

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.

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

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

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

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Chapter 1

Chapter Introduction to Powers of 10

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
   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 ')
9
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 0.00000000000016 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 0.000000000000016 = 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)  
    4.75*102 (b) 6.8*10-5.  
6  
7 disp ('To convert 4.75*102 into decimal notation,  
    the decimal point must be shifted 2 places to the  
    right.')
```

```
8 disp ('Therefore 4.75*102 = 475 in decimal')
```

```
9  
10 disp ('To convert 6.8*10-5 into decimal notation,  
    the decimal point must be shifted 5 places to the  
    left.')
```

```
11 disp ('Therefore 6.8*10-5 = 0.000068 in decimal')
```

Scilab code Exa 0.4 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

```

1 // 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')
```

Scilab code Exa 0.6 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

```

1 // 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 .
6
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 10^3 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 Example 8

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_8
4 clc; clear;
5 // Make the following conversions: (a) convert 25 mA
   to uA (b) convert 2700 kOhms to MOhms.
6
7 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
   (10^3), the numerical part of the expression
   must be increased by a factor of 1000 (10^3).')
8 disp ('Therefore, 25 mA = 25*10^-3 A = 25,000*10^-6
   A = 25,000 uA.')
```

```
9
10 disp ('To convert 2700 kOhms to MOhms, recall that
   the metric prefix kilo (k) corresponds to 10^3
   and that the metric prefix mega (M) corresponds
   to 10^6. Since 10^6 is larger than 10^3 by a
   factor of 1000 (10^3), 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

```
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.
6
7 // Given data
8
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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_10
4 clc; clear;
5 // Subtract 250*10^3 and 1.5*10^6. Express the
   final answer in scientific notation.
6
7 // Given data
8
9 A = 1.5*10^6;          // Variable 1
10 B = 250*10^3;         // Variable 2
11
12 C = A-B;
13 disp (C, 'The subtraction of 250*10^3 and 1.5*10^6
   is ')
14 disp ('i.e 1.25*10^6 ')

```

Scilab code Exa 0.11 Example 11

```

1 // Grob's Basic Electronics 11e

```

```

2 // Chapter No. I
3 // Example No. I_11
4 clc; clear;
5 // Multiply  $3 \times 10^6$  by  $150 \times 10^2$ . Express the final
   answer in scientific notation.
6
7 // Given data
8
9 A =  $3 \times 10^6$ ;           // Variable 1
10 B =  $150 \times 10^2$ ;      // Variable 2
11
12 C = A*B;
13 disp (C, 'The multiplication of  $3 \times 10^6$  by  $150 \times 10^2$  is
   ')
14 disp ('i.e  $4.5 \times 10^{10}$ ')

```

Scilab code Exa 0.12 Example 12

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_12
4 clc; clear;
5 // Divide  $5.0 \times 10^7$  by  $2.0 \times 10^4$ . Express the final
   answer in scientific notation.
6
7 // Given data
8
9 A =  $5.0 \times 10^7$ ;       // Variable 1
10 B =  $2.0 \times 10^4$ ;     // Variable 2
11
12 C = A/B;
13 disp (C, 'The division of  $5.0 \times 10^7$  by  $2.0 \times 10^4$  is ')
14 disp ('i.e  $2.5 \times 10^3$ ')

```

Scilab code Exa 0.13 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  $10^5$  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  $10^3$ ')
```

Scilab code Exa 0.14 Example 14

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_14
4 clc; clear;
5 // Square  $3.0 \times 10^4$ . Express the answer in scientific
   notation.
6
7 // Given data
```

```
8
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

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_15
4 clc; clear;
5 // Find the squareroot of 4*10^6. Express the answer
  in scientific notation.
6
7 // Given data
8
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

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. I
3 // Example No. I_16
4 clc; clear;
5 // Find the squareroot of 90*10^5. Express the
  answer in scientific notation.
6
```

```

7 // Given data
8
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

```

1 // 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
8
9 A = 40*10^-3;        // Variable 1
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 2

Chapter 01 Electricity

Scilab code Exa 1.1 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  $1.25 \times 10^{18}$ 
   electrons. What is its charge in coulombs?
6
7 // Given data
8
9 ec =  $1.25 \times 10^{18}$ ; // Electron charge
   =  $1.25 \times 10^{18}$  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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_2
4 clc; clear;
5 // A dielectric has a positive charge of  $12.5 \times 10^{18}$ 
   protons. What is its charge in coulombs?
6
7 // Given data
8
9 ec =  $12.5 \times 10^{18}$ ;           // Electron charge
   = $12.5 \times 10^{18}$  electrons
10
11 disp ("This number of electrons is double the charge
   of 1 C and positive.")
12 disp ('Therefore, +Q = 2 Columbs')

```

Scilab code Exa 1.3 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  $12.5 \times 10^{18}$ 
   electrons added. What is its charge then?
6
7 // Given data
8
9 ec =  $12.5 \times 10^{18}$ ;           // Electron charge
   = $12.5 \times 10^{18}$  electrons
10
11 disp ("The 2-C of negative charge added by the
   electron cancels the 2-C of positive charge,
   making the dielectric neutral.")
12 disp ('Therefore, Q = 0')

```

Scilab code Exa 1.4 Example 21

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 01
3 // Example No. 1_4
4 clc; clear;
5 // A neutral dielectric has  $12.5 \times 10^{18}$  electrons
   removed. What is its charge?
6
7 // Given data
8
9 ec =  $12.5 \times 10^{18}$ ; // Electron charge
   = $12.5 \times 10^{18}$  electrons
10
11 disp ('The 2-C of electron charge removed allows an
   excess of  $12.5 \times 10^{18}$  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

```
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?
6
7 // Given data
8
```

```

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 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?
6
7 // Given data
8
9 Q = 12;           // Charge=12 Columb
10 T = 1;           // Time=1 Sec i.e every second
11
12 I = Q/T;
13 disp (I, 'The Intensity of Charge Flow in Amps')

```

Scilab code Exa 1.7 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?
6
7 // Given data

```

```

8
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

```

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
6
7 // Given data
8
9 G1 = 0.05;       // G1=0.05 Siemens
10 G2 = 0.1;       // G1=0.1 Siemens
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')

```

Scilab code Exa 1.9 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 3

Chapter 02 Resistors

Scilab code Exa 2.1 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?
6
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  $\pm 0.5\%$ .')
```

8

```
9 disp ('Therefore R = 365 Ohms  $\pm 0.5\%$ . The
   permissible ohmic range is calculated as
    $365 * 0.005 = \pm 1.825$  Ohms, or 363.175 to 366.825
```

Ohms. ')

Scilab code Exa 2.2 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 .
6
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 4

Chapter 03 Ohms Law

Scilab code Exa 3.1 Example 29

```
1 // 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?
6
7 // Given data
8
9 V = 120;           // Voltage of Power line=120 Volts
10 R = 8;           // Heater Resistance=8 Ohms
11
12 I = V/R;
13 disp (I, 'The Current I in Amps')
```

Scilab code Exa 3.2 Example 30

```

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

```

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?
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')

```

Scilab code Exa 3.4 Example 32

```
1 // 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
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

```
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?
6
7 // Given data
8
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

```
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?
6
7 // Given data
8
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')
```

Scilab code Exa 3.7 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?
6
7 // Given data
8
9 V = 120;          // Voltage of Power line=120 Volts
10 I = 10;          // Current drawn from Powerline=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

```
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?
6
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;
13 disp (I, 'The Current I in Amps')
```

Scilab code Exa 3.9 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?
6
7 // Given Data
8
```

```

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')

```

Scilab code Exa 3.10 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

```

1 // 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.

```

```

6
7 // Given data
8
9 I = 2;           // Current=2 Amps
10 R = 50;         // Resistance=50 Ohms
11 V = 100;        // Voltage Source=100 Volts
12
13 P = I*I*R;
14 disp (P, 'The Power in Watts')

```

Scilab code Exa 3.12 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
7 // Given data
8
9 I = 4;           // Current=4 Amps
10 R = 25;         // Resistance=25 Ohms
11 V = 100;        // Voltage Source=100 Volts
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

```

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

```

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?
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')

```

Scilab code Exa 3.16 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.
6
7 // Given data
8
9 I = 20*10^-3;    // Current=20m Amps
10 V = 30;         // Voltage Drop=30 Volts
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

```
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.
6
7 // Given data
8
9 I = 150*10^-6; // Current=150 uAmps
10 V = 225; // Voltage Drop=225 Volts
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 5

Chapter 04 Series Circuits

Scilab code Exa 4.1 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?
6
7 // Given data
8
9 R1 = 5;      // Resistor 1=5 Ohms
10 R2 = 5;     // Resistor 2=5 Ohms
11 R3 = 10;    // Resistor 3=10 Ohms
12
13 Rt = R1+R2+R3;
14 disp (Rt, 'The Combined Series Resistance in Ohms')
```

Scilab code Exa 4.2 Example 47

```

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

```

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
8
9 R1 = 10;      // Resistor 1=10 Ohms
10 R2 = 20;     // Resistor 2=20 Ohms
11 R3 = 30;     // Resistor 3=30 Ohms
12 Vt = 12;     // Applied Voltage=12 Volts
13
14 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 V3 = I*R3
28 disp (V3, 'The Voltage Drop of Resistor R3 in Volts')

```

Scilab code Exa 4.4 Example 49

```

1 // 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 Kirchhoffs voltage law, how much
   is the applied voltage Vt ?
6
7 // Given data
8
9 V1 = 40; // Voltage drop at R1=40 Volts
10 V2 = 60; // Voltage drop at R2=60 Volts
11 V3 = 180; // Voltage drop at R3=180 Volts
12
13 Vt = V1+V2+V3;
14 disp (Vt, 'The Applied Voltage Vt in Volts')

```

Scilab code Exa 4.5 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?
6
7 // Given data
8
9 V1 = 40;      // Voltage drop at R1=40 Volts
10 Vt = 120;    // Applied Voltage=120 Volts
11
12 V2 = Vt-V1;
13 disp (V2, 'The Voltage Drop across Resistor R2 in
   Volts')
```

Scilab code Exa 4.6 Example 51

```
1 // 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 20 has
   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
8
9 R1 = 150;      // Resistor 1=150 Ohms
10 R2 = 120;    // Resistor 2=120 Ohms
11 R3 = 180;    // Resistor 3=180 Ohms
12 R4 = 150;    // Resistor 4=150 Ohms
13 Vt = 24;     // Applied Voltage=24 Volts
14
15 Rt = R1+R2+R3+R4;
16
17 I = Vt/Rt;
18
19 V1 = I*R1
20 disp (V1, 'The Voltage Drop of Resistor R1 in Volts')
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 V4 = I*R4
29 disp (V4, 'The Voltage Drop of Resistor R4 in Volts')
30
31 disp ('The Resistor R3 is defective since it is open
        circuit and drops all the voltage arround it')

```

Scilab code Exa 4.7 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
10 R2 = 120;     // Resistor 2=120 Ohms
11 R3 = 180;     // Resistor 3=180 Ohms
12 R4 = 150;     // Resistor 4=150 Ohms
13 Vt = 24;      // Applied Voltage=24 Volts
14
15 disp ('Calculated from the Circuit')
16
17 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 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 $V4=I \cdot R4=I \cdot 0(\text{Ohms})=0 \text{ V. '}$)

Chapter 6

Chapter 05 Parallel Circuits

Scilab code Exa 5.1 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.
6
7 R1 = 1*10^3; // Resistor 1=1*10^3 Ohms
8 R2 = 600; // Resistor 2=600 Ohms
9 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')
```

Scilab code Exa 5.2 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 Kirchhoffs 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
11 R3 = 60;          // Resistor 3=60 Ohms
12 Va = 120;         // Applied Voltage=120 Volts
13
14 I1 = Va/R1;
15 I2 = Va/R2;
16 I3 = Va/R3;
17
18 It = I1+I2+I3
19 disp (It, 'The Total Current in the Mainline in Amps'
   )

```

Scilab code Exa 5.3 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?
6

```

```

7 // Given data
8
9 I1 = 10;           // Current in R1 branch=10 Amps
10 It = 15;         // Total Current=15 Amps
11
12 I2 = It-I1;
13 disp (I2, 'The Current in R2 branch in Amps')

```

Scilab code Exa 5.4 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 Kirchhoffs current law,
   calculate It.
6
7
8 // Given data
9
10 I1 = 0.1;         // Branch Current 1=0.1 Amps
11 I2 = 0.5;         // Branch Current 2=500m Amps
12 I3 = 800*10^-6;  // Branch Current 3=800u Amps
13
14 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

```

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?
6
7 // Given data
8
9 I1 = 5;           // Branch Current 1=5 Amps
10 I2 = 5;          // Branch Current 2=5 Amps
11 Va = 90;         // Applied Voltage=90 Volts
12
13 It = I1+I2;
14 Req = Va/It;
15 disp (Req, 'The Equivalent Resistance Req in Ohms')

```

Scilab code Exa 5.6 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
8
9 R = 40;           // Resistance=40 Ohms
10 Req = 24;        // Equivqlent 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

```
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
6
7 // Given data
8
9 R1 = 50*10^3;           // R1=50k Ohms
10 Req = 25*10^3;        // Req=25k 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

```
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?
6
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 confirm 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 7

Chapter 06 Series Parallel Circuits

Scilab code Exa 6.1 Example 61

```
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?
6
7 // Given data
8
9 Rs = 5642;           // Standard Resistor=5642 Ohms
10 R1 = 1*10^3;       // Resistor 1=1k Ohms
11 R2 = 10*10^3;      // Resistor 2=10k Ohms
12
13 Rx = Rs*(R1/R2);
14 disp (Rx, 'The Unknown Resistance Rx in Ohms')
```

Scilab code Exa 6.2 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
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'
   )
```

Scilab code Exa 6.3 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 V; VAB = 9 V; V4 = 16.2 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
8
9 V1 = 10.8; // Voltage at R1=10.8 Volts
10 Vab = 9; // Voltage at point (AB)=9 Volts
11 V4 = 16.2; // Voltage at R4=16.2 Volts
12 R1 = 120; // Resistor 1=120 Ohms
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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 06
3 // Example No. 6_4
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 = 14.4 V; VAB = 0 V; V4 = 21.6 V. These
   voltage readings are shown in Fig. 6 15c . Based
   on the voltmeter readings shown, which component
   is defective and what type of defect does it
   have?

6
7 // Given data
8
9 V1 = 14.4; // Voltage at R1=14.4 Volts
10 Vab = 0; // Voltage at point (AB)=0 Volts
11 V4 = 21.6; // Voltage at R4=21.6 Volts
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 0 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 8

Chapter 07 Voltage and Current Dividers

Scilab code Exa 7.1 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?
6
7 // Given data
8
9 R1 = 50*10^3;           // Resistor 1=50k Ohms
10 R2 = 50*10^3;         // Resistor 2=50k Ohms
11 R3 = 50*10^3;         // Resistor 3=50k Ohms
12 Vt = 180;             // Applied Voltage=180 Volts
13
14 R = R1                 // R = R1 = R2 = R3
15 Rt = R1+R2+R3;
16 V = Vt*(R/Rt);
17 disp (V, 'The Voltage Drop across each Resistor in
```

Volts ')

Chapter 9

Chapter 08 Analog and Digital Multimeters

Scilab code Exa 8.1 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?
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')
```

Scilab code Exa 8.2 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?
6
7 // Given data
8
9 It = 500*10^-6;      // Total Current=500u Amps
10 Im = 50*10^-6;     // Current (cause of meter
   movement)=50 uAmps
11 rm = 1000;         // Resistance of moving coil
   =1000 Ohms
12
13 Is = It-Im;
14 Vm = Im*rm;
15
16 Rs = Vm/Is;
17 disp (Rs, 'The Shunt Resistance Rs needed to extend
   the range to 500 uA in Ohms')
```

Chapter 10

Chapter 09 Kirchhoffs Laws

Scilab code Exa 9.1 Example 68

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 09
3 // Example No. 9_1
4 clc; clear;
5 // Apply Kirchhoffs current law to solve for the
   unknown current, I3.
6
7 // Given data
8
9 I1 = 2.5;      // Branch 1 Current=2.5 Amps
10 I2 = 8;       // Branch 2 Current=8 Amps
11 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 I3 = I4+I5-I1-I2;
18 disp (I3, 'The Branch 3 Current I3 in Amps')
```

Scilab code Exa 9.2 Example 69

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 09
3 // Example No. 9_2
4 clc; clear;
5 // Apply Kirchoffs voltage law to solve for the
   voltages V(AG) & V(BG).
6
7 // Given data
8
9 V1 = 18;           // Source Voltage 1=18 Volts
10 V2 = 18;          // Source Voltage 2=18 Volts
11 R1 = 120;         // Resistor 1=120 Ohms
12 R2 = 100;         // Resistor 2=100 Ohms
13 R3 = 180;         // Resistor 3=180 Ohms
14
15 Vt = V1+V2;
16 Rt = R1+R2+R3;
17
18 I = Vt/Rt;
19
20 VR1 = I*R1;
21 VR2 = I*R2;
22 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 Vt = VR1+VR2+VR3;
28
29 VAG = VR2+VR3-V2;
```

```
30 disp (VAG, 'The Voltage V(AG) in Volts ')
31
32 VBG = V1-VR1-VR2;
33 disp (VBG, 'The Voltage V(BG) in Volts ')
```

Chapter 12

Chapter 11 Conductors and Insulators

Scilab code Exa 11.1 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.?
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')
```

Scilab code Exa 11.2 Example 71

```
1 // 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
9 N = 16;           // No. of strands=16
10 A27 = 201.5     // Circular area of No. 27 Guage
   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

```
1 // 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?
```

```

6
7 // Given data
8
9 roh = 10.4;           // roh or specific resistance
    =10.4 (for Copper)
10 l = 100;            // Lenght=100 feet
11 A = 1022;           // Area of No. 20 Gage=1022 cmil
12
13 R = roh*(l/A);
14 disp (R, 'The Resistance of 100 ft of No. 20 gage
    Copper Wire in Ohms')
15 disp ('i.e 1.02 Ohms')

```

Scilab code Exa 11.4 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
8
9 roh = 10.4;           // roh or specific resistance
    =10.4 (for Copper)
10 l = 100;            // Lenght=100 feet
11 A = 509.5;           // Area of No. 23 Gage=509.5
    cmil
12
13 R = roh*(l/A);
14 disp (R, 'The Resistance of 100 ft of No. 20 gage
    Copper Wire in Ohms')

```

Scilab code Exa 11.5 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
   ?
6
7 // Given data
8
9 roh = 55;           // roh or specific resistance=55 (
   for Germanium)
10 l = 0.2*10^-2;    // Lenght=100 feet
11 A = 1*10^-2;      // Area=1 sqcm
12
13 R = roh*(l/A);
14 disp (R, 'The Resistance of a Slab of Germanium in
   Ohms')
```

Scilab code Exa 11.6 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 .
6
7 // Given data
8
```

```
9 Tmax = 120;           // Temp(max)=120 degree
   Centigrates
10 Tmin = 20;           // Temp(min)=20 degree
   Centigrates
11 Ro = 14;             // Wire Resistance=14 Ohms
12 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 13

Chapter 12 Batteries

Scilab code Exa 12.1 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 I1
   is 2 A.
6
7 // Given data
8
9 Vo0 = 100;           // Vo at zero load current=100 Volts
10 Vo1 = 80;           // Vo at 2 A load current=80 Volts
11 I1 = 2;             // Load current=2 Amps
12
13 Ri = (Vo0-Vo1)/I1;
14 disp (Ri, 'The Resistance ri in Ohms')
```

Chapter 14

Chapter 13 Magnetism

Scilab code Exa 13.1 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.
6
7 // Given data
8
9 A = 25000;           // A=25000 Maxwell
10 B = 0.005;         // B=0.005 Wabers
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 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

```
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
   ?
6
7 // Given data
8
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

```
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?
6
7 // Given data
8
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

```
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;
6 // (b) 15,000 G to T.
7 // Given data
8
9 A = 0.003; // A=0.003 Tesla
10 B = 15000; // B=15000 Guass
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);
17 disp (T, 'The 15,000 Guass in Tesla is ')
```

Chapter 15

Chapter 14 Electromagnetism

Scilab code Exa 14.1 Example 81

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 14
3 // Example No. 14_1
4 clc; clear;
5 // Calculate the ampere-turns of mmf for a coil with
   2000 turns and a 5-mA current.
6
7 // Given data
8
9 I = 5*10^-3;           // Current=5 mAmps
10 N = 2000;            // No. of Turns=2000
11
12 mmf = I*N;
13 disp (mmf, 'The Amps-Turn (A.t) of Magneto-Motive
   Force (mmf) in A.t')
```

Scilab code Exa 14.2 Example 82

```

1 // 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 ')

```

Scilab code Exa 14.3 Example 83

```

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

```

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.
6
7 // Given data
8
9 V = 6;           // Voltage=6 Volts
10 R = 3;          // Resistance=3 Ohms
11 N = 250;        // No. of Turns=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 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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 14
3 // Example No. 14_5
4 clc; clear;
5 // A magnetic material has a  $\mu_r$  of 500. Calculate
   the absolute  $\mu$  as B/H (a) in CGS units and (b) in
   SI units.
6
7 // Given data
8

```

```

9  ur = 500;           // ur=500
10 uoa = 1;           // uo for CGS Units=1
11 uob = 1.26*10^-6; // uo for SI Units=1.26 u
12
13 ua = ur*uo;
14 disp (ua, 'The Absolute u as B/H in CGS in (G/Oe)')
15
16 ub = ur*uob;
17 disp (ub, 'The Absolute u as B/H in SI in (T/(A.t/m))
18      ')
18 disp ('i.e 630*10^-6 T/(A.t/m)')

```

Scilab code Exa 14.6 Example 86

```

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
6 // density B that will be produced by the field
7 // intensity H equal to 1000 A.t/m.
8
9 // Given data
10 u = 630*10^-6; // u=630 micro T/(A.t/m)
11 H = 1000; // H=1000 A.t/m
12
13 B = u*H;
14 disp (B, 'The Flux density in Tesla')

```

Chapter 16

Chapter 15 Alternating Voltage and Current

Scilab code Exa 15.1 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 ?
6
7 // Given data
8
9 Vm = 100;           // Vm=100 Volts
10 t1 = 30;           // Theta 1=30 .
11 t2 = 45;           // Theta 2=45 .
12 t3 = 90;           // Theta 3=90 .
13 t4 = 270;          // Theta 4=270 .
14
15 v1 = Vm*sind(t1);
16 disp (v1, 'The Voltage at 30 in Volts ')
17
```

```

18 v2 = Vm*sind(t2);
19 disp (v2,'The Voltage at 45    in Volts ')
20
21 v3 = 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

```

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.
6
7 // Given data
8
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 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

```

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.
6
7 // Given data
8
9 f1 = 1*10^6;           // Freq=1 MHz
10 f2 = 2*10^6;          // Freq=2 MHz
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 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 with f of 30 GHz
   .
6
7 // Given data
8
9 c = 3*10^10;           // Speed of light=3*10^10 cm/s

```

```

10 f = 30*10^9;          // Freq=30 GHz
11
12 l = c/f;
13 disp (1, 'The Lamda or Wavelenght in cm')

```

Scilab code Exa 15.5 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?
6
7 // Given data
8
9 c = 3*10^10;          // Speed of light=3*10^10 cm/s
10 f = 60*10^6;        // Freq=60 MHz
11 in = 2.54;          // 2.54 cm = 1 in
12 ft = 12;            // 12 in = 1 ft
13
14 l1 = c/f;
15 l = l1/2;
16 disp (1, 'The Height in cm')
17
18 li = l/in
19 lf = li/ft;
20 disp (lf, 'The Height in feet')

```

Scilab code Exa 15.6 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?
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/l
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

```

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?
6
7 // Given data
8
9 c = 1130;      // Speed of light=1130 ft/s
10 f = 100;      // Freq=100 Hz
11
12 l = c/f;
13 disp (l, 'The Lamda or Wavelength in ft ')

```

Scilab code Exa 15.8 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.
6
7 // Given data
8
9 c = 1130; // Speed of light=1130 ft/s
10 f = 34.44*10^3; // Freq=100 Hz
11 in = 2.54; // 2.54 cm = 1 in
12 ft = 12; // 12 in = 1 ft
13
14 l = c/f;
15 disp (l, '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 ('approx 1 cm')
```

Chapter 17

Chapter 16 Capacitance

Scilab code Exa 16.1 Example 95

```
1 // 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')
```

Scilab code Exa 16.2 Example 96

```

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

```

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.
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')

```

Scilab code Exa 16.4 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.
6
7 //Given data
8
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')
```

Scilab code Exa 16.5 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?
6
7 // Given data
8
9 I = 5*10^-3;      // Current=5 mAmps
10 t = 1;           // Time=1 Sec
```

```

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

```

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.
6
7 // Given data
8
9 c = 8.85*10^-12;      // Constant=8.85 p
10 A = 2;                // Area=2 sqm
11 d = 1*10^-2;         // Distance=1 cm
12 K = 1                 // Permeability=1
13
14 C = K*c*(A/d);
15 disp (C, 'The Capacitance in Farad')
16 disp ('i.e 1700*10^-12 F OR 1770 pF')

```

Scilab code Exa 16.7 Example 101

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 16
3 // Example No. 16_7
4 clc; clear;

```

```

5 // Determine the value of capacitance 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.'
   )

```

Scilab code Exa 16.8 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.')
8

```

```
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 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 .
6
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  $\pm 5\%$ .')
```

Scilab code Exa 16.10 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.
6
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

```
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
8
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

```
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)
   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 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 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.')
```


Chapter 18

Chapter 17 Capacitive Reactance

Scilab code Exa 17.1 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?
6
7 // Given data
8
9 f = 1400;           // Frequency=1400 Hz
10 C1 = 0.1*10^-6;   // Cap1=0.1 uF
11 C2 = 1*10^-6;     // Cap2=1 uF
12
13 Xc1 = 1/(2*%pi*f*C1);
14 disp (Xc1, 'The Capacitive Reactance in Ohms')
15 disp ('approx 1140 Ohms')
16
17 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

```
1 // 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
8
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

```
1 // 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?
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 ('approx 468 pF')

```

Scilab code Exa 17.4 Example 110

```

1 // 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?
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 ('approx 159 Hz')

```

Scilab code Exa 17.5 Example 111

```

1 // Grob's Basic Electronics 11e

```

```

2 // Chapter No. 17
3 // Example No. 17_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.
6
7 // Given data
8
9 C = 6*10^-6; // Cap=6 uF
10 dv = 50; // differential voltage increased by
   50 Volts
11 dt = 1; // differectial time is 1 sec
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

```

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.
6
7 // Given data
8
9 C = 6*10^-6; // Cap=6 uF
10 dv = -50; // differential voltage decreased
   by 50 Volts
11 dt = 1; // differectial 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 uAmps')

```

Scilab code Exa 17.7 Example 113

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 17
3 // 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.
6
7 // Given data
8
9 C = 250*10^-12; // Cap=250 pF
10 dv = 50; // differential voltage increased
   by 50 Volts
11 dt = 1*10^-6; // differectial time is 1 usec
12
13 ic = C*(dv/dt);
14 disp (ic, 'The Instantaneous Value of ic produced in
        Amps')
15 disp ('12500 uAmps or 12.5 mAmps')

```

Chapter 19

Chapter 18 Capacitive Circuits

Scilab code Exa 18.1 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
8
9 R = 30; // Resistance=30 Ohms
10 Xc = 40; // Capacitive Reactance=40 Ohms
11 Vt = 100; // Applied Voltage=100 Volts
12
13 R1 = R*R;
14 Xc1 = Xc*Xc;
15
16 Zt = sqrt(R1+Xc1);
```

```

17 disp (Zt, 'Zt in Ohms');
18
19 I = (Vt/Zt);
20 disp (I, 'I in Amperes');
21
22 Vr = I*R;
23 disp (Vr, 'Voltage Across Resistor in Volts');
24
25 Vc = I*Xc;
26 disp (Vc, 'Voltage Across Capacitive Reactance in
    Volts');
27
28 Oz = 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 18.2 Example 115

```

1 // 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.
6
7 // Given data
8
9 Ir = 30*10^-3; // Current Ir=30 mA

```

```
10 Ic = 40*10^-3; // Current Ic=40 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 Zeq = Va/It;
21 disp (Zeq, 'The Equivqlent 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 20

Chapter 19 Inductance

Scilab code Exa 19.1 Example 116

```
1 // 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')
```

Scilab code Exa 19.2 Example 117


```

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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_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
8
9 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

```
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 2us?
6
7 // Given data
8
9 V1 = 1000;           // Induced voltage=1000 Volts
10 di = 50*10^-3;     // differential current=50 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 Example 120

```
1 // 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?
6
```

```

7 // Given data
8
9 L = 4; // Inductor=4 H
10 R = 12; // current change=di/dt=12 A/s
11
12 V1 = L*R;
13 disp (V1, 'The Value of Self-Induced Voltage in Volts
    ')

```

Scilab code Exa 19.6 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 mA in 2 us. How much is V1 ?
6
7 // Given data
8
9 L = 200*10^-3; // Inductor=200 mH
10 di = 100*10^-3; // differential current=100
    mAmps
11 dt = 2*10^-6; // differectial time=2 usec
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')

```

Scilab code Exa 19.7 Example 122

```

1 // 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 are linked 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

```

1 // 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 ')

```

Scilab code Exa 19.9 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.
6
7 // Given data
8
9 L1 = 400*10^-3; // L1=400 mH
10 L2 = 400*10^-3; // L2=400 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')
```

Scilab code Exa 19.10 Example 125

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_10
4 clc; clear;
5 // If the two coils had a mutual inductance LM of 40
   mH, how much would k be?
6
7 // Given data
8
9 L1 = 400*10^-3; // Coil Inductance 1=400 mH
```

```

10 L2 = 400*10^-3; // Coil Inductance 2=400 mH
11 Lm = 40*10^-3; // Mutual inductance=40 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

```

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
8
9 np = 100; // Turns in primary coil=100
10 ns = 600; // Turns in secondary coil=600
11 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 ')

```

Scilab code Exa 19.12 Example 127

```

1 // 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 vs = vp*(ns/np);
17 disp (vs, 'The Secondary Voltage in Volts')

```

Scilab code Exa 19.13 Example 128

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_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
7 // Given data
8
9 vs = 720;           // Secondary voltage=720 Volts
10 R1 = 7200;          // Secondary load=7200 Ohms

```

```

11 tr = 1/6;          // Turns ratio=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')

```

Scilab code Exa 19.14 Example 129

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_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?
6
7 // Given data
8
9 vs = 6;           // Secondary voltage=6 Volts
10 Rl = 0.6;       // Secondary load=0.6 Ohms
11 tr = 20/1;      // Turns ratio=20:1
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')

```

Scilab code Exa 19.15 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
   A.
6
7 // Given data
8
9 vs = 25.2;      // Secondary voltage=25.2 Volts
10 vp = 120;      // Primary voltage=120 Volts
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

```

1 // 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
9
10 Vp = 32;      // Primary Voltage = 32 Volts
11 Rl = 8;       // Load Resistance = 8 Ohms
12 TR = 4;      // Turns Ratio Np/Ns = 4/1
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*Rl;
26 disp (Zp, 'Primary Impedence in Ohms by Method 2');

```

Scilab code Exa 19.17 Example 132

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_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
7 // Given data
8
9 Zs = 300; // Secondary impedance=300 Ohms
10 Zp1 = 75; // Primary impedance=75 Ohms
11 Zp2 = 600; // Primary impedance=600 Ohms
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

```
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?
6
7 // Given data
8
9 l1 = 5*10^-3; // Inductor 1=5 mH
10 l2 = 10*10^-3; // Inductor 2=10 mH
11
12 Lt = l1+l2;
13 disp (Lt, 'The Total Inductance in Henry')
14 disp ('i.e 15 mH')
```

Scilab code Exa 19.19 Example 134

```
1 // 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?
6
7 // Given data
8
9 l1 = 8*10^-3; // Inductor 1=8 mH
10 l2 = 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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_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
8
9 l1 = 250*10^-6; // Coil Inductance 1=250 uH
10 l2 = 250*10^-6; // Coil Inductance 2=250 uH
11 Lts = 550*10^-6; // Inductance series –aiding=550
   uH
12 Lto = 450*10^-6; // Inductance series –opposing
   =450 uH
13
14 Lm = (Lts-Lto)/4
15 disp (Lm, 'The Mutual Inductance in Henry')
16 disp ('i.e 25 uH')
17
18 lt = sqrt(l1*l2);
19
20 k = Lm/lt;

```

21 `disp` (k, 'The Coupling coefficient k is')

Scilab code Exa 19.21 Example 136

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 19
3 // Example No. 19_21
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?
6
7 // Given data
8
9 l1 = 0.4;      // Coil Inductance l=0.4 H
10 I = 1.2;     // Current=1.2 Amps
11
12 E = (l1*I*I)/2;
13 disp (E, 'The Energy Stored in the Magnetic Field in
   // Joules')
```

Chapter 21

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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20_2
4 clc; clear;
5 // Calculate the  $X_L$  of (a) a 10-H L at 60 Hz and (b)
   a 5-H L at 60 Hz.
6
7 // Given data
8
9 f = 60; // Frequency=60 Hz
10 L1 = 10; // Inductor 1=10 H
11 L2 = 5; // Inductor 2=5 H
12 pi = 3.14
13
14 Xl1 = 2*pi*f*L1;
15 disp (Xl1, 'The Inductive Reactance in Ohms')
16
17 Xl2 = 2*pi*f*L2;
18 disp (Xl2, 'The Inductive Reactance in Ohms')

```

Scilab code Exa 20.3 Example 139

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 20
3 // Example No. 20_3
4 clc; clear;
5 // Calculate the  $X_L$  of a 250- $\mu$ H coil at (a) 1 MHz
   and (b) 10 MHz.
6
7 // Given data
8
9 f1 = 1*10^6; // Frequency1=1 MHz
10 f2 = 10*10^6; // Frequency2=10 MHz
11 L = 250*10^-6; // Inductor=250  $\mu$ H
12 pi = 3.14;

```

```

13
14 // For 1 Mhz
15
16 Xl1 = 2*pi*f1*L;
17 disp (Xl1, 'The Inductive Reactance in Ohms')
18
19 // For 10 Mhz
20
21 Xl2 = 2*pi*f2*L;
22 disp (Xl2, 'The Inductive Reactance in Ohms')

```

Scilab code Exa 20.4 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 Xl?
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

```

1 // 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.
6
7 // Given data
8
9 Xl = 6280;           // Inductive reactance=6280 Ohms
10 f = 1000;          // Frequency=1000 Hz
11 pi = 3.14;
12
13 L = Xl/(2*pi*f);
14 disp (L, 'The value of Inductor in Henry')

```

Scilab code Exa 20.6 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
8
9 Xl = 15700;         // Inductive reactance=15700 Ohms
10 f = 12*10^6;       // Frequency=12 MHz
11 pi = 3.14;
12
13 L = Xl/(2*pi*f);
14 disp (L, 'The value of Inductor in Henry')
15 disp ('i.e Apox 208.8*10^-6 OR 208.8 uH')

```

Scilab code Exa 20.7 Example 143

```
1 // 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 Xl = 1000;      // Inductive reactance=1000 Ohms
10 L = 1;        // Inductor=1 H
11
12 f = Xl/(2*%pi*L);
13 disp (f, 'The Frequency in Hertz')
```

Chapter 22

Chapter 21 Inductive Circuits

Scilab code Exa 21.1 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 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
8
9 R = 30; // Resistance=30 Ohms
10 Xl = 40; // Inductive reactance=40 Ohms
11 Vt = 100; // Applied voltage=100 Volts
12
13
14 R1 = R*R;
15 Xl1 = Xl*Xl;
16
```

```

17 Zt = sqrt(R1+Xl1);
18 disp (Zt, 'Zt in ohms');
19
20 I = (Vt/Zt);
21 disp (I, 'I in Amperes');
22
23 Vr = I*R;
24 disp (Vr, 'Vr in Volts');
25
26 Vl = I*Xl;
27 disp (Vl, 'Vl in Volts');
28
29 Oz = atand(Xl/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 21.2 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 Xl? Assume 600 V for the applied
    voltage.
6
7 // Given data
8
9 R = 600; // Resistance=600 Ohms

```

```

10 Xl = 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

```

1 // 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
  .
6
7 // Given data
8
9 Xl = 700;    // Inductive reactance=700 Ohms
10 Re = 2;     // AC effective resistance=2 Ohms
11
12 Q = Xl/Re;
13 disp (Q, 'The Q of Coil is ')

```

Scilab code Exa 21.4 Example 147

```

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.
6
7 // Given data
8
9 L = 200*10^-6; // L of coil=200 uHenry
10 Q = 40; // Q=40
11 f = 0.5*10^6; // Frequency=0.5 MHz
12 pi = 3.14;
13
14 Xl = 2*pi*L*f;
15
16 Re = Xl/Q;
17 disp (Re, 'The AC Effective Resistance in Ohms')
```

Chapter 23

Chapter 22 RC and LR Time Constants

Scilab code Exa 22.1 Example 148

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 22
3 // Example No. 22_1
4 clc; clear;
5 // What is the time constant of a 20-H coil having
   100 Ohms of series resistance?
6
7 // Given data
8
9 L = 20;      // Inductor=20 Henry
10 R = 100;    // Resistor=100 Ohms
11
12 T = L/R;
13 disp (T, 'The Time Constant in Seconds')
```

Scilab code Exa 22.2 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
8
9 L = 20;           // Inductor=20 Henry
10 R = 100;        // Resistor=100 Ohms
11 I = 100*10^-3;  // Steady-state current=100 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 22.3 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
8

```



```

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

```

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?
6
7 // Given data
8
9 C = 0.01*10^-6;   // Capacitor=0.01 uFarad
10 R = 1*10^6;     // Resistor=1 MOhms
11
12 T = C*R;
13 disp (T, 'The Time Constant in Seconds')

```

Scilab code Exa 22.5 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?
6
7 // Given data
8
9 C = 0.01*10^-6;      // Capacitor=0.01 uFarad
10 R = 1*10^6;        // Resistor=1 MOhms
11 V = 300;           // Applied DC=300 Volts
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 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

```

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.
6
7 // Given data
8
9 C = 0.01*10^-6;      // Capacitor=0.01 uFarad
10 R = 1*10^6;        // Resistor=1 MOhms
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

```

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.
6
7 // Given data
8
9 C = 0.01*10^-6;      // Capacitor=0.01 uFarad
10 R = 1*10^6;        // Resistor=1 MOhms
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

```

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?
6
7 // Given data
8
9 C = 0.01*10^-6;      // Capacitor=0.01 uFarad
10 R = 2*10^6;        // Resistor= 2 MOhms
11
12 T = C*R;
13 disp (T,'The Time Constant in Seconds')

```

Scilab code Exa 22.9 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?
6
7 // Given data
8
9 RC = 3;      // RC time constant=3 Sec
10 t = 6;      // Discharge time=6 Sec
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 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?
6
7 C = 0.05*10^-6;    // Capacitor=0.05 uFarad
8 R = 10*10^3;      // Resistor=10 kOhms
9 V = 36;           // Applied voltage=36 Volts
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 approx 0.549*10-3 Sec OR 0.549 mSec')
```

Chapter 24

Chapter 23 Alternating Current Circuits

Scilab code Exa 23.1 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.
6
7 // Given data
8
9 R = 27;           // Resistance=27 Ohms
10 Xl = 54;         // Inductive reactance=54 Ohms
11 Vt = 50*10^-3;  // Applied voltage=100 Volts
12 Xc = 27;         // Capacitive reactance=27 Ohms
13
14 nXl = Xl-Xc;     // Net Inductive reactance
15 R1 = R*R;
16 nXl1 = 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 Amperes')
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

```

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 mA; Il=2.8 mA; Ic=1 mA.
   // Calculate It, Zeq, and Theta I.
6
7 // Given data
8
9 Va = 50*10^-3; // Applied voltage=50m Volts
10 Ir = 1.8*10^-3; // Ir=1.8 mAmps
11 Il = 2.8*10^-3; // Ir=2.8 mAmps
12 Ic = 1*10^-3; // Ic=1 mAmps
13
14 nI = Il-Ic; // net current
15 Ir1 = Ir*Ir;
16 nI1 = 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 Zeq = Va/It;
23 disp (Zeq, 'The Equivalent Impedance Zeq in Ohms')
24 disp ('Approx 19.61 Ohms')
25
26 Oz = atand(-(nI/Ir));
27 disp (Oz, 'Theta z in Degree');
```

Chapter 26

Chapter 25 Resonance

Scilab code Exa 25.1 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
8
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

```

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.
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')

```

Scilab code Exa 25.3 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
8
9 L = 239*10^-6;        // Inductor=239 uHenry
10 fr = 1000*10^3;      // Resonant frequency=1000
   kHzertz
11
12 A = %pi*%pi;         // pi square
13 B = fr*fr;           // Resonant frequency square
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 25.4 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?
6
7 // Given data
8
9 C = 106*10^-12; // Capacitor=106 pFarad
10 fr = 1*10^6; // Resonant frequency=1 MHertz
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')
17 disp ('i.e 239 uF')
```

Scilab code Exa 25.5 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 .
6
7 // Given data
8
9 Vo = 100*10^-3;      // Output voltage=100 mVolts
10 Vi = 2*10^-3;      // Input voltage=2 mVolts
11 L = 250*10^-6;     // Inductor=250 uHenry
12 f = 0.4*10^6;      // Frequency=0.4 MHertz
13
14 Q = Vo/Vi;
15 disp (Q, 'The Magnification factor Q is ')

```

Scilab code Exa 25.6 Example 165

```

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.
6
7 // Given data
8
9 Vo = 100*10^-3;     // Output voltage=100 mVolts
10 Vi = 2*10^-3;     // Input voltage=2 mVolts
11 L = 250*10^-6;    // Inductor=250 uHenry
12 f = 0.4*10^6;     // Frequency=0.4 MHertz
13 pi = 3.14;
14
15 Q = Vo/Vi;
16 Xl = 2*pi*f*L;
17

```

```
18 rs = Xl/Q;
19 disp (rs, 'The Ac Resistance of Coil in Ohms')
```

Scilab code Exa 25.7 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.
6
7 // Given data
8
9 vin = 4*10^-3; // Input AC signal=4 mVac
10 R1 = 225*10^3; // Resistance1=225 kOhms
11 vR1 = 2*10^-3; // Voltage across Resistor1=2
   mVac
12 x1 = 1.5*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

```
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.
6
7 // Given data
8
9 L = 350*10^-6;           // Inductor=350 uHenry
10 f = 200*10^3;          // Frequency=200 kHzertz
11 Zeq = 17600;           // Equivalent Impedance=17600
   Ohms
12
13 Xl = 2*%pi*f*L;
14
15 Q = Zeq/Xl;
16 disp (Q, 'The Magnification factor Q is ')

```

Scilab code Exa 25.9 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.
6
7 // Given data
8
9 fr = 2000*10^3;         // Resonant frequency=2000
   kHzertz
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 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

```

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.
6
7 // Given data
8
9 fr = 6000*10^3;           // Resonant frequency=6000
   kHzertz
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

Scilab code Exa 26.1 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
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 Xc = 1/(2*pi*fc*C);
23
24 Zt = sqrt((R*R)+(Xc*Xc));
25
26 Vout = 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');

```

Scilab code Exa 26.2 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)
6
7 // Given data
8
9 R = 1*10^3; // Resistor=1 kOhms
10 L = 50*10^-3 // Inductor=50 mHenry
11 Vin = 10; // Input Voltage=10Vpp
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 Xl = 2*%pi*f*L;
22
23 Zt = sqrt((R*R)+(Xl*Xl));
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(-(Xl/R));
32 disp (Theta, 'The Phase angle (Theta z) in Degree');

```

Scilab code Exa 26.3 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
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')
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

```

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.
6
7 //Given data
8
9 R1 = 1*10^3; // Resistor 1=1 kOhms
10 C1 = 1*10^-6; // Capacitor 1=1 uFarad
11 R2 = 100*10^3; // Resistor 2=100 kOhms
12 C2 = 0.001*10^-6; // Capacitor 2=0.001 uFarad
13
14 // To calculate fc1 for RC high-pass filter
15
16 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 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

```

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.
6
7 // Given data
8
9 R1 = 1*10^3; // Resistor 1=1 kOhms
10 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')

```

Scilab code Exa 26.6 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.
6
7 // Given data
8
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')
```

Scilab code Exa 26.7 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.
6
7 // Given data
8
9 Pi = 100*10^-3;    // Input power=1 Watts
```

```

10 Po = 5*10^-3;          // Output power=100 Watts
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

```

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
8
9 f1 = 0;                // Frequency 1=0 Hz
10 f2 = 1.592*10^3;      // Frequency 2=1.592 kHz (
   cutoff frequency)
11 f3 = 15.92*10^3;      // Frequency 3=15.92 kHz
12 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 pi = 3.14;
16
17 Vo1 = Vi;
18 Vo2 = 0.707*Vi;
19
20 // At 0 Hz
21
22 N1 = 20*log10(Vo1/Vi);

```



```

23 disp (N1, 'The Attenuation at 0 Hz in dB')
24
25 //At 1.592 kHz (cutoff frequency)
26
27 N2 = 20*log10(Vo2/Vi);
28 disp (N2, 'The Attenuation at 1.592 kHz in dB')
29
30 // At 15.92 kHz
31
32 Xc = 1/(2*%pi*f3*C);
33
34 A = R*R;
35 B = Xc*Xc;
36
37 Zt = sqrt (A+B);
38
39 N3 = 20*log10(Xc/Zt);
40 disp (N3, 'The Attenuation at 15.92 kHz in dB')

```

Scilab code Exa 26.9 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 kHz?
6
7 disp ('At F = 100 Hz, N(dB) = 0 dB, as indicated by
   point A on the graph.')
8 disp ('At F = 10 kHz, N(dB) = -16 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.')

```


Chapter 28

Chapter 27 Diodes and Diode Applications

Scilab code Exa 27.1 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
8
9 Vf1 = 0.65;           // Forward votage 1=0.65 Volts
10 If1 = 11*10^-3      // Forward current 1=11 mAmps
11 Vf2 = 0.7;          // Forward votage 2=0.7 Volts
12 If2 = 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

```
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.
6
7 // Given data
8
9 Vf1 = 1.1; // Forward votage 1=1.1 Volts
10 If1 = 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

```
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.
6
7 // Given data
8
9 R1 = 100;           // Load resistance=100 Ohms
10 Rb = 2.5;          // Resistance=2.5 Ohms
11 Vin = 10;          // Input voltage=10 Volts
12 Vb = 0.7;          // Voltage=0.7 Volts
13
14
15 // Using first approximation
16
17 V11 = Vin
18 disp (V11, 'The Load Voltage of First Approximation
   in Volts(dc)')
19
20 I11 = V11/R1;
21 disp (I11, 'The Load Current of First Approximation
   in Amps')
22 disp ('i.e 100 mAmps')
23
24 // Using second approximation
25
26 V12 = 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 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 V13 = I13*R1;
40 disp (V13, 'The Load Voltage of Third Approximation
    in Volts')

```

Scilab code Exa 27.4 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.
6
7 // Given data
8
9 Vp = 120; // Primary voltage=120 Vac
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 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 Vdc = 0.318*C;

```

```

23 disp (Vdc, 'The DC Voltage in Volts ')
24
25 I1 = 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

```

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, I1, Idiode, PIV for D1, and fout.
6
7 // Given data
8
9 Vp = 120;           // Primary voltage=120 Vac
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/2);
16 Vopk = Vspk-0.7;
17
18 Vdc = 0.636*Vopk;

```

```

19 disp (Vdc, 'The DC Voltage in Volts ')
20
21 I1 = Vdc/R1;
22 disp (I1, '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 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

```

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, I1, Idiode, PIV for each diode,
   and fout.
6
7 // Given data
8
9 Vp = 120;           // Primary voltage=120 Vac
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 Vopk = Vspk-1.4;
17
18 Vdc = 0.636*Vopk;
19 disp (Vdc, 'The DC Voltage in Volts ')
20
21 Il = Vdc/Rl;
22 disp (Il, 'The Load Current in Amps')
23 disp ('i.e 350.8 mAmps')
24
25 Idiode = Il/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 PIV = C;
32 disp (PIV, 'The PIV for each Diode in Volts ')
33
34 f =120;
35 disp (f, 'The Output Frequency in Hertz ')

```

Scilab code Exa 27.7 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  $N_p:N_s = 4:1$  in
   Fig. 27 21 a and  $2:1$  in Fig. 27 22a . Compare
   Vripple and Vdc if  $C = 500 \mu F$  and  $R_l = 250$ .
6
7 // Given data
8

```

```

 9 A1 = 4/1;           // Turns ratio Np:Ns=4:1
10 B1 = 1/4;           // Turns ratio Ns:Np=1:4
11 A2 = 2/1;           // Turns ratio Np:Ns=2:1
12 B2 = 1/2;           // Turns ratio Ns:Np=1:2
13 Vp = 120;           // Primary voltage=120 Vac
14 Vb = 0.7;           //
15 t1 = 16.67*10^-3;   // Charging Time of Capacitor of
    Turns ratio Np:Ns=4:1=16.67 mSec
16 t2 = 8.33*10^-3;   // Charging Time of Capacitor of
    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 Vs1 = B1*Vp;
23 Vspk1 = Vs1*1.414;
24 Vopk1 = Vspk1 - Vb;
25 D = -t1/(R1*C);
26
27 Vrp1 = 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 Vdc1 = Vopk1-(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 Vs2 = B2*Vp;
38 V2 = Vs2/2;
39 V2pk2 = V2*1.414
40 Vopk2 = V2pk2 - 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 Vdc2 = Vopk2-(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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_8
4 clc; clear;
5 // Calculate the LED current.
6
7 // Given data
8
9 Vin = 24; // Input voltage=24 Volts
10 Vled = 2; // Voltage drop at LED=2 Volts
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')

```

Scilab code Exa 27.9 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.
6
7 // Given data
8
9 Vin = 24;           // Input voltage=24 Volts
10 Vled = 2;          // Voltage drop at LED=2 Volts
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')

```

Scilab code Exa 27.10 Example 188

```

1 // 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.
6
7 // Given data
8
9 Pzm = 1;           // Power rating of zener= 1 Watts
10 Vz = 10;          // Voltage rating of zener= 10 Volts
11
12 Izm = Pzm/Vz;
13 disp (Izm, 'The Maximum Rated Current of Zener in
   Amps')
14 disp ('i.e 100 mAmps')

```

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.
6
7 // Given data
8
9 Vin = 25;           // Input voltage=25 Volts
10 Vz = 10;          // Zener voltage=10 Volts
11 Rs = 1*10^3;      // Source Resistance=1 kOhms
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

```
1 // 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 mAmps
13
14 disp (Is, 'The Source Current in Amps')
```

```

15 disp ('i.e 75 mAmps')
16
17 I1 = Vz/R1;
18 disp (I1, 'The Load Current in Amps')
19 disp ('i.e 30 mAmps')
20
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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 27
3 // Example No. 27_13
4 clc; clear;
5 // Calculate Is, I1 and Iz for (a)R1=200 ohms; (b)R1
   =500 ohms.
6
7 // Given data
8
9 Vin = 16;           // Vin=16 Volts given
10 Vz = 10;          // Vz=10 Volts given
11 Rs = 100;         // Source Resistance = 100 ohms
   given
12 R1a = 200;        // Load Resistance A = 200 ohms
   given
13 R1b = 500;        //Load Resistance B = 500 ohms given
14
15 // For R1 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/R1a;
22 disp (Ila, 'The Load Current for 200 ohms Load in
    Amps. ')
23 disp ('i.e 50 mAmps')
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/R1b;
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 29

Chapter 28 Bipolar Junction Transistors

Scilab code Exa 28.1 Example 192

```
1 // 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')
```

Scilab code Exa 28.2 Example 193


```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_2
4 clc; clear;
5 // A transistor has the following currents: Ie is
   100 mA, Ib is 1.96 mA. Calculate Ic.
6
7 // Given data
8
9 Ie = 100*10^-3;      // Emitter current=100 mAmps
10 Ib = 1.96*10^-3;   // Base current=1.96 mAmps
11
12 Ic = Ie-Ib;
13 disp (Ic, 'The Collector Current Ic in Amps')
14 disp ('i.e 98.04 mAmps')

```

Scilab code Exa 28.3 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.
6
7 // Given data
8
9 Ie = 50*10^-3;      // Emitter current=50 mAmps
10 Ic = 49*10^-3;    // Collector current=49 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

```
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).
6
7 // Given data
8
9 Ie = 15*10^-3;      // Emitter current=15 mAmps
10 Ib = 60*10^-6;    // Base current=60 uAmps
11
12 Ic = Ie-Ib;
13
14 Adc = Ic/Ie;
15 disp (Adc, 'The Value of Alpha(dc) is ')
```

Scilab code Exa 28.5 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).
6
7 // Given data
8
9 Ic = 10*10^-3;     // Collector current=10 mAmps
10 Ib = 50*10^-6;    // Base current=50 uAmps
```

```
11
12 Bdc = Ic/Ib;
13 disp (Bdc, 'The Value of Beta(dc) is')
```

Scilab code Exa 28.6 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.
6
7 // Given data
8
9 Bdc = 150;           // Beta(dc)=150
10 Ib = 75*10^-6;     // Base current=75 uAmps
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

```
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).
6
7 // Given data
8
```

```

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

```

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
8
9 Adc = 0.995; // 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

```

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.
6
7 // Given data
8
9 Bdc = 100; // Beta(dc)=100

```

```

10 Ib = 50*10^-6;           // Base current=50 uAmps
11 Vcc = 10;                // Supply voltage=10 Volts
12
13 Vce = Vcc
14
15 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

```

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 transistors power rating.
6
7 // Given data
8
9 Pdmax = 0.5;              // Power dissipation(max)=0.5
   // Watts
10 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

```
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 .
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
11 Ta = 25; // Ambient Temperature=25 C
12 Tp = 50; // Power rating at 50 C
13
14 delT = Tp-Ta; // Difference between max and
    min temp
15
16 delPd = delT*f;
17
18 Prate = Pd-delPd;
19 disp (Prate, 'The Power Rating at 50 C in Watts')
20 disp ('i.e 280 mWatts')
```

Scilab code Exa 28.12 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 valuse of Ic(sat), Vce(off), Icq
   , Vceq.
6
7 // Given data
8 Vcc = 12; // Supply voltage=12 Volts
9 Vbe = 0.7; // Base-Emitter Voltage=0.7
   Volts
10 Rb = 390*10^3; // Base Resistor=390K Ohms
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 Vceq = Vcc-(Icq*Rc);
23 disp (Vceq, 'The Voltage Collector-Emitter in Volts'
   )
24
25 // For DC load line
26
27 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")

```

Scilab code Exa 28.13 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.
6
7 // Given data
8
9 R1 = 33*10^3; // Resistor 1=33 kOhms
10 R2 = 5.6*10^3; // Resistor 2=5.6 kOhms
11 Rc = 1.5*10^3; // Collector resistance=1.5
   kOhms
12 Re = 390; // Emitter resistance=390 Ohms
13 Bdc = 200; // Beta(dc)= 200
14 Vcc = 18; // Supply voltage = 18 Volts
15 Vbe = 0.7; // Base-Emmitter Voltage=0.7
   Volts
16
17 Vb = Vcc*(R2/(R1+R2));

```



```

18 disp (Vb, 'The Base Voltage in Volts')
19
20 Ve = Vb-Vbe;
21 disp (Ve, 'The Emmitter Voltage in Volts')
22
23 Ie = Ve/Re;           // Emitter current
24
25 Ic = Ie;
26
27 Vc = Vcc-(Ic*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-Emmitter Voltage in Volts')
33 disp ('Appox 8.74 Volts')
34
35 Icsat = 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 Vce1=[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

```

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
8
9 R1 = 33*10^3; // Resistor1=33 kOhms
10 R2 = 6.2*10^3; // Resistor2=6.2 kOhms
11 Rc = 2*10^3; // Collector resistance=2 kOhms
12 Re = 500; // Emitter resistance=500 Ohms
13 Vcc = 12; // Supply voltage=12 Volts
14 Vbe = 0.7; // Base-Emmitter Voltage=0.7 Volts
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 = ~ Ie
26 disp (Ic, 'The Collector Current in Amps')

```

```

27 disp ('Appox 2.4 mAmps')
28
29 Vc = -Vcc+(Ic*Rc)
30 disp (Vc,'The Collector Voltage in Volts')
31
32 Vce = -Vcc+(Ic*(Rc+Re));
33 disp (Vce,'The Collector-Emmitter Voltage in Volts');

```

Scilab code Exa 28.15 Example 206

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 28
3 // Example No. 28_15
4 clc;clear;
5 // Calculate Ie and Vc
6
7 // Given data
8
9 Vee = 6;           // Supply voltage at emitter=6 Volts
10 Vcc = 15;         // Supply voltage at collector=15
    Volts
11 Vbe = 0.7;       // Base-Emmitter Voltage=0.7 Volts
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 30

Chapter 29 Transistor Amplifiers

Scilab code Exa 29.1 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.
6
7 // Given data
8
9 R1 = 10*10^3; // Resistance 1=10 kOhms
10 R2 = 5*10^3; // Resistance 2=5 kOhms
11 R3 = 1*10^3; // Resistance 3=1 kOhms
12 Vdc = 10; // DC supply=10 Volts
13 V = 0.7; // Starting voltage of diode=0.7
   Volts
14 A = 25*10^-3; // Constant
15
```

```

16 // For R=10 kOhms
17
18 Id1 = (Vdc-V)/R1;
19
20 rac1 = A/Id1;
21 disp (rac1, 'The Ac Resistance with R=10 kOhms in
        Ohms')
22
23 // For R=5 kOhms
24
25 Id2 = (Vdc-V)/R2;
26
27 rac2 = A/Id2;
28 disp (rac2, 'The Ac Resistance with R=5 kOhms in Ohms
        ')
29
30 // For R=1 kOhms
31
32 Id3 = (Vdc-V)/R3;
33
34 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

```

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

```

```

8
9 Vin = 25*10^-3;      // Input voltage=25 mVolts(p-p)
10 Vo = 5;             // Output voltage=5 Volts(p-p).
11
12 Av = Vo/Vin;
13 disp (Av, 'The Voltage Gain Av is ')

```

Scilab code Exa 29.3 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.
6
7 // Given data
8
9 Vin = 5*10^-3;      // Input voltage=5 mVolts(p-p)
10 Av = 300;          // Voltage gain=300
11
12 Vo = Av*Vin;
13 disp (Vo, 'The Output Voltage in Volts(p-p)')

```

Scilab code Exa 29.4 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
7 // Given data
8
9 r1 = 600;           // Load resistance=600 Ohms
10 re = 6.67;        // Internal emitter resistance=6.67
    Ohms
11
12 Av = r1/re;
13 disp (Av, 'The Voltage Gain Av is ')
14 disp ('Appox 90 ')

```

Scilab code Exa 29.5 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
8
9 r1 = 600;           // Load resistance=600 Ohms
10 re1 = 3.33;        // Internal emitter resistance=3.33
    Ohms
11 re2 = 6.67;        // Internal emitter resistance=6.67
    Ohms
12 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

```
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.
6
7 // Given data
8
9 rl = 909;           // Load resistance=909 Ohms
10 re = 3.35;        // Internal emitter resistance=3.35
    Ohms
11 Vin = 1;          // Input voltage=1 Volts(p-p)
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

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_7
4 clc; clear;
5 // Calculate Zin.
```



```

6
7 // Given data
8
9 r1 = 909;           // Load resistance=909 Ohms
10 re = 3.35;        // Internal emitter resistance
    =3.35 Ohms
11 B = 100;          // Beta=100
12 R1 = 4.7*10^3;    // Resistance1=4.7 kOhms
13 R2 = 5.6*10^3;    // Resistance2=5.6 kOhms
14
15 Zibase = B*(re+r1);
16 A = (R1*R2)/(R1+R2);
17
18 Zin = (Zibase*A)/(A+Zibase);
19 disp (Zin, 'The Input impedance in Ohms')
20 disp ('i.e 2.48 kOhms')

```

Scilab code Exa 29.8 Example 214

```

1 // 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.
6
7 // Given data
8
9 R1 = 22*10^3;      // Resistance1=22 kOhms
10 R2 = 18*10^3;     // Resistance2=18 kOhms
11 Rg = 600;         // Generator resistance=600 Ohms
12 Re = 1.5*10^3;    // Emitter resistance=1.5 kOhms
13 Rl = 1*10^3;      // Load resistance=1 kOhms
14 Vcc = 20;         // Supply Voltage=20 Volts

```

```

15 Vbe = 0.7;          // Voltage Base-Emitter=0.7 Volts
16 B = 200;           // Beta=200
17 vin = 5;           // Input Voltage=5 Volts(p-p)
18
19 // Calculate the DC quantities first:
20
21 Vb = Vcc*(R2/(R1+R2));
22 disp (Vb, 'The Base Voltage in Volts')
23
24 Ve = Vb-Vbe;
25 disp (Ve, 'The Emitter Voltage in Volts')
26
27 Ie = Ve/Re;
28 Ic = Ie;           // Ic =~ Ie
29 disp (Ic, 'The Collector current in Amps')
30 disp ('i.e 5.53 mAmps')
31
32 Vc = Vcc;          // Since the collector is tied
                    // directly to Vcc
33 disp (Vc, 'The Collector Voltage in Volts')
34
35 Vce = Vcc-Ve;
36 disp (Vce, 'The Collector-Emmitter 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 re = a/Ie;
47 disp (re, 'The AC emmitter resistance in Ohms')
48 disp ('Appox 4.52 Ohms')
49
50 b = Re*R1;
51 c = Re+R1;

```

```

52 r1 = b/c;
53
54 Av = r1/(r1+re);
55 disp (Av,'The Voltage gain is ')
56
57 Zinbase = B*(re+r1);
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 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 vout = Av*vb;
73 disp(vout,'The AC output voltage in Volts(p-p)')
74
75 Icq = Ic
76 Vceq = 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 29.9 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
  and zin.
6
7 // Given data
8
9 Rc = 1.5*10^3;      // Collector resistance=1.5
   kOhms
10 Re = 1.8*10^3;    // Emitter resistance=1.8 kOhms
11 Rl = 1.5*10^3;    // Load resistance=1.5 kOhms
12 Vcc = 15;         // +ve Supply Voltage=15 Volts
13 Vee = 9;          // -ve Supply Voltage=9 Volts
14 Vbe = 0.7;        // Voltage Base-Emitter=0.7
   Volts
15 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 mAmps')
21
22 Ic = Ie;          // Ic =~ Ie
23
24 Vcb = 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 re = a/Ie;
31 disp (re, 'The AC emmitter resistance in Ohms')
32
33 b = Rc*Rl;
34 c = Rc+Rl;
35
36 rl = b/c;
37
38 Av = rl/re;
39 disp (Av, 'The Voltage gain is ')
40
41 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')

```

Scilab code Exa 29.10 Example 216

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 29
3 // Example No. 29_10
4 clc; clear;
5 // Calculate the ac output voltage, vout.
6
7 // Given data
8
9 Rc = 1.2*10^3; // Collector resistance=1.2

```

```

        kOhms
10 Re = 2.2*10^3;           // Emitter resistance=2.2 kOhms
11 Rl = 3.3*10^3;           // Load resistance=3.3 kOhms
12 Rg = 600;                // Generator Resistance=600 Ohms
13 Vcc = 12;                // +ve Supply Voltage=15 Volts
14 Vee = 12;                // -ve Supply Voltage=9 Volts
15 Vbe = 0.7;              // Voltage Base-Emitter=0.7
        Volts
16 vin = 1;                 // Input Voltage=1 Volts(p-p)
17
18 Ie = (Vee-Vbe)/Re;
19
20 a = 25*10^-3;
21 re = a/Ie;
22
23 b = Rc*Rl;
24 c = Rc+Rl;
25 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 31

Chapter 30 Field Effect Transistors

Scilab code Exa 30.1 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
6
7 // Given Data
8
9 Vgs1 = 0;           // Voltage Gate-Source 1=0 Volts
10 Vgs2 = -0.5;      // Voltage Gate-Source 2=-0.5
   Volts
11 Vgs3 = -1;        // Voltage Gate-Source 3=-1
   Volts
12 Vgs4 = -2;        // Voltage Gate-Source 4=-2
   Volts
13 Vgs5 = -3;        // Voltage Gate-Source 5=-3
   Volts
14 Vgsoff = -4;      // Voltage Gate-Source(off)=-4
```

```

    Volts
15 Idss = 10*10^-3      // Idss = 10m Amps
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 Id1 = Idss*a*a
26 disp (Id1, 'The Value of Id for Vgs = 0 Volts in Amps
    ')
27 disp ('i.e 10 mAmps')
28
29 // Vgs = -0.5 Volts
30
31 Id2 = 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 // Vgs = -1 Volts
36
37 Id3 = 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 // Vgs = -2 Volts
42
43 Id4 = Idss*d*d
44 disp (Id4, 'The Value of Id for Vgs = -2 Volts in
    Amps')
45 disp ('i.e 2.5 mAmps')
46
47 // Vgs = -3 Volts

```



```

48
49 Id5 = 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

```

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
6
7 // Given Data
8
9 Idssmin = 2*10^-3; // Idss (min)=2m Amp
10 Idssmax = 20*10^-3; // Idss (max)=20m Amp
11 Vgs = -1.5; // Voltage Gate-Source=-1.5V
12 Vgsoffmin = -2; // Voltage Gate-Source(off)(
    min)=-2 Volts
13 Vgsoffmax = -8; // Voltage Gate-Source(off)(
    max)=-8 Volts
14 Vdd = 20; // Supply Voltage(Drain)=20
    Volts
15 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 Id1 = Idssmin*a*a;
23 disp (Id1, 'The Value of Id in Amps using Minimum

```

```

        Values ')
24 disp ('i.e 125 uAmps')
25
26 Vds1 = Vdd-Id1*Rd;
27 disp (Vds1, 'The Value of Vds in Volts using Minimum
        Values ')
28
29 // Calculation using Maximum Values
30
31 Id2 = Idssmax*b*b;
32 disp (Id2, 'The Value of Id in Amps using Maximum
        Values ')
33 disp ('i.e 13.2 mAmps')
34
35 Vds2 = Vdd-Id2*Rd;
36 disp (Vds2, 'The Value of Vds in Volts using Maximun
        Values ')
37
38 Vp = -Vgsoffmax;
39
40 Vdsp = Vp+Vgs;
41 disp (Vdsp, 'The Value of Vds(p) in Volts using
        Maximun Values ')

```

Scilab code Exa 30.3 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
6
7 // Given Data
8
9 Vs = 1;           // Voltage at Resistor Rs=1 Volts

```

```

10 Rs = 200;           // Source Resistor=200 Ohms
11 Vdd = 10;          // Supply Voltage(Drain)=10 Volts
12 Rd = 1*10^3;      // Drain Resistor=1k Ohms
13
14 Is=Vs/Rs;
15
16 Id = Is;
17
18 Vd = Vdd-Id*Rd;
19 disp (Vd, 'The Drain Voltage Vd in Volts ')

```

Scilab code Exa 30.4 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.
6
7 // Given Data
8
9 R1 = 390*10^3;      // Resistor 1=390k Ohms
10 R2 = 100*10^3;    // Resistor 2=100k Ohms
11 Rd = 1*10^3;      // Drain Resistor=1k Ohms
12 Vdd = 15;         // Supply Voltage(Drain)=15
    Volts
13 Vgs = -1;         // Voltage Gate-Source=-1 Volts
14 Rs = 800;         // Source Resistor=800 Ohms
15
16 Vg = (R2/(R1+R2))*Vdd;
17 disp (Vg, 'The Value of Vg in Volts ')
18 disp ('i.e 3 Volts ')
19
20 Vs = 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 Vd = Vdd-Id*Rd
29 disp (Vd,'The Value of Vd in Volts')
30 disp ('Appox 10 Volts')
```

Scilab code Exa 30.5 Example 221

```

1 // 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.
6
7 // Given Data
8
9 Vdd = 15;           // Supply Voltage(Drain)=15
  Volts
10 Vbe = 0.7;        // Voltage Base-Emitter=0.7
  Volts
11 Re = 2.2*10^3;    // Emitter Resistor=2.2 kOhms
12 Rd = 1*10^3;      // Drain Resistor=1 kOhms
13 Vee = 15;         // Supply Voltage(Emitter)=15
  Volts
14
15
16 Ic = (Vee-Vbe)/Re;
17
18 Id = Ic;
19 disp (Id,'The Drain Current Id in Amps')
```

```

20 disp ('i.e 6.5 mAmps')
21
22 Vd = Vdd-Id*Rd;
23 disp (Vd,'The Drain Voltage Vd in Voltage')

```

Scilab code Exa 30.6 Example 222

```

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
6
7 // Given Data
8
9 Rd = 1.5*10^3; // Drain Resistor=1.5 kOhms
10 Rl = 10*10^3; // Load Resistor=10 kOhms
11 Idss = 10*10^-3; // Idss=10 mAmps
12 Vgs = -1; // Voltage Gate-Source=-1 Volts
13 Vgsoff = -4; // Voltage Gate-Source(off)=-4
  Volts
14 Vin = 0.2; // Input Voltage=0.2 Volts(p-p)
15
16 gmo = 2*Idss/(-Vgsoff);
17
18 gm = gmo*(1-(Vgs/Vgsoff));
19
20 rl = (Rd*Rl)/(Rd+Rl);
21
22 Av = gm*rl;
23 disp (Av,'The Voltage Gain Av is ')
24 disp ('Appox 4.875 ')
25
26 Vo = Av*Vin

```

```

27 disp (Vo, 'The Output Voltage Vo in Volts(p-p)')
28 disp ('Appox 0.975 Volts(p-p)')

```

Scilab code Exa 30.7 Example 223

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_7
4 clc; clear;
5 // Calculate Av, Vo & Zo.
6
7 // Given Data
8
9 Rs = 240; // Source Resistor=240 Ohms
10 Rl = 1.8*10^3; // Load Resistor=1.8 kOhms
11 Vgsoff = -8; // Voltage Gate-Source(off)=-8
    Volts
12 Vgs = -2; // Voltage Gate-Source=-2 Volts
13 Idss = 15*10^-3 // Idss=15 mAmps.
14 Vin = 1; // Input Voltage=1 Volts(p-p)
15
16 rl = ((Rs*Rl)/(Rs+Rl));
17 gmo = 2*Idss/-Vgsoff;
18 gm = gmo*(1-(Vgs/Vgsoff));
19
20 Av = gm*rl/(1+gm*rl);
21 disp (Av, 'The Voltage Gain Av is ')
22
23 Vo = Av*Vin;
24 disp (Vo, 'The Output Voltage Vo in Volts(p-p)')
25
26 A = (1/gm);
27 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

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 30
3 // Example No. 30_8
4 clear; clc;
5 // Calculate Av, Vo, Zin.
6
7 // Given Data
8
9 Rd = 1.2*10^3; // Drain Resistor=1.2 kOhms
10 Rl = 15*10^3; // Load Resistor=15 kOhms
11 gm = 3.75*10^-3; // Transconductance=3.75
    mSiemens
12 Vin = 10*10^-3; // Input Voltage=10 mVpp
13 Rs = 200; // Source Resistor=200 Ohms
14
15 rl = ((Rd*Rl)/(Rd+Rl));
16
17 Av = gm*rl;
18 disp (Av, 'The Voltage Gain Av is ')
19
20 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 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

```
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
6
7 // Given Data
8 Vgs1 = 2;           // Voltage Gate-Source 1=2 Volts
9 Vgs2 = -2;         // Voltage Gate-Source 2=-2
   Volts
10 Vgs3 = 0;          // Voltage Gate-Source 3=0 Volts
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 // Vgs = 2 Volts
19
20 Id1 = Idss*a*a;
21 disp (Id1, 'The Value of Id for Vgs = 2 Volts in Amps
   ')
22 disp ('i.e 22.5 mAmps')
23
24 // Vgs = -2 Volts
25
26 Id2 = 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 // Vgs = 0 Volts
31
```



```

32 Id3 = 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

```

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
7 // Given Data
8
9 Vdd = 15;           // Suppy Voltage(Drain)=15 Volts
10 Vgson = 10;        // Voltage Gate-Source(on)=10
    Volts
11 Idon = 10*10^-3;   // Drain Current(on)=10m Amps
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')

```

Chapter 32

Chapter 31 Power Amplifiers

Scilab code Exa 31.1 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  $I_{cq}$ ,  $V_{ceq}$ ,
   Pd,  $I_{c(sat)}$  and  $V_{ce(off)}$ . Also draw the dc load
   line
6
7 // Given Data
8
9 R1 = 18*10^3;           // Resistor 1=18k Ohms
10 R2 = 2.7*10^3;        // Resistor 2=2.7k Ohms
11 Vcc = 20;              // Supply Voltage(Collector)=20
   Volts
12 Vbe = 0.7;            // Voltage Base-Emitter=0.7
   Volts
13 Re = 240;              // Emitter Resistor=240 Ohms
14 Rc = 1*10^3;          // Collector Resistor=1k Ohms
15
16 Vb = Vcc*(R2/(R1+R2));
17
```

```

18 Ve = Vb-Vbe;
19
20 //Ie = Ic;
21
22 Icq = Ve/Re;
23 disp (Icq, 'The value of Icq in Amps')
24 disp ('i.e Appox 7.91 mAmps')
25
26 Vceq = Vcc-Icq*(Rc+Re);
27 disp (Vceq, 'The value of Vceq in Volts')
28 disp ('Appox 10.19 Volts')
29
30 Pd = Vceq*Icq;
31 disp (Pd, 'The Power Dissipation in Watts')
32 disp ('i.e 80.6 mWatts')
33
34 Icsat = 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

```

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
6
7 // Given data
8
9 Icq = 7.91*10^-3; // Collector Currect(Q-point
  )=7.91 mAmps
10 Rl = 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
14 R2 = 2.7*10^3; // Resistor 2=2.7 kOhms
15 Vcc = 20; // Supply Voltage(Collector)
  =20 Volts
16 Vceq = 10.19; // Voltage Colector-Emitter(
  Q-point)=10.19 Volts
17
18 rc = (25*10^-3)/Icq;
19 rl = (Rc*Rl)/(Rc+Rl)
20
21 Av = rl/rc;
22 disp (Av, 'The Voltage Gain Av is ')

```

```

23 disp ('Appox 190 ')
24
25 Vout = Av*Vin;
26 disp (Vout, 'The Output Voltage in Volts')
27 disp ('Appox 4.75 Volts ')
28
29 P1 = (Vout*Vout)/(8*R1);
30 disp (P1, '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 Pcc = Vcc*Icc;
38 disp (Pcc, 'The Dc Input Power in Watts')
39 disp ('i.e Appox 177.4 mWatts')
40
41 efficiency = ((P1/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

```

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
6
7 // Given data
8
9 Vin = 20;           // Input Voltage=20 Volts(p-p)
10 Vopp = 20;         // Output Voltage(p-p)=20 Volts(p-p)
11 Vcc = 24;          // Supply Voltage(Collector)=24
   Volts
12 Vop = 10;          // Output Voltage(peak)=10 Volts
13 Rl = 8;            // Load Resistor=8 Ohms
14
15 Vopp1 = Vopp*Vopp;
16 Pl = (Vopp1/(8*Rl));
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 = ((P1/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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 31
3 // Example No. 31_4
4 clear; clc;
5 // Calculate the following quantities P1, Pcc &
   percent efficiency
6
7 // Given data
8
9 R1 = 8; // Load Resistor=8 Ohms
10 Vopp = 50; // Output Voltage(p-p)=50 Volts(
   p-p)
11 Vcc = 30; // Supply Voltage(Collector)=30
   Volts
12 Vopk = Vopp/2; // Output Voltage(peak)
13
14 P1 = (Vopp*Vopp)/(8*R1);
15 disp (P1, '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');
```

Scilab code Exa 31.5 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
8
9 L = 100*10^-6; // Inductor=100 uHenry
10 C = 63.325*10^-12; // Capacitor=63.325 pFarad
11 Vin = 1.5; // Input Voltage(peak)=1.5 Volts
12 Vbe = 0.7; // Voltage Base-Emitter=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

```
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
8
9 C = 0.01*10^-6;      // Capacitor=0.01 uFarad
10 fr = 2*10^6;       // Resonant Frequency=2 MHertz
11
12 fin = fr
13 T = 1/fin
14
15 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

```

1 // 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 kOhms
13
14 Xl = 2*3.14*fr*L;
15 Qcoil = Xl/ri;
16 Ztank = Qcoil*Xl;

```

```
17
18 A = Ztank;
19 B = Rp;
20 C = (A*B)/(A+B);
21 Qckt = C/Xl;
22
23 BW = fr/Qckt;
24 disp (BW, 'The Bandwidth in Hertz')
25 disp ('i.e Appox 45 kHz')
```

Chapter 33

Chapter 32 Thyristors

Scilab code Exa 32.1 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 emmitter voltage
   waveform. Assume n=0.6
6
7 // Given data
8
9 Rt = 220*10^3;           // Resistor Rt=220k Ohms
10 Ct = 0.1*10^-6;       // Capacitor Ct=0.1u Farad
11 n = 0.6;               // Constant
12
13 A = 1/(1-n);
14 T = Rt*Ct*log(A);
15
16 f = 1/T;
17 disp (f, 'The Frequency of the Emmitter Voltage
   Waveform in Hertz')
```

Chapter 34

Chapter 33 Operational Amplifiers

Scilab code Exa 33.1 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.
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 Av = Ad
20
21 Vo = Av*Vin;
22 disp (Vo, 'The Ac Output Voltage in Volts(p-p)')

```

Scilab code Exa 33.2 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).
6
7 // Given data
8
9 Rc = 10*10^3; // Collector resistance=10 kOhms
10 Re = 10*10^3; // Emitter resistance=10 kOhms
11 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 CMRR = 20*log10(Ad/Acm);
17 disp (CMRR, 'The Common-Mode Rejection Ratio in dB')

```

Scilab code Exa 33.3 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
7 // Given data
8
9 Vpk = 10;           // Peak output voltage=10 Volts
10 Sr = 5/10^-6;     // Slew rate=5 V/us
11 pi = 3.14;        // 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')

```

Scilab code Exa 33.4 Example 238

```

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.
6
7 // Given data
8
9 Vin = 1;           // Input voltage=1 Volts(p-p)
10 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 Vo = -Vin*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')

```

Scilab code Exa 33.5 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
8
9 Avol = 100000; // Open loop voltage gain=100,000
10 Vo = 10; // Output voltage=10 Volts(p-p)
11
12 Vid = Vo/Avol;
13 disp (Vid, 'The Differential Input Voltage in Volts(p
  -p)')
14 disp ('i.e 100 uVolts(p-p)')
```

Scilab code Exa 33.6 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.
6
7 // Given data
8
9 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
12 Zool = 75;      // Output impedance (open-loop)=75
    Ohms
13
14 Zi = Ri;
15 disp (Zi, 'The Input Impedance in Ohms')
16 disp ('i.e 1 kOhms')
17
18 Beta = Ri/(Ri+Rf);
19
20 A = Avol*Beta;
21
22 Zocl = Zool/(1+A);
23 disp (Zocl, 'The Closed Loop Output Impedance in Ohms
    ')

```

Scilab code Exa 33.7 Example 241

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_7
4 clc; clear;
5 // Calculate the 5-V power bandwidth.
6
7 // Given data
8
9 Vo = 10;          // Output voltage=10 Volts(p-p)
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

```
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
9 Vin = 1;           // Input voltage=1 Volts(p-p)
10 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 Vo = Vin*Acl;
17 disp (Vo, 'The Output Voltage in Volts(p-p)')
```

Scilab code Exa 33.9 Example 243

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_9
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.
6
7 // Given data
```

```

8
9 Avol = 100000; // Open loop voltage gain=100,000
10 Ri = 2*10^6; // Input resistance=2 MOhms
11 B = 0.0909; // Beta=0.0909
12 Zool = 75; // Output impedance (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 Zocl = Zool/(1+A);
21 disp (Zocl, 'The Closed-Loop Output Impedence in Ohms
    ')

```

Scilab code Exa 33.10 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)
6
7 // Given data
8
9 Avol = 100000; // Open loop voltage gain=100,000
10 Ri = 2*10^6; // Input resistance=2 MOhms
11 B = 1; // Beta=1
12 Zool = 75; // Output impedance (open-loop)=75
    Ohms
13

```

```

14 Zicl = Ri*(1+Avol*B);
15 disp (Zicl, 'The Input impedance closed-loop in Ohms'
      )
16 disp ('i.e 200 GOhms')
17
18 A = Avol*B;
19
20 Zocl = Zool/(1+A);
21 disp (Zocl, 'The Closed loop Output Impedence in Ohms
      ')

```

Scilab code Exa 33.11 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.
6
7 // Given data
8
9 V = 15;           // Voltage at +ve terminal of op-amp
  =15 Volts
10 Rf = 10*10^3;   // Feedback resistance=10 kOhms
11 Ri = 1*10^3;    // Input resistance=1 kOhms
12 R1 = 10*10^3;   // Resistance1=10 kOhms
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')

```

Scilab code Exa 33.12 Example 246

```
1 // 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
12
13 Vo = -(V1+V2+V3);
14 disp (Vo, 'The Output Voltage in Volts')
```

Scilab code Exa 33.13 Example 247

```
1 // 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
12 R1 = 1*10^3; // Resistance1=1 kOhms
13 R2 = 2.5*10^3; // Resistance2=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')

```

Scilab code Exa 33.14 Example 248

```

1 // 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.
6
7 // Given data
8
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 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
14 Vy2 = 0.5; // Input voltage Vy2 at +ve terminal
   // of op-amp=0.5 Volts
15 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 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 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.
6
7 // Given data
8
9 Vi = 5;           // Voltage input=5 Volts(dc)
10 Rf = 10*10^3;    // Feedback resistance=10 kOhms
11 R1 = 1*10^3;     // Resistancel=1 kOhms
12 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 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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_16
4 clc; clear;
5 // Calculate the cutoff frequency, fc.
6
7 // Given data
8
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 ')

```

Scilab code Exa 33.17 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
6
7 // Given data
8
9 f1 = 1*10^6;           // Frequency=1 MHertz
10 Rf = 10*10^3;        // Feedback resistance=10 kOhms
11 R1 = 1*10^3;         // Resistance1=1 kOhms
12 Cf = 0.01*10^-6;    // Feedback capacitance=0.01
   uFarad
13 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 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

```
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 kHz
6
7 // Given data
8
9 f1 = 1.591*10^3; // Frequency=1.591 kHertz
10 Rf = 10*10^3; // Feedback resistance=10 kOhms
11 Ri = 1*10^3; // Input resistance=1 kOhms
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 Ac1 = 20*log10(A);
19 disp (Ac1, '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 Zf = (Xcf*Rf/sqrt(B+C));
27 D = Zf/Ri;
28
29 Ac11 = 20*log10(D);
30 disp (Ac11, 'The Voltage Gain at 1.591 kHz in dB')
31 disp ('Appox 17dB')
```

Scilab code Exa 33.19 Example 253

```
1 // 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')
```

Scilab code Exa 33.20 Example 254

```
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.
6
7 // Given data
8
9 Vin = 5;              // Input votage=5 Volts
10 Ri = 1*10^3;         // Input resistance=1 kOhms
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

```
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.
6
7 // Given data
8
9 Iin = 1.5*10^-3; // Input votage=5 Volts
10 Ri = 1*10^3; // Input resistance=1 kOhms
11 Rl = 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

```
1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_22
4 clc; clear;
5 // R1 is 1 kOhms and R2 is 100 kOhms. Calculate UTP,
   LTP, and VH.
6
7 // Given data
8
```

```

 9 R1 = 1*10^3;           // Resistance1=1 kOhms
10 R2 = 100*10^3;        // Resistance2=100 kOhms
11 Vcc = 15;             // Applied votage=15 Volts
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

```

1 // Grob's Basic Electronics 11e
2 // Chapter No. 33
3 // Example No. 33_23
4 clc; clear;
5 // R1 is 1 kOhms and the frequency of the input
   voltage equals 100 Hz. Calculate the minimum
   value of C required.
6
7 // Given data
8
9 f = 100;           // Applied frequency=100 Hertz
10 R1 = 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')
```
