

Scilab Textbook Companion for
Electronics Devices and Circuits
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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.

Contents

| | |
|--|-----|
| List of Scilab Codes | 4 |
| 1 Common Electronic Materials and Properties | 5 |
| 2 Passive Component and DC Sources and Circuit Theorems and Basic Meters | 18 |
| 3 Electrodynamics and CRO | 29 |
| 4 Diode Characteristics and Applications | 40 |
| 5 Rectifier and DC Power Supplies | 44 |
| 6 Transistor Characteristics And Applications | 54 |
| 7 Transistor Biasing and Stabilization Techniques | 64 |
| 8 Analysis of transistor Amplifier using Hybrid Equivalent Circuit | 73 |
| 9 Field Effect Transistor | 84 |
| 10 Feedback Amplifier | 91 |
| 11 Power Amplifiers | 98 |
| 13 Oscillators | 106 |
| 14 Operational Amplifier and Applications | 109 |

List of Scilab Codes

| | | |
|----------|--|----|
| Exa 1.1 | Fusing current | 5 |
| Exa 1.2 | Fusing current | 6 |
| Exa 1.3 | Fusing Current | 6 |
| Exa 1.4 | Resistance of wire | 10 |
| Exa 1.5 | Resistance of Copper Wire | 10 |
| Exa 1.6 | Resistance of Tungsten Wire | 11 |
| Exa 1.7 | Force on Electron | 11 |
| Exa 1.8 | Electric Field applied on Electron | 11 |
| Exa 1.9 | Charge in Region | 12 |
| Exa 1.10 | Force on Electorn | 12 |
| Exa 1.11 | Force on Electron due to field | 12 |
| Exa 1.12 | Donor atom concentration | 13 |
| Exa 1.13 | Free electron concentration | 13 |
| Exa 1.14 | Hole concentration | 14 |
| Exa 1.15 | Resistivity of Intrinsic semiconductor | 14 |
| Exa 1.16 | Mobility and conductivity | 15 |
| Exa 1.17 | Carrier concentration | 15 |
| Exa 1.18 | Trivalent Impurity | 16 |
| Exa 1.19 | Pentavalent Impurity | 16 |
| Exa 1.20 | carrier concentration and conductivity | 16 |
| Exa 1.21 | Volt Equivalent Temperature | 17 |
| Exa 2.1 | Capacitance of capacitor | 18 |
| Exa 2.2 | Charge stored in Capacitor | 18 |
| Exa 2.3 | Capacitance of capacitor | 19 |
| Exa 2.4 | Charge stored in Capacitor | 19 |
| Exa 2.5 | Charge stored and voltage across capacitor | 19 |
| Exa 2.6 | Reactance of Capacitor | 20 |
| Exa 2.7 | Reactance of Capacitor | 20 |

| | | |
|----------|--|----|
| Exa 2.8 | Series Capacitance | 21 |
| Exa 2.9 | Parallel Capacitance | 21 |
| Exa 2.10 | Energy Stored in Capacitor | 22 |
| Exa 2.11 | Instantaneous Current in capacitor | 22 |
| Exa 2.12 | Rate of Current | 22 |
| Exa 2.13 | Inductance Value | 23 |
| Exa 2.14 | Energy in Inductor | 23 |
| Exa 2.15 | Coupling Coefficient | 24 |
| Exa 2.16 | Mutual Inductance | 24 |
| Exa 2.17 | Series Inductance | 25 |
| Exa 2.18 | Parallel Inductance | 25 |
| Exa 2.19 | Source Resistance | 25 |
| Exa 2.20 | Series Voltage | 26 |
| Exa 2.21 | Net Voltage | 26 |
| Exa 2.22 | Thevenin Equivalent Circuit | 27 |
| Exa 3.1 | Force on electron | 29 |
| Exa 3.2 | Force on electron | 29 |
| Exa 3.3 | Force on electron | 30 |
| Exa 3.4 | Force on electron | 30 |
| Exa 3.5 | Current density | 31 |
| Exa 3.6 | Current density | 31 |
| Exa 3.7 | Frequency of Signal | 32 |
| Exa 3.8 | RMS voltage | 32 |
| Exa 3.9 | Current in 100 ohm resistance | 33 |
| Exa 3.10 | Deflection Sensitivity | 33 |
| Exa 3.11 | force on current element | 34 |
| Exa 3.12 | Velocity of electron and kinetic energy | 34 |
| Exa 3.13 | Deflection of electron beam | 34 |
| Exa 3.14 | Deflection sensitivity | 35 |
| Exa 3.15 | Electric field and velocity and deflection sensitivity | 36 |
| Exa 3.16 | Phase difference using Lissajous pattern | 37 |
| Exa 3.17 | Phase difference using Lissajous pattern | 38 |
| Exa 3.18 | Phase difference using Lissajous pattern | 38 |
| Exa 3.19 | Phase difference using Lissajous pattern | 38 |
| Exa 4.1 | Current in silicon diode | 40 |
| Exa 4.2 | Voltage in silicon diode | 41 |
| Exa 4.3 | Dynamic resistance of diode | 41 |
| Exa 4.4 | Transition Capacitance | 42 |

| | | |
|----------|---|----|
| Exa 4.5 | Diffusion Capacitance | 42 |
| Exa 5.1 | Current and ripple factor | 44 |
| Exa 5.2 | DC and peak voltage | 45 |
| Exa 5.3 | Current and Voltage and Ripple Factor | 45 |
| Exa 5.4 | Power and Rectification Efficiency | 46 |
| Exa 5.5 | Voltage and Current and Power and percentage regulation | 46 |
| Exa 5.6 | Peak Inverse Voltage | 48 |
| Exa 5.11 | Half wave rectification | 48 |
| Exa 5.12 | Full wave rectification | 49 |
| Exa 5.13 | Bridge Rectifier | 49 |
| Exa 5.14 | Ripple Voltage | 50 |
| Exa 5.15 | Ripple factor and DC current and load resistance | 50 |
| Exa 5.16 | Design pi section full wave filter | 51 |
| Exa 5.17 | DC voltage and current and Resistance | 52 |
| Exa 6.1 | current gain | 54 |
| Exa 6.2 | Transistor current and current gain | 54 |
| Exa 6.3 | Unknown Resistance in transistor | 55 |
| Exa 6.4 | transistor current and resistance | 56 |
| Exa 6.5 | Base current and collector resistance | 57 |
| Exa 6.6 | Current gain and base resistance | 58 |
| Exa 6.7 | base current and transistor resistance | 59 |
| Exa 6.8 | Base and current current | 60 |
| Exa 6.9 | resistance and conductance calculation of CC configuration | 61 |
| Exa 6.10 | common emitter current gain | 62 |
| Exa 6.11 | common base current gain | 62 |
| Exa 6.12 | peak to peak collector voltage and current | 62 |
| Exa 6.13 | Current gain in CE amplifier | 63 |
| Exa 7.1 | Emitter Resistance | 64 |
| Exa 7.2 | Thermal resistance of transistor | 64 |
| Exa 7.3 | power dissipation of transistor | 65 |
| Exa 7.4 | Q point in fixed bias circuit | 65 |
| Exa 7.5 | calculate base resistance to obtain optimum operating point | 66 |
| Exa 7.6 | Q point for voltage divider base bias circuit | 67 |
| Exa 7.7 | Q point for self bias circuit | 68 |
| Exa 7.8 | Operating point and stability factor of silicon transistor | 69 |

| | | |
|-----------|---|----|
| Exa 7.9 | Operating point and stability factor of self bias circuit | 70 |
| Exa 7.10 | Stability factor of self bias circuit | 71 |
| Exa 7.11 | Thermal resistance of transistor | 71 |
| Exa 7.12 | power dissipation of transistor | 72 |
| Exa 8.1 | Calculating h parameters | 73 |
| Exa 8.2 | current gain and input resistance | 74 |
| Exa 8.3 | current and voltage gain | 75 |
| Exa 8.4 | current and voltage gain and input and output resistance | 76 |
| Exa 8.5 | Amplifier current gain | 78 |
| Exa 8.6 | voltage gain of CE amplifier | 78 |
| Exa 8.7 | current and voltage gain and input and output resistance | 79 |
| Exa 8.8 | load resistance of CE transistor | 81 |
| Exa 8.9 | voltage gain of CE amplifier | 81 |
| Exa 8.10 | current gain of CE amplifier | 82 |
| Exa 8.11 | Input resistance of CE amplifier | 82 |
| Exa 9.1 | Pinch off Voltage | 84 |
| Exa 9.2 | Impedance and amplification factor | 85 |
| Exa 9.3 | pinch off voltage | 85 |
| Exa 9.4 | Conductance and Resistance | 86 |
| Exa 9.5 | Resistance | 87 |
| Exa 9.6 | Voltage | 87 |
| Exa 9.7 | Amplification Factor | 88 |
| Exa 9.8 | Current and Voltage | 88 |
| Exa 9.9 | Drain Voltage and Current | 89 |
| Exa 9.10 | Drain Current and Voltage | 89 |
| Exa 10.1 | Close loop gain | 91 |
| Exa 10.2 | Close loop gain and bandwidth | 91 |
| Exa 10.3 | Feedback with reduced distortion | 92 |
| Exa 10.4 | Change in close loop gain | 92 |
| Exa 10.5 | Open loop gain and feedback ratio | 93 |
| Exa 10.6 | Close loop and bandwidth | 94 |
| Exa 10.7 | Voltage gain and feedback ratio | 94 |
| Exa 10.8 | Feedback ratio | 95 |
| Exa 10.9 | Gain and 3dB frequency | 96 |
| Exa 10.10 | Voltage and input and output resistance | 96 |
| Exa 11.1 | Efficiency | 98 |
| Exa 11.2 | Power Losses | 99 |
| Exa 11.3 | Second Harmonic Distortion | 99 |

| | | |
|-----------|---|-----|
| Exa 11.4 | Total Harmonic Distortion | 100 |
| Exa 11.5 | Amplifier Efficiency | 101 |
| Exa 11.6 | Efficiency | 101 |
| Exa 11.7 | Turns Ratio | 102 |
| Exa 11.8 | Amplifier Efficiency | 102 |
| Exa 11.9 | Efficiency | 103 |
| Exa 11.10 | Efficiency | 103 |
| Exa 11.11 | Voltage Gain | 104 |
| Exa 11.12 | Power Gain | 104 |
| Exa 11.13 | Power Dissipated At Collector Junction | 105 |
| Exa 11.14 | Power Efficiency | 105 |
| Exa 13.1 | Feedback fraction to obtain sustained oscillator | 106 |
| Exa 13.2 | Frequency of RC phase oscillator | 106 |
| Exa 13.3 | Frequency of Wein Bridge oscillator | 107 |
| Exa 13.4 | Feedback fractor and frequency of Colpitts oscillator | 107 |
| Exa 14.1 | Common Mode Rejection Ratio | 109 |
| Exa 14.2 | Common Mode Rejection Ratio | 109 |
| Exa 14.3 | Output Voltage Of Op amp Adder Circuit | 110 |
| Exa 14.4 | Output Voltage Of Op amp Adder Circuit | 110 |
| Exa 14.7 | Designing a close loop op amp | 111 |

Chapter 1

Common Electronic Materials and Properties

Scilab code Exa 1.1 Fusing current

```
1 //Ex1.1
2 clc
3 disp("I = K(d^1.5)") //formula used for fusing
  current
4 d=0.0031
5 disp("d = "+string(d)+" inches") //initializing
  values of diameter
6 I1=10244*(d^1.5); I2=7585*(d^1.5); I3=5320*(d^1.5);
  I4=3148*(d^1.5); I5=1642*(d^1.5) //calculation
  for fusing current
7 disp("for Copper , I = 10244*(d^1.5) = "+string(I1)+"
  Amp.")
8 disp("for Aluminum , I = 7585*(d^1.5) = "+string(I2)+
  "Amp.")
9 disp("for Silver , I = 5320*(d^1.5) = "+string(I3)+"
  Amp.")
10 disp("for Iron , I = 3148*(d^1.5) = "+string(I4)+"Amp
  .")
11 disp("for Tin , I = 1642*(d^1.5) = "+string(I5)+"Amp.
```

)

Scilab code Exa 1.2 Fusing current

```
1 //Ex1.2
2 clc
3 disp("fusing current , I = K(d^1.5) Amp.")//formula
   used for fusing current
4 d=0.0201
5 disp("d = "+string(d)+" inches") //initializing value
   of diameter
6 I1=10244*(d^1.5);I2=7585*(d^1.5); I3=5320*(d^1.5);
   I4=3148*(d^1.5); I5=1642*(d^1.5) //calculation
   for fusing current
7 disp("for Copper , I = 10244*(d^1.5) = "+string(I1)+"
   Amp.")
8 disp("for Aluminum , I = 7585*(d^1.5) = "+string(I2)+
   "Amp.")
9 disp("for Silver , I = 5320*(d^1.5) = "+string(I3)+"
   Amp.")
10 disp("for Iron , I = 3148*(d^1.5) = "+string(I4)+"Amp
   .")
11 disp("for Tin , I = 1642*(d^1.5) = "+string(I5)+"Amp.
   ")
12
13
14 // note : calculation for fusing current of Iron is
   wrong.
```

Scilab code Exa 1.3 Fusing Current

```
1 //Ex1.3
2 clc
```

```

3 disp("fusing current , I = K(d^1.5) Amp.") //formula
  used for fusing current
4 disp("(a)")
5 d=0.0159
6 disp("d = "+string(d)+" inches") //initializing value
  of diameter
7 I1=10244*(d^1.5);I2=7585*(d^1.5); I3=5320*(d^1.5);
  I4=3148*(d^1.5); I5=1642*(d^1.5) //calculation
  for fusing current
8 disp("for Copper , I = 10244*(d^1.5) = "+string(I1)+"
  Amp.")
9 disp("for Aluminum , I = 7585*(d^1.5) = "+string(I2)+
  "Amp.")
10 disp("for Silver , I = 5320*(d^1.5) = "+string(I3)+"
  Amp.")
11 disp("for Iron , I = 3148*(d^1.5) = "+string(I4)+"Amp
  .")
12 disp("for Tin , I = 1642*(d^1.5) = "+string(I5)+"Amp.
  ")
13
14
15 disp("(b)")
16 d=0.0063
17 disp("d = "+string(d)+" inches") //initializing value
  of diameter
18 I1=10244*(d^1.5);I2=7585*(d^1.5); I3=5320*(d^1.5);
  I4=3148*(d^1.5); I5=1642*(d^1.5) //calculation
  for fusing current
19 disp("for Copper , I = 10244*(d^1.5) = "+string(I1)+"
  Amp.")
20 disp("for Aluminum , I = 7585*(d^1.5) = "+string(I2)+
  "Amp.")
21 disp("for Silver , I = 5320*(d^1.5) = "+string(I3)+"
  Amp.")
22 disp("for Iron , I = 3148*(d^1.5) = "+string(I4)+"Amp
  .")
23 disp("for Tin , I = 1642*(d^1.5) = "+string(I5)+"Amp.
  ")

```

```

24
25
26 disp("(c)")
27 d=0.0403
28 disp("d = "+string(d)+" inches") //initializing value
    of diameter
29 I1=10244*(d^1.5); I2=7585*(d^1.5); I3=5320*(d^1.5);
    I4=3148*(d^1.5); I5=1642*(d^1.5) //calculation
    for fusing current
30 disp("for Copper, I = 10244*(d^1.5) = "+string(I1)+"
    Amp.")
31 disp("for Aluminum, I = 7585*(d^1.5) = "+string(I2)+
    "Amp.")
32 disp("for Silver, I = 5320*(d^1.5) = "+string(I3)+"
    Amp.")
33 disp("for Iron, I = 3148*(d^1.5) = "+string(I4)+"Amp
    .")
34 disp("for Tin, I = 1642*(d^1.5) = "+string(I5)+"Amp.
    ")
35
36
37 disp("(d)")
38 d=0.0452
39 disp("d = "+string(d)+" inches") //initializing value
    of diameter
40 I1=10244*(d^1.5); I2=7585*(d^1.5); I3=5320*(d^1.5);
    I4=3148*(d^1.5); I5=1642*(d^1.5) //calculation
    for fusing current
41 disp("for Copper, I = 10244*(d^1.5) = "+string(I1)+"
    Amp.")
42 disp("for Aluminum, I = 7585*(d^1.5) = "+string(I2)+
    "Amp.")
43 disp("for Silver, I = 5320*(d^1.5) = "+string(I3)+"
    Amp.")
44 disp("for Iron, I = 3148*(d^1.5) = "+string(I4)+"Amp
    .")
45 disp("for Tin, I = 1642*(d^1.5) = "+string(I5)+"Amp.
    ")

```

```

46
47
48 disp("(e)")
49 d=0.0508
50 disp("d = "+string(d)+" inches") //initializing value
    of diameter
51 I1=10244*(d^1.5); I2=7585*(d^1.5); I3=5320*(d^1.5);
    I4=3148*(d^1.5); I5=1642*(d^1.5) //calculation
    for fusing current
52 disp("for Copper, I = 10244*(d^1.5) = "+string(I1)+"
    Amp.")
53 disp("for Aluminum, I = 7585*(d^1.5) = "+string(I2)+
    "Amp.")
54 disp("for Silver, I = 5320*(d^1.5) = "+string(I3)+"
    Amp.")
55 disp("for Iron, I = 3148*(d^1.5) = "+string(I4)+"Amp
    .")
56 disp("for Tin, I = 1642*(d^1.5) = "+string(I5)+"Amp.
    ")
57
58
59 disp("(f)")
60 d=0.162
61 disp("d = "+string(d)+" inches") //initializing value
    of diameter
62 I1=10244*(d^1.5); I2=7585*(d^1.5); I3=5320*(d^1.5);
    I4=3148*(d^1.5); I5=1642*(d^1.5) //calculation
    for fusing current
63 disp("for Copper, I = 10244*(d^1.5) = "+string(I1)+"
    Amp.")
64 disp("for Aluminum, I = 7585*(d^1.5) = "+string(I2)+
    "Amp.")
65 disp("for Silver, I = 5320*(d^1.5) = "+string(I3)+"
    Amp.")
66 disp("for Iron, I = 3148*(d^1.5) = "+string(I4)+"Amp
    .")
67 disp("for Tin, I = 1642*(d^1.5) = "+string(I5)+"Amp.
    ")

```

```

68
69
70
71 // note : in part (e) ... calculation for fusing
    current of silver is wrong.
72 // note : in part (f) ... calculation for fusing
    current of Iron is wrong.

```

Scilab code Exa 1.4 Resistance of wire

```

1 //Ex1.4
2 clc
3 A=0.5189*10^-6//wire cross sectional area
4 rho=1.725*10^-8//resistivity
5 l=100 //wire length
6 disp("A =" +string(A)+" merer square")
7 disp(" rho =" +string(rho)+" ohm-m")
8 disp(" l =" +string(l)+"m")
9 disp("R = rho*l/A = " +string(rho*l/A)+" ohm") //
    resistance

```

Scilab code Exa 1.5 Resistance of Copper Wire

```

1 //Ex1.5
2 clc
3 A=0.2588*10^-6//wire cross-sectional area
4 rho=1.725*10^-8//resistivity
5 l=100 //wire length
6 disp("A =" +string(A)+" merer square")
7 disp(" rho =" +string(rho)+" ohm-m")
8 disp(" l =" +string(l)+"m")
9 disp("R = rho*l/A = " +string(rho*l/A)+" ohm") //
    resistance of wire

```

Scilab code Exa 1.6 Resistance of Tungsten Wire

```
1 //Ex1.6
2 clc
3 R1 = 14//resistance at temperature T1
4 alpha=0.005
5 T1=20;//initial temperature
6 T2=120 //final temperature
7 disp("R1 = "+string(R1)+ "ohm; alpha = "+string(
    alpha)+"; T1 = "+string(T1)+"degreeC; T2 = "+
    string(T2)+"degreeC")
8 disp("R2 = R1(1+(alpha*(T1-T2))) = "+string(R1*(1+(
    alpha*(T2-T1))))+"ohm") //resistance at
    temperature T2
```

Scilab code Exa 1.7 Force on Electron

```
1 //EX1.7
2 clc
3 Ex=3;Ey=4;Ez=2//electric field
4 e=1.6*10^-19 //electorn charge
5 disp("E = 3ax + 4ay + 2az k V/m")
6 disp("e = 1.6*10^-19 C")
7 disp("F=eE = "+string(Ex*e*1000)+" ax + "+string(Ey*e
    *1000)+" ay + "+string(Ez*e*1000)+" az N") //force
```

Scilab code Exa 1.8 Electric Field applied on Electron

```
1 //Ex1.8
```



```

2  clc
3  F=0.1*10^-12//force applied
4  e = 1.6*10^-19//electron charge
5  disp("F= "+string(F)+"N ; e = "+string(e)+"C")
6  disp("E = F/e =" +string(F/e)+"V/m")//electric field

```

Scilab code Exa 1.9 Charge in Region

```

1  //Ex1.9
2  clc
3  F = 3*(10^-12) //force applied
4  E = 5*(10^-6) //electric field
5  disp("F = "+string(F)+"N")
6  disp("E = "+string(E)+"V/m")
7  disp("Q= F/E = "+string(F/E)+"C") //chage

```

Scilab code Exa 1.10 Force on Electorn

```

1  //Ex1.10
2  clc
3  B = 2*10^-6 //magnetic flux density
4  V = 4*10^6 //electron velocity
5  e= 1.6*10^-19//elcetron charge
6  disp("B =" +string(B)+" ax wb/m.sq")
7  disp("V =" +string(V)+" az m/s")
8  disp("e = "+string(e)+ "C")
9  disp("F = e[VxB] =" +string(e*V*B)+" ay N")//force

```

Scilab code Exa 1.11 Force on Electron due to field

```

1 //Ex1.11
2 clc
3 Hx = 1*10^-3 //magnetic field in x-axis
4 Hy = 2*10^-3 //magnetic field in y-axis
5 V = (4*10^6) //electron velocity
6 micro_not=(4*%pi*(10^-7)) //permitivity in vaccum
7 e=1.6*10^-19 //charge of electorn
8 disp("H = "+string(Hx)+" ax + "+string(Hy)+" ay A/m")
9 disp("V = "+string(V)+" ay m/s")
10 Bx = micro_not*Hx; By = micro_not*Hy //magnetic flux
    density
11 disp("B = micro_not*H = "+string(Bx)+" ax + "+string(
    By)+" ay wb/m. sq")
12 disp("F = e[VxB] = "+string(e*V*Bx)+" az N") //force
    on electron due to field
13
14
15 // note : there is a misprint in the textbook for
    the above problem

```

Scilab code Exa 1.12 Donor atom concentration

```

1 //Ex1.12
2 clc
3 n = 5*10^22//number of atoms in silicon/cm.cube
4 donors = 10^-7 //donor atoms
5 disp("n = "+string(n)+" /cm. cube")
6 disp("donors = "+string(donors))
7 disp("ND = "+string(n*donors)+" /cm. cube") //donor
    atom concentration

```

Scilab code Exa 1.13 Free electron concentration

```

1 //Ex1.13
2 clc
3 ND =5*10^16//donor atom concentration
4 disp("n = "+string(ND)+" /cm.cube") //free electrons

```

Scilab code Exa 1.14 Hole concentration

```

1 //Ex1.14
2 clc
3 ni = 1.5*10^10 //intrinsic concentration
4 ND = 5*10^16 //donor atom concentration
5 disp("ni = "+string(ni)+" /cm.cube")
6 disp("ND = "+string(ND)+" /cm.cube")
7 disp("p = (ni^2)/ND = "+string((ni^2)/ND)+" atom/cm.
      cube") //hole concentration

```

Scilab code Exa 1.15 Resistivity of Intrinsic semiconductor

```

1 //Ex1.15
2 clc
3 ni = 1.52*10^10 //intrinsic concentration
4 e=1.6*10^-19 //charge of electron
5 micro_n = 1350; micro_p = 480 // charge mobility
6 disp("e = "+string(e)+"C")
7 disp("ni = pi = "+string(ni)+" /cm.cube")
8 disp("micro_n = "+string(micro_n)+" cm.sq/V-s")
9 disp("micro_p = "+string(micro_p)+" cm.sq/V-s")
10 disp("sigma = e(micro_n*ni + micro_p*pi ) = "+string(
      e*(micro_n*ni + micro_p*ni))+" mho/cm") //
      conductivity
11 disp("rho = 1/sigma = "+string(1/(e*(micro_n*ni +
      micro_p*ni)))+" ohm-cm") //resistivity

```

Scilab code Exa 1.16 Mobility and conductivity

```
1 //Ex1.16
2 clc
3 ni = 2.5*(10^13) //intrinsic concentration
4 donor = 10^-7 //donor atoms
5 ND = 4.41*(10^22)*(10^-7) //donor atom concentration
6 e = 1.6*(10^-19) //electron charge
7 micro_n = 3800; micro_p = 1800 //charge mobility
8 disp("ni =" + string(ni) + " /cm.cube")
9 disp("donor = " + string(donor))
10 disp("n = ND =" + string(ND) + " /cm.cube")
11 disp("p = (ni^2)/ND = " + string((ni^2)/ND) + " /cm.cube
    ") //hole concentration
12 disp("micro_n = 3800 cm.sq/V-s; micro_p = 1800 cm.sq
    /V-s")
13 sigma = ni*e*(micro_n+micro_p) //conductivity
14 disp("sigma = ni*e(micro_n + micro_p) = " + string(
    sigma) + "mho/cm")
```

Scilab code Exa 1.17 Carrier concentration

```
1 //Ex1.17
2 clc
3 ni = 2.5*10^19 //intrinsic concentration
4 NA = 10^21 //acceptor atom concentration
5 disp("ni = " + string(ni) + " /m.cube")
6 disp("NA = " + string(NA) + " /m.cube ")
7 disp("np = (ni^2)/ NA =" + string((ni^2)/NA) + " e/m.cube
    ") //electron concentration
8 //textbook has not calculatated for hole concentration
```

Scilab code Exa 1.18 Trivalent Impurity

```
1 //Ex1.18
2 clc
3 micro_p = 1800 //hole mobility
4 rho_p = 1 //resistivity
5 e = 1.6*10^-19 //electorn charge
6 disp("micro_p =" +string(micro_p)+" cm.sq/V-s")
7 disp("rho_p = " +string(rho_p)+" ohm-cm")
8 disp("e = " +string(e)+" C")
9 disp("pp = 1/(e*micro_p*rho_p) = " +string(1/(e*
    micro_p*rho_p))+" holes/cm.cube") //number of
    trivalent impurity
```

Scilab code Exa 1.19 Pentavalent Impurity

```
1 //Ex1.19
2 clc
3 micro_n = 1300 //eletron mobility
4 rho_n = 2 //resistivity
5 e = 1.6*10^-19 //electron charge
6 disp("micro_n =" +string(micro_n)+" cm.sq/V-s")
7 disp("rho_n = " +string(rho_n)+" ohm-cm")
8 disp("e" +string(e)+" C")
9 disp("nn = 1/(e*micro_n*rho_n) = " +string(1/(e*
    micro_n*rho_n))+" e/cm.cube") //number of
    pentavalent impurity
```

Scilab code Exa 1.20 carrier concentration and conductivity

```

1 //Ex1.20
2 clc
3 EGo = 1.1 //energy band gap
4 micro_n = 0.13 //electron mobility
5 micro_p = 0.05 //hole mobility
6 N = 3*10^25 //atom concentration
7 K = 1.38*10^-23 //Boltzmann constant
8 T = 300 //room temperature
9 e=1.6*10^-19//electron charge
10 disp("EGo = "+string(EGo)+"eV = "+string(EGo*e)+" J")
11 disp("micro_n = "+string(micro_n)+" m.sq/V-s")
12 disp("micro_p = "+string(micro_p)+"m.sq/V-s")
13 disp("N = "+string(N)+" /m.cube")
14 disp("T = "+string(T)+" degree_K")
15 disp("K = "+string(K)+" J/K")
16 disp("ni = N*exp(-(EGo/(2*T*K))) = "+string(N*exp(-(
    EGo*e/(2*T*K)))))+" /m.cube") //intrinsic
    concentration
17 ni = N*exp(-(EGo*e/(2*T*K)))
18 disp("sigma = ni*e(micro_n+micro_p) = "+string(ni*e
    *(micro_n+micro_p))+" mho/m") //conductivity

```

Scilab code Exa 1.21 Volt Equivalent Temperature

```

1 //Ex1.21
2 clc
3 K = 1.38*10^-23 //Boltzmann constant
4 e = 1.6*10^-19 //electron charge
5 T = 300 //room temperature
6 disp("K = "+string(K)+" J/K")
7 disp("e = "+string(e)+" C")
8 disp("T = "+string(T)+" degree_K")
9 disp("VT = K*T/e = "+string(K*T/e)+" V") //volt-
    equivalent temperature

```

Chapter 2

Passive Component and DC Sources and Circuit Theorems and Basic Meters

Scilab code Exa 2.1 Capacitance of capacitor

```
1 //Ex2_1
2 clc
3 Q = 2*10^-6; V = 10
4 disp("Q = "+string(Q)+"C") // charge
5 disp("V = "+string(V)+"V") // voltage
6 disp("C = Q/V = "+string(Q/V)+"F") // calculation for
   capacitance
```

Scilab code Exa 2.2 Charge stored in Capacitor

```
1 //Ex2_2
2 clc
3 C= 10*10^-6
4 V = 10
```

```
5 disp("C =" +string(C)+"F") // capacitance
6 disp("V = " +string(V)+"V") // voltage
7 disp("Q = C*V = " +string(C*V)+"C") // calculation for
  charge
```

Scilab code Exa 2.3 Capacitance of capacitor

```
1 //Ex2_3
2 clc
3 Q = 5*10^-12
4 V = 50
5 disp("Q = " +string(Q)+"C") // charge
6 disp("V = " +string(V)+"V") // voltage
7 disp("C = Q/V = " +string(Q/V)+"F") // calculation for
  capacitance
```

Scilab code Exa 2.4 Charge stored in Capacitor

```
1 //Ex2_4
2 clc
3 I = 10*10^-6
4 t= 10
5 disp("I = " +string(I)+"A") // current
6 disp("t = " +string(t)+" seconds") // time
7 disp("Q = I*t = " +string(I*t)+"C") // calculation for
  charge
```

Scilab code Exa 2.5 Charge stored and voltage across capacitor

```
1 //Ex2_5
```



```

2  clc
3  C = 2.0*10^-6
4  t= 2
5  I = 10*10^-6
6  Q = I*t
7  disp("C = "+string(C)+"F") // capacitance
8  disp("t = "+string(t)+" seconds") // time
9  disp("I = "+string(I)+"A") // current
10 disp("Q = I*t = "+string(Q)+"C") // calculation for
    charge
11 disp("V = Q/C = "+string(Q/C)+"V") // calculation for
    voltage

```

Scilab code Exa 2.6 Reactance of Capacitor

```

1  //Ex2_6
2  clc
3  C = 12* 10^ -6
4  f = 1.0*10^3
5  Xc = 1/(2*%pi*f*C)
6  disp("C = "+string(C)+"F") // capacitance
7  disp("at ... f = "+string(f)+"Hz") // frequency
8  disp("Xc = 1/(2*pi*f*C) = "+string(1/(2*%pi*f*C))+
    "ohm") // calculation for capacitive reactance

```

Scilab code Exa 2.7 Reactance of Capacitor

```

1  //Ex2_7
2  clc
3  C = 0.2*10^-6
4  f1 = 1.0*10^3
5  f2 = 50
6  disp("C = "+string(C)+"F") // capacitance

```

```

7 disp(" at ... f = "+string(f1)+"Hz")//frequency
8 disp("Xc = 1/(2*pi*f*C) = "+string(1/(2*pi*f1*C))+
    ohm")//calculation for capacitive reactance
9 disp(" at ... f = "+string(f2)+"Hz")//frequency
10 disp("Xc = 1/(2*pi*f*C) = "+string(1/(2*pi*f2*C))+
    ohm")//calculation for capacitive reactance

```

Scilab code Exa 2.8 Series Capacitance

```

1 //Ex2_8
2 clc
3 C1 = 0.5*10^-6
4 C2 = 0.5*10^-6
5 CT = (C1*C2)/(C1+C2)
6 disp("C1 = "+string(C1)+"F")//capacitance 1
7 disp("C1 = "+string(C1)+"F")//capacitance 2
8 disp("1/CT = 1/C1 + 1/C2 = (C1*C2)/(C1+C2) = "+
    string(C1*C2/(C1+C2))+ "F")//series capacitance
9 // proper ans. = 0.25*10^-6F

```

Scilab code Exa 2.9 Parallel Capacitance

```

1 //Ex2_9
2 clc
3 C1 = 0.2*10^-12
4 C2 = 0.6*10^-12
5 C3 = 1.0*10^-12
6 disp("C1 = "+string(C1)+"F")//capacitance
7 disp("C2 = "+string(C2)+"F")//capacitance
8 disp("C3 = "+string(C3)+"F")//capacitance
9 disp("CT = C1+C2+C3 = "+string(C1+C2+C3)+"F")//
    parallel capacitance

```

Scilab code Exa 2.10 Energy Stored in Capacitor

```
1 //Ex2_10
2 clc
3 C = 10*10^-6
4 V = 100
5 W = C*(V^2)/2
6 disp("C = "+string(C)+"F")// capacitance
7 disp("V = "+string(V)+"V")// voltage
8 disp("W = C*(V^2)/2 = "+string(W)+" Joules")//
   calculating for energy stored
```

Scilab code Exa 2.11 Instantaneous Current in capacitor

```
1 //Ex2_11
2 clc
3 C = 10*10^-6
4 delta_V = 100
5 delta_t = 10
6 ic = C*delta_V/delta_t
7 disp("C = "+string(C)+"F")// capacitance
8 disp("delta_V = "+string(delta_V)+"V")//change in
   voltage
9 disp("delta_t = "+string(delta_t)+"sec")//change in
   time
10 disp("ic = C*(delta_V/delta_t) = "+string(ic)+
   "A")//calculation for instantaneous current
```

Scilab code Exa 2.12 Rate of Current

```

1 //Ex2_12
2 clc
3 Ii = 10
4 If = 15
5 delta_t = 2
6 dI = Ii - If
7 disp(" Ii = "+string(Ii)+"A")//initial current
8 disp(" If = "+string(If)+"A")//final current
9 disp(" delta_t = "+string(delta_t)+"sec")//time taken
  to change current
10 disp(" dI/dt = "+string(abs(dI)/delta_t)+"Amp/sec.")
  //calculation for rate of change of current
11 //wronge answer given in the textbook i.e. 0.5 Amp/
  sec.

```

Scilab code Exa 2.13 Inductance Value

```

1 //Ex2_13
2 clc
3 r = 5.0//rate of current change
4 vL = 50//induced voltage
5 L = vL/(r)
6 disp(" diL/dt = "+string(r)+"A/s")//rate of current
  change
7 disp(" vL = "+string(vL)+"V")
8 disp(" vL = L*(diL/dt)")
9 disp(" L = vL/(diL/dt) = "+string(L)+" Henry")//
  calculation for inductane

```

Scilab code Exa 2.14 Energy in Inductor

```

1 //Ex2_14
2 clc

```

```

3 I = 5
4 L = 5
5 WL = L*(I^2)/2
6 disp("I = "+string(I)+"A")//current flow
7 disp("L = "+string(L)+"H")//inductance
8 disp("WL= "+string(WL)+" joules")//energy stored

```

Scilab code Exa 2.15 Coupling Coefficient

```

1 //Ex2_15
2 clc
3 flux1 = 100*10^-6
4 flux2 = 50*10^-6
5 flux12 = flux1 - flux2
6 disp("flux1 = "+string(flux1)+"Wb")//flux of coil 1
7 disp("flux2 = "+string(flux2)+"Wb")//flux of coil 2
8 disp("K = flux linkage between coil 1 and coil 2 /
    flux of coil 1")//coefficient of coupling
9 disp("    = "+string(flux12/flux1))

```

Scilab code Exa 2.16 Mutual Inductance

```

1 //Ex2_16
2 clc
3 L1 = 100*10^-3
4 L2 = 50*10^-3
5 K = 0.3
6 M = K*(L1*L2)^0.5
7 disp("L1 = "+string(L1)+"H")//inductance of coil 1
8 disp("L2 = "+string(L2)+"H")//inductance of coil 2
9 disp("K = "+string(K))//coefficient of coupling
10 disp("M = K*(L1*L2)^0.5")
11 disp("M = "+string(M)+"H")//mutual inductance

```

Scilab code Exa 2.17 Series Inductance

```
1 //Ex2_17
2 clc
3 L1 = 10*10^-3
4 L2 = 15*10^-3
5 LT = L1 + L2
6 disp("L1 = "+string(L1)+"H")//inductance of coil 1
7 disp("L2 = "+string(L2)+"H")//inductance of coil 2
8 disp("LT = L1+L2 = "+string(LT)+"H")//series
   inductance
```

Scilab code Exa 2.18 Parallel Inductance

```
1 //Ex2_18
2 clc
3 L1 = 1*10^-3
4 L2 = 5*10^-3
5 LT = (L1*L2)/(L1+L2)
6 disp("L1 = "+string(L1)+"H")//inductance of coil 1
7 disp("L2 = "+string(L2)+"H")//inductance of coil 2
8 disp("1/LT = 1/L1 + 1/L2")
9 disp("LT = (L1*L2)/(L1+L2) = "+string(LT)+"H")//
   parallel inductance
```

Scilab code Exa 2.19 Source Resistance

```
1 //Ex2_19
2 clc
```

```

3 VNL = 50
4 VL = 40
5 IL = 4
6 Rs = (VNL - VL)/IL
7 disp("VNL = "+string(VNL)+"V")//no load voltage
8 disp("VL = "+string(VL)+"V")//load voltage
9 disp("IL = "+string(IL)+"A")//load current
10 disp("Rs = (VNL - VL)/IL = "+string(Rs)+"ohm")//
    source resistane

```

Scilab code Exa 2.20 Series Voltage

```

1 //Ex2_20
2 clc
3 V = 2.5
4 disp("V1 = V2 = V3 = V4 = "+string(V)+"V")//four
    batteries of equal voltage connected in series
5 disp("VT = V1+V2+V3+V4 = "+string(V+V+V+V)+"V")//
    resultant voltage(series voltage)

```

Scilab code Exa 2.21 Net Voltage

```

1 //Ex2_20
2 clc
3 V = 2
4 disp("V1 = V2 = V3 = V4 = "+string(V)+"V")//four
    batteries of equal voltage connected in series
5 disp("VT = V1 = V2 = V3 = V4 = "+string(V)+"V")//
    parallel voltage

```

Scilab code Exa 2.22 Thevenin Equivalent Circuit

```
1 //Ex2_22
2 clc
3 //considering the fig. 2.17 given in the question
4 R1 = 1
5 R2 = 3
6 R3 = 2
7 V = 20
8 disp("R1 =" + string(R1) + "ohm") // value of resistance R1
9 disp("R2 =" + string(R2) + "ohm") // value of resistance R2
10 disp("R3 =" + string(R3) + "ohm") // value of resistance R3
    (across A and B terminals ,
11                                     // across which thevenin
                                         equivalent circuit is
                                         need to determine)
12 disp("V =" + string(V) + "V") // value of D.C. voltage
    applied
13
14 //TO FIND THEVENIN'S RESISTANCE (RTH) ,..
15 //CONSIDERING FIG 2.17
16 // WE REMOVE THE RESISTANCE (R1) ACROSS LOAD
    TERMINAL AB I.E.
17 //AND ALSO WE SHORT THE VOLTAGE SOURCE
18 //NOW ACCORDING TO MODIFIED CIRCUIT
19
20 disp("1/RTH = 1/R3 + 1/R2 = " + string(1/((1/R3)+(1/R2
    ))) + "ohm") //R1 and R2 are in parallel
21
22 //TO FIND THEVENIN VOLTAGE (VTH) ,..
23 //CONSIDERING FIG 2.17
24 //WE DISCONNECT LOAD RESISTANCE (R1) AND MADE
    TERMINAL AB OPEN CIRCUIT
25 //ACCORDING TO MODIFIED CIRCUIT
26
27 //applying KVL in the loop, to find the amount of
    current flowing in circuit
28 //taking current as 'I' amperes
```



```
29
30 disp("V = (R3*I)+(R2*I)")
31 I = V/(R2+R3)
32 disp("or , I = V/(R2+R3) = "+string(I)+" amperes")
33 //Voltage drop across R2 resistance = Thevenin
    voltage
34 //thus, voltage across AB i.e., thevenin voltage, is
    given as
35 disp("VTH = R2*I = "+string(R2*I)+"V")
36
37 // NOTE : Notations used in the program are as
    mentioned in the main fig. 2.17
```

Chapter 3

Electrodynamics and CRO

Scilab code Exa 3.1 Force on electron

```
1 //Ex3_1
2 clc
3 E = 20*10^3
4 e = -(1.6*10^-19)
5 F = e*E
6 disp("E = "+string(E)+" ax V/m")//initializing
   electric field
7 disp("e = "+string(e)+"C")//initializing electron
   charge
8 disp("F = eE = "+string(F)+" ax N")//calculation for
   force on electron due to electric field
9
10 // NOTE : answer provided in the textbook is wrong
   Correct answer is ,  $-3.2*10^{16}$ ax N
```

Scilab code Exa 3.2 Force on electron

```
1 //Ex3_2
```

```

2  clc
3  E = 50*10^3
4  e = -1.6*10^-19
5  N = 10^6
6  F = N*e*E
7  disp("E = "+string(E)+" az V/m")//value of Electric
   field applied
8  disp("e = "+string(e)+"C")//value of eletron charge
9  disp("N = "+string(N))//total number of charge
10 disp("F = NeE = "+string(F)+" az N")//force on
    electron

```

Scilab code Exa 3.3 Force on electron

```

1  //Ex3_3
2  clc
3  v = 5*10^6
4  e = -1.6*10^-19
5  B = 20*10^-6
6  F = e*v*B
7  disp("v = "+string(v)+"m/s")//velocity of electron
8  disp("e = "+string(e)+"C")//charge of electron
9  disp("B = "+string(B)+"Wb/m-sq")//magnetic field
10 disp("F = e(VxB) = e*v*B = "+string(F)+"N")//force
    on the electron due to field

```

Scilab code Exa 3.4 Force on electron

```

1  //Ex3_4
2  clc
3  Bx = 40*10^-6
4  By = 10*10^-6
5  N = 10^6

```

```

6 e = -1.6*10^-19
7 v = 8*10^6
8 disp("B = "+string(Bx)+" ax + "+string(By)+" ay Wb/m-
      sq")//magnetic field
9 disp("N = "+string(N))//number of electrons
10 disp("e = "+string(e)+"C")//electron charge
11 disp("v = "+string(v)+" ax m/s")//velocity of
    electron
12 disp("F = Q(VxB) = "+string(e*N*v*By)+" az N")//
    force on electron
13 //as we are taking curl of V and B,.. thus Vx X Bx =
    0
14 //force will be only due to V x By.

```

Scilab code Exa 3.5 Current density

```

1 //Ex3_5
2 clc
3 e = -1.6*10^-19
4 n = 10^6
5 v = 5*10^6
6 J = n*e*v
7 disp("e = "+string(e)+"C")//charge of electrons
8 disp("n = "+string(n)+" /m-cube")//electron density
9 disp("v = "+string(v)+"m/s")//electron velocity
10 disp("J = nev = "+string(abs(J))+"A/m-sq")//current
    density

```

Scilab code Exa 3.6 Current density

```

1 //Ex3_6
2 clc
3 v = 2*10^7

```

```

4 e = -1.6*10^-19
5 n = 10^8
6 J = n*e*v
7 disp("v = "+string(v)+"m/s")//velocity of electron
8 disp("e = "+string(e)+"C")//electron charge
9 disp("n = "+string(n)+" /m-cube")//electron density
10 disp("J = nev = "+string(abs(J))+"A/m-sq")//current
    density
11
12 //note: formula for current density in the solution
    in the textbook is misprinted
13 //      also the answer is provide in the textbook
    for above problem is misprinted.

```

Scilab code Exa 3.7 Frequency of Signal

```

1 //Ex3_7
2 clc
3 l = 4//cycle length
4 t = 10*10^-6//scale setting
5 T = l*t//time period for full cycle
6 disp("T = "+string(T)+" s")
7 disp("Frequency = 1/T = "+string(1/T)+" Hz")//
    frequency of the signal

```

Scilab code Exa 3.8 RMS voltage

```

1 //Ex3_8
2 clc
3 Vpp = 4.2*10*10^-3//peak to peak voltage of
    sinusoidal signal //notation not used in
    textbook
4 Vm = Vpp/2//maximum positive voltage

```

```

5 Vrms = Vm/(2^.5)//root mean square value of voltage
6 disp("Vm = "+string(Vm)+"V")
7 disp("Vrms = Vm/(2^.5) = "+string(Vrms)+"V")

```

Scilab code Exa 3.9 Current in 100 ohm resistance

```

1 //Ex3_9
2 clc
3 V = 4.5*10^-3//applied dc voltage
4 r = 100// given resistance
5 I = V/r//flow of current
6 disp("DC voltage = "+string(V)+"V")
7 disp("The current in 100 ohm = "+string(I)+"A")

```

Scilab code Exa 3.10 Deflection Sensitivity

```

1 //Ex3_10
2 clc
3 l = .03
4 d = 0.01
5 L = 0.18
6 Va = 1000
7 disp("l = "+string(l)+"m")//length of deflection
  plate
8 disp("d = "+string(d)+"m")//plate separation
9 disp("L = "+string(L)+"m")//distance of screen from
  plate
10 disp("Va = "+string(Va)+"V")//anode voltage
11 SE = (l*L)/(2*d*Va)
12 disp("SE = (l*L)/(2*d*Va) = "+string(SE)+"m/V")

```

Scilab code Exa 3.11 force on current element

```
1 //Ex3_11
2 clc
3 disp("fm = BIL")//formula used for finding FORCE ON
  CURRENT ELEMENT
4 B = 2.0
5 IL = 10*10^-3
6 fm = B*IL
7 disp("B = "+string(B)+"Wb/m-sq")//magnetic field
8 disp("IL = "+string(IL)+"A-m")//current element
9 disp("fm =" +string(fm)+"Newton")//answer displayed
```

Scilab code Exa 3.12 Velocity of electron and kinetic energy

```
1 //Ex3_12
2 clc
3 disp("v = (2*e*Va/m)^.5")//formula used to calculate
  velocity of electrons
4 e = -1.6*10^-19
5 m = 9.1*10^-31
6 Va = 3.0*10^3
7 disp("e = "+string(e)+"C")//electron charge
8 disp("m = "+string(m)+"Kg")//mass of electron
9 disp("Va = "+string(Va)+"V")//potential difference =
  anode voltage
10 v = abs((2*e*Va/m))^0.5
11 disp("v = "+string(v)+"m/s")
12 W = e*Va//kinetic energy
13 disp("W = e*Va = "+string(W)+"joules")//Kinetic
  energy
```

Scilab code Exa 3.13 Deflection of electron beam

```

1 //Ex3_13
2 clc
3 e = -1.6*10^-19
4 m = 9.1*10^-31
5 Va = 400
6 v = (abs(2*e*Va/m))^0.5
7 disp("e = "+string(e)+"C")//electron charge
8 disp("m = "+string(m)+"Kg")//mass of electron
9 disp("Va = "+string(Va)+"V")//anode voltage
10 disp("v = (2*e*Va/m)^0.5 = "+string(v)+"m/s")//
    formula used to calculate velocity of electrons
11 //as electron traces a circular path, radius of
    circular path
12 H = 47.75
13 micro_not = 4*pi*10^-7
14 B = H*micro_not
15 disp("B = "+string(B)+"Wb/m-sq")
16 r = (v/(e/m)/B)
17 disp("r = (v/(e/m))/B = "+string(r)+"m")
18
19 // NOTE : Question is incompletely solved in the
    textbook

```

Scilab code Exa 3.14 Deflection sensitivity

```

1 //Ex3_14
2 clc
3 l = 22
4 d = 1.5
5 Va = 625
6 e = 1.6*10^-19
7 m = 9.1*10^-31
8 disp("l = "+string(l)+"cm")//distance from location
    of magnetic field
9 disp("d = "+string(d)+"cm")//length over which

```



```

    magnetic field is present
10 disp("Va = "+string(Va)+"V")//voltage applied to
    anode
11 disp("e = "+string(e)+"C")//electron charge
12 disp("m = "+string(m)+"Kg")//mass of electron
13 SH = l*10^-2*d*10^-2*(e/(2*m*Va))^0.5
14 disp("SH = D/B = l*d*(e/(2*m*Va))^0.5 = "+string(SH)+
    "m/tesla")//magnetic deflection sensitivity in
    terms of meter and tesla
15 // as B = micro_not*H
16 micro_not = 4*pi*10^-7
17 disp("SH = D/H = micro_not*l*d*(e/(2*m*Va))^0.5 = "+
    string(SH*micro_not)+"m-sq/Amp.")//magnetic
    deflection sensitivity in terms of meter and
    amperes

```

Scilab code Exa 3.15 Electric field and velocity and deflection sensitivity

```

1 //Ex3_15
2 clc
3 Vd = 50
4 d = 1
5 disp("(a)")
6 disp("Vd = "+string(Vd)+"V")//voltage applied to
    deflection plates
7 disp("d = "+string(d)+"cm")//plate separation
8 E = Vd/d/10^-2
9 disp("E = Vd/d = "+string(E)+"V/m")//electric field
    produced
10
11 disp("(b)")
12 e = -1.6*10^-19
13 m = 9.1*10^-31
14 Va = 500
15 v = abs((2*e*Va/m))^0.5

```

```

16 disp("v = (2*e*Va/m) ^ .5") // formula for Velocity OF
    Electron
17 disp("e = "+string(e)+"C") //electron charge
18 disp("m = "+string(m)+"Kg") //mass of electron
19 disp("Va = "+string(Va)+"V") //voltage applied at
    anode
20 disp("v = "+string(v)+"m/s")
21
22 disp("(c)")
23 l = 2
24 L = 30
25 Va = 500
26 SE = l*L/2/Va/d*10
27 disp("l = "+string(l)+"cm") //length of deflection
    plate
28 disp("L = "+string(L)+"cm") //distance between plates
    and screen
29 disp("d = "+string(d)+"cm") //plate separation
30 disp("Va = "+string(Va)+"V") //anode voltage
31 disp("SE = (l*L)/(2*Va*d) = "+string(SE)+"mm/volts")
    //Electrostatic deflection sensitivity

```

Scilab code Exa 3.16 Phase difference using Lissajous pattern

```

1 //Ex3_16
2 clc
3 //considering Lissajous pattern given in question
4 y1 = 0
5 y2 = 5
6 phi = asind(y1/y2)
7 disp("y1 = "+string(y1)+"cm") //minor axis
8 disp("y2 = "+string(y2)+"cm") //major axis
9 disp("phi = sin-1(y1/y2) = "+string(phi)+"degree") //
    phase difference

```

Scilab code Exa 3.17 Phase difference using Lissajous pattern

```
1 //Ex3_17
2 clc
3 //considering Lissajous pattern given in question
4 y1 = 4
5 y2 = 5
6 phi = asind(y1/y2)
7 disp("y1 = "+string(y1)+" unit")//minor axis
8 disp("y2 = "+string(y2)+" unit")//major axis
9 disp("phi = sin-1(y1/y2) = "+string(phi)+" degree")//
   phase difference
```

Scilab code Exa 3.18 Phase difference using Lissajous pattern

```
1 //Ex3_16
2 clc
3 //considering Lissajous pattern given in question
4 y1 = 4
5 y2 = 4
6 phi = asind(y1/y2)
7 disp("y1 = "+string(y1)+" cm")//minor axis
8 disp("y2 = "+string(y2)+" cm")//major axis
9 disp("phi = sin-1(y1/y2) = "+string(phi)+" degree")//
   phase difference
```

Scilab code Exa 3.19 Phase difference using Lissajous pattern

```
1 //Ex3_16
```

```
2 clc
3 //considering Lissajous pattern given in question
4 y1 = 2
5 y2 = 6
6 phi = asind(y1/y2)
7 disp("y1 = "+string(y1)+"cm")//minor axis
8 disp("y2 = "+string(y2)+"cm")//major axis
9 disp("phi =  $\sin^{-1}(y1/y2)$  = "+string(phi)+" degree")//
    phase difference
10 disp("OR")
11 phi = 180 - phi
12 disp("phi = "+string(phi)+" degree")
```

Chapter 4

Diode Characteristics and Applications

Scilab code Exa 4.1 Current in silicon diode

```
1 //Ex4_1
2 clc
3 Irs = 0.2*10^-6
4 Vf = 0.1
5 VT = 26*10^-3
6 eta = 1//for germanium
7 I = Irs*(exp(Vf/eta/VT)-1)
8 disp("Irs = "+string(Irs)+"A")//reverse saturation
  current
9 disp("Vf = "+string(Vf)+"V")//applied voltage
10 disp("VT = "+string(VT)+"V")//voltage at room
  temperature
11 disp("eta = "+string(eta))
12 disp("I = Irs*(exp(Vf/eta/VT)-1)")//current at room
  temperature
13 disp("I = "+string(I)+"A")
14
15 //current in silicon:
16 eta = 2//for silicon
```

```

17 disp("eta = "+string(eta))
18 I = Irs*(exp(Vf/eta/VT)-1)
19 disp("I = "+string(I)+"A")
20
21
22
23
24 // note: incomplete solution in textbook for above
    question.

```

Scilab code Exa 4.2 Voltage in silicon diode

```

1 //Ex4_2
2 clc
3 Irs = 2.0*10^-6
4 I = 10*10^-3
5 VT = 26*10^-3
6 eta = 2//for silicon
7 disp("Irs = "+string(Irs)+"A")//reverse saturation
    current
8 disp("I = "+string(I)+"A")//forward current
9 disp("VT = "+string(VT)+"V")//voltage at room
    temperature
10 disp("eta = "+string(eta))
11 Vf = eta*VT*log((I/Irs)+1)//voltage produced
12 disp("Vf = eta*VT*log((I/Irs)+1) = "+string(Vf)+"V")

```

Scilab code Exa 4.3 Dynamic resistance of diode

```

1 //Ex4_3
2 clc
3 If = 3*10^-3//forward current
4 eta = 1//for germanium

```

```

5 T = 300//room temperature
6 VT = T/11600//voltage at room temperature
7 disp("If = "+string(If)+"A")
8 disp("eta = "+string(eta))
9 disp("T = "+string(T)+" degreeK")
10 disp("VT = "+string(VT)+"V")
11 Rdf = (eta*VT/If)//dynamic resistance at room
    temperature
12 disp("Rdf = (eta*VT/If) = "+string(Rdf)+"ohm")

```

Scilab code Exa 4.4 Transition Capacitance

```

1 //Ex4_4
2 clc
3 A = 4*10^-6
4 W = 1.5*10^-6
5 apsilent_r = 16//for germanium
6 apsilent_not = 8.85*10^-12//permitivity in vaccum
7 disp("A = "+string(A)+"m_sq")//cross sectional are
8 disp("W = "+string(W)+"m")//width of depletion layer
9 disp("apsilent_r = "+string(apsilent_r))//relative
    permittivity
10 disp("CT = apsilent*A/W")//transition capacitance
11 disp("    = "+string(apsilent_r*apsilent_not*A/W)+"F"
    )
12
13
14 // note: units given in textbook in the solution for
    cross sectional area and width are misprinted.

```

Scilab code Exa 4.5 Diffusion Capacitance

```

1 //Ex4_5

```

```
2 clc
3 I = 10*10^-3
4 eta = 1//for germanium
5 VT = 26*10^-3
6 tawo = 6*10^-3
7 CD = I*tawo/eta/VT
8 disp("I = "+string(I)+"A")//forward current
9 disp("eta = "+string(eta))
10 disp("VT = "+string(VT)+"V")//voltage at room
    temperature
11 disp("tawo = "+string(tawo)+"sec")//mean lifetime
12 disp("CD = I*tawo/eta/VT = "+string(CD)+"F")//
```

Chapter 5

Rectifier and DC Power Supplies

Scilab code Exa 5.1 Current and ripple factor

```
1 //Ex5_
2 clc
3 Vm = 24
4 RL = 1.8*10^3
5 Im = Vm/RL
6 Irms = Im/2
7 Idc = Im/(%pi)
8 r = ((Irms/Idc)^2 - 1)^.5
9 disp("Vm = "+string(Vm)+"V")//applied voltage to
    half wave rectifier
10 disp("RL = "+string(RL)+"ohm")//load resistance
11 disp("Im = Vm/RL = "+string(Im)+"A")//peak current
12 disp("Irms = Im/2 = "+string(Irms)+"A")//rms current
13 disp("Idc = Im/pi = "+string(Idc)+"A")//D.C. current
14 disp("r ((Irms/Idc)^2 - 1)^.5 = "+string(r))//ripple
    factor
```

Scilab code Exa 5.2 DC and peak voltage

```
1 //Ex5_2
2 clc
3 Vm = 18
4
5 //in half wave circuit
6 Vdc = Vm/%pi
7 PIV = Vm
8 disp("Vm = "+string(Vm)+"V")//peak voltage to
  rectifier
9 disp("Vdc = Vm/pi = "+string(Vdc)+"V")//D.C. voltage
10 disp("PIV = Vm = "+string(PIV)+"V")//peak inverse
  voltage
11
12 //in full wave circuit
13 Vdc = (2*Vm/%pi)
14 PIV = 2*Vm
15 disp("Vdc = 2*Vm/pi = "+string(Vdc)+"V")//D.C.
  voltage
16 disp("PIV = 2*Vm = "+string(PIV)+"V")//peak inverse
  voltage for center trapped
17
18 //in full wave Bridge rectifier
19 disp("PIV = Vm = "+string(Vm)+"V")//peak inverse
  voltage
```

Scilab code Exa 5.3 Current and Voltage and Ripple Factor

```
1 //Ex5_3
2 clc
3 Vm = 12
4 RL = 1.5*10^3
5 Im = Vm/RL
6 Irms = Im/(2^.5)
```

```

7 Idc = (2*Im/%pi)
8 r =(((Irms/Idc)^2)-1)^.5
9 disp("Vm = "+string(Vm)+"V")//peak voltage to full
  rectifier
10 disp("Im = Vm/RL = "+string(Im)+"A")//peak current
11 disp("Irms = Im/(2^0.5) = "+string(Irms)+"A")//rms
  current
12 disp("Idc = (2*Im/pi) = "+string(Idc)+"A")//D.C.
  current
13 disp("r = (((Irms/Idc)^2)-1)^0.5 = "+string(r))//
  ripple factor

```

Scilab code Exa 5.4 Power and Rectification Efficiency

```

1 //Ex5_4
2 clc
3 Idc = 10*10^-3
4 Irms = 14*10^-3
5 RL = 1*10^3
6 Pdc = (Idc^2)*RL
7 Pac = (Irms^2)*RL
8 disp("Idc = "+string(Idc)+"A")//D.C. current
9 disp("Irms = "+string(Irms)+"A")//rms current
10 disp("RL = "+string(RL)+"ohm")//load resistance
11 disp("Pdc = (Idc^2)*RL = "+string(Pdc)+"W")//D.C.
  power
12 disp("Pac = (Irms^2)*RL = "+string(Pac)+"W")//A.C.
  power
13 disp("eta_r = Pdc/Pac = "+string(Pdc/Pac*100)+"%")//
  Rectification efficiency

```

Scilab code Exa 5.5 Voltage and Current and Power and percentage regulation

```

1 //Ex5_5
2 clc
3 disp("v = 12 sin(wt)")
4 Vm = 12
5 RL = 1*10^3
6 Rf = 10
7 Im = Vm/(RL+Rf)
8 Idc = Im/%pi
9 Vdc = Idc*RL
10 Irms = Im/2
11 Pi = (Irms^2)*(RL+Rf)
12 VNL = Vm/%pi
13 VL = Idc*RL
14 Regulation = (VNL - VL)/VL
15 disp("Vm = "+string(Vm)+"V")//amplitude of applied
    signal
16 disp("RL = "+string(RL)+"ohm")//load resistance
17 disp("Rf = "+string(Rf)+"ohm")//forward resistance
18 disp("Im = Vm/(RL+Rf) = "+string(Im)+"A")//peak
    current
19 disp("Idc = Im/pi = "+string(Idc)+"A")//D.C. current
20 disp("Vdc = Idc*RL = "+string(Vdc)+"V")//D.C,
    voltage
21 disp("Pi = (Irms^2)*(RL+Rf)")
22 disp("Irms = Im/2 = "+string(Irms)+"A")//rms current
23 disp("Pi = "+string(Pi)+"W")//input power
24 disp("%Regulation = (VNL - VL)/VL")
25 disp("VNL = Vm/pi = "+string(VNL)+"V")//non load
    voltage
26 disp("VL = Idc*RL = "+string(VL)+"")//load voltage
27 disp("%Regulation = "+string(Regulation*100)+"%")//
    percentage regulation
28
29
30 // NOTE : THE POWER CALCULATED IN THE TEXTBOOK IS
    WRONG.

```

Scilab code Exa 5.6 Peak Inverse Voltage

```
1 //Ex5_6
2 clc
3 Vdc = 15
4 disp("Vdc = "+string(Vdc)+"V")//applied D.C. voltage
5 //Half Wave Rectifier
6 Vm = %pi*Vdc
7 PIV = Vm
8 disp("Vm = Vdc*pi = "+string(Vm)+"V")//D.C. voltage
   for half wave rectifier
9 disp("PIV = Vm = "+string(PIV)+"V")//peak inverse
   voltage for half wave rectifier
10 //Full Wave Rectifier
11 Vm = %pi*Vdc/2
12 PIV = 2*Vm
13 disp("Vm = Vdc*pi/2 = "+string(Vm)+"V")//D.C.
   voltage for full wave rectifier
14 disp("PIV = 2*Vm = "+string(PIV)+"V")//peak inverse
   voltage for full wave rectifier
15 //Bridge Rectifier
16 Vm = %pi*Vdc/2
17 PIV = Vm
18 disp("Vm = Vdc*pi/2 = "+string(Vm)+"V")//D.C.
   voltage for bridge rectifier
19 disp("PIV = Vm = "+string(PIV)+"V")//peak inverse
   voltage for bridge rectifier
```

Scilab code Exa 5.11 Half wave rectification

```
1 //Ex5_11
2 clc
```

```

3 Rf = 10
4 RL = 150
5 eta_r = 40.6/(1+Rf/RL)
6 disp("Rf = "+string(Rf)+"ohm")//forward resistance
7 disp("RL = "+string(RL)+"ohm")//load resistance
8 disp("eta_r = 40.6/(1+Rf/RL) = "+string(eta_r)+"%")
   //rectification efficiency

```

Scilab code Exa 5.12 Full wave rectification

```

1 //Ex5_12
2 clc
3 Rf = 12.5
4 RL = 100
5 eta_r = 80.1/(1+Rf/RL)
6 disp("Rf = "+string(Rf)+"ohm")//forward resistance
7 disp("RL = "+string(RL)+"ohm")//load resistance
8 disp("eta_r = 80.1/(1+Rf/RL) = "+string(eta_r)+"%")
   //rectification efficiency

```

Scilab code Exa 5.13 Bridge Rectifier

```

1 //Ex5_13
2 clc
3 Vdc = 32
4 Vm = %pi*Vdc/2
5 Vrms = Vm/(2^.5)
6 PIV = Vm
7 disp("Vdc = "+string(Vdc)+"V")//D.C. voltage
8 disp("Vm = pi*Vdc/2 = "+string(Vm)+"V")//peak
   voltage
9 disp("Vrms = Vm/(2^.5) = "+string(Vrms)+"V")//rms
   voltage

```

```

10 disp("PIV = "+string(PIV)+"V")//peak inverse voltage
11
12
13 // note : value calculated for Vrms in the textbook
    is wrong.

```

Scilab code Exa 5.14 Ripple Voltage

```

1 //Ex5_14
2 clc
3 C = 10*10^-3
4 f = 50
5 Idc = 200*10^-3
6 Vr = Idc/(2*f*C)
7 disp("C = "+string(C)+"F")//circuit capacitance
8 disp("f = "+string(f)+"Hz")//operating frequency
9 disp("Idc = "+string(Idc)+"A")//D.C. current
10 disp("Vr = Idc/(2*f*C) = "+string(Vr)+"V")//ripple
    voltage

```

Scilab code Exa 5.15 Ripple factor and DC current and load resistance

```

1 //Ex5_15
2 clc
3 C = 600*10^-6
4 T = 20*10^-3
5 Vr = 1.2
6 Vdc = 9
7 Vac =Vr/(2*(3^.5))
8 r = Vac/Vdc
9 Idc = (Vr*C)/(T/2)
10 RL = Vdc/Idc
11 disp("C = "+string(C)+"F")//rectifier capacitance

```

```

12 disp("T = "+string(T)+" s") //time
13 disp("Vr = "+string(Vr)+"V") //ripple voltage
14 disp("Vdc = "+string(Vdc)+"V") //D.C. voltage
15 disp("Vac = "+string(Vac)+"V") //A.C. voltage
16 disp("r = "+string(r)) //ripple factor
17 disp("Idc = "+string(Idc)+"A") //D.C. current
18 disp("RL = "+string(RL)+"ohm") //load resistance

```

Scilab code Exa 5.16 Design pi section full wave filter

```

1 //Ex5_16
2 clc
3 L = 1// assuming inductance
4 f = 50//operating frequency
5 XL = 2*%pi*f*L//inductance
6 RL = 100//assuming load resistance
7 r = .01//ripple factor
8
9 //let , capacitances C1 = C2 = C
10 //that implies XC1 = XC2 = XC
11 disp("XL = 2*%pi*f*L = "+string(XL)+" ohm")
12 disp("r = "+string(r))
13 XC = ((r*8*XL*RL)/(2^.5))^.5//capacitive resistance
14 disp("XC = ((r*8*XL*RL)/(2^.5))^.5 = "+string(XC)+"
      ohm")
15 disp("XC = 1/wC = 1/(2*pi*f*C) = "+string(XC))
16 C = 1/(2*%pi*f*XC)//capacitance
17 disp("C = 1/(2*pi*f*XC) = "+string(C)+"F")
18 // thus , design parameters are :
19 disp("design parameters:")
20 disp("C1 = C2 = "+string(C)+"F")
21 disp("RL = "+string(RL)+"ohm")
22 disp("L = "+string(L)+"H")
23
24

```


25 // Note : the calculations done in the textbook for
the given problem is wrong.

Scilab code Exa 5.17 DC voltage and current and Resistance

```
1 //Ex5_17
2 clc
3 f =50
4 disp("vi = 16 sin(wt)")
5 Vdc = 16
6 RL = 100
7 C1 = 2*10^-3
8 C2 = 2*10^-3
9 L = 1.0
10 Idc = Vdc/RL
11 XC1 = 1/(2*%pi*f*C1)
12 XC2 = 1/(2*%pi*f*C2)
13 XL = 2*%pi*f*L
14 r = ((2^.5)*XC1*XC2)/(8*XL*RL)
15 disp("L = "+string(L)+"H")//inductance
16 disp("C1 = "+string(C1)+"F")//capacitance 1
17 disp("C2 = "+string(C2)+"F")//capacitance 2
18 disp("RL = "+string(RL)+"ohm")//load resistance
19 disp("f = "+string(f)+"Hz")//operating frequency
20 disp("Vdc = "+string(Vdc)+"V")//d.c. voltage
21 disp("Idc = Vdc/RL = "+string(Idc)+"A")//d.c.
    current
22 disp("XL = 2*%pi*f*L = "+string(XL)+"ohm")//
    inductive resistance
23 disp("XC1 = 1/(2*%pi*f*C1) = "+string(XC1)+"ohm")//
    capacitive resistance due to capacitance 1
24 disp("XC2 = 1/(2*%pi*f*C2) = "+string(XC2)+"ohm")//
    capacitive resistance due to capacitance 2
25 disp("r = ((2^.5)*XC1*XC2)/(8*XL*RL) = "+string(r))
    //ripple factor
```


Chapter 6

Transistor Characteristics And Applications

Scilab code Exa 6.1 current gain

```
1 //Ex6_1
2 clc
3 IB = 40*10^-6
4 IC = 3*10^-3
5 beta = IC/IB
6 alpha = beta/(1+beta)
7 disp("IB = "+string(IB)+"A")//base current
8 disp("IC = "+string(IC)+"A")//collector current
9 disp("beta = IC/IB = "+string(beta))//current gain
   in CE configuration
10 disp("alpha = beta/(1+beta) = "+string(alpha))//
   current gain in CB configuration
```

Scilab code Exa 6.2 Transistor current and current gain

```
1 //Ex6_2
```

```

2  clc
3  IE = 1.2*10^-3
4  beta = 60
5  alpha = beta/(1+beta)
6  disp("beta = "+string(beta))//current gain in CE
   configuration
7  disp("alpha = beta/(1+beta) = "+string(alpha))//
   current gain in CB configuraion
8  disp("IE = "+string(IE)+"A")//emitter current
9  IB = IE/(beta+1)
10 IC = beta*IB
11 disp("IB = IE/(beta+1) = "+string(IB)+"A")//base
   current
12 disp("IC = beta*IB = "+string(IC)+"A")//collector
   current

```

Scilab code Exa 6.3 Unknown Resistance in transistor

```

1  //Ex6_3
2  clc
3  alpha = 0.98
4  VBE = 0.7
5  IE = -2*10^-3
6  Re = 100
7  RL = 3.3*10^3
8  disp("alpha = "+string(alpha))//current gain
9  disp("VBE = "+string(VBE)+"V")//voltage across base-
   emitter
10 disp("IE = "+string(IE)+"A")//emitter current
11 disp("Re = "+string(Re)+"ohm")//emitter resistance
12 disp("RL = "+string(RL)+"ohm")//load resistance
13 //now according to circuit given for the question in
   the textbook
14 IC = -alpha * IE
15 disp("IC = -alpha*IE = "+string(IC)+"A")//collector

```

```

    current
16 IB = -IC - IE
17 disp("IB = -IC - IE = "+string(IB)+"A")//base
    current
18 VBN = VBE+(abs(IE)*Re)
19 disp("VBN = VBE+(IE*Re) = "+string(VBN)+"V")//
    voltage across base and ground(N)
20 //ASSUMING... value for R1 = 30*10^3 ohm
21 R1 = 30*10^3
22 disp("R1 = "+string(R1)+"ohm")//resistance R1 as
    given in circuit
23 I = VBN/R1
24 disp("I = VBN/R1 = "+string(I)+"A")//current across
    resistance R1
25 //ASSUMING... VCC = 9V
26 VCC = 9//collector voltage
27 disp("VCC = "+string(VCC)+"V")
28 VCN = VCC - (RL*(IC+I+IB))
29 disp("VCN = VCC - RL*(IC+I+IB) = "+string(VCN)+"V")
    //voltage across collector and ground(N)
30 // according to the given diagram for the question
    in the textbook, unknown resistance is,
31 R = (VCN - VBN)/(I+IB)
32 disp("R = (VCN - VBN)/(I+IB) = "+string(R)+"ohm")//
    unknown resistance

```

Scilab code Exa 6.4 transistor current and resistance

```

1 //Ex6_4
2 clc
3 RC = 2.3*10^3
4 Re = 1*10^3
5 VCC = 12
6 VCE = 5
7 VBE = 0.7

```

```

8 beta = 50
9 disp("RC = "+string(RC)+"ohm")//collector resistance
10 disp("Re = "+string(Re)+"ohm")//emitter resistance
11 disp("VCC = "+string(VCC)+"V")//supply voltage
12 disp("VCE = "+string(VCE)+"V")//voltage across
    collector and emitter
13 disp("VBE = "+string(VBE)+"V")//voltage across base
    and emitter
14 disp("beta = "+string(beta))//current gain
15 // according to the given circuit , we have
16 IB = (VCC - VCE)/((beta+1)*[RC+Re])
17 disp("IB = (VCC - VCE)/((beta+1)*[RC+Re]) = "+string
    (IB)+"A")//base current
18 IC = beta*IB
19 disp("IC = "+string(IC)+"A")//collector current
20 //from the circuit we have,
21 Rt = (VCE-VBE)/IB
22 disp("Rt = (VCE - VBE)/IB = "+string(Rt)+"ohm")//
    resistance Rt as given in circuit

```

Scilab code Exa 6.5 Base current and collector resistance

```

1 //Ex6_5
2 clc
3 VBB = 1
4 VCC = 12
5 IC = 12*10^-3
6 VCE = 4
7 beta = 80
8 VBE = 0.7
9 disp("VBB = "+string(VBB)+"V")//base supply voltage
10 disp("VCC = "+string(VCC)+"V")//collector supply
    voltage
11 disp("IC = "+string(IC)+"A")//collector current
12 disp("VCE = "+string(VCE)+"V")//voltage across

```

```

    collector and emitter
13 disp("beta = "+string(beta))//current gain
14 disp("VBE = "+string(VBE)+"V")//voltage across base
    and emitter
15 IB = IC/beta
16 disp("IB = IC/beta = "+string(IB)+"A")//base current
17 RC = (VCC - VCE)/IC
18 disp("RC = (VCC - VCE)/IC = "+string(int(RC))+"ohm")
    //collector resistance

```

Scilab code Exa 6.6 Current gain and base resistance

```

1 //Ex6_6
2 clc
3 VCC = 9
4 VBB = 3
5 IC = 2*10^-3
6 beta = 50
7 VBE = 0.7
8 VCE = 4
9 disp("VCC = "+string(VCC)+"V")//collector supply
    voltage
10 disp("VBB = "+string(VBB)+"V")//base supply voltage
11 disp("IC = "+string(IC)+"A")//collector current
12 disp("beta = "+string(beta))//current gain
13 disp("VBE = "+string(VBE)+"V")//voltage across base
    and emitter
14 disp("VCE = "+string(VCE)+"V")//voltage across
    collector and emitter
15 IB = IC/beta
16 disp("IB = IC/beta = "+string(IB)+"A")//base current
17 RB = (VBB - VBE)/IB
18 disp("RB = (VBB - VBE)/IB = "+string(RB)+"ohm")//
    base resistance according to the given in circuit
19

```

```

20
21 // note: misprint in the question , author is asking
    for IB instead of beta , as beta is already
        provided.
22 // note: calculation done in the textbook for the
    problem is wrong.

```

Scilab code Exa 6.7 base current and transistor resistance

```

1 //Ex6_7
2 clc
3 VCC = 12
4 VBB = 3
5 IC = 12*10^-3
6 VCE = 5.5
7 beta = 100
8 VBE = 0.7
9 Re = 50
10 disp("VCC = "+string(VCC)+"V")//collector supply
    voltage
11 disp("VBB = "+string(VBB)+"V")//base supply voltage
12 disp("IC = "+string(IC)+"A")//collector current
13 disp("VCE = "+string(VCE)+"V")//voltage across
    collector and emitter
14 disp("beta = "+string(beta))//current gain
15 disp("VBE = "+string(VBE)+"V")//voltage across base
    and emitter
16 disp("Re = "+string(Re)+"ohm")//emittter resistance
17 IB = IC/beta
18 disp("IB = IC/beta = "+string(IB)+"A")//base current
19 //from base-emitter circuit;
20 IE = IC+IB
21 Rb = (VBB - VBE - (IE*Re))/IB
22 disp("Rb = (VBB - VBE - IE*Re)/IB = "+string(Rb)+"
    ohm")//base resistance

```



```

23 //from collector-emitter circuit , we have
24 Rc = (VCC - VCE - (IE*Re))/(IC)
25 disp("Rc = (VCC - VCE - (IE*Re))/IC = "+string(Rc)+"
      ohm")//collector resistance
26
27
28 //NOTE : in textbook the notation used for base and
      emitter resistance in fig. and in calculation are
      different
29
30
31
32 // note : calculation perform in the textbook is
      wrong for the above problem

```

Scilab code Exa 6.8 Base and current current

```

1 //Ex6_8
2 clc
3 VBB = 10
4 RB = 500*10^3
5 VCC = 15
6 RC = 1.2*10^3
7 beta =100
8 disp("beta = "+string(beta))//current gain
9 disp("VBB = "+string(VBB)+"V")//base supply voltage
10 disp("RB = "+string(RB)+"ohm")//resistance across
      base terminal
11 disp("VCC = "+string(VCC)+"V")//collector supply
      voltage
12 disp("RC = "+string(RC)+"ohm")//resistance across
      collector terminal
13 IB = VBB/RB
14 disp("IB = VBB/RB = "+string(IB)+"A")//base current
15 IC = beta*IB

```

```

16 disp("IC = beta*IB = "+string(IC)+"A")// collector
    current
17 VCE = VCC - (IC*RC)
18 disp("VCE = VCC - IC*RC = "+string(VCE)+"V")//
    voltage across collector and emitter
19
20
21 // the answer printed in the textbook for VCE is
    wrong.

```

Scilab code Exa 6.9 resistance and conductance calculation of CC configuration

```

1 //Ex6_9
2 clc
3 ic = 2*10^-3
4 ie = ic// as base current is negligible
5 VT = 25*10^-3
6 re = VT/ie
7 gm = ie/VT
8 disp("ic = "+string(ic)+"A")// collector current
9 disp("ie = "+string(ie)+"A")// emitter current with
    negligible base current
10 disp("VT = "+string(VT)+"V")// voltage at room
    temperature
11 disp("re = VT/ie = "+string(re)+"ohm")// emitter
    resistance
12 disp("gm = ie/VT = "+string(gm)+"mho")// conductance
13 rc = 100*10^3//slope of output characteristics
14 disp("rc = "+string(rc)+"ohm")
15 hoe = 1/rc
16 disp("hoe = 1/rc = "+string(hoe)+"Mho")// output
    conductance

```

Scilab code Exa 6.10 common emitter current gain

```
1 //Ex6_10
2 clc
3 ic = 2.5*10^-3
4 ib = 50*10^-6
5 disp("ib = "+string(ib)+"A")//base current
6 disp("ic = "+string(ic)+"A")//collector current
7 beta = ic/ib
8 disp("beta = ic/ib = "+string(beta))//current gain
```

Scilab code Exa 6.11 common base current gain

```
1 //Ex6_11
2 clc
3 ic = 3*10^-3
4 ib = 3.08*10^-3
5 disp("ib = "+string(ib)+"A")//base current
6 disp("ic = "+string(ic)+"A")//collector current
7 alpha = ic/ib
8 disp("alpha = ie/ib = ic/ib = "+string(alpha))//
   current gain, assuming ie = ic
```

Scilab code Exa 6.12 peak to peak collector voltage and current

```
1 //Ex6_12
2 clc
3 //given, collector voltage swings between 11V to 4V
4 //thus,
```

```

5 vc = 11-4
6 disp("vc = 11 - 4 = "+string(vc)+"V")//PEAK-to-PEAK
  collector voltage
7 //given, collector current swings between 5mA to 1.4
  mA
8 //thus,
9 ic = (5 - 1.4)*10^-3
10 disp("ic = 5m - 1.4m = "+string(ic)+"A")//PEAK-to-
  PEAK collector current

```

Scilab code Exa 6.13 Current gain in CE amplifier

```

1 //Ex6_13
2 clc
3 ic = 4*10^-3
4 ib = 80*10^-6
5 disp("ib = "+string(ib)+"A")//base current
6 disp("ic = "+string(ic)+"A")//collector current
7 Ai = ic/ib
8 disp("Ai = ic/ib = "+string(Ai))//current gain in CE
  amplifier

```

Chapter 7

Transistor Biasing and Stabilization Techniques

Scilab code Exa 7.1 Emitter Resistance

```
1 //Ex7_1
2 clc
3 Ie = 6.0*10^-3
4 Ve = 1.1
5 Re = Ve/Ie
6 disp("Ie = "+string(Ie)+"A")//current flowing in
  emitter resistance
7 disp("Ve = "+string(Ve)+"V")//voltage drop across
  emitter resistance
8 disp("Re = "+string(Re)+"ohm")//emitter resistance
```

Scilab code Exa 7.2 Thermal resistance of transistor

```
1 //Ex7_2
2 clc
3 TA = 30
```

```

4 TJ = 48
5 PD = 4
6 TR = (TJ - TA)/PD
7 disp("TA = "+string(TA)+" degreeC") // ambient
  temperature at which transistor is operated
8 disp("TJ = "+string(TJ)+" degreeC") // junction
  temperature
9 disp("PD = "+string(PD)+"W") // dissipated power
10 disp("TR = (TJ - TA)/PD = "+string(TR)+" degreeC/W")
    // thermal resistance

```

Scilab code Exa 7.3 power dissipation of transistor

```

1 //Ex7_3
2 clc
3 TA = 28
4 TJ = 50
5 TR = 10
6 PD = (TJ - TA)/TR
7 disp("TA = "+string(TA)+" degreeC") // ambient
  temperature at which transistor is operated
8 disp("TJ = "+string(TJ)+" degreeC") // junction
  temperature
9 disp("TR = "+string(TR)+" degreeC/W") // thermal
  resistance
10 disp("PD = (TJ - TA)/TR = "+string(PD)+"W") //
    dissipated power

```

Scilab code Exa 7.4 Q point in fixed bias circuit

```

1 //Ex7_4
2 clc
3 RC = 4*10^3

```

```

4 RB = 1.2*10^6
5 VCC = 9
6 VBE = .2
7 beta = 80
8 disp("RC = "+string(RC)+"ohm")//collector resistance
9 disp("RB = "+string(RB)+"ohm")//base resistance
10 disp("VCC = "+string(VCC)+"V")//collector supply
    voltage
11 disp("VBE = "+string(VBE)+"V")//voltage across base
    and emittter
12 disp("beta = "+string(beta))//current gain
13 IB = (VCC - VBE)/RB
14 disp("IB = (VCC - VBE)/RB = "+string(IB)+"A")//base
    current
15 IC = beta*IB
16 disp("IC = beta*IB = "+string(IC)+"A")//collector
    current
17 VCE = VCC - (IC*RC)
18 disp("VCE = VCC - (IC*RC) = "+string(VCE)+"V")//
    collector-emitter voltage
19 disp("The Q-point is ("+string(VCE)+"V, "+string(IC)+
    "A)")//Q-point in fixed bias circuit

```

Scilab code Exa 7.5 calculate base resistance to obtain optimum operatin point

```

1 //Ex7_5
2 clc
3 VBE = 0.6
4 beta = 100
5 disp("beta = "+string(beta))//current gain
6 disp("VBE = "+string(VBE)+"V")//voltage across base
    and emitter
7 //according to given circuit;
8 VCC = 12

```

```

9 RC = 5*10^3
10 disp("VCC = "+string(VCC)+"V")//collector supply
    voltage
11 disp("RC = "+string(RC)+"ohm")//collector resistance
12 // optimum operating point is half of (VCC/RC)
13 IC = (1/2)*(VCC/RC)
14 disp("IC = VCC/(2*RC) = "+string(IC)+"A")//collector
    current at optimum operating point
15 IB = IC/beta
16 disp("IB = IC/beta = "+string(IB)+"A")//base current
17 //from the closed circuit in the given fig., we have
18 disp("IB*RB = VCC - VBE")
19 RB = (VCC - VBE)/IB
20 disp("RB = (VCC - VBE)/IB = "+string(RB)+"ohm")//
    variable resistance across base-collector as
    given in circuit

```

Scilab code Exa 7.6 Q point for voltage divider base bias circuit

```

1 //Ex7_6
2 clc
3 RC = 2*10^3
4 beta = 100
5 VCC = 9
6 RB = 500*10^3
7 VBE = 0.6
8 disp("RC = "+string(RC)+"ohm")//collector resistance
9 disp("beta = "+string(beta))//current gain
10 disp("VCC = "+string(VCC)+"V")//collector supply
    voltage
11 disp("RB = "+string(RB)+"ohm")//base resistance
12 disp("VBE = "+string(VBE)+"V")//base-emitter voltage
13 IB = (VCC - VBE)/RB
14 disp("IB = (VCC - VBE)/RB = "+string(IB)+"Amp")//
    base current

```



```

15 IC = beta*IB
16 disp("IC = beta*IB = "+string(IC)+"A")//collector
    current
17 VCE = VCC - IC*RC
18 disp("VCE = VCC - IC*RC = "+string(VCE)+"V")//
    collector-emitter voltage
19 disp("operating point is ("+string(VCE)+"V, "+string(
    IC)+"A)")

```

Scilab code Exa 7.7 Q point for self bias circuit

```

1 //Ex7_7
2 clc
3 VCC = 12
4 RB = 300*10^3
5 RC = 1.5*10^3
6 Re = 2*10^3
7 beta = 100
8 disp("VCC = "+string(VCC)+"V")//collector supply
    voltage
9 disp("RB = "+string(RB)+"ohm")//base resistance
10 disp("RC = "+string(RC)+"ohm")//collector resistance
11 disp("Re = "+string(Re)+"ohm")//emitter resistance
12 disp("beta = "+string(beta))//current gain
13 IB = VCC/(RB + beta*Re)
14 disp("IB = VCC/(RB + beta*Re) = "+string(IB)+"A")//
    base current
15 IC = beta*IB
16 disp("IC = beta*IB = "+string(IC)+"A")//collector
    current
17 IE = IB + IC
18 disp("IE = IB + IC = "+string(IE)+"A")//emitter
    current
19 VCE = VCC - IC*RC - IE*Re
20 disp("VCE = VCC - IC*RC - IE*Re = "+string(VCE)+"V")

```

```

//collector-emitter voltage
21 disp("quiescent point is (" +string(VCE)+"V, " +string(
    IC)+"A)")

```

Scilab code Exa 7.8 Operating point and stability factor of silicon transistor

```

1 //Ex7_8
2 clc
3 VCC = 9
4 RC = 3*10^3
5 RB = 500*10^3
6 beta = 100
7 VBE = 0.7
8 disp("VCC = " +string(VCC)+"V") //collector supply
    voltage
9 disp("RC = " +string(RC)+"ohm") //collector resistance
10 disp("RB = " +string(RB)+"ohm") //base resistance
11 disp("beta = " +string(beta)) //current gain
12 disp("VBE = " +string(VBE)+"V") //emitter-base voltage
13 //for a Fixed Bias Circuit;
14 IB = (VCC - VBE)/RB
15 disp("IB = (VCC - VBE)/RB = " +string(IB)+"A") //base
    current
16 IC = beta*IB
17 disp("IC = beta*IB = " +string(IC)+"A") //collector
    current
18 VCE = VCC - IC*RC
19 disp("VCE = VCC - IC*RC = " +string(VCE)+"V") //
    collector-emitter voltage
20 disp("operating point is (" +string(VCE)+"V, " +string(
    IC)+"A)")
21 S = 1+beta
22 disp("S = 1 + beta = " +string(S)) //stability factor
23

```

```

24
25 // NOTE : in the textbook author has taken beta =
      100 for calculation
26 //           but has mention beta = 50 in Question
27 //           I am working with beta = 100.

```

Scilab code Exa 7.9 Operating point and stability factor of self bias circuit

```

1 //Ex7_9
2 clc
3 R1 = 80*10^3
4 R2 = 25*10^3
5 Re = 2*10^3
6 Rc = 2*10^3
7 beta = 100
8 VCC = 12
9 VBE = 0.7
10 disp("R1 = "+string(R1)+"ohm")
11 disp("R2 = "+string(R2)+"ohm")
12 disp("Re = "+string(Re)+"ohm") //emitter resistance
13 disp("Rc = "+string(Rc)+"ohm") //collector resistance
14 disp("beta = "+string(beta)) //current gain
15 disp("VCC = "+string(VCC)+"V") //collector supply
      voltage
16 disp("VBE = "+string(VBE)+"V") //base-emitter voltage
17 Rb = R1*R2/(R1+R2)
18 disp("Rb = R1*R2/(R1+R2) = "+string(Rb)+"ohm") //base
      resistance
19 VB = VCC*(R2/(R1+R2))
20 disp("VB = VCC(R2/(R1+R2)) = "+string(VB)+"V") //base
      voltage
21 IB = (VB - VBE)/(Rb*(1+((1+beta)*(Re/Rb))))
22 disp("IB = (VB - VBE)/(Rb*(1+((1+beta)*(Re/Rb))))")
23 disp("      = "+string(IB)+"A") //base current

```

```

24 IC = beta*IB
25 disp("IC = beta*IB = "+string(IC)+"A")//collector
    current
26 IE = IC
27 VCE = VCC - IC*Rc - IE*Re
28 disp("VCE = VCC - IC*Rc - IE*Re = "+string(VCE)+"V")
    //collector-emitter voltage
29 disp("operating point is ("+string(VCE)+"V, "+string(
    IC)+"A)")
30 S = (1+beta)*[(1+Rb/Re)/(1+beta+Rb/Re)]
31 disp("S = (1+beta)*[(1+Rb/Re)*(1+beta+Rb/Re)] = "+
    string(S))
32 disp("S'' = -(beta/Re)/(1+beta+Rb/Re) = "+string((-
    beta/Re)/(1+beta+Rb/Re)))

```

Scilab code Exa 7.10 Stability factor of self bias circuit

```

1 //Ex7-10
2 clc
3 delta_IC = 0.01*10^-3
4 delta_beta = 5
5 disp("delta_IC = "+string(delta_IC)+"A")//change of
    collector current
6 disp("delta_beta = "+string(delta_beta)+"A")//change
    in current gain
7 disp("S'''' = delta_IC/delta_beta = "+string(
    delta_IC/delta_beta))//stability

```

Scilab code Exa 7.11 Thermal resistance of transistor

```

1 //Ex7-11
2 clc
3 TA = 30

```

```

4 TJ = 48
5 PD = 4
6 TR = (TJ - TA)/PD
7 disp("TA = "+string(TA)+" degreeC") // ambient
  temperature at which transistor is operated
8 disp("TJ = "+string(TJ)+" degreeC") // junction
  temperature
9 disp("PD = "+string(PD)+"W") // dissipated power
10 disp("TR = (TJ - TA)/PD = "+string(TR)+" degreeC/W")
    // thermal resistance

```

Scilab code Exa 7.12 power dissipation of transistor

```

1 // Ex7_12
2 clc
3 TA = 28
4 TJ = 50
5 TR = 10
6 PD = (TJ - TA)/TR
7 disp("TA = "+string(TA)+" degreeC") // ambient
  temperature at which transistor is operated
8 disp("TJ = "+string(TJ)+" degreeC") // junction
  temperature
9 disp("TR = "+string(TR)+" degreeC/W") // thermal
  resistance
10 disp("PD = (TJ - TA)/TR = "+string(PD)+"W") //
    dissipated power

```

Chapter 8

Analysis of transistor Amplifier using Hybrid Equivalent Circuit

Scilab code Exa 8.1 Calculating h parameters

```
1 //Ex8_1
2 clc
3 disp("(a)")
4 Vce=0
5 Ic=2*10^-3
6 Ib=30*10^-6
7 Vbe=50*10^-3
8 disp("Vce = "+string(Vce)+"V")//collector-emitter
   voltage
9 disp("Ic = "+string(Ic)+"A")//collector current
10 disp("Ib = "+string(Ib)+"A")//base current
11 disp("Vbe = "+string(Vbe)+"V")//base-emitter voltage
12 hfe=Ic/Ib
13 disp("hfe = Ic/Ib = "+string(hfe))//current gain in
   CE amplifier
14 hie=Vbe/Ib
15 disp("hie = Vbe/Ib = "+string(hie)+"ohm")//input
```

```

    impedance in CE amplifier
16 disp("(b)")
17 Ib=0
18 Vce=1
19 Vbe=0.3*10^-3
20 Ic=0.1*10^-3
21 disp("Vce = "+string(Vce)+"V")//collector-emitter
    voltage
22 disp("Ic = "+string(Ic)+"A")//collector current
23 disp("Ib = "+string(Ib)+"A")//base current
24 disp("Vbe = "+string(Vbe)+"V")//base-emitter voltage
25 hoe=Ic/Vce
26 disp("hoe = Ic/Vce = "+string(hoe)+"mho")//output
    conductance in CE amplifier
27 hre=Vbe/Vce
28 disp("hre = Vbe/Vce = "+string(hre))//voltage gain
    in CE amplifier
29
30 // note: textbook answers has printing mistake ,
    regaeding hre.

```

Scilab code Exa 8.2 current gain and input resistance

```

1 //Ex8_2
2 clc
3 RL = 8*10^3
4 hie=1.0*10^3
5 hre=2.5*10^-4
6 hfe=50
7 hoe=25*10^-6
8 disp("RL = "+string(RL)+"ohm")//load resistance
9 //h-parameters for CE transistor amplifier are as
    follows:
10 disp("hie = "+string(hie)+"ohm")//input resistance
    of CE transistor

```

```

11 disp(" hre = "+string(hre))//voltage gain of CE
    transistor
12 disp(" hfe = "+string(hfe))//current gain of CE
    transistor
13 disp(" hoe = "+string(hoe)+"mho")//output conductance
    of CE transistor
14 //calculation for current gain:
15 Ai=-hfe/(1+(hoe*RL))
16 disp(" Ai = -hfe/(1+(hoe*RL)) = "+string(Ai))
17 disp(" Ai = "+string(abs(Ai)))
18 //calculation for input resistance:
19 Ri = hie+(hre*Ai*RL)
20 disp(" Ri = hie+(hre*Ai*RL) = "+string(Ri)+"ohm")
21
22 //note : answer in the textbook regarding above
    problem is not accuratly calculated.

```

Scilab code Exa 8.3 current and voltage gain

```

1 //Ex8_3
2 clc
3 RL = 8*10^3
4 Rs= 500
5 hie=1.0*10^3
6 hre=2.5*10^-4
7 hfe=50
8 hoe=25*10^-6
9 disp("RL = "+string(RL)+"ohm")//load resistance
10 disp("Rs = "+string(Rs)+"ohm")//source resistance
11 //h-parameters for CE transistor amplifier are as
    follows:
12 disp(" hie = "+string(hie)+"ohm")//input resistance
    of CE transistor
13 disp(" hre = "+string(hre))//voltage gain of CE
    transistor

```



```

14 disp(" hfe = "+string(hfe))//current gain of CE
    transistor
15 disp(" hoe = "+string(hoe)+"mho")//output conductance
    of CE transistor
16
17 Ai=-hfe/(1+(hoe*RL))
18 disp(" Ai = -hfe/(1+(hoe*RL)) = "+string(Ai))//
    calculation for current gain
19
20 Ri = hie+(hre*Ai*RL)
21 disp(" Ri = hie+(hre*Ai*RL) = "+string(Ri)+"ohm")//
    calculation for input resistance
22
23 Ais=(Ai*Rs)/(Ri+Rs)
24 disp(" Ais = (Ai*Rs)/(Ri+Rs)= "+string(Ais))//current
    gain with source resistance
25
26 Avs = Ai*RL/Ri
27 disp(" Avs = Ai*RL/Ri = "+string(Avs))//voltage gain
    with source resistance
28
29 //note : in the textbook above problem has given two
    values for hie BUT no value for hfe ...
30 //      thus assuming hie=50 as hfe =50, as given
    in the previous example 8_2
31
32 //note : answer in the textbook is not accurately
    calculated.

```

Scilab code Exa 8.4 current and voltage gain and input and output resistance

```

1 //Ex8_4
2 clc
3 RL=5*10^3

```

```

4 Rs=1.2*10^3
5 hre=2.5*10^-4
6 hie=1.1*10^3
7 hfe=100
8 hoe=25*10^-6
9 disp("RL = "+string(RL)+"ohm")//load resistance
10 disp("Rs = "+string(Rs)+"ohm")//source resistance
11 //h-parameters for CE transistor amplifier are as
    follows:
12 disp("hie = "+string(hie)+"ohm")//input resistance
    of CE transistor
13 disp("hre = "+string(hre))//voltage gain of CE
    transistor
14 disp("hfe = "+string(hfe))//current gain of CE
    transistor
15 disp("hoe = "+string(hoe)+"mho")//output conductance
    of CE transistor
16 //calculation for current gain:
17 Ai=-hfe/(1+(hoe*RL))
18 disp("Ai = -hfe/(1+(hoe*RL)) = "+string(abs(Ai)))
19 //calculation for input resistance:
20 Ri = hie+(hre*Ai*RL)
21 disp("Ri = hie+(hre*Ai*RL) = "+string(Ri)+"ohm")
22 //calculation for voltage gain:
23 Av = Ai*RL/Ri
24 disp("Av = Ai*RL/Ri = "+string(Av))
25 //calculation for output resistance:
26 Go=hoe-((hre*hfe)/(hie+Rs))
27 Ro = 1/Go
28 disp("Ro = 1/Go")
29 disp("Go = hoe-((hre*hfe)/(hie+Rs)) = "+string(Go)+"
    mho")
30 disp("Ro = "+string(Ro)+"ohm")
31
32 //note : in the textbook, above problem has given
    two values for "hfe" and no value for "hre"...
33 //      thus assuming value for "hre = 2.5*10^-4"
    as taken in previous example 8_2

```

```

34 //          and "hfe=100"
35
36 //note : in text LOAD RESISTANCE is noted as Rc in
           question , but RL in solution.
37 //          I have work with Load Resistance with
           notification RL.

```

Scilab code Exa 8.5 Amplifier current gain

```

1 //Ex8_5
2 clc
3 RL = 22*10^3
4 hfb=-0.98
5 hob=7.6*10^-7
6 disp("RL = "+string(RL)+"ohm")//load resistance
7 disp("hfb = "+string(hfb))//forward current gain in
           CB amplifier
8 disp("hob = "+string(hob)+"mho")//output conductance
           in CB amplifier
9 Ai = -hfb/(1+(hob*RL))
10 disp("Ai = -hfb/(1+(hob*RL)) = "+string(Ai))//
           current gain

```

Scilab code Exa 8.6 voltage gain of CE amplifier

```

1 //Ex8_6
2 clc
3 hfb = -0.999
4 hib = 50
5 hob = 0.82*10^-6
6 hrb = 4*10^-6
7 RL = 22*10^3
8 disp("RL = "+string(RL)+"ohm")//load impedance

```

```

9 //h-parameters for CB transistor amplifier are as
  follows:
10 disp("hib = "+string(hib)+"ohm")//input resistance
    of CB transistor
11 disp("hrb = "+string(hrb))//voltage gain of CB
    transistor
12 disp("hfb = "+string(hfb))//current gain of CB
    transistor
13 disp("hob = "+string(hob)+"mho")//output conductance
    of CB transistor
14 Av = -(hfb*RL)/((RL*(hib*hob-hfb*hrb))+hib)
15 disp("Av = -(hfb*RL)/((RL*(hib*hob-hfb*hrb))+hib) =
    "+string(Av))//voltage gain
16
17
18 //note : answer provided in the textbook is not
    precised.

```

Scilab code Exa 8.7 current and voltage gain and input and output resistance

```

1 //Ex8_7
2 clc
3 RL = 1.2*10^3
4 //assuming Rs = RL as given in problem
5 Rs = RL
6 //assuming values for h-parameters
7 hie = 1.0*10^3
8 hre=2.5*10^-4
9 hfe = 50
10 hoe = 25*10^-6
11 disp("RL = "+string(RL)+"ohm")//load resistance
12 disp("Rs = RL = "+string(RL)+"ohm")//source
    resistance
13 //h-parameters for CE transistor amplifier are as

```

```

follows :
14 disp(" hie = "+string(hie)+"ohm")//input resistance
    of CE transistor
15 disp(" hre = "+string(hre))//voltage gain of CE
    transistor
16 disp(" hfe = "+string(hfe))//current gain of CE
    transistor
17 disp(" hoe = "+string(hoe)+"mho")//output conductance
    of CE transistor
18 //calculation for current gain:
19 Ai=-hfe/(1+(hoe*RL))
20 disp(" Ai = -hfe/(1+(hoe*RL)) = "+string(Ai))
21 //calculation for input impedance:
22 Ri = hie+(hre*Ai*RL)
23 disp(" Ri = hie+(hre*Ai*RL) = "+string(Ri)+"ohm")
24 //calculation for voltage gain:
25 disp(" Av = Ai*RL/Ri")
26 Av = Ai*RL/Ri
27 disp("      = "+string(Av))
28 //calculation for output impedance:
29 Ro = 1/((hoe - (hfe*hre)/(hie+Rs)))
30 disp(" Ro = 1/((hoe - (hfe*hre)/(hie+Rs)))")
31 disp("      = "+string(Ro)+"ohm")
32 //current gain with source impedance:
33 Ais=(Ai*Rs)/(Ri+Rs)
34 disp(" Ais = (Ai*Rs)/(Ri+Rs)= "+string(Ais))
35 //voltage gain with source impedance:
36 Avs = Av*Ri/(Ri+Rs)
37 disp(" Avs = Av*Ri/(Ri+Rs) = "+string(Avs))
38
39
40
41 // NOTE : calculation in the textbook for the above
    problem is wrong.
42 //      while calculating Ri author has use " hie =
    1.2*10^3" instead of ASSUMED9 value i.e., " hie =
    1.0*10^3"

```

Scilab code Exa 8.8 load resistance of CE transistor

```
1 //Ex8_8
2 clc
3 Ai = -60
4 hfe = 100
5 hoe = 10*10^-6
6 disp(" hfe = "+string(hfe))//forward current gain
7 disp(" hoe = "+string(hoe)+"A/V")//output conductance
8 disp(" Ai = "+string(Ai))//current gain
9 disp("But , ...
10 Ai = -hfe/(1+ hoe*RL)")
11 RL = -(1/hoe)*(1+(hfe/Ai))
12 disp("Thus , ...
13 RL = -(1/hoe)*(1+(hfe/Ai)) = "+string(RL)+"ohm")//
    load resistance
```

Scilab code Exa 8.9 voltage gain of CE amplifier

```
1 //Ex8_9
2 clc
3 Ai = -60
4 Ri = 2.0*10^3
5 RL = 15*10^3
6 disp(" Ai = "+string(Ai))//current gain
7 disp(" Ri = "+string(Ri)+"ohm")//input resistance
8 disp(" RL = "+string(RL)+"ohm")//load resistance
9 Av = Ai*RL/Ri
10 disp("Av = Ai*RL/Ri = "+string(Av))//voltage gain
11
12 //note : in textbook ,
```

```
13 //          author notify LOAD RESISTANCE as 'Rc' in
    question BUT 'RL' in solution.
14 //          I have work with "load resistance notified
    as RL".
```

Scilab code Exa 8.10 current gain of CE amplifier

```
1 //Ex8_10
2 clc
3 Av = -200
4 Ri = 10*10^3
5 RL = 3*10^3
6 Ai = Av*Ri/RL
7 disp("Av = "+string(Av))//voltage gain
8 disp("Ri = "+string(Ri)+"ohm")//input resistance
9 disp("RL = "+string(RL)+"ohm")//load resistance
10 disp("Ai = Av*Ri/RL = "+string(Ai))//current gain
11
12 // note : there are mis-printing in the textbook
    for the above problem regarding formula and
    notations.
13 //          answer in the textbook for above problem
    is wrong.
```

Scilab code Exa 8.11 Input resistance of CE amplifier

```
1 //Ex8_11
2 clc
3 Av = -250
4 Ai = -50
5 RL = 12*10^3
6 disp("Av = "+string(Av))//voltage gain
7 disp("Ai = "+string(Ai))//current gain
```

```
8 disp("RL = "+string(RL)+" ohm")//load resistance
9 Ri = Ai*RL/Av
10 disp("Ri = Ai*RL/Av = "+string(Ri)+" ohm")//input
    resistance
```

Chapter 9

Field Effect Transistor

Scilab code Exa 9.1 Pinch off Voltage

```
1 //Ex9_1
2 clc
3 h = 5*10^-4 //channel height in centimeters
4 a= (1/2)*h //channel width in centimeters
5 rho = 10 //resistivity in ohm_cm
6 sigma = 1/rho //conductivity in mho/cm
7 micro_p = 500 //mobility in cm_sq/Vs
8 apsilent_r = 12 //relative permiability in F/cm of
   silicon
9 apsilent_not=8.854*10^-14 //permiability in vaccum
   in F/cm
10 disp("a = "+string(a)+"cm")
11 disp("sigma = "+string(sigma)+"mho/cm")
12 disp("micro_p = "+string(micro_p)+"cm-sq/Vs")
13 disp("apsilent_r = "+string(apsilent_r)+"F/cm")
14 Vp = (a^2)*sigma/(2*apsilent_r*apsilent_not*micro_p)
   // pinch off voltage for silicon p channel FET
15 disp("Vp = (a^2)*sigma/(2* apsilent_r*apsilent_not*
   micro_p)")
16 disp("Vp = "+string(Vp)+"V")
```

Scilab code Exa 9.2 Impedance and amplification factor

```
1 //Ex9_2
2 clc
3 //calculating for conductance:
4 delta_ID = (4*10^-3)-(2*10^-3)//change in drain
    current in amperes
5 delta_VGS = 3-2//chande in gate-source voltage in
    volts
6 disp("delta_ID = "+string(delta_ID)+"A")
7 disp("delta_VGS = "+string(delta_VGS)+"V")
8 gm = delta_ID/delta_VGS//condutance at VDS =
    constant
9 disp("gm = delta_ID/delta_VGS")
10 disp("gm = "+string(gm)+" mho")
11 //calculating for drain resistance:
12 delta_ID = (3.2-3)*10^-3//change in drain current in
    amperes
13 delta_VDS = (12-8)//change in voltage across drai
    and source
14 disp("delta_ID = "+string(delta_ID)+"A")
15 disp("delta_VDS = "+string(delta_VDS)+"V")
16 rd = delta_VDS/delta_ID
17 disp("rd = delta_VDS/delta_ID")
18 disp("rd = "+string(rd)+" ohm")
19 //calculating for micro:
20 micro = rd*gm//amplification factor
21 disp("micro = rd*gm")
22 disp("micro = "+string(micro))
```

Scilab code Exa 9.3 pinch off voltage

```

1 //Ex9_3
2 clc
3 disp("Vp = (a^2)*sigma/(2*apsilent*micro_p)")//
    piunch off voltage
4 h = 2*10^-4 //channel height in centimeters
5 a= h/2 //channel width in centimeters
6 rho = 1 //resistivity in ohm_cm
7 sigma = 1/rho //conductivity in mho/cm
8 micro_p = 1800 //mobility in cm_sq/Vs
9 apsilent_r = 16 //relative permiability in F/cm of
    germanium
10 apsilent_not=8.854*10^-14 //permiability in vaccum
    in F/cm
11 disp("a = "+string(a)+"cm")
12 disp("rho = "+string(rho)+"ohm-cm")
13 disp("sigma = "+string(sigma)+"mho/cm")
14 disp("micro = "+string(micro_p)+"cm_sq/Vs")
15 disp("apsilent_r = "+string(apsilent_r)+"F/cm")
16 disp("apsilent_not = "+string(apsilent_not)+"F/cm")
17 Vp = (a^2)*sigma/(2*apsilent_r*apsilent_not*micro_p)
    // pinch off voltage for germanium p_channel FET
18 disp("Vp = "+string(Vp)+"V")

```

Scilab code Exa 9.4 Conductance and Resistance

```

1 //Ex9_4
2 clc
3 gm1= 2*10^-3; gm2 =4*10^-3//conductance
4 disp("gm1 = "+string(gm1)+"mho")
5 disp("gm2 = "+string(gm2)+"mho")
6 Effective_gm = gm1+gm2
7 disp("Effective gm = gm1 + gm2 = "+string(
    Effective_gm)+"mho")//resulant conductance
8 rd1 = 20*10^3; rd2 = 30*10^3//resistances
9 Effective_rd = (rd1*rd2)/(rd1+rd2)

```

```

10 disp("rd1 = "+string(rd1)+"ohm")
11 disp("rd2 = "+string(rd2)+"ohm")
12 disp("Effective rd = (rd1*rd2)/(rd1+rd2) = "+string(
    Effective_rd)+"ohm")//resulant resistance

```

Scilab code Exa 9.5 Resistance

```

1 //Ex9_5
2 clc
3 VGS = 4// voltage applied to gate terminal
4 IG = 2*10^-9//current flowing in gate
5 RGS = VGS/IG
6 disp("VGS = "+string(VGS)+"V")
7 disp("IG = "+string(IG)+"A")
8 disp("RGS = VGS/IG = "+string(RGS)+"ohm")//
    resistance btween gate and source

```

Scilab code Exa 9.6 Voltage

```

1 //Ex9_6
2 clc
3 Vp = -4//pinch off voltage
4 ID = 4*10^-3//drain current
5 IDSS = 6*10^-3//maximum drain current
6 disp("Vp = "+string(Vp)+"V")
7 disp("ID = "+string(ID)+"A")
8 disp("IDSS = "+string(IDSS)+"A")
9 VGS = abs(Vp)*((ID/IDSS)^.5-1)
10 disp("VGS = Vp*((ID/IDSS)^.5-1) = "+string(VGS)+"V")
    //voltage across gate and source

```

Scilab code Exa 9.7 Amplification Factor

```
1 //Ex9_7
2 clc
3 //parameters of JFET 1:
4 rd1 = 20*10^3//resistance
5 gm1 = 3*10^-3//conductance
6 disp("rd1 = "+string(rd1)+"ohm")
7 disp("gm1 = "+string(gm1)+"mho")
8 //parameters of JFET 2:
9 rd2 = 40*10^3//resistance
10 gm2 = 4*10^-3//conductance
11 disp("rd2 = "+string(rd2)+"ohm")
12 disp("gm2 = "+string(gm2)+"mho")
13 //the given JFETs are connected in parallel manner
14 micro = [(rd1*rd2*gm1)+(rd1*rd2*gm2)]/(rd1+rd2)
15 disp("micro = (rd1*rd2*gm1)+(rd1*rd2*gm2)/(rd1+rd2)
      = "+string(micro))//amplification factor
```

Scilab code Exa 9.8 Current and Voltage

```
1 //Ex9_8
2 clc
3 //according to the given figure in the textbook for
  problem 8 in chapter 9:
4 VGS = -2//voltage across gate and source
5 IDSS = 6*10^-3//maximum drain current
6 Vp = -6//pinch-off voltage
7 disp("IDSS = "+string(IDSS)+"A")
8 disp("Vp = "+string(Vp)+"V")
9 disp("VGS = "+string(VGS)+"V")
10 ID = IDSS*(1-(VGS/Vp))^2
11 disp("ID = IDSS*(1-(VGS/Vp))^2 = "+string(ID)+"A")//
  drainm current
12 Rd = 2*10^3//drain resistance
```

```

13 VDD = 9//drain voltage
14 VDS = VDD - ID*Rd
15 disp("VDD = "+string(VDD)+"V")//drain voltage
16 disp("Rd = "+string(Rd)+"ohm")//drain resistance
17 disp("VDS = VDD - ID*Rd = "+string(VDS)+"V")//
    voltage across drain and source

```

Scilab code Exa 9.9 Drain Voltage and Current

```

1 //Ex9_9
2 clc
3 Vp = -4//pinch off voltage
4 VGS = -1.5//gate source voltage
5 VDS_minimum = VGS - Vp//minimum VDS for Pinch Off
    voltage
6 disp("Vp = "+string(Vp)+"V")
7 disp("VGS = "+string(VGS)+"V")
8 disp("VDS_minimum = VGS - Vp = "+string(VDS_minimum)
    +"V")
9 IDSS = 6*10^-3//maximum drain current
10 ID = IDSS*(1-(VGS/Vp))^2//drain current at VGS = 0V
11 disp("IDSS = "+string(IDSS)+"A")
12 disp("ID = IDSS*(1-(VGS/Vp))^2 = "+string(ID)+"A")

```

Scilab code Exa 9.10 Drain Current and Voltage

```

1 //Ex9_10
2 clc
3 VGS = -2//voltage across gate and source
4 IDSS = 8*10^-3//maximum drain current
5 Vp = -6//pinch-off voltage
6 disp("IDSS = "+string(IDSS)+"A")
7 disp("Vp = "+string(Vp)+"V")

```

```

8 disp("VGS = "+string(VGS)+"V")
9 ID = IDSS*(1-(VGS/Vp))^2
10 disp("ID = IDSS*(1-(VGS/Vp))^2 = "+string(ID)+"A")//
    drainm current
11 RD = 2*10^3//drain resistance
12 VDD = 12//drain voltage
13 VDS = VDD - ID*RD
14 disp("VDD = "+string(VDD)+"V")//drain voltage
15 disp("RD = "+string(RD)+"ohm")//drain resistance
16 disp("VDS = VDD - ID*RD = "+string(VDS)+"V")//
    voltage across drain and source
17
18 // note : notification used for saturated drain-
    soucre current is given wrong in question i.e.,
    IDS but is right in solution i.e., IDSS.

```

Chapter 10

Feedback Amplifier

Scilab code Exa 10.1 Close loop gain

```
1 //Ex10_1
2 clc
3 Av = 80//voltage gain
4 beta = 0.001//feedback ratio
5 disp("Av = "+string(Av))
6 disp("beta = "+string(beta))
7 Avf = Av/(1+beta*Av)//gain with negative feedback
8 disp("Avf = Av/(1+beta*Av) = "+string(Avf))
```

Scilab code Exa 10.2 Close loop gain and bandwidth

```
1 //Ex10_2
2 clc
3 Av = 50//voltage gain
4 beta = 0.01//feedback ratio
5 BW = 100*10^3//bandwidth
6 disp("Av = "+string(Av))
7 disp("beta = "+string(beta))
```



```

8 disp(" Bandwidth = "+string(BW)+" Hz")
9 Avf = Av/(1+beta*Av)//gain with negative feedback
10 disp(" Avf = Av/(1+beta*Av) = "+string(Avf))
11 BWf = BW*(1+beta*Av)//bandwidth with negative
    feedback
12 disp(" (B.W) f = "+string(BWf)+" Hz")
13
14
15 // note : using variable "BW" instad of "B.W" ... as
    , if using B.W the software takes it as a
    function.
16 // similarly using "BWf" instead of (B.W) f.

```

Scilab code Exa 10.3 Feedback with reduced distortion

```

1 //Ex10_3
2 clc
3 Av = 200// voltage gain
4 D = 0.05// harmonic distortion in amplifier
5 Df = 0.02//final reduced distortion
6 beta = (D/Df-1)/Av//feedback gain
7 disp("Av = "+string(Av))
8 disp("D = "+string(D))
9 disp("Df = "+string(Df))
10 disp("beta = (D/Df - 1)/Av = "+string(beta))
11 disp("beta = "+string(beta*100)+"%")

```

Scilab code Exa 10.4 Change in close loop gain

```

1 //Ex10_4
2 clc
3 Av1 = 100//initial voltage gain
4 beta = 0.001//feedback ratio

```

```

5 disp("Av1 = "+string(Av1))
6 disp("beta = "+string(beta))
7 Af1 = Av1/(1+beta*Av1)//initial gain with negative
  feedback
8 disp("Af1 = Av1/(1+beta*Av1) = "+string(Af1))
9
10 Av2 = 150//final voltage gain
11 beta = 0.001//feedback ratio
12 disp("Av2 = "+string(Av2))
13 disp("beta = "+string(beta))
14 Af2 = Av2/(1+beta*Av2)//final gain with negative
  feedback
15 disp("Af2 = Av2/(1+beta*Av2) = "+string(Af2))
16
17 change_in_gain = Af2 - Af1//required change in gain
18 disp("change in gain required = Af2 - Af1 = "+string
  (change_in_gain))
19 delta_Avf = change_in_gain/Af1
20 disp("delta_Avf = Af2-Af1/Af1 = "+string(delta_Avf)+
  "%")

```

Scilab code Exa 10.5 Open loop gain and feedback ratio

```

1 //Ex10_5
2 clc
3 Av = 40//voltage gain in decibels
4 disp("Av = "+string(Av)+"dB")
5 Av = 10^(Av/20)//voltage gain in V/V
6 disp("Av = "+string(Av))
7 Avf = 20//voltage gain with negative feedback in
  decibels
8 disp("Avf = "+string(Avf)+"dB")
9 Avf = 10^(Avf/20)//voltage gain with negative
  feedback in V/V
10 disp("Avf = "+string(Avf))

```

```

11 beta = ((Av/Avf)-1)/Av//feedback ratio
12 disp("beta = (Av/Avf - 1)/Av = "+string(beta))
13
14
15
16 // note: solution in the textbook for the above
    problem is wrong.

```

Scilab code Exa 10.6 Close loop and bandwidth

```

1 //Ex10_6
2 clc
3 Av = 100//voltage gain
4 beta = 0.05//feedback ratio
5 BW = 400*10^3 //bandwidth
6 disp("Av = "+string(Av))
7 disp("beta = "+string(beta))
8 disp("B.W. = "+string(BW)+"Hz")
9 Af = Av/(1+beta*Av)//gain with negative feedback
10 disp("Af = Av/(1+beta*Av) = "+string(Af))
11 BWf = BW*(1+beta*Av)//bandwidth with negative
    feedback
12 disp("(B.W)f = "+string(BWf)+"Hz")
13
14
15 // note : using variable "BW" instad of "B.W" ... as
    , if using B.W the software takes it as a
    function.
16 // similarly using "BWf" instead of (B.W)f.

```

Scilab code Exa 10.7 Voltage gain and feedback ratio

```

1 //Ex10_7

```

```

2  clc
3  Po = 100//output power
4  RL = 10//load resistance
5  disp("Po = "+string(Po)+"W")
6  disp("RL = "+string(RL)+"ohm")
7  vo = (RL*Po)^0.5//output voltage
8  vi = 2//input voltage
9  disp("vo = (RL*Po)^0.5 = "+string(vo)+"V")
10 disp("vi = "+string(vi)+"V")
11 Av = vo/vi//voltage gain
12 disp("Av = vo/vi = "+string(Av))
13 D = 0.04// harmonic distortion in amplifier
14 Df = 0.0002//distortion after feedback
15 beta = (D/Df-1)/Av//feedback gain
16 disp("D = "+string(D))
17 disp("Df = "+string(Df))
18 disp("beta = (D/Df - 1)/Av = "+string(beta))

```

Scilab code Exa 10.8 Feedback ratio

```

1  //Ex10_8
2  clc
3  BW = 500*10^3//bandwidth
4  A = 200//gain of amplifier
5  BWf = 2*10^6//bandwidth with negative feedback
6  disp("B.W = "+string(BW)+"HZ")
7  disp("A = "+string(A))
8  disp("(B.W)f = "+string(BWf)+"Hz")
9  beta = ((BWf/BW)-1)/A//feedback ratio
10 disp("beta = ((B.W)f/B.W - 1)/A = "+string(beta))
11 disp("beta = "+string(beta*100)+"%")
12
13 // note : using variable "BW" instad of "B.W" ... as
    , if using B.W the software takes it as a
    function .

```

14 // similarly using "Bwf" instead of (B.W)f.

Scilab code Exa 10.9 Gain and 3dB frequency

```
1 //Ex10_9
2 clc
3 A = 150//gain of amplifier
4 beta = 0.05//feedback ratio
5 disp("A = "+string(A))
6 disp("beta = "+string(beta))
7 Af = A/(1+beta*A)//gain with negative feedback
8 disp("Af = A/(1+beta*A) = "+string(Af))
9 fL = 20*10^3//lower 3dB frequency
10 fU = 160*10^3//upper 3dB frequency
11 disp("fL = "+string(fL)+"Hz")
12 disp("fU = "+string(fU)+"Hz")
13 fLf = fL/(1+beta*A)//lower 3dB gain with negative
    feedback
14 disp("fLf = fL/(1+beta*A) = "+string(fLf)+"Hz")
15 fUf = fU*(1+beta*A)//upper 3dB gain with negative
    feedback
16 disp("fUf = fU*(1+beta*A) = "+string(fUf)+"Hz")
```

Scilab code Exa 10.10 Voltage and input and output resistance

```
1 //Ex10_10
2 clc
3 //parameters of emitter follower circuit:
4 hie = 1.1*10^3//input resistance
5 hfe = 80//current gain
6 hoe = 2*10^-5//output conductance
7 Re = 2.2*10^3//emitter resistance
8 disp("hie = "+string(hie)+"ohm")
```

```
9 disp(" hfe = "+string(hfe))
10 disp(" hoe = "+string(hoe)+" mho")
11 disp(" Re = "+string(Re)+" ohm")
12 gm = hfe/hie
13 Rif = hie*(1+gm*Re)//input resistance with feedback
14 disp(" Rif = hie*(1+gm*Re) = "+string(Rif)+" ohm")
15 Rof = hie/(1+hfe)//output resistance with feedback
16 disp(" Rof = hie/(1+hfe) = "+string(Rof)+" ohm")
17 Avf = gm*Re/(1+gm*Re)//voltage gain with negative
    feedback
18 disp(" Avf = gm*Re/(1+gm*Re) = "+string(Avf))
```

Chapter 11

Power Amplifiers

Scilab code Exa 11.1 Efficiency

```
1 //Ex11_1
2 clc
3 VCC = 20//collector voltage
4 RL = 12//load resistance
5 disp("VCC = "+string(VCC)+"V")
6 disp("RL = "+string(RL)+"ohm")
7 Pi_dc = (VCC^2)/(2*RL)//input power
8 disp("Pi(dc) = (VCC^2)/(2*RL) = "+string(Pi_dc)+"W")
9 Po_ac = (VCC^2)/(8*RL)//output power
10 disp("Po_ac = (VCC^2)/(8*RL) = "+string(Po_ac)+"W")
11 eta = Po_ac/Pi_dc//efficiency
12 disp("eta = Po_ac/Pi_dc = "+string(eta*100)+"%")
13
14
15 // note : has modified variables :
16 //         using Po_ac instead of Po(ac)
17 //         and   Pi_dc instead of Pi(dc).
18
19 // note: there is a misprinting in the above problem
20 //         given in the textbook
21 //         author want to ask for efficiency instead
```

of frequency.

Scilab code Exa 11.2 Power Losses

```
1 //Ex11-2
2 clc
3 Po_ac = 64//output power
4 eta = 0.3//efficiency
5 Pi_dc = Po_ac/eta//input power
6 disp("Po_ac = "+string(Po_ac)+"W")
7 disp("eta = "+string(eta))
8 disp("Pi_dc = Po_ac/eta = "+string(Pi_dc)+"W")
9 power_losses = Pi_dc - Po_ac//power losses
10 disp("Power losses = Pi_dc - Po_ac = "+string(
    power_losses)+"W")
11
12 // note : has modified variables :
13 //       using Po_ac instead of Po(ac)
14 //       and Pi_dc instead of Pi(dc).
```

Scilab code Exa 11.3 Second Harmonic Distortion

```
1 //Ex11-3
2 clc
3 VCEmax = 18// highest value for collector emitter
    voltage
4 VCEmin = 2// lowest value for collector emitter
    voltage
5 VQ = 9//operating point voltage
6 disp("VCEmin = "+string(VCEmin)+"V")
7 disp("VCEmax = "+string(VCEmax)+"V")
8 disp("VQ = "+string(VQ)+"V")
```



```

9 D2 = [(1/2)*(VCEmax + VCEmin) - VQ]/(VCEmax - VCEmin
    )*100//second harmonic distortion
10 disp("D2 = [(1/2)*(VCEmax + VCEmin) - VQ]/(VCEmax -
    VCEmin)*100")
11 disp("    =" + string(D2) + "%")
12
13 // note : for above problem there is a misprint for
    the formula given in solution in the textbook

```

Scilab code Exa 11.4 Total Harmonic Distortion

```

1 //Ex11_4
2 clc
3 //according to the given equation for output current,
    we have:
4 I1 = 5.0
5 I2 = 0.9
6 I3 = 0.6
7 I4 = 0.3
8 I5 = 0.01
9 D2 = I2/I1// second harmonic distortion
10 D3 = I3/I1//third harmonic distortion
11 D4 = I4/I1//fourth harmonic distortion
12 D5 = I5/I1//fifth harmonic distortion
13 disp(" I1 = " + string(I1) + "A")
14 disp(" I2 = " + string(I2) + "A")
15 disp(" I3 = " + string(I3) + "A")
16 disp(" I4 = " + string(I4) + "A")
17 disp(" I5 = " + string(I5) + "A")
18 disp(" D2 = I2/I1 = " + string(D2))
19 disp(" D3 = I3/I1 = " + string(D3))
20 disp(" D4 = I4/I1 = " + string(D4))
21 disp(" D5 = I5/I1 = " + string(D5))
22 D = [(D2^2)+(D3^2)+(D4^2)+(D5^2)]^(1/2) //total
    harmonic distortion

```

```
23 disp("D = [(D2^2)+(D3^2)+(D4^2)+(D5^2)]^(1/2) = " +
      string(D*100)+"%")
```

Scilab code Exa 11.5 Amplifier Efficiency

```
1 //Ex11_5
2 clc
3 VCC = 9//collector voltage
4 Vp = 5//output peak voltage
5 VQ = VCC//operating point
6 VCEmax = VQ + Vp// maximum value of collector
  emitter voltage
7 VCEmin = VQ - Vp// minimum value of collector
  emitter voltage
8 disp("VCC = "+string(VCC)+"V")
9 disp("Vp = "+string(Vp)+"V")
10 disp("VQ = VCC = "+string(VQ)+"V")
11 disp("VCEmax = VQ + Vp = "+string(VCEmax)+"V")
12 disp("VCEmin = VQ - Vp = "+string(VCEmin)+"V")
13 eta = 50*[(VCEmax - VCEmin)/(VCEmax + VCEmin)]//
  amplifier efficiency
14 disp("eta = 50*[(VCEmax - VCEmin)/(VCEmax + VCEmin)]
      = "+string(eta)+"%")
```

Scilab code Exa 11.6 Efficiency

```
1 //Ex11_6
2 clc
3 VCC = 20//collector voltage
4 RL = 10//load resistance
5 disp("VCC = "+string(VCC)+"V")
6 disp("RL = "+string(RL)+"ohm")
7 Pi_dc = (VCC^2)/(RL)//input power
```

```

8 disp(" Pi(dc) = (VCC^2)/(RL) = "+string(Pi_dc)+"W")
9 Po_ac = (VCC^2)/(2*RL)//output power
10 disp(" Po_ac = (VCC^2)/(2*RL) = "+string(Po_ac)+"W")
11 eta = Po_ac/Pi_dc//efficiency
12 disp(" eta = Po_ac/Pi_dc = "+string(eta*100)+"%")
13
14
15 // note : has modified variables :
16 //         using Po_ac instead of Po(ac)
17 //         and   Pi_dc instead of Pi(dc).

```

Scilab code Exa 11.7 Turns Ratio

```

1 //Ex11_7
2 clc
3 RL = 3.6*10^3//output impedance of power amplifier
4 RL_dash = 4//resistance of speaker
5 n = (RL/RL_dash)^.5//turns ratio
6 disp("RL = "+string(RL)+"ohm")
7 disp("RL_dash = "+string(RL_dash)+"ohm")
8 disp("n = RL/RL_dash = "+string(n))
9 disp("turn ratio = "+string((numer(n)))+": "+string(
    denom(n)))

```

Scilab code Exa 11.8 Amplifier Efficiency

```

1 //Ex11_8
2 clc
3 VCC = 15//collector voltage
4 Vp = 12//output peak voltage
5 disp("VCC = "+string(VCC)+"V")
6 disp("Vp = "+string(Vp)+"V")
7 eta = 78.5*(Vp/VCC)//amplifier efficiency

```

```
8 disp(" eta = 78.5*(Vp/VCC) = "+string(eta)+"%")
```

Scilab code Exa 11.9 Efficiency

```
1 //Ex11_9
2 clc
3 VCC = 25//collector voltage
4 Vi = 9//inout rms voltage
5 RL = 10//load resistnce
6 Vi_peak = 1.414*Vi//input peak voltage
7 Vo = Vi_peak//output peak voltage
8 Po_ac = (Vo^2)/(2*RL)//output power
9 Io = Vo/RL//output current
10 IC = (2/%pi)*Io//collector current
11 Pi_dc = VCC*IC//input power
12 eta = Po_ac/Pi_dc//efficiency
13 disp("VCC = "+string(VCC)+"V")
14 disp("Vi = "+string(Vi)+"V")
15 disp("RL = "+string(RL)+"ohm")
16 disp("Vi_peak = (2^2)Vi = "+string(Vi_peak)+"V")
17 disp("Vo = Vi_peak = "+string(Vo)+"V")
18 disp("Po_ac = (Vo^2)/(2*RL) = "+string(Po_ac)+"W")
19 disp("Io = Vo/RL = "+string(Io)+"A")
20 disp("IC = (2/%pi)*Io = "+string(IC)+"A")
21 disp("Pi_dc = VCC*IC = "+string(Pi_dc)+"W")
22 disp("eta = Po_ac/Pi_dc = "+string(eta*100)+"%")
```

Scilab code Exa 11.10 Efficiency

```
1 //Ex11_10
2 clc
3 VCC = 18//collector voltage
4 Vp = 15//output peak voltage
```

```

5 RL = 12//load resistnce
6 disp("VCC = "+string(VCC)+"V")
7 disp("Vp = "+string(Vp)+"V")
8 disp("RL = "+string(RL)+"ohm")
9 Ip = Vp/RL//output peak current
10 Idc = (2/%pi)*Ip//input direct current
11 disp("Ip = Vp/RL = "+string(Ip)+"A")
12 disp("Idc = (2/%pi)*Ip = "+string(Idc)+"A")
13 Pi_dc = VCC*Idc//input power
14 disp("Pi_dc = VCC*Idc = "+string(Pi_dc)+"W")
15 Po_ac = (Vp^2)/(2*RL)//output power
16 disp("Po_ac = (Vp^2)/(2*RL) = "+string(Po_ac)+"W")
17 eta = Po_ac/Pi_dc//efficiency
18 disp("eta = Po_ac/Pi_dc = "+string(eta*100)+"%")

```

Scilab code Exa 11.11 Voltage Gain

```

1 //Ex11-11
2 clc
3 Vop_p = 7//peak to peap output voltage
4 Vip_p = 100*10^-3//peak to peap input voltage
5 Av = Vop_p/Vip_p
6 disp("Av = output voltage/input voltage")
7 disp("    = "+string(Av))//voltage gain

```

Scilab code Exa 11.12 Power Gain

```

1 //Ex11-12
2 clc
3 Ai = 50//current gain
4 Av = 70//voltage gain
5 disp("Ai = "+string(Ai))
6 disp("Av = "+string(Av))

```

```
7 Ap = Ai*Av//power gain
8 disp("Ap = Ai*Av = "+string(Ap))
```

Scilab code Exa 11.13 Power Dissipated At Collector Junction

```
1 //Ex11_13
2 clc
3 vc = 9//collector voltage
4 ic = 3*10^-3//collector current
5 Pd = vc*ic//power dissipated at collector junction
6 disp("vc = "+string(vc)+"V")
7 disp("ic = "+string(ic)+"A")
8 disp("Pd = vc*ic = "+string(Pd)+"W")
```

Scilab code Exa 11.14 Power Efficiency

```
1 //Ex11_14
2 clc
3 Pac = 3.2*10^-3//output power
4 Pd = 27*10^-3//power dissipated collector junction
5 P_eta = Pac/Pd//power efficiency
6 disp("Pac = "+string(Pac)+"W")
7 disp("Pd = "+string(Pd)+"W")
8 disp("P_eta = Pac/Pd = "+string(P_eta*100)+"%")
```

Chapter 13

Oscillators

Scilab code Exa 13.1 Feedback fraction to obtain sustained oscillator

```
1 //Ex13_1
2 clc
3 A = 100//amplification gain
4 A_Beta = 1//for sustain oscillation
5 Beta = A_Beta/A//feedback ratio
6 disp("A = "+string(A))
7 disp("A_Beta = "+string(A_Beta))
8 disp("Beta = "+string(Beta))
```

Scilab code Exa 13.2 Frequency of RC phase oscillator

```
1 //Ex13_2
2 clc
3 Rf = 0.5*10^6//feedback resistance
4 Cf = 100*10^-12//capacitance across feedback
5 Rc = 0.5*10^6//critical resistance
6 f0 = 1/[2*%pi*Rf*Cf*(6+4*(Rc/Rf))^(1/2)]//frequency
   of oscillation
```

```

7 disp(" Rf = "+string(Rf)+"ohm")
8 disp(" Cf = "+string(Cf)+"F")
9 disp(" Rc = "+string(Rc)+"ohm")
10 disp(" f0 = 1/[2*pi*Rf*Cf*(6+4*(Rc/Rf))^(1/2)] = "+
      string(f0)+"Hz")

```

Scilab code Exa 13.3 Frequency of Wein Bridge oscillator

```

1 //Ex13_3
2 clc
3 Rf = 1.5*10^6//feedback resistance
4 Cf = 1*10^-9//capacitance across feedback
5 f0 = 1/(2*pi*Rf*Cf)//frequency of oscillation
6 disp(" Rf = "+string(Rf)+"ohm")
7 disp(" Cf = "+string(Cf)+"F")
8 disp(" f0 = 1/(2*pi*Rf*Cf) = "+string(f0)+"Hz")

```

Scilab code Exa 13.4 Feedback factor and frequency of Colpitts oscillator

```

1 //Ex13_4
2 clc
3 C1 = 1*10^-9//capacitance of capacitor 1
4 C2 = 10*10^-9//capacitance of capacitor 2
5 L = 110*10^-6//inductance of inductor
6 beta = C1/C2//feedback factor
7 f0 = ((C1+C2)/(C1*C2*L))^0.5/(2*pi)//operating
      frequency
8 disp(" C1 = "+string(C1)+"F")
9 disp(" C2 = "+string(C2)+"F")
10 disp(" L = "+string(L)+"H")
11 disp(" beta = "+string(beta))

```



```
12 disp("f0 = ((C1+C2)/(C1*C2*L))^.5/(2*pi) = "+string(f0)+"Hz")
13
14 //note : unit given for inductance "L" is wrong in
    the textook for the above question.
```

Chapter 14

Operational Amplifier and Applications

Scilab code Exa 14.1 Common Mode Rejection Ratio

```
1 //Ex14_1
2 clc
3 Ad = 100//differential gain
4 Ac = 0.01//common mode gain
5 CMRR = Ad/Ac//Common Mode Rejection Ratio
6 CMRR_dB = 20*log10(CMRR)//Common Mode Rejection
   Ratio in decibles
7 disp("Ad = "+string(Ad))
8 disp("Ac = "+string(Ac))
9 disp("CMRR = Ad/Ac = "+string(CMRR))
10 disp("CMRR = "+string(CMRR_dB)+" dB")
```

Scilab code Exa 14.2 Common Mode Rejection Ratio

```
1 //Ex14_2
2 clc
```

```

3 CMRR_dB = 100 //Common Mode Rejection Ratio in
  decibles
4 CMRR = 10^(100/20) //CMRR as a ratio
5 disp("CMRR = "+string(CMRR_dB)+"dB")
6 disp("CMRR = 10^(100/20) = "+string(CMRR))

```

Scilab code Exa 14.3 Output Voltage Of Op amp Adder Circuit

```

1 //Ex14_3
2 clc
3 Rf = 10*10^3 //feedback resistance
4 R1 = 10*10^3 //resistance 1
5 R2 = 2*10^3 //resistance 2
6 v1 = 10 //input voltage across resistance 1
7 v2 = 4 //input voltage across resistance 2
8 //note: according to the given fig. in the textbook
  for the question we have:
9
10 vo = -Rf*((v1/R1)+(v2/R2)) //output voltage of adder
  circuit
11 disp("Rf = "+string(Rf)+"ohm")
12 disp("R1 = "+string(R1)+"ohm")
13 disp("R2 = "+string(R2)+"ohm")
14 disp("v1 = "+string(v1)+"V")
15 disp("v2 = "+string(v2)+"V")
16 disp("vo = -Rf*((v1/R1)+(v2/R2)) = "+string(vo)+"V")

```

Scilab code Exa 14.4 Output Voltage Of Op amp Adder Circuit

```

1 //Ex14_4
2 clc
3 Rf = 1*10^3 //feedback resistance
4 R1 = 1*10^3 //resistance 1

```

```

5 R2 = 1*10^3//resistance 2
6 R3 = 1*10^3//resistance 3
7 v1 = 2//input voltage 1
8 v2 = 1//input voltage 2
9 v3 = 3//input voltage 3
10 vo = -Rf*((v1/R1)+(v2/R2)+(v3/R3))//output voltage
    of adder circuit
11 disp(" Rf = "+string(Rf)+"ohm")
12 disp(" R1 = "+string(R1)+"ohm")
13 disp(" R2 = "+string(R2)+"ohm")
14 disp(" R3 = "+string(R3)+"ohm")
15 disp(" v1 = "+string(v1)+"V")
16 disp(" v2 = "+string(v2)+"V")
17 disp(" v3 = "+string(v3)+"V")
18 disp(" vo = -Rf*((v1/R1)+(v2/R2)+(v3/R3)) = "+string(
    vo)+"V")

```

Scilab code Exa 14.7 Designing a close loop op amp

```

1 //Ex14_7
2 clc
3 Af = -20//closed loop gain of op-amp
4 R = 10*10^3//output resistance
5 Rf = -Af*R//feedback resistance
6 disp(" Af = "+string(Af))
7 disp(" R = "+string(R)+"ohm")
8 disp(" Rf = -Af/R = "+string(Rf)+"ohm")

```
