Scilab Textbook Companion for Electrical And Electronic Systems by Neil Storey[1]

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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

Chapter 2

basic electric circuits and components

Scilab code Exa 2.1 Current I

```
clear
//Initialisation
v1=15.8                    //voltage across r1
v2=12.3                    //voltage across r2
r2=220                     //resistance R2 in ohm

//Calculation
v=v1-v2                    //voltage difference across
   the resistor
i=v/r2                     //current in ampere

//Result
printf("\n Current, I = %.1f mA",i*1000)
```

Scilab code Exa 2.2 Calculate I2

```
clear
//Initialisation
i1=10                       //current in amp
i3=3                        //current in amp


//Calculation
i2=i1-i3                       //current in amp

//Result
printf("\n I2 = %d A",i2)
```

Scilab code Exa 2.3 `Calculate V1`

```
clear
//Initialisation
E=12                        //EMF in volt
v2=7                        //volt


//Calculation
v1=E-v2                        //volt

//Result
printf("\n V1 = %d V",v1)
```

Scilab code Exa 2.4 `Calculate P`

```
clear
//Initialisation
i=3                            //current in amp
r=50                           //resistance in ohm

```

```
//Calculation
p=(i**2)*r                                      //power in watt

//Result
printf("\n P = %d W",p)
```

Scilab code Exa 2.5 Calculate R

```
clear
//Initialisation
r1=10                           //resistance in ohm
r2=20                           //resistance in ohm
r3=15                           //resistance in ohm
r4=25                           //resistance in ohm


//Calculation
r=r1+r2+r3+r4                                   //series
   resistance in ohm

//Result
printf("\n R = %d ohm",r)
```

Scilab code Exa 2.6 Calculate R

```
clear
//Initialisation
r1=10                           //resistance in ohm
r2=20                           //resistance in ohm



```

```
//Calculation
r=(r1*r2)*(r1+r2)**-1                              //parallel resistance in ohm

//Result
printf("\n R = %.2f ohm",r)
```

Scilab code Exa 2.7 Calculate V

```
clear
//Initialisation
r1=200                             //resistance in ohm
r2=300                             //resistance in ohm


//Calculation
v=(10*r2)/(r1+r2)                            //resistance in ohm

//Result
printf("\n V = %d V",v)
```

Scilab code Exa 2.8 Calculate V

```
clear
//Initialisation
r1=1*10**3                            //resistance in ohm
r2=500                             //resistance in ohm
v1=15                               //voltage
v2=3                               //voltage

//Calculation
```

```
v=v2+((v1-v2)*((r2)*(r1+r2)**-1))
                                    //resistance in ohm

//Result
printf("\n V = %d V",v)
```

Scilab code Exa 2.9 `Calculate T`

```
clear
//Initialisation
f=50                                 //frequency in herts


//Calculation
t=(1*f**-1)                                //time period


//Result
printf("\n T = %d ms",t*10**3)
```

Chapter 5

signals and data transmission

Scilab code Exa 5.1 An 32 bit word

```
clear
//Initialisation
n=8                                    //8 bit
n2=16                                  //16 bit
n3=32                                  //32 bit

//Calculation
c=2**n                                  //value for 8
   bit
c2=2**n2                                //value for 16
   bit
c3=2**n3                                //value for 32
   bit

//Result
printf("\n An 8-bit word can take 2^8 = %d values\n"
   ,c)

printf("\n An 16-bit word can take 2^16 = %d values\
   n",c2)

```

```
printf("\n An 32-bit word can take 2^32 = %f x 10^9 values\n",c3/10**9)
```

Scilab code Exa 5.2 `An 32 bit word resolution`

```
clear
//Initialisation
n=8                                    //8 bit
n2=16                                  //16 bit
n3=32                                  //32 bit


//Calculation
c=2**n                                  //value for 8 bit
p=(1*c**-1)*100                         //percent
c2=2**n2                                //value for 16 bit
p2=(1*c2**-1)*100                         //percent
c3=2**n3                                //value for 32 bit
p3=(1*c3**-1)*100                         //percent

//Result
printf("\n An 8-bit word resolution = %.2f percent\n",p)

printf("\n An 16-bit word resolution = %.4f percent\n",p2)

printf("\n An 32-bit word resolution = %.9f percent\n",p3)
```

Scilab code Exa 5.5 `Bandwidth`

```
clear
//Initialisation
f1=7000                                //Human Speech Frequency Upper limit in HZ
f2=50                                  //Human Speech Frequency Lower limit in Hz

//Calculation
B=f1-f2                                   //Bandwidth in Hz

//Result
printf("\n Bandwidth = %.1f kHz",B*1000**-1)
```

Chapter 6

amplification

Scilab code Exa 6.1 `Output voltage of and amplifier`

```
clear
//Initialisation
Ri=1000                          //Input Resistance of amplifier in Ohm
Rs=100                          //Output Resistance of sensor in Ohm
Rl=50                          //Load Resistance
Ro=10                         //Output Resistance of amplifier in Ohm
Av=10                          //Voltage gain
Vs=2                            //Sensor voltage

//Calculation
Vi=Ri*Vs*(Rs+Ri)**-1                     //Input Voltage of Amplifier
Vo=Av*Vi*Rl*(Ro+Rl)**-1                     //Output Voltage of Amplifier

//Result
printf("\n Ouput voltage of and amplifier = %.1f V",Vo)
```

Scilab code Exa 6.2 Voltage Gain Av

```
clear
//Initialisation
Vo=15.2                    //Output Voltage of Amplifier
Vi=1.82                    //Input Voltage of Amplifier

//Calculation
Av=Vo/Vi                              //Voltage gain

//Result
printf("\n Voltage Gain, Av = %.2f",Av)
```

Scilab code Exa 6.3 Ouput voltage of and amplifier

```
clear
//Initialisation
Av=10                         //Voltage gain
Vi=2                          //Input Voltage of
   Amplifier
Rl=50                         //Load Resistance
Ro=0                        //Output Resistance of
   amplifier in Ohm


//Calculation
Vo=Av*Vi*Rl/(Ro+Rl)                     //Output Voltage
   of Amplifier

//Result
printf("\n Ouput voltage of and amplifier = %.1f V",
   Vo)
```

Scilab code Exa 6.4 `Output Power Po`

```
clear
//Initialisation
Vo=15.2                                    //Output
   Voltage
Rl=50                                      //Load
   Resistance

//Calculation
Po=(Vo**2)/Rl                                //Output
   Power

//Result
printf("\n Output Power, Po = %.1f W",Po)
```

Scilab code Exa 6.5 `Power Gain Ap`

```
clear
//Initialisation
Vi=1.82                      //Input Voltage of
   Amplifier
Ri=1000                     //Input Resistance of
   amplifier in Ohm
Vo=15.2                      //Output Voltage of
   Amplifier
Rl=50                       //Load Resistance


//Calculation
Pi=(Vi**2)*Ri**-1                 //Input Power in
   Watt
```

```
Po=(Vo**2)*Rl**-1                          //Output Power in
    Watt
Ap=Po/Pi                                    //Power Gain


//Result
printf("\n Power Gain, Ap = %d",Ap)
```

Scilab code Exa 6.6 `Power Gain dB`

```
clear
//
//Initialisation
P=1400                                     //Power gain

//Calculation
pdb=10*log10(P)                            //Power Gain in dB

//Result
printf("\n Power Gain (dB) = %.1f dB",pdb)
```

Chapter 8

operational amplifier

Scilab code Exa 8.3 `Gain`

```
clear
//Initialisation
f=20*10**3                  //bandwidth frequency in KHz

//Calculation
gain=(10**6)/(f)            //gain

//Result
printf("\n Gain = %d",gain)
```

Scilab code Exa 8.4 `Input Resistance`

```
clear
//Initialisation
OG=2*10**5                                //Open Loop Gain
CG=20                                    //Closed Loop
    Gain
OR1=75                                    //Output
    Resistance
```

```
IR1=2*10**6                                  //Input Resistance

//Calculation
AB=OG*CG**-1                                 //factor (1+AB)
OR2=OR1/AB                                   //Output Resistance
IR2=IR1*AB                                   //Input Resistance

//Result
printf("\n Output Resistance = %.1f mOhm\n",OR2*1000)

printf("\n Input Resistance = %d GOhm",IR2*10**-9)
```

Scilab code Exa 8.5 Input Resistance

```
clear
//Initialisation
OG=2*10**5                                   //Open Loop Gain
CG=20                                        //Closed Loop Gain
OR1=75                                       //Output Resistance
IR1=2*10**6                                  //Input Resistance
R1=20*10**3                                  //Resistnce in Ohm
R2=10**3                                     //Resistnce in Ohm

//Calculation
AB=OG*CG**-1                                 //factor (1+AB)
```

```
OR2=OR1*AB**-1                                          //Output Resistance
//the input is connected to a virtual earth point by the resistance R2,
//so the input resistance is equal to R 2 ,
IR2=R2                                          //Input Resistance

//Result
printf("\n Output Resistance = %.1 f mOhm\n",OR2*1000)

printf("\n Input Resistance = %d KOhm",IR2*10**-3)
```

Scilab code Exa 8.6 Input Resistance

```
clear
//Initialisation
OG=2*10**5                                          //Open Loop Gain
CG=1                                          //Closed Loop Gain
OR1=75                                          //Output Resistance
IR1=2*10**6                                          //Input Resistance

//Calculation
AB=OG*CG**-1                                          //factor (1+AB)
OR2=OR1*AB**-1                                          //Output Resistance
IR2=IR1*AB                                          //Input Resistance

//Result
printf("\n Output Resistance = %d uOhm\n",OR2*10**6)

```

```
printf("\n Input Resistance = %d GOhm",IR2*10**-9)
```

Chapter 9

digital electronics

Scilab code Exa 9.8 Decimal Equivalent

```
clear
//Initialization
ni1=11010                    //binary number

//Calculation
ni=ni1
deci = 0
i = 0
while (ni > 0)
      rem = ni-int(ni/10.)*10
      ni = int(ni/10.)
      deci = deci + rem*2**i
      i = i + 1
    end

w=deci                  //calling the function

//Declaration
printf("\n Decimal Equivalent = %f",w)
```

Scilab code Exa 9.9 Binary Equivalent

```
clear
//Initialization
ni=26                    //Decimal number

//Calculation

bini = 0
i = 1
while (ni > 0)
      rem = ni-int(ni/2)*2
      ni = int(ni/2)
      bini = bini + rem*i
      i = i * 10
end
w= bini



//Declaration
printf("\n Binary Equivalent = %d",w)
```

Scilab code Exa 9.10 Decimal equivalent

```
clear
//Initializaton

no=34.6875                //decimal number
n_int = int(no)         // Extract the integral part
n_frac = no-n_int      // Extract the fractional part

```

```
//Calculation

bini = 0
i = 1
ni = n_int
while (ni > 0)
      rem = ni-int(ni/2)*2
      ni = int(ni/2)
      bini = bini + rem*i
      i = i * 10
end

// Function to convert binary fraction to decimal
   fraction
binf = 0
i = 0.1,

nf = n_frac

while (nf > 0)
      nf = nf*2
      rem = int(nf)
      nf = nf-rem
      binf = binf + rem*i
      i = i/10
end



//Result
printf("\n Decimal equivalent of 34.6875 = %.4f",(
   bini+binf))
```

Scilab code Exa 9.11 A013

```
clear
//initialization
n='A013'                    //Hex number

//Calculation
w=hex2dec(n)        //Hex to Decimal Coversion


//Result
printf("\n W = %d",w)
```

Scilab code Exa 9.12 The hexadecimal equivalent of 7046

```
clear
//Variable declaration
n=7046                      //Hex number

//Calculations
h = dec2hex(n)                              //decimal to hex conversion

//Result
printf ("The hexadecimal equivalent of 7046 is %s ",h)
```

Scilab code Exa 9.13 Decimal equivalent

```
clear
//Initializaton

n='f851'                    //Hex Number

//Calculation
```

```

w=hex2dec(n)                    //Hex to Decimal Coversion
w1 =dec2bin(w)


//Result
printf("\n Binary of f851 = %s",(w1))
```

Scilab code Exa 9.14 `hexadecimal equivalent of 111011011000100`

```
clear
//Initialiation
ni1=111011011000100                    //binary number

//Calculation

deci = 0
i = 0
ni=ni1
while (ni > 0)
      rem = ni-int(ni/10.)*10
      ni = int(ni/10.)
      deci = deci + rem*2**i
      i = i + 1
      end
w=deci                  //calling the function
h = dec2hex(w)                              //decimal to hex conversion

//Result
printf("The hexadecimal equivalent of 111011011000100 is %s",h)
```

Chapter 11

measurement of voltages and currents

Scilab code Exa 11.1 Peak to Peak Voltage

```
clear
//Initialisation
t=0.02                         //time period in seconds
   from diagram
v1=7                           //peak voltage from diagram


//Calculation
f=1*t**-1                     //frequency in Hz
v2=2*v1                       // Peak to Peak Voltage

//Result
printf("\n Frequency = %d Hz\n",f)

printf("\n Peak to Peak Voltage = %d V\n",v2)
```

Scilab code Exa 11.2 `Find time`

```
clear
//
//Initialisation
t=0.05                         //time period in seconds
   from diagram
v1=10                           //peak voltage from
   diagram


//Calculation
f1=1*t**-1                     //frequency in Hz
w1=2*%pi*f1             //Angular velocity

//Result
printf("\n %d sin %.1ft Hz\n",v1,w1)
```

Scilab code Exa 11.3 `Calculate v1`

```
clear
//
//Initialisation
t=0.1                          //time period in seconds
   from diagram
v1=10                           //peak voltage from
   diagram
t1=25*10**-3

//Calculation
f1=1*t**-1                     //frequency in Hz
w1=2*%pi*f1             //Angular velocity
phi=-(t1*t**-1)*360          //phase angle

//Result
```

```
printf("\n phi = %d degree",phi)

printf("\n %d sin(%dt%d) Hz\n",v1,w1,phi)
```

Scilab code Exa 11.4 Calculate Pav

```
clear
//
//Initialisation
v1=5                                    //constant 5V
r=10                                    //resistance in Ohm
vrms=5                                  //sine wave of 5 V r.m.s
vp=5                                    //5 V peak

//Calculation
p=(v1**2)*r**-1                         //Power in watts
p2=(vrms**2)*r**-1                      //Power average in watts
a=(vp*sqrt(2)**-1)**2
p3=a*r**-1                              //Power average in watts

//Result
printf("\n (1) P = %.1f W\n",p)

printf("\n (2) Pav = %.1f W\n",p2)

printf("\n (3) Pav = %.2f W\n",p3)
```

Scilab code Exa 11.5 Calculate Resistor

```
clear
//Initialisation
fsd1=50*10**-3                          //full scale
    deflection of ammeter in Ampere
fsd2=1*10**-3                           //full scale
    deflection of moving coil meter in Ampere
Rm=25                                   //resistance of moving
     coil meter in Ohms

//Calculation
Rsm=fsd1*fsd2**-1                       //sensitivity factor
Rsh=Rm*49**-1                           //shunt resistor

//Result
printf("\n Therefore, Resistor = %d mOhm\n",round(
    Rsh*10**3))
```

Scilab code Exa 11.6 Calculate Resistor

```
clear
//Initialisation
fsd1=50                                 //full scale
    deflection of voltmeter in Volts
fsd2=1*10**-3                           //full scale
    deflection of moving coil meter in Ampere
Rm=25                                   //resistance of moving
     coil meter in Ohms

//Calculation
Rsm=fsd1*fsd2**-1
Rse=Rsm-Rm

//Result
printf("\n Rse = %.3f KOhm\n",Rse*10**-3)

```

```
printf("\n Therefore, Resistor ~ %d KOhm\n",round(
    Rse*10**-3))
```

Chapter 12

resistance and dc circuits

Scilab code Exa 12.1 Calculate Magnitude

```
clear
//Initialization
i1=8                                        //current in
   Amp
i2=1                                        //current in Amp
i3=4                                        //current in Amp

//Calculation
i4=i2+i3-i1                                      //current
    in Amp

//Results
printf("\n Magnitude, I4 = %d A",i4)
```

Scilab code Exa 12.2 Calculate V2

```
clear
//Initialization
```

```
e=12                          //EMF source in volt
v1=3                          //node voltage
v3=3                          //node voltage

//Calculation
v2=v1+v3-e                          //node voltage

//Results
printf("\n V2 = %d V",v2)
```

Scilab code Exa 12.5 Voltage V

```
clear
//Initialization
r1=100                         //Resistance in Ohm
r2=200                        //Resistance in Ohm
r3=50                        //Resistance in Ohm
v1=15                        //voltage source
v2=20                        //voltage source

//Calculation
//Considering 15 V as a source & replace the other
   voltage source by its internal resistance,
r11=(r2*r3)*(r2+r3)**-1                     //resistance in
    parallel
v11=v1*(r11/(r1+r11))                      //voltage
//Considering 20 V as a source & replace the other
   voltage source by its internal resistance,
r22=(r1*r3)*(r1+r3)**-1                     //resistance in
    parallel
v22=v2*(r22/(r2+r22))                      //voltage

//output of the original circuit
v33=v11+v22

```

```
//Results
printf("\n Voltage, V = %.2f",v33)
```

Scilab code Exa 12.6 `Output Current I`

```
clear
//Initialization
r1=10                       //Resistance in Ohm
r2=5                       //Resistance in Ohm
v2=5                      //voltage source
i=2                      //current in Amp

//Calculation
//Considering 5 V as a source & replace the current source by its internal resistance,
i1=v2*(r1+r2)**-1                              //current using Ohms law
//Considering current source & replace the voltage source by its internal resistance,
r3=(r1*r2)*(r1+r2)**-1                         //resistance in parallel
v3=i*r3                                    //voltage using Ohms law
i2=v3*r2**-1                              //current using Ohms law
i3=i1+i2                                  //total current

//Results
printf("\n Output Current, I = %.2f A",i3)
```

Chapter 13

capacitance and electric fields

Scilab code Exa 13.1 `Charge q`

```
clear
//Initialization
c=10*10**-6                                  //capacitance
    in Farad
v=10                                         //voltage

//Calculation
q=c*v                                         //charge in
   coulomb

//Results
printf("\n Charge, q = %.1f uC",q*10**6)
```

Scilab code Exa 13.2 `Capacitance C`

```
clear
//Initialization
l=25*10**-3                //length in meter
```

```
b=10*10**-3                    //breadth in meter
d=7*10**-6                    //distance between plates in meter
e=100                          //dielectric constant of material
e0=8.85*10**-12                 //dielectric constant of air

//Calculation
c=(e0*e*l*b)*d**-1              //Capacitance
//Results
printf("\n Capacitance , C = %.1f nF",c*10**9)
```

Scilab code Exa 13.3 `Electric Field Strength E`

```
clear
//Initialization
v=100                                   //voltage
d=10**-5                                //distance in meter

//Calculation
e=v*d**-1                               //Electric Field Strength

//Results
printf("\n Electric Field Strength , E = %d ^7 V/m",round(e*10**-6))
```

Scilab code Exa 13.4 `Calculate D`

```
clear
//Initialization
q=15*10**-6                              //charge in coulomb
a=200*10**-6                             //area
```

```
//Calculation
d=q/a                                   //electric flux
    density

//Results
printf("\n D = %d mC/m^2",d*10**3)
```

Scilab code Exa 13.5 `Calculate C`

```
clear
//Initialization
C1=10*10**-6                            //capacitance in
    Farad
C2=25*10**-6                            //capacitance in
    Farad

//Calculation
C=C1+C2                             //capacitance in Farad

//Results
printf("\n C = %d uF",C*10**6)
```

Scilab code Exa 13.6 `Calculate C`

```
clear
//Initialization
C1=10*10**-6                            //capacitance in
    Farad
C2=25*10**-6                            //capacitance in
    Farad

//Calculation
```

```
C=(C1*C2)/(C1+C2)                    //capacitance in Farad

//Results
printf("\n C = %.2f uF",C*10**6)
```

Scilab code Exa 13.7 Calculate E

```
clear
//Initialization
C1=10*10**-6                  //capacitance in Farad
V=100                         //voltage

//Calculation
E=(0.5)*(C1*V**2)            //Energy stored

//Results
printf("\n E = %.1f mJ",E*10**3)
```

Chapter 14

inductance and magnetic fields

Scilab code Exa 14.1 Magnetic Field Strength H

```
clear
//Initialization
i=5                              //current in ampere
l=0.628                          //circumference


//Calculation
h=i/l                               //magnetic field
   strength

//Results
printf("\n Magnetic Field Strength , H = %.2f A/m",h)
```

Scilab code Exa 14.2 Toal Flux phi

```
clear
//
//Initialization
```

```
i=6                           //current in ampere
n=500                         //turns
l=0.4                         //circumference
uo=4*%pi*10**-7               //epsilon zero constant
a=300*10**-6                  //area

//Calculation
f=n*i                         //Magnetomotive Force
h=f/l                         //magnetic field strength
b=uo*h                        //magnetic induction
phi=b*a                       //flux

//Results
printf("\n (a) Magnetomotive Force, H = %.2f ampere-turns",f)

printf("\n (b) Magnetic Field Strength, H = %.2f A/m",h)

printf("\n (c B = %.2f mT",b*10**3)
printf("\n (d Toal Flux, phi = %.2f uWb",phi*10**6)
```

Scilab code Exa 14.3 `Voltage V`

```
clear
//Initialization
l=10*10**-3                   //inductance in henry
di=3


//Calculation
v=l*di                        //voltage

//Results
```

```
printf("\n Voltage, V = %d mV",v*10**3)
```

Scilab code Exa 14.4 `InductanceL`

```
clear
//
//Initialization
n=400                              //turns
l=200*10**-3                       //circumference
uo=4*%pi*10**-7              //epsilon zero constant
a=30*10**-6                       //area

//Calculation
L=(uo*a*n**2)/l                      //Inductance in henry

//Results
printf("\n Inductance,L = %d uH",L*10**6)
```

Scilab code Exa 14.5 `Inductance in parallelL`

```
clear
//
//Initialization
l1=10                //Inductance in henry
l2=20                //Inductance in henry

//Calculation
ls1=l1+l2                    //Inductance in henry
lp=((l1*l2)*(l1+l2)**-1)      //Inductance in henry
//Results
printf("\n (a) Inductance in series,L = %d uH",ls1)

```

```
printf("\n (b) Inductance in parallel ,L = %.2f uH",
    lp)
```

Scilab code Exa 14.6 `Stored Energy`

```
clear
//
//Initialization
l=10**-2                        //Inductance in henry
i=5                        //current in ampere

//Calculation
s=0.5*l*i**2                 //stored energy

//Results
printf("\n Stored Energy = %d mJ",s*10**3)
```

Chapter 15

alternating voltages and currents

Scilab code Exa 15.1 Reactance Xl

```
clear
//Initialisation
w=1000                          //Angular Frequency
L=10**-3                        //Inductance

//Calculation
Xl=w*L                          //Reactance

//Result
printf("\n Reactance , Xl = %d Ohm",Xl)
```

Scilab code Exa 15.2 Reactance Xl

```
clear
//

```

```
//Initialisation
f=50                      //frequency
C=2*10**-6                //Capacitance

//Calculation
w=2*%pi*f                    //Angular Frequency
Xc=1/(w*C)                    //Reactance

//Result
printf("\n Reactance , Xl = %.2f KOhm",Xc/1000)
```

Scilab code Exa 15.3 `Peak Current IL`

```
clear
//

//Initialisation
f=100                     //frequency
l=25*10**-3                  //Inductance
Vl=5                        //AC Voltage (Sine)

//Calculation
w=2*%pi*f                    //Angular Frequency
Xl=w*l                    //Reactance
Il=Vl*Xl**-1

//Result
printf("\n Peak Current , IL = %d mA",Il*10**3)
```

Scilab code Exa 15.4 `Voltage appear across the capacitor V`

```
clear
//
```

```

//Initialisation
Ic=2                    //sinusoidal Current
C=10*10**-3             //Capacitance
w=25                    //Angular Frequency



//Calculation
Xc=1/(w*C)                          //Reactance
Vc= Ic*Xc                            //Voltage

//Result
printf("\n Voltage appear across the capacitor , V = %d V r.m.s",Vc)
```

Scilab code Exa 15.5 Calculate V

```
clear
//

//Initialisation
I=5                     //sinusoidal Current
R=10                    //Resistance in Ohm
f=50                    //Frequency in Hertz
L=0.025                 //Inductancec in Henry


//Calculation
Vr=I*R                                  //Voltage across resistor
Xl=2*%pi*f*L                        //Reactance
VL= I*Xl                                //Voltage across inductor
V=sqrt((Vr**2)+(VL**2))     //total voltage
```

```
phi=atan(VL*Vr**-1)        //Phase Angle in radians

//Result
printf("\n (a V = %.1f V",V)
printf("\n (b V = %.2f V",phi*180/%pi)
```

Scilab code Exa 15.6 Calculate V

```
clear
//

//Initialisation
R=10**4                    //Resistance in Ohm
f=10**3                    //Frequency in Hertz
C=3*10**-8                 //Capacitance in Farad
V=10                       //Voltage

//Calculation
Xc=1/(2*%pi*f*C)                //Reactance
a=((10**4)**2)+(5.3*10**3)**2
I=sqrt((V**2)/a)               //Current in Amp
Vr=I*R                            //Voltage
Vc=Xc*I                            //Voltage
phi=atan(Vc/Vr)        //Phase Angle in radians

//Result
printf("\n (a) Current , I = %d uA",round(I*10**6))

printf("\n (b V = %.2f V",-phi*180/%pi)
```

Scilab code Exa 15.7 Calculate Z

```
clear
```

```
//

//Initialisation
I=5                         //sinusoidal Current
R=200                        //Resistance in Ohm
f=50                        //Frequency in Hertz
L=400*10**-3                     //Inductancec in Henry
C=50*10**-6                     //Capacitance in Henry

//Calculation
Vr=I*R                               //Voltage across
   resistor
Xl=2*%pi*f*L                      //Reactance
Xc=1/(2*%pi*f*C)                       //Reactance
i=Xl-Xc

//Result
printf("\n Z = %d + j %d Ohms",R,i)
```

Chapter 16

power in ac circuits

Scilab code Exa 16.1 `Active Power P`

```
clear
//

//Initialisation
V=50                          //Voltage
I=5                          //Current in Ampere r.m.s
phase=30                      //in degrees

//Calculation
S=V*I                                 //apparent power
pf=cos(phase*%pi/180)         //power factor
apf=S*pf                               //active power

//Result
printf("\n (a) Apparent power, S = %d VA",S)

printf("\n (b) Power Factor = %.3f",pf)

printf("\n (c) Active Power, P = %.1f",apf)
```

Scilab code Exa 16.2 `Current I`

```
clear
//

//Initialisation
pf=0.75                                  //power factor
S=2000                                   //apparent power in VA
V=240                                     //Voltage in volts

//Calculation
apf=S*pf                                  //active power
sin1=sqrt(1-(pf**2))
Q=S*sin1                                 //Reactive Power
I=S*V**-1                                  //Current
//Result
printf("\n  Apparent Power, P = %d W",S)

printf("\n  Active Power, P = %d W",apf)

printf("\n  Reactive Power, Q = %d var",Q)

printf("\n  Current I = %.2f A",I)
```

Scilab code Exa 16.3 `Current I`

```
clear
//

//Initialisation
pf=0.75                                  //power factor
```

```
S=1500                                    //apparent power in W
V=240                                      //Voltage in volts
P1 = 2000                                  //apparent power
P2 = 1500                                   //active power
Q = 1322                                    //reactive power
I = 8.33                                     //current in amp
f=50                                         //frequency in hertz

//Calculation
Xc=V**2/Q                                 //reactive capacitance
C=1/(Xc*2*%pi*f)                      //capacitance
I=S*V**-1                                        //current
apf=S*pf                                   //active power
//Result
printf("\n  Apparent Power, S = %d W",S)

printf("\n  Active Power, P = %d W",apf)

printf("\n  Reactive Power, Q = %d var",Q)

printf("\n  Current I = %.2f A",I)
```

Chapter 18

transient behaviour

Scilab code Exa 18.1 Calculate v

```
clear
//Initialisation
c=100*10**-6                    //capacitance in farad
r=100*10**3                     //resistance in ohm
v=20                            //volt
t=25                            //time in seconds
e=2.71828                       //mathematical constant

//Calculation
T=c*r                          //time in seconds
v1=v*(1-e**(-t*T**-1))         //volt

//Result
printf("\n v = %.2f V",v1)
```

Scilab code Exa 18.2 Calculate t

```
clear
```

```
//

//Initialisation
l=400*10**-3                    //inductance in henry
i1=300                          //current in milliamp
r=20                            //resistance in ohm
v=15                            //volt
t1=25                            //time in seconds
e=2.71828                       //mathematical constant

//Calculation
T=l/r                          //time in seconds
i=(v*r**-1)*10**3              //current in amp
t2=((log(i/(i-i1)))/(log(e)))*0.02   //expression to find time t

//Result
printf("\n t = %.1f mSec",t2*10**3)
```

Scilab code Exa 18.3 Calculate v

```
clear
//Initialisation
c=20*10**-6                    //capacitance in farad
r=10*10**3                     //resistance in ohm
v=5                            //volt
v2=10                            //volt

//Calculation
T=c*r                          //time in seconds

//Result
printf("\n v = %d - %d*e^(-t/%.1f) V",v2,v,T)
```

Chapter 19

semiconductor diodes

Scilab code Exa 19.1 `Peak Ripple Voltage`

```
clear
//Introduction
i=0.2                   //current in amp
C=0.01                  //Capacitance in farad
t=20*10**-3             //time in sec

//Calculation
dv=i/C                  //change in voltage w.r.t time
v=dv*t                  //peak ripple voltage

//Result
printf("\n Peak Ripple Voltage = %.1f V",v)
```

Scilab code Exa 19.2 `Peak Ripple Voltage`

```
clear
//Introduction
i=0.2                   //current in amp
```

```
C=0.01                      //Capacitance in farad
t=10*10**-3                 //time in sec

//Calculation
dv=i/C                      //change in voltage w.r.t time
v=dv*t                      //peak ripple voltage

//Result
printf("\n Peak Ripple Voltage = %.1f V",v)
```

Chapter 20

field effect transistors

Scilab code Exa 20.1 Low frequency cut off

```
clear
//

//Introduction
gm=2*10**-3
rd=2*10**3                          //resistance in ohm
C=10**-6                            //capacitance in farad
R=10**6                             //resistance in ohm


//Calculation
G=-gm*rd                              //Small signal voltage gain
fc=1/(2*%pi*C*R)                    //frequency in Hz

//Result
printf("\n Small signal voltage gain = %d ",G)

```

```
printf("\n Low frequency cut off = %.2f Hz",fc)
```

Scilab code Exa 20.2 Calculate Rd

```
clear
//

//Introduction
idd=4*10**-3                                    //current in
    ampere
vo=8                                           //voltage
vdd=12                                         //voltage

//Calculation
Rd=vo*(vdd-idd)**-1

//Result
printf("\n Rd = %.2f kOhm",Rd)
```

Chapter 21

bipolar transistors

Scilab code Exa 21.1 Decimal Equivalent

```
clear
//Initialization
ni=11010                    //binary number

//Calculation
deci = 0
i = 0
while ni>0
      rem = ni-int(ni/10.)*10
      ni = int(ni/10.)
      deci = deci + rem*2**i
      i = i + 1

end
//Declaration
printf("\n Decimal Equivalent = %f",deci)
```

Chapter 23

electric motors and generators

Scilab code Exa 23.3 `Output Voltage V`

```
clear
//
//Initialization
vcc=10                          //voltage
vbe=0.7                          //voltage, base-to-
   emitter junction
rb=910*10**3                     //resistance in ohm
hfe=200
rc=2.7*10**3                      //resistance in ohm

//Calculation
ib=(vcc-vbe)/rb                    //base current in
   ampere
ic=hfe*ib                          //collector in current
    in ampere
vo=vcc-(ic*rc)                     //output voltage

//Result
printf("\n Output Current, I = %.2f mA",ic*10**3)

printf("\n Output Voltage, V = %.1f V",vo)
```