox 1.88 mWatts')
32
33 Ivd = Vcc/(R1+R2);
34 // Ic = Icq
35 \text{ Icc} = \text{Ivd+Icq};
36
37 \text{ Pcc} = \text{Vcc*Icc};
38 disp (Pcc, 'The Dc Input Power in Watts')
39 disp ('i.e Appox 177.4 mWatts')
40
41 efficiency = ((Pl/Pcc)*100);
42 disp (efficiency, 'The Efficiency in \% is')
43 disp ('Appox 1%')
44
45 // Endpoints of AC load line
46
47 icsat = Icq+(Vceq/rl);
48 disp (icsat, 'The Y-axis Value of AC Load-line is ic(
      sat) in Amps')
49 disp ('i.e 24.89 mAmps')
50
51 vceoff = Vceq+Icq*rl;
52 disp (vceoff, 'The X-axis value of AC Load-line is
      vce(off) in Volts')
53
54 // For AC load line
55
56 Vce1=[vceoff Vceq 0]
57 Ic1=[0 Icq icsat]
```

```
58
59 //To plot AC load line
60
61 printf("Q(%f,%f)\n", Vceq, Icq)
62 plot2d(Vce1, Ic1)
63 plot(Vceq, Icq,".r")
64 plot(0, Icq,".r")
65 plot(Vceq,0,".r")
66 plot(0, icsat,".b")
67 plot(vceoff,0,".b")
68 xlabel("Vce in volt")
69 ylabel("Ic in Ampere")
70 xtitle("AC Load-line for Common-Emitter Class A Amplifier Circuit")
```

Scilab code Exa 31.3 Example 229

```
Scilab code Exa 31.3 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_3
4 clear; clc;
5 // Calculate the following quantities: Pl, Pcc, Pdmax
       & percent efficiency
  // Given data
8
9 \text{ Vin} = 20;
                     // Input Voltage=20 Volts(p-p)
10 \text{ Vopp} = 20;
                     // Output Voltage (p-p)=20 Volts (p-p)
11 \ Vcc = 24;
                     // Supply Voltage (Collector) = 24
      Volts
12 \text{ Vop} = 10;
                     // Output Voltage (peak)=10 Volts
13 R1 = 8;
                     // Load Resistor=8 Ohms
```

```
14
15 Vopp1 = Vopp*Vopp;
16 \text{ Pl} = (Vopp1/(8*R1));
17 disp (Pl, 'The Load Power in Watts');
18
19 Icc = ((Vop/R1)*0.318);
20
21 \text{ Pcc} = \text{Vcc*Icc}
22 disp (Pcc, 'The DC Input Power in Watts');
23
24 \text{ eff} = ((Pl/Pcc)*100);
25 disp (eff, 'The Efficiency in \% is');
26
27 \text{ Pd} = (Vcc*Vcc)/(40*R1);
28 disp (Pd, 'The Maximum Power Dissipation in Watts');
   Example 229
1 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_3
4 clear; clc;
5 // Calculate the following quantities: Pl, Pcc, Pdmax
       & percent efficiency
7 // Given data
9 \text{ Vin} = 20;
                      // Input Voltage=20 Volts(p-p)
10 \text{ Vopp} = 20;
                     // Output Voltage (p-p)=20 Volts (p-p)
11 \ Vcc = 24;
                     // Supply Voltage (Collector) = 24
      Volts
                     // Output Voltage (peak)=10 Volts
12 \text{ Vop} = 10;
                     // Load Resistor=8 Ohms
13 R1 = 8;
14
15 \text{ Vopp1} = \text{Vopp*Vopp};
16 \text{ Pl} = (Vopp1/(8*R1));
17 disp (Pl, 'The Load Power in Watts');
18
```

```
19  Icc = ((Vop/R1)*0.318);
20
21  Pcc = Vcc*Icc
22  disp (Pcc, 'The DC Input Power in Watts');
23
24  eff = ((Pl/Pcc)*100);
25  disp (eff, 'The Efficiency in % is');
26
27  Pd = (Vcc*Vcc)/(40*R1);
28  disp (Pd, 'The Maximum Power Dissipation in Watts');
```

Scilab code Exa 31.4 Example 230

```
Scilab code Exa 31.4 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_4
4 clear; clc;
5 // Calculate the following quantities Pl, Pcc &
      percent efficiency
7 // Given data
                        // Load Resistor=8 Ohms
9 R1 = 8;
                        // Output Voltage (p-p)=50 Volts (
10 \text{ Vopp} = 50;
     p-p)
11 \ Vcc = 30;
                        // Supply Voltage (Collector)=30
      Volts
12 Vopk = Vopp/2; // Output Voltage (peak)
13
14 Pl = (Vopp*Vopp)/(8*Rl);
15 disp (Pl, 'The Load Power in Watts');
16
```

```
17 Pcc = Vcc*0.636*(Vopk/R1);
18 disp (Pcc, 'The DC Input Power in Watts')
19
20 efficiency = ((P1/Pcc)*100);
21 disp (efficiency, 'The Efficiency in \% is');
   Example 230
1 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_4
4 clear; clc;
5 // Calculate the following quantities Pl, Pcc &
      percent efficiency
7 // Given data
9 R1 = 8;
                        // Load Resistor=8 Ohms
10 \text{ Vopp} = 50;
                        // Output Voltage (p-p)=50 Volts (
     p-p)
11 \ Vcc = 30;
                        // Supply Voltage (Collector)=30
      Volts
                        // Output Voltage (peak)
12 Vopk = Vopp/2;
13
14 Pl = (Vopp*Vopp)/(8*R1);
15 disp (Pl, 'The Load Power in Watts');
16
17 Pcc = Vcc*0.636*(Vopk/R1);
18 disp (Pcc, 'The DC Input Power in Watts')
19
20 efficiency = ((Pl/Pcc)*100);
21 disp (efficiency, 'The Efficiency in \% is');
```

```
Scilab code Exa 31.5 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_5
4 clear; clc;
5 // Calculate the fr of LC tank circuit and dc bias
      voltage at base
6
7 // Given data
9 L = 100*10^-6; // Inductor=100 uHenry
10 C = 63.325*10^-12; // Capacitor=63.325 pFarad
                       // Input Voltage (peak) = 1.5 Volts
11 Vin = 1.5;
                    // Voltage Base-Emitter=0.7
12 \text{ Vbe} = 0.7;
      Volts
13
14 A = sqrt(L*C);
15 fr = 1/(2*3.14*A);
16 disp (fr, 'The Resonant Frequency in Hertz')
17 disp ('i.e 2 MHz')
18
19 Vdc = (Vin-Vbe);
20 disp (Vdc, 'The DC Bias Voltage at Base in Volts')
   Example 231
1 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_{-}5
4 clear; clc;
5 // Calculate the fr of LC tank circuit and dc bias
      voltage at base
6
7 // Given data
                       // Inductor=100 uHenry
9 L = 100*10^-6;
10 C = 63.325*10^{-12}; // Capacitor = 63.325 pFarad
                         // Input Voltage (peak)=1.5 Volts
11 Vin = 1.5;
                         // Voltage Base-Emitter=0.7
12 \text{ Vbe} = 0.7;
```

```
Volts

13

14 A = sqrt(L*C);
15 fr = 1/(2*3.14*A);
16 disp (fr, 'The Resonant Frequency in Hertz')
17 disp ('i.e 2 MHz')
18

19 Vdc = (Vin-Vbe);
20 disp (Vdc, 'The DC Bias Voltage at Base in Volts')
```

Scilab code Exa 31.6 Example 232

```
Scilab code Exa 3116 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_6
4 clc; clear;
5 // Calculate the minimum base reisitance Rb,
      necessary to provide clamping action
7 // Given data
9 C = 0.01*10^-6; // Capacitor = 0.01 uFarad
                        // Resonant Frequency=2 MHertz
10 \text{ fr} = 2*10^6;
11
12 \text{ fin = fr}
13 T = 1/fin
14
15 \text{ Rb} = 10*T/C
16 disp (Rb, 'The Minimum Base Reisitance Rb to Provide
      Clamping Action in Ohms')
   Example 232
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_6
4 clc; clear;
5 // Calculate the minimum base reisitance Rb,
      necessary to provide clamping action
6
7 // Given data
9 C = 0.01*10^-6; // Capacitor=0.01 uFarad
10 fr = 2*10^6;
                        // Resonant Frequency=2 MHertz
11
12 \text{ fin = fr}
13 T = 1/fin
14
15 \text{ Rb} = 10 * T/C
16 disp (Rb, 'The Minimum Base Reisitance Rb to Provide
      Clamping Action in Ohms')
```

Scilab code Exa 31.7 Example 233

```
Scilab code Exa 3117 // Grob's Basic Electronics 11e

2 // Chapter No. 31

3 // Example No. 31_7

4 clc; clear;

5 // Calculate the Bandwidth

6

7 // Given data

8

9 L = 100*10^-6; // Inductor=100 uHenry

10 fr = 2*10^6; // Resonant Frequency=2 MHertz

11 ri = 12.56; // Resistance of Coil=12.56 Ohms
```

```
12 Rp = 100*10^3; // Rp=100 \text{ kOhms}
13
14 X1 = 2*3.14*fr*L;
15 Qcoil = X1/ri;
16 Ztank = Qcoil*X1;
17
18 A = Ztank;
19 B = Rp;
20 C = (A*B)/(A+B);
21 \text{ Qckt} = \text{C/X1};
22
23 \text{ BW} = \text{fr/Qckt};
24 disp (BW, 'The Bandwidth in Hertz')
25 disp ('i.e Appox 45 kHz')
   Example 233
1 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_7
4 clc; clear;
5 // Calculate the Bandwidth
7 // Given data
                          // Inductor=100 uHenry
9 L = 100*10^-6;
                          // Resonant Frequency=2 MHertz
10 \text{ fr} = 2*10^6;
11 \text{ ri} = 12.56;
                          // Resistance of Coil=12.56 Ohms
12 \text{ Rp} = 100*10^3;
                          // Rp=100 kOhms
13
14 X1 = 2*3.14*fr*L;
15 Qcoil = X1/ri;
16 Ztank = Qcoil*X1;
17
18 A = Ztank;
19 B = Rp;
20 C = (A*B)/(A+B);
21 \text{ Qckt} = C/X1;
```

```
22
23 BW = fr/Qckt;
24 disp (BW, 'The Bandwidth in Hertz')
25 disp ('i.e Appox 45 kHz')
```

Chapter 39
Chapter 32 Thyristors

Chapter 32 Thyristors

Scilab code Exa 32.1 Example 234

```
Scilab code Exa 3211 // Grob's Basic Electronics 11e
2 // Chapter No. 32
3 // Example No. 32_1
4 clear; clc;
5 // Calculate the frequency of the emmiter voltage
     waveform. Assume n=0.6
7 // Given data
                     // Resistor Rt=220k Ohms
9 \text{ Rt} = 220*10^3;
                      // Capacitor Ct=0.1u Farad
10 Ct = 0.1*10^-6;
                        // Constant
11 n = 0.6;
12
13 A = 1/(1-n);
14 T = Rt*Ct*log(A);
15
16 f = 1/T;
17 disp (f, 'The Frequency of the Emmiter Voltage
```

Example 234

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 32
3 // Example No. 32_1
4 clear; clc;
5 // Calculate the frequency of the emmiter voltage
      waveform. Assume n=0.6
7 // Given data
9 Rt = 220*10^3; // Resistor Rt=220k Ohms
10 Ct = 0.1*10^-6; // Capacitor Ct=0.1u Farad
10 Ct = 0.1*10^-6;
                         // Constant
11 n = 0.6;
12
13 A = 1/(1-n);
14 T = Rt*Ct*log(A);
15
16 f = 1/T;
17 disp (f, 'The Frequency of the Emmiter Voltage
      Waveform in Hertz')
```

Chapter 33 Operational Amplifiers

Chapter 33 Operational Amplifiers

Scilab code Exa 33.1 Example 235

```
Scilab code Exa 33:1  // Grob's Basic Electronics 11e
2  // Chapter No. 33
3  // Example No. 33_1
4  clc; clear;
5  // Calculate the differential voltage gain, Ad, and the ac output voltage, Vout.
6
7  // Given data
8
9  Vin = 10*10^-3;  // Input voltage=10 mVolts(p-p)
10  Rc = 10*10^3;  // Collector resistance=10 kOhms
11  Ie = 715*10^-6;  // Emitter current=715 uAmps
12
13  re = (25*10^-3)/Ie;
14
15  Ad = Rc/(2*re);
```

```
16 disp (Ad, 'The Differential Voltage Gain is')
17 disp ('i.e 142.86 = 143')
18
19 \text{ Av} = \text{Ad}
20
21 \text{ Vo = Av*Vin};
22 disp (Vo, 'The Ac Output Voltage in Volts(p-p)')
   Example 235
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_1
4 clc; clear;
5 // Calculate the differential voltage gain, Ad, and
      the ac output voltage, Vout.
7 // Given data
9 Vin = 10*10^-3; // Input voltage=10 \text{ mVolts}(p-p)
                       // Collector resistance=10 kOhms
10 \text{ Rc} = 10*10^3;
11 Ie = 715*10^-6; // Emitter current=715 uAmps
12
13 re = (25*10^-3)/Ie;
14
15 Ad = Rc/(2*re);
16 disp (Ad, 'The Differential Voltage Gain is')
17 disp ('i.e 142.86 = 143')
18
19 \text{ Av} = \text{Ad}
20
21 \text{ Vo = Av*Vin};
22 disp (Vo, 'The Ac Output Voltage in Volts(p-p)')
```

Scilab code Exa 33.2 Example 236

```
Scilab code Exa 3312 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_2
4 clc; clear;
5 // calculate the common-mode voltage gain, ACM, and
      the CMRR (dB).
  // Given data
                      // Collector resistance=10 kOhms
9 \text{ Rc} = 10*10^3;
10 Re = 10*10^3;
                      // Emitter resistance=10 kOhms
11 \text{ Ad} = 142.86;
                      // Differential gain = 142.86
12
13 Acm = Rc/(2*Re);
14 disp (Acm, 'The Common-Mode Voltage Gain Acm is')
15
16 \quad CMRR = 20*log10(Ad/Acm);
17 disp (CMRR, 'The Commom-Mode Rejection Ratio in dB')
   Example 236
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_2
4 clc; clear;
5 // calculate the common-mode voltage gain, ACM, and
      the CMRR (dB).
7 // Given data
8
                      // Collector resistance=10 kOhms
9 \text{ Rc} = 10*10^3;
                     // Emitter resistance=10 kOhms
10 Re = 10*10^3;
                     // Differential gain = 142.86
11 \text{ Ad} = 142.86;
12
13 Acm = Rc/(2*Re);
```

```
14 disp (Acm, 'The Common-Mode Voltage Gain Acm is')
15
16 CMRR = 20*log10(Ad/Acm);
17 disp (CMRR, 'The Common-Mode Rejection Ratio in dB')
```

Scilab code Exa 33.3 Example 237

```
Scilab code Exa 33.13 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_3
4 clc; clear;
5 // Calculate fmax for an op amp that has an Sr of 5
      V/us and a peak output voltage of 10 V.
7 // Given data
8
                    // Peak output voltage=10 Volts
9 \text{ Vpk} = 10;
                    // Slew rate=5 V/us
10 \text{ Sr} = 5/10^{-6};
                    // JI = 3.14
11 \text{ pi} = 3.14;
12
13 fo = Sr/(2*pi*Vpk);
14 disp (fo, 'The Output Frequency in Hertz')
15 disp ('i.e 79.6 kHz')
   Example 237
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33\_3
4 clc; clear;
5 // Calculate fmax for an op amp that has an Sr of 5
      V/us and a peak output voltage of 10 V.
6
```

Scilab code Exa 33.4 Example 238

```
Scilab code Exa 334 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_4
4 clc; clear;
5 // calculate the closed-loop voltage gain, Acl, and
      the output voltage, Vout.
7 // Given data
9 \text{ Vin} = 1;
                    // Input voltage=1 Volts(p-p)
10 \text{ Rf} = 10*10^3;
                    // Feedback resistance=10 kOhms
11 Ri = 1*10^3;
                    // Input resistance=1 kOhms
12
13 Acl = -(Rf/Ri);
14 disp (Acl, 'The Closed-Loop Voltage Gain Acl is')
15
16 \text{ Vo } = -\text{Vin}*\text{Acl};
17 disp (Vo, 'The Output Voltage in Volts(p-p)')
18 disp ('The -ve sign indicates that input and output
      voltages are 180
                           out-of-phase')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_4
4 clc; clear;
5 // calculate the closed-loop voltage gain, Acl, and
      the output voltage, Vout.
  // Given data
                    // Input voltage=1 Volts(p-p)
9 \text{ Vin} = 1;
                    // Feedback resistance=10 kOhms
10 Rf = 10*10^3;
11 Ri = 1*10^3;
                    // Input resistance=1 kOhms
12
13 Acl = -(Rf/Ri);
14 disp (Acl, 'The Closed-Loop Voltage Gain Acl is')
15
16 \text{ Vo } = -\text{Vin}*\text{Acl};
17 disp (Vo, 'The Output Voltage in Volts(p-p)')
18 disp ('The -ve sign indicates that input and output
                          out-of-phase')
      voltages are 180
```

Scilab code Exa 33.5 Example 239

```
Scilab code Exa 3315 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_5
4 clc; clear;
5 // If Avol equals 100,000, calculate the value of Vid.
```

```
7 // Given data
                     // Open loop voltage gain=100,000
9 \text{ Avol} = 100000;
                     // Output voltage=10 Volts(p-p)
10 \text{ Vo} = 10;
11
12 \text{ Vid} = \text{Vo/Avol};
13 disp (Vid, 'The Differential Input Voltage in Volts (p
      −p)')
14 disp ('i.e 100 uVolts(p-p)')
   Example 239
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_5
4 clc; clear;
5 // If Avol equals 100,000, calculate the value of
      Vid.
6
7 // Given data
9 Avol = 100000; // Open loop voltage gain = 100,000
                     // Output voltage=10 Volts(p-p)
10 \text{ Vo} = 10;
11
12 Vid = Vo/Avol;
13 disp (Vid, 'The Differential Input Voltage in Volts (p
      −p)')
14 disp ('i.e 100 \text{ uVolts}(p-p)')
```

Scilab code Exa 33.6 Example 240

```
Scilab code Exa 33.16 // Grob's Basic Electronics 11e
2 // Chapter No. 33
```

```
3 // Example No. 33_6
4 clc; clear;
5 // calculate Zin and Zout(CL). Assume AVOL is
      100,000 and Zout (OL) is 75 Ohms.
  // Given data
9 \text{ Avol} = 100000;
                    // Open loop voltage gain = 100,000
                    // Feedback resistance=10 kOhms
10 Rf = 10*10^3;
                    // Input resistance=1 kOhms
11 Ri = 1*10^3;
12 \ Zool = 75;
                    // Output impedence (open-loop)=75
      Ohms
13
14 Zi = Ri;
15 disp (Zi, 'The Input Impedence in Ohms')
16 disp ('i.e 1 kOhms')
17
18 Beta = Ri/(Ri+Rf);
19
20 A = Avol*Beta;
21
22 \operatorname{Zocl} = \operatorname{Zool}/(1+A);
23 disp (Zocl, 'The Closed Loop Output Impedence in Ohms
      ')
   Example 240
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_6
4 clc; clear;
5 // calculate Zin and Zout(CL). Assume AVOL is
      100,000 and Zout (OL) is 75 Ohms.
7
  // Given data
9 \text{ Avol} = 100000;
                    // Open loop voltage gain=100,000
10 Rf = 10*10^3; // Feedback resistance=10 kOhms
```

```
11 Ri = 1*10^3; // Input resistance=1 kOhms
                    // Output impedence (open-loop)=75
12 \text{ Zool} = 75;
      Ohms
13
14 Zi = Ri;
15 disp (Zi, 'The Input Impedence in Ohms')
16 disp ('i.e 1 kOhms')
17
18 Beta = Ri/(Ri+Rf);
19
20 A = Avol*Beta;
21
22 \operatorname{Zocl} = \operatorname{Zool}/(1+A);
23 disp (Zocl, 'The Closed Loop Output Impedence in Ohms
      ')
```

Scilab code Exa 33.7 Example 241

```
15 disp (fo, 'The Output Frequency in Hertz')
16 disp ('i.e 15.915 kHz')
   Example 241
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33<sub>-</sub>7
4 clc; clear;
5 // Calculate the 5-V power bandwidth.
7 // Given data
8
                        // Output voltage=10 Volts(p-p)
9 \text{ Vo} = 10;
10 Sr = 0.5/10^{-6}; // Slew rate = 0.5 V/us
11
12 Vpk = Vo/2;
13
14 fo = Sr/(2*\%pi*Vpk);
15 disp (fo, 'The Output Frequency in Hertz')
16 disp ('i.e 15.915 kHz')
```

Scilab code Exa 33.8 Example 242

```
Scilab code Exa 3318 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_8
4 clc; clear;
5 // Calculate the closed-loop voltage gain, Acl, and the output voltage, Vout.
6
7 // Given data
```

```
// Input voltage=1 Volts(p-p)
9 \text{ Vin} = 1;
                    // Feedback resistance=10 kOhms
10 \text{ Rf} = 10*10^3;
11 Ri = 1*10^3;
                    // Input resistance=1 kOhms
12
13 Acl = 1+(Rf/Ri);
14 disp (Acl, 'The Closed-Loop Voltage Gain Acl is')
15
16 \text{ Vo = Vin*Acl};
17 disp (Vo, 'The Output Voltage in Volts(p-p)')
   Example 242
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_8
4 clc; clear;
5 // Calculate the closed-loop voltage gain, Acl, and
      the output voltage, Vout.
6
7 // Given data
8
                    // Input voltage=1 Volts(p-p)
9 \text{ Vin} = 1;
10 \text{ Rf} = 10*10^3;
                    // Feedback resistance=10 kOhms
11 Ri = 1*10^3; // Input resistance=1 kOhms
12
13 Acl = 1+(Rf/Ri);
14 disp (Acl, 'The Closed-Loop Voltage Gain Acl is')
15
16 \text{ Vo = Vin*Acl};
17 disp (Vo, 'The Output Voltage in Volts(p-p)')
```

Scilab code Exa 33.9 Example 243

```
Scilab code Exa 3319 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_9
4 clc; clear;
  // Calculate Zin(CL) and Zout(CL). Assume Rin is 2
     MOhms, Avol is 100,000, and Zout(OL) is 75 Ohms.
6
  // Given data
                    // Open loop voltage gain = 100,000
9 \text{ Avol} = 100000;
                    // Input resistance=2 MOhms
10 Ri = 2*10^6;
                    // Beta = 0.0909
11 B = 0.0909;
12 \ Zool = 75;
                    // Output impedence (open-loop)=75
      Ohms
13
14 Zicl = Ri*(1+Avol*B);
15 disp (Zicl, 'The Input Impedence Closed-Loop in Ohms'
16 disp ('i.e 18 GOhms')
17
18 A = Avol*B;
19
20 \text{ Zocl} = \text{Zool}/(1+A);
21 disp (Zocl, 'The Closed-Loop Output Impedence in Ohms
      ')
   Example 243
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33<sub>9</sub>
4 clc; clear;
5 // Calculate Zin(CL) and Zout(CL). Assume Rin is 2
     MOhms, Avol is 100,000, and Zout(OL) is 75 Ohms.
7 // Given data
9 Avol = 100000; // Open loop voltage gain = 100,000
```

```
10 \text{ Ri} = 2*10^6;
                     // Input resistance=2 MOhms
                     // Beta = 0.0909
11 B = 0.0909;
                     // Output impedence (open-loop)=75
12 \ Zool = 75;
      Ohms
13
14 Zicl = Ri*(1+Avol*B);
15 disp (Zicl, 'The Input Impedence Closed-Loop in Ohms'
  disp ('i.e 18 GOhms')
16
17
18 A = Avol*B;
19
20 \operatorname{Zocl} = \operatorname{Zool}/(1+A);
21 disp (Zocl, 'The Closed-Loop Output Impedence in Ohms
      ')
```

Scilab code Exa 33.10 Example 244

```
Scilab code Exa 33.10 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_10
4 clc; clear;
5 // Assume Rin is 2 MOhms, Avol is 100,000, and Zout (
     OL) is 75 Ohms. Calculate Zin(CL) and Zout(CL)
6
  // Given data
                   // Open loop voltage gain = 100,000
9 \text{ Avol} = 100000;
                   // Input resistance=2 MOhms
10 Ri = 2*10^6;
11 B = 1;
                    // Beta=1
                   // Output impedence (open-loop)=75
12 \ Zool = 75;
     Ohms
```

```
13
14 Zicl = Ri*(1+Avol*B);
15 disp (Zicl, 'The Input impedence closed-loop in Ohms'
16 disp ('i.e 200 GOhms')
17
18 A = Avol*B;
19
20 \text{ Zocl} = \text{Zool}/(1+A);
21 disp (Zocl, 'The Closed loop Output Impedence in Ohms
      ')
   Example 244
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_10
4 clc; clear;
5 // Assume Rin is 2 MOhms, Avol is 100,000, and Zout (
      OL) is 75 Ohms. Calculate Zin(CL) and Zout(CL)
  // Given data
                    // Open loop voltage gain=100,000
9 \text{ Avol} = 100000;
                    // Input resistance=2 MOhms
10 Ri = 2*10^6;
                    // Beta=1
11 B = 1;
                    // Output impedence (open-loop)=75
12 \ Zool = 75;
      Ohms
13
14 Zicl = Ri*(1+Avol*B);
15 disp (Zicl, 'The Input impedence closed-loop in Ohms'
16 disp ('i.e 200 GOhms')
17
18 A = Avol*B;
19
20 \text{ Zocl} = \text{Zool}/(1+A);
21 disp (Zocl, 'The Closed loop Output Impedence in Ohms
```

Scilab code Exa 33.11 Example 245

```
Scilab code Exa 33.111 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_11
4 clc; clear;
5 // Calculate the closed-loop voltage gain, Acl, and
      the dc voltage at the op-amp output terminal.
7 // Given data
9 V = 15;
                   // Voltage at +ve terminal of op-amp
     =15 Volts
                   // Feedback resistance=10 kOhms
10 Rf = 10*10^3;
                   // Input resistance=1 kOhms
11 Ri = 1*10^3;
                   // Resistance1=10 kOhms
12 R1 = 10*10^3;
13 R2 = 10*10^3;
                   // Rsistance2=10 kOhms
14
15 Acl = -(Rf/Ri);
16 disp (Acl, 'The Closed-Loop Voltage Gain Acl is')
17
18 Vo = V*(R2/(R1+R2));
19 disp (Vo, 'The Output Voltage in Volts')
  Example 245
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_11
4 clc; clear;
```

```
5 // Calculate the closed-loop voltage gain, Acl, and
     the dc voltage at the op-amp output terminal.
7 // Given data
9 V = 15;
                   // Voltage at +ve terminal of op-amp
     =15 \text{ Volts}
10 Rf = 10*10^3;
                   // Feedback resistance=10 kOhms
                   // Input resistance=1 kOhms
11 Ri = 1*10^3;
                   // Resistance1=10 kOhms
12 R1 = 10*10^3;
                   // Rsistance2=10 kOhms
13 R2 = 10*10^3;
14
15 Acl = -(Rf/Ri);
16 disp (Acl, 'The Closed-Loop Voltage Gain Acl is')
17
18 Vo = V*(R2/(R1+R2));
19 disp (Vo, 'The Output Voltage in Volts')
```

Scilab code Exa 33.12 Example 246

```
Scilab code Exa 33.12 // Grob's Basic Electronics 11e

2 // Chapter No. 33

3 // Example No. 33_12

4 clc; clear;

5 // Calculate the output voltage, Vout.

6

7 // Given data

8

9 V1 = 1; // Input voltage1=1 Volts

10 V2 = -5; // Input voltage2=-5 Volts

11 V3 = 3; // Input voltage3=3 Volts
```

```
13 Vo = -(V1+V2+V3);
14 disp (Vo, 'The Output Voltage in Volts')
   Example 246
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33<sub>-</sub>12
4 clc; clear;
5 // Calculate the output voltage, Vout.
7 // Given data
               // Input voltage1=1 Volts
9 V1 = 1;
              // Input voltage2=-5 Volts
10 \ V2 = -5;
               // Input voltage3=3 Volts
11 \ V3 = 3;
12
13 Vo = -(V1+V2+V3);
14 disp (Vo, 'The Output Voltage in Volts')
```

Scilab code Exa 33.13 Example 247

```
Scilab code Exa 33.13 // Grob's Basic Electronics 11e

2 // Chapter No. 33

3 // Example No. 33_13

4 clc; clear;

5 // Calculate the output voltage, Vout.

6

7 // Given data

8

9 V1 = 0.5; // Input voltage1=0.5 Volts

10 V2 = -2; // Input voltage2=-2 Volts

11 Rf = 10*10^3; // Feedback resistance=10 kOhms
```

```
// Resistance1=1 kOhms
12 R1 = 1*10^3;
13 R2 = 2.5*10^3; // Rsistance2=2.5 kOhms
14
15 A = Rf/R1;
16 B = Rf/R2;
17
18 Vo = -(A*V1+B*V2);
19 disp (Vo, 'The Output Voltage in Volts')
   Example 247
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33<sub>-</sub>13
4 clc; clear;
5 // Calculate the output voltage, Vout.
7 // Given data
                   // Input voltage1=0.5 Volts
9 V1 = 0.5;
                   // Input voltage2=-2 Volts
10 \ V2 = -2;
                   // Feedback resistance=10 kOhms
11 Rf = 10*10^3;
12 R1 = 1*10^3;
                   // Resistance1=1 kOhms
                   // Rsistance2 = 2.5 kOhms
13 R2 = 2.5*10^3;
14
15 A = Rf/R1;
16 B = Rf/R2;
17
18 Vo = -(A*V1+B*V2);
19 disp (Vo, 'The Output Voltage in Volts')
```

Scilab code Exa 33.14 Example 248

```
Scilab code Exa 33.14 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_14
4 clc; clear;
5 // Calculate the output voltage, Vout, if (a) Vx is
      1 Vdc and Vy is -0.25 Vdc, (b) -Vx is 0.5 Vdc and
       Vy is 0.5 Vdc, (c) Vx is 0.3 V and Vy is 0.3 V.
7 // Given data
9 Rf = 10*10^3; // Feedback resistance=10 kOhms
10 R1 = 1*10^3; // Resistance1=1 kOhms
10 R1 = 1*10^3;
11 \ Vx1 = 1;
                    // Input voltage Vx1 at -ve terminal
       of op-amp=1 Volts
12 \text{ Vy1} = -0.25;
                   // Input voltage Vy1 at +ve terminal
       of op-amp=-0.25 Volts
13 \text{ Vx2} = -0.5;
                  // Input voltage Vx2 at -ve terminal
       of op-amp=-0.5 Volts
                  // Input voltage Vy2 at +ve terminal
14 \text{ Vy2} = 0.5;
      of op-amp=0.5 Volts
15 \text{ Vx3} = 0.3;
                 // Input voltage Vx3 at -ve
      terminal of op-amp=0.3 Volts
16 Vy3 = 0.3; // Input voltage Vy3 at +ve terminal
      of op-amp=0.3 Volts
17
18 \quad A = -Rf/R1;
19
20 // Case A
21
22 \quad Voa = A*(Vx1-Vy1);
23 disp(Voa, 'The Output Voltage of Case A in Volts')
24
25 // Case B
26
27 \quad Voa = A*(Vx2-Vy2);
28 disp(Voa, 'The Output Voltage of Case B in Volts')
29
30 // Case C
```

```
31
32 Voa = A*(Vx3-Vy3);
33 disp(Voa, 'The Output Voltage of Case C in Volts')
   Example 248
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33<sub>1</sub>14
4 clc; clear;
5 // Calculate the output voltage, Vout, if (a) Vx is
      1 Vdc and Vy is -0.25 Vdc, (b) -Vx is 0.5 Vdc and
       Vy is 0.5 Vdc, (c) Vx is 0.3 V and Vy is 0.3 V.
7 // Given data
9 Rf = 10*10^3; // Feedback resistance=10 kOhms
10 R1 = 1*10^3; // Resistance1=1 kOhms
11 \ Vx1 = 1;
                    // Input voltage Vx1 at -ve terminal
       of op-amp=1 Volts
12 \text{ Vy1} = -0.25;
                  // Input voltage Vy1 at +ve terminal
       of op-amp=-0.25 Volts
13 \ Vx2 = -0.5;
                  // Input voltage Vx2 at -ve terminal
       of op-amp=-0.5 Volts
                  // Input voltage Vy2 at +ve terminal
14 \text{ Vy2} = 0.5;
      of op-amp=0.5 Volts
15 \text{ Vx3} = 0.3;
                 // Input voltage Vx3 at -ve
      terminal of op-amp=0.3 Volts
16 Vy3 = 0.3; // Input voltage Vy3 at +ve terminal
      of op-amp=0.3 Volts
17
18 \quad A = -Rf/R1;
19
20 // Case A
21
22 Voa = A*(Vx1-Vy1);
23 disp(Voa, 'The Output Voltage of Case A in Volts')
24
```

```
25  // Case B
26
27  Voa = A*(Vx2-Vy2);
28  disp(Voa, 'The Output Voltage of Case B in Volts')
29
30  // Case C
31
32  Voa = A*(Vx3-Vy3);
33  disp(Voa, 'The Output Voltage of Case C in Volts')
```

Scilab code Exa 33.15 Scilab code Exa 33.15 Example 249 Example 249

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_15
4 clc; clear;
5 // Assume that Rd increases to 7.5 k due to an
      increase in the ambient temperature. Calculate
     the output of the differential amplifier. Note:
     Rb is 5 kOhms.
7 // Given data
                   // Voltage input=5 Volts(dc)
9 \text{ Vi} = 5;
10 \text{ Rf} = 10*10^3;
                   // Feedback resistance=10 kOhms
                   // Resistance1=1 kOhms
11 R1 = 1*10^3;
12 \text{ Ra} = 5*10^3;
                   // Resistance A at wein bridge=5
     kOhms
13 Rb = 10*10^3; // Resistance B at wein bridge=10
     kOhms
14 Rc = 5*10^3; // Resistance C at wein bridge=5
     kOhms
15 Rd = 7.5*10^3; // Resistance D at wein bridge=7.5
```

```
kOhms
16
17 Vx = Vi*(Ra/Rb);
18 Vy = Vi*(Rd/(Rd+Rc));
19 \quad A = -Rf/R1
20
21 Vo = A*(Vx-Vy);
22 disp (Vo, 'The Output of Differential Amplifier in
      Volts')
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33<sub>-</sub>15
4 clc; clear;
5 // Assume that Rd increases to 7.5 k due to an
      increase in the ambient temperature. Calculate
      the output of the differential amplifier. Note:
     Rb is 5 kOhms.
  // Given data
                    // Voltage input=5 Volts(dc)
9 \text{ Vi} = 5;
                   // Feedback resistance=10 kOhms
10 Rf = 10*10^3;
                   // Resistance1=1 kOhms
11 R1 = 1*10^3;
                    // Resistance A at wein bridge=5
12 Ra = 5*10^3;
     kOhms
13 \text{ Rb} = 10*10^3;
                    // Resistance B at wein bridge=10
     kOhms
14 \text{ Rc} = 5*10^3;
                    // Resistance C at wein bridge=5
     kOhms
15 Rd = 7.5*10^3; // Resistance D at wein bridge=7.5
     kOhms
16
17 Vx = Vi*(Ra/Rb);
18 Vy = Vi*(Rd/(Rd+Rc));
19 A = -Rf/R1
20
```

```
21 Vo = A*(Vx-Vy);
22 disp (Vo, 'The Output of Differential Amplifier in Volts')
```

Scilab code Exa 33.16 Example 250

```
Scilab code Exa 33.16 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_16
4 clc; clear;
5 // Calculate the cutoff frequency, fc.
7 // Given data
9 Rf = 10*10^3; // Feedback resistance=10 kOhms
10 Cf = 0.01*10^-6; // Feedback capacitance=0.01
      uFarad
11
12 fc = 1/(2*\%pi*Rf*Cf);
13 disp (fc, 'The Cutoff Frequency in Hertz')
14 disp ('i.e 1.591 kHz')
   Example 250
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33<sub>-</sub>16
4 clc; clear;
5 // Calculate the cutoff frequency, fc.
7 // Given data
9 Rf = 10*10^3; // Feedback resistance=10 \text{ kOhms}
```

Scilab code Exa 33.17 Example 251

```
Scilab code Exa 33.17 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_17
4 clear; clc;
5 // Calculate the Voltage gain, Acl at (a)0 Hz and (b
      ) 1 MHz
7 // Given data
9 	 f1 = 1*10^6;
                         // Frequency=1 MHertz
                         // Feedback resistance=10 kOhms
10 Rf = 10*10^3;
                         // Resistance1=1 kOhms
11 R1 = 1*10^3;
11 KI = 1*10 3; // Resistance1=1 kOnms

12 Cf = 0.01*10^-6; // Feedback capacitance=0.01
      uFarad
13 \text{ pi} = 3.14;
14
15 // At 0 Hz, Xcf = infinity ohms, So, Zf=Rf
16
17 Acl = -Rf/R1;
18 disp (Acl, 'The Closed-Loop Voltage Gain at 0 Hz is')
19
20 // At 1 MHz
```

```
21
22 \text{ Xcf} = 1/(2*pi*f1*Cf);
23
24 \quad A = (Rf*Rf);
25 B = (Xcf*Xcf);
26
27 \text{ Zf} = ((Xcf*Rf)/sqrt(A+B));
28
29 Acl1 = -Zf/R1;
30 disp (Acl1, 'The Closed-Loop Voltage Gain at 1 MHz is
      <sup>'</sup>);
   Example 251
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_17
4 clear; clc;
5 // Calculate the Voltage gain, Acl at (a) 0 Hz and (b)
      ) 1 MHz
7 // Given data
                        // Frequency=1 MHertz
9 	 f1 = 1*10^6;
                         // Feedback resistance=10 kOhms
10 \text{ Rf} = 10*10^3;
                         // Resistance1=1 kOhms
11 R1 = 1*10^3;
12 Cf = 0.01*10^-6; // Feedback capacitance = 0.01
      uFarad
13 \text{ pi} = 3.14;
14
15 // At 0 Hz, Xcf = infinity ohms, So, Zf=Rf
16
17 \text{ Acl} = -Rf/R1;
18 disp (Acl, 'The Closed-Loop Voltage Gain at 0 Hz is')
19
20 // At 1 MHz
21
```

```
22  Xcf = 1/(2*pi*f1*Cf);
23
24  A = (Rf*Rf);
25  B = (Xcf*Xcf);
26
27  Zf = ((Xcf*Rf)/sqrt(A+B));
28
29  Acl1 = -Zf/R1;
30  disp (Acl1, 'The Closed-Loop Voltage Gain at 1 MHz is ');
```

Scilab code Exa 33.18 Example 252

```
Scilab code Exa 33.18 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_18
4 clear; clc;
5 // Calculate the dB voltage gain, at (a)0 Hz and (b)
       1.591 \text{ kHz}
7 // Given data
                        // Frequency=1.591 kHertz
9 	 f1 = 1.591*10^3;
10 Rf = 10*10^3;
                        // Feedback resistance=10 kOhms
                        // Input resistance=1 kOhms
11 Ri = 1*10^3;
                     // Feedback capacitance=0.01
12 \text{ Cf} = 0.01*10^-6;
      uFarad
13
14 // At 0 Hz, Xcf = infinity ohms, So, Zf=Rf
15
16 A = Rf/Ri
17
```

```
18 Acl = 20*log10(A);
19 disp (Acl, 'The Voltage Gain at 0 Hz in dB');
20
21 // At 1.591 kHz
22
23 Xcf = 1/(2*\%pi*f1*Cf);
24 B = (Rf*Rf);
25 C = (Xcf*Xcf);
26 \text{ Zf} = (Xcf*Rf/sqrt(B+C));
27 D = Zf/Ri;
28
29 Acl1 = 20*log10(D);
30 disp (Acl1, 'The Voltage Gain at 1.591 kHz in dB')
31 disp ('Appox 17dB')
   Example 252
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_18
4 clear; clc;
5 // Calculate the dB voltage gain, at (a)0 Hz and (b)
       1.591 \text{ kHz}
6
7 // Given data
9 f1 = 1.591*10^3; // Frequency=1.591 kHertz
10 \text{ Rf} = 10*10^3;
                        // Feedback resistance=10 kOhms
                       // Input resistance=1 kOhms
11 Ri = 1*10^3;
12 Cf = 0.01*10^-6; // Feedback capacitance=0.01
     uFarad
13
14 // At 0 Hz, Xcf = infinity ohms, So, Zf=Rf
15
16 A = Rf/Ri
17
18 Acl = 20*log10(A);
19 disp (Acl, 'The Voltage Gain at 0 Hz in dB');
```

Scilab code Exa 33.19 Example 253

```
Scilab code Exa 33.19 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_19
4 clc; clear;
5 // Calculate the cutoff frequency, fc.
6
7 // Given data
8
9 Ri = 1*10^3; // Input resistance=10 kOhms
10 Ci = 0.1*10^-6; // Input capacitance=0.01 uFarad
11
12 fc = 1/(2*%pi*Ri*Ci);
13 disp (fc, 'The Cutoff Frequency in Hertz')
14 disp ('i.e 1.591 kHz')
Example 253
```

```
// Grob's Basic Electronics 11e
// Chapter No. 33
// Example No. 33_19

clc; clear;
// Calculate the cutoff frequency, fc.

Ri = 1*10^3; // Input resistance=10 kOhms
Ci = 0.1*10^-6; // Input capacitance=0.01 uFarad

fc = 1/(2*%pi*Ri*Ci);
disp (fc, 'The Cutoff Frequency in Hertz')
disp ('i.e 1.591 kHz')
```

Scilab code Exa 33.20 Example 254

```
Scilab code Exa 33.20 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_20
4 clc; clear;
5 // Vin is 5 V, R is 1 kOhms, and Rl is 100 Ohms.
      Calculate the output current, Iout.
7 // Given data
9 \text{ Vin} = 5;
                   // Input votage=5 Volts
                 // Input resistance=1 kOhms
10 Ri = 1*10^3;
                   // Load resistance=100 Ohms
11 R1 = 100;
12
13 Io = Vin/Ri;
14 disp (Io, 'The Output Current in Amps')
15 disp ('i.e 5 mAmps')
```

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_20
4 clc; clear;
5 // Vin is 5 V, R is 1 kOhms, and Rl is 100 Ohms.
      Calculate the output current, Iout.
7 // Given data
                   // Input votage=5 Volts
9 \text{ Vin} = 5;
                   // Input resistance=1 kOhms
10 Ri = 1*10^3;
11 Rl = 100;
                   // Load resistance=100 Ohms
12
13 Io = Vin/Ri;
14 disp (Io, 'The Output Current in Amps')
15 disp ('i.e 5 mAmps')
```

Scilab code Exa 33.21 Example 255

```
// Load resistance=100 Ohms
11 R1 = 100;
12
13 Vo = Iin*Ri;
14 disp (Vo, 'The Output Voltage in Volts')
   Example 255
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_21
4 clc; clear;
5 // Iin is 1.5 mA, R is 1 kOhms, and Rl is 10 kOhms.
      Calculate Vout.
7 // Given data
9 Iin = 1.5*10^-3; // Input votage=5 Volts
                       // Input resistance=1 kOhms
10 Ri = 1*10^3;
11 R1 = 100;
                       // Load resistance=100 Ohms
12
13 Vo = Iin*Ri;
14 disp (Vo, 'The Output Voltage in Volts')
```

Scilab code Exa 33.22 Example 256

```
8
                        // Resistance1=1 kOhms
9 R1 = 1*10^3;
                        // Resistance2=100 kOhms
10 R2 = 100*10^3;
                       // Applied votage=15 Volts
11 \ Vcc = 15;
12 Vsat = 13;
                        // Assume Saturation voltage=13
      Volts
13
14 Beta = R1/(R1+R2);
15
16 Utp = Beta*Vsat;
17 disp(Utp, 'The Upper Trigger Point in Volts')
18 disp ('i.e 128.7 mVolts')
19
20 Ltp = -Beta*Vsat;
21 disp(Ltp, 'The Lower Trigger Point in Volts')
22 disp ('i.e -128.7 mVolts')
23
24 Vh = Utp-Ltp;
25 disp (Vh, 'The Hysterisis Voltage in Volts')
26 disp ('i.e 257.4 mVolts')
   Example 256
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33<sub>2</sub>22
4 clc; clear;
5 // R1 is 1 kOhms and R2 is 100 kOhms. Calculate UTP,
      LTP, and VH.
7 // Given data
                        // Resistance1=1 kOhms
9 R1 = 1*10^3;
                        // Resistance 2 = 100 kOhms
10 R2 = 100*10^3;
                        // Applied votage=15 Volts
11 \ Vcc = 15;
12 Vsat = 13;
                        // Assume Saturation voltage=13
      Volts
13
```

```
14 Beta = R1/(R1+R2);
15
16 Utp = Beta*Vsat;
17 disp(Utp, 'The Upper Trigger Point in Volts')
18 disp ('i.e 128.7 mVolts')
19
20 Ltp = -Beta*Vsat;
21 disp(Ltp, 'The Lower Trigger Point in Volts')
22 disp ('i.e -128.7 mVolts')
23
24 Vh = Utp-Ltp;
25 disp (Vh, 'The Hysterisis Voltage in Volts')
26 disp ('i.e 257.4 mVolts')
```

Scilab code Exa 33.23 Example 257

```
Scilab code Exa 33.23 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_23
4 clc; clear;
5 // Rl is 1 kOhms and the frequency of the input
      voltage equals 100 Hz. Calculate the minimum
      value of C required.
  // Given data
8
9 f = 100;
                   // Applied frequency=100 Hertz
10 Rl = 1*10^3;
                   // Load resistance=1 kOhms
11
12 T = 1/f;
13
14 C = (10*T)/R1;
```

```
15 disp (C, 'The Minimum value of required Capacitor in
     Farads')
16 disp ('i.e 100 uFarad')
  Example 257
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_23
4 clc; clear;
5 // Rl is 1 kOhms and the frequency of the input
     voltage equals 100 Hz. Calculate the minimum
     value of C required.
7 // Given data
                 // Applied frequency=100 Hertz
9 f = 100;
11
12 T = 1/f;
13
14 C = (10*T)/R1;
15 disp (C, 'The Minimum value of required Capacitor in
     Farads')
16 disp ('i.e 100 uFarad')
```