Scilab Textbook Companion for Basic Electronics And Linear Circuits by N. N. Bhargava, D. C. Kulshreshtha And S. C. Gupta[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.

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Chapter 1

INTRODUCTION TO ELECTRONICS

Scilab code Exa 1.1 `Resistor Range Calculation using Colour Band Sequence`

```
//Example 1.1
//Program to find Range of a Resistor so as to satisfy manufacturer's Tolerances
//Colour Band Sequence: YELLOW, VIOLET, ORANGE, GOLD
clear;
clc ;
close ;
A=4;//NUMERICAL CODE FOR BAND YELLOW
B=7;//NUMERICAL CODE FOR BAND VIOLET
C=3;//NUMERICAL CODE FOR BAND ORANGE
D=5;//TOLERANCE VALUE FOR BAND GOLD i.e. 5%
//Resistor Value Calculation
R=(A*10+B)*10^C;
//Tolerance Value Calulation
T=D*R/100;
R1=R-T;
R2=R+T;
//Displaying The Results in Command Window
printf("\n\n\t Resistor Value is %f kOhms +- %f
```

```
percent.",R/1000,D);
printf("\n\n\t Resistor Value is %f kOhms +- %f kOhms.",R/1000,T/1000);
printf("\n\n\t Range of Values of the Resistor is %f kOhms & %f kOhms.",R1/1000,R2/1000);
```

Scilab code Exa 1.2 `Resistor Range Calculation using Colour Band Sequence`

```
//Example 1.2
//Program to find Range of a Resistor so as to satisfy manufacturer's Tolerances
//Colour Band Sequence: GRAY, BLUE, GOLD, GOLD
clear;
clc ;
close ;
A=8;//NUMERICAL CODE FOR BAND GRAY
B=6;//NUMERICAL CODE FOR BAND BLUE
C=-1;//NUMERICAL CODE FOR BAND GOLD
D=5;//TOLERANCE VALUE FOR BAND GOLD i.e. 5%
//Resistor Value Calculation
R=(A*10+B)*10^C;
//Tolerance Value Calulation
T=D*R/100;
R1=R-T;
R2=R+T;
//Displaying The Results in Command Window
printf("\n\n\t Resistor Value is %f Ohms +- %f percent.",R,D);
printf("\n\n\t Resistor Value is %f Ohms +- %f Ohms.",R,T);
printf("\n\n\t Range of Values of the Resistor is %f Ohms & %f Ohms.",R1,R2);
```

Chapter 2

CURRENT AND VOLTAGE SOURCES

Scilab code Exa 2.1 Equivalent Current Source Representation

```
//Example 2.1
//Program to Obtain Equivalent Current Source
   Representaion from Given Voltage Source
   Representation
clear;
clc ;
close ;
//Voltage Source or Thevenin's Representaion (Series
    Voltage Source & Resistor)
Vs=2; //Volts
Rs=1; //Ohm
//Current Source or Norton's Representaion (Parallel
    Current Source & Resistor)
Is=Vs/Rs; //Amperes
//Displaying The Results in Command Window
printf("\n\n\t The Short Circuit Current Value is %f
    Amperes.",Is);
printf("\n\n\t The Source Impedence Value is %f Ohm.
   ",Rs);
```

```
printf("\n\n\t The Current Source & Source Impedance
    are connected in Parallel.");
```

Scilab code Exa 2.2 Equivalent Voltage Source Representation

```
//Example 2.2
//Program to Obtain Equivalent Voltage Source
   Representaion from Given Current Source
   Representation
clear;
clc ;
close ;
//Current Source or Norton's Representaion (Parallel
    Current Source & Resistor)
Is=0.2; //Amperes
Zs=100; //Ohms
//Voltage Source or Thevenin's Representaion (Series
    Voltage Source & Resistor)
Vs=Is*Zs; //Volts
//Displaying The Results in Command Window
printf("\n\n\t The Open Circuit Voltage is %f Volts.
   ",Vs);
printf("\n\n\t The Source Impedence Value is %f Ohms
   .",Zs);
printf("\n\n\t The Voltage Source & Source Impedance
    are connected in Series.");
```

Scilab code Exa 2.3 Current Determination using Voltage Source and Current Source

```
//Example 2.3
//Program to Calculate Current in a Branch by Using
   Current Source Representation
```

```
//Verify the Circuit's Result for its equivalence with Voltage Source Representation
clear;
clc ;
close ;
//Given Circuit Data
Is=1.5*10^(-3);//Amperes
Zs=2*10^3; //Ohms
Z1=10*10^3; //Ohms
Z2=40*10^3; //Ohms
//Calculation for Current Source Representation
Zl=Z1*Z2/(Z1+Z2);
I2=Is*Zs/(Zs+Zl);
I4I=I2*Z1/(Z1+Z2);//Using Current Divider Rule
//Calculation for Current Source Representation
Vs=Is*Zs;//Open Circuit Volatge
I=Vs/(Zs+Zl);
I4V=I*Z1/(Z1+Z2);//Using Current Divider Rule
//Displaying The Results in Command Window
printf("\n\n\t The Load Current using Current Source Representaion is I4I = %f Amperes.",I4I);
printf("\n\n\t The Load Current using Voltage Source Representaion is I4V = %f Amperes.",I4V);
if I4I==I4V then
printf("\n\n\t Both Results are Equivalent.");
else
printf("\n\n\t Both Results are Not Equivalent.");
end;
```

Scilab code Exa 2.4 `Output Voltage Determination`

```
//Example 2.4
//Program to Obtain Output Voltage Vo from Given A.C. Equivalent of an Amplifier using a Transistor
clear;
```

```
clc ;
close ;
//Given Circuit Data
//Input Side
Vs=10*10^(-3);//i.e. 10 mV
Rs=1*10^3;//i.e. 1 kOhms
//Output Side
Ro1=20*10^3;//i.e. 20 kOhms
Ro2=2*10^3;//i.e. 2 kOhms
//Calculation
i=Vs/Rs;//Input Current
Io=100*i;//Output Current
Il=Io*Ro1/(Ro1+Ro2);//Using Current Divider Rule
Vo=Il*Ro2;//Output Volatge
//Displaying The Results in Command Window
printf("\n\t The Output Voltage Vo = %f Volts.",Vo);
```

Chapter 4

SEMICONDUCTOR DIODE

Scilab code Exa 4.1 `DC Voltage and PIV Calculation`

```
//Example 4.1
//Program to determine DC Voltage across the load
   and PIV of the Diode
clear;
clc ;
close ;
//Given Circuit Data
Vrms=220; //Volts
n2=1; //Assumption
n1=12*n2; //Turns Ratio
//Calculation
Vp=sqrt(2)*Vrms;//Maximum(Peak) Primary Voltage
Vm=n2*Vp/n1;//Maximum Secondary Voltage
Vdc=Vm/%pi;//DC load Voltage
//Displaying The Results in Command Window
printf("\n\t The DC load Voltage is = %f V .",Vdc);
printf("\n\t The Peak Inverse Voltage(PIV) is = %f V
    .",Vm);
```

Scilab code Exa 4.2 DC Voltage and PIV Calculation

```
//Example 4.2
//Program to determine DC Voltage across the load and PIV of the
//Centre Tap Rectifier and Bridge Rectifier
clear;
clc ;
close ;
//Given Circuit Data
Vrms=220; //Volts
n2=1; //Assumption
n1=12*n2; //Turns Ratio
//Calculation
Vp=sqrt(2)*Vrms;//Maximum(Peak) Primary Voltage
Vm=n2*Vp/n1;//Maximum Secondary Voltage
Vdc=2*Vm/%pi;//DC load Voltage
//Displaying The Results in Command Window
printf("\n\t The DC load Voltage is = %f V .",Vdc);
printf("\n\t The Peak Inverse Voltage(PIV) of Bridge Rectifier is = %f V .",Vm);
printf("\n\t The Peak Inverse Voltage(PIV) of Centre-tap Rectifier is = %f V .",2*Vm);
```

Scilab code Exa 4.3.a Peak Value of Current Calculation

```
//Example 4.3(a)
//Program to determine the Peak Value of Current
clear;
clc ;
close ;
//Given Circuit Data
Rl=1*10^(3);//Ohms
rd=10;//Ohms
Vm=220; //Volts(Peak Value of Voltage)
```

```
//Calculation
Im=Vm/(rd+Rl);//Peak Value of Current
//Displaying The Results in Command Window
printf("\n\t The Peak Value of Current is = %f mA ."
    ,Im/10^(-3));
```

Scilab code Exa 4.3.b DC or Average Value of Current Calculation

```
//Example 4.3(b)
//Program to determine the DC or Average Value of
    Current
clear;
clc ;
close ;
//Given Circuit Data
Rl=1*10^(3);//Ohms
rd=10;//Ohms
Vm=220; //Volts(Peak Value of Voltage)
//Calculation
Im=Vm/(rd+Rl);//Peak Value of Current
Idc=2*Im/%pi;//DC Value of Current
//Displaying The Results in Command Window
printf("\n\t The DC or Average Value of Current is =
    %f mA .",Idc/10^(-3));
```

Scilab code Exa 4.3.c RMS Value of Current Calculation

```
//Example 4.3(c)
//Program to determine the RMS Value of Current
clear;
clc ;
close ;
//Given Circuit Data
```

```
Rl=1*10^(3); //Ohms
rd=10; //Ohms
Vm=220; //Volts(Peak Value of Voltage)
//Calculation
Im=Vm/(rd+Rl);//Peak Value of Current
Irms=Im/sqrt(2);//RMS Value of Current
//Displaying The Results in Command Window
printf("\n\t The RMS Value of Current is = %f mA .",
    Irms/10^(-3));
```

Scilab code Exa 4.3.d `Ripple Factor Determination`

```
//Example 4.3(d)
//Program to determine the Ripple Factor of Centre-
    tap Full Wave Rectifier
clear;
clc ;
close ;
//Given Circuit Data
Rl=1*10^(3); //Ohms
rd=10; //Ohms
Vm=220; //Volts(Peak Value of Voltage)
//Calculation
Im=Vm/(rd+Rl);//Peak Value of Current
Idc=2*Im/%pi;//DC Value of Current
Irms=Im/sqrt(2);//RMS Value of Current
r=sqrt((Irms/Idc)^2-1)//Ripple Factor
//Displaying The Results in Command Window
printf("\n\t The Ripple Factor r = %f .",r);
```

Scilab code Exa 4.3.e `Rectification Efficiency Calculation`

```
//Example 4.3(e)
```

```
//Program to determine the Rectification Efficiency of Centre-tap Full Wave Rectifier
clear;
clc ;
close ;
//Given Circuit Data
Rl=1*10^(3); //Ohms
rd=10; //Ohms
Vm=220; //Volts(Peak Value of Voltage)
//Calculation
Im=Vm/(rd+Rl);//Peak Value of Current
Idc=2*Im/%pi;//DC Value of Current
Irms=Im/sqrt(2);//RMS Value of Current
Pdc=Idc^2*Rl;
Pac=Irms^2*(rd+Rl);
n=Pdc/Pac;//Rectification Efficiency
//Displaying The Results in Command Window
printf("\n\t The Rectification EFficiency n(eeta) = %f percent.",n*100);
```

Scilab code Exa 4.4 Maximum Permissible Current Determination

```
//Example 4.4
//Program to determine Maximum Current the Given Zener Diode can handle
clear;
clc ;
close ;
//Given Circuit Data
Vz=9.1; //Volts
P=364*10^(-3); //Watts
//Calculation
Iz=P/Vz;
//Displaying The Results in Command Window
printf("\n\t The Maximum permissible Current is Iz(
```

```
max) = %f mA .",Iz/10^(-3));
```

Scilab code Exa 4.5 `Capacitance Determination on changing Bias Voltage`

```
//Example 4.5
//Program to determine Capacitance of Varactor Diode if the
//Reverse-Bias Voltage is increased from 4V to 8V
clear;
clc ;
close ;
//Given Circuit Data
Ci=18*10^(-12);//i.e. 18 pF
Vi=4; //Volts
Vf=8; //Volts
//Calculation
K=Ci*sqrt(Vi);
Cf=K/sqrt(Vf);
//Displaying The Results in Command Window
printf("\n\t The Final Value of Capacitance is C = %f pF .",Cf/10^(-12));
```

Chapter 5

TRANSISTORS

Scilab code Exa 5.1 `Collector and Base Currents Calculation`

```
//Example 5.1
//Program to Calculate Collector and Base Currents
clear;
clc ;
close ;
//Given Circuit Data
alpha=0.98; //alpha(dc)
Ico=1*10^(-6); //Ampere
Ie=1*10^(-3); //Ampere
//Calculation
Ic=alpha*Ie+Ico; //Collector Current
Ib=Ie-Ic; //Base Current
//Displaying The Results in Command Window
printf("\n\t The Collector Current is Ic= %f mA .",Ic/10^(-3));
printf("\n\t The Base Current is Ib= %f uA .",Ib/10^(-6));
```

Scilab code Exa 5.2 `Dynamic Input Resistance Determination`

```
//Example 5.2
//Program to Determine Dynamic Input Resistance of the Transistor at //the point: Ie=0.5 mA and Vcb=−10 V.
clear;
clc ;
close ;
//From the Input Characteristics
dIe=(0.7-0.3)*10^(-3); //A
dVeb=(0.7-0.62); //V
//Calculation
ri=dVeb/dIe; //Dynamic Input Resistance at Vcb= −10 V
//Displaying The Results in Command Window
printf("\n\t The Dynamic Input Resistance is ri= %f Ohms .",ri);
```

Scilab code Exa 5.3 `Short Circuit Current Gain Determination`

```
//Example 5.3
//Program to Determine Short Circuit Current Gain of the Transistor
clear;
clc ;
close ;
//Given Data
dIe=1*10^(-3); //A
dIc=0.99*10^(-3); //A
//Calculation
hfb=dIc/dIe; //Short Circuit Current Gain
//Displaying The Results in Command Window
printf("\n\t The Short Circuit Current Gain is alpha or hfb= %f .",hfb);
```

Scilab code Exa 5.4.a Common Base Short Circuit Current Gain Calculation

```
//Example 5.4(a)
//Program to Determine Common Base Short Circuit Current Gain (alpha)
//of the Transistor
clear;
clc ;
close ;
//Given Data
dIe=1*10^(-3); //A
dIc=0.995*10^(-3); //A
//Calculation
alpha=dIc/dIe; //Common Base Short Circuit Current Gain
//Displaying The Results in Command Window
printf("\n\t The Common Base Short Circuit Current Gain is alpha= %f .",alpha);
```

Scilab code Exa 5.4.b Common Emitter Short Circuit Current Gain Calculation

```
//Example 5.4(b)
//Program to Determine Common Emitter Short Circuit Current Gain (beeta)
//of the Transistor
clear;
clc ;
close ;
//Given Data
dIe=1*10^(-3); //A
dIc=0.995*10^(-3); //A
//Calculation
```

```
alpha=dIc/dIe; //Common Base Short Circuit Current Gain
beeta=alpha/(1-alpha); //Common Emitter Short Circuit Current Gain
//Displaying The Results in Command Window
printf("\n\t The Common Emitter Short Circuit Current Gain is beeta= %f .",beeta);
```

Scilab code Exa 5.5 `DC Current Gain in Common Base Configuration`

```
//Example 5.5
//Program to Determine DC Current Gain in Common Base Configuration
clear;
clc ;
close ;
//Given Data
Beeta=100;
//Calculation
Alpha=Beeta/(Beeta+1); //DC Current Gain in Common Base Configuration
//Displaying The Results in Command Window
printf("\n\t The DC Current Gain in Common Base Configuration is Alpha= %f .",Alpha);
```

Scilab code Exa 5.6 `Determination of Dynamic Output Resistance and AC and DC Curre`

```
//Example 5.6
//Refer Figure 5.20 in the Textbook
//Program to Determine the Dynamic Output Resistance,
//DC Current Gain & AC Current Gain from given output characteristics
```

```
clear;
clc ;
close ;
//Given Data
Vce=10; //V
Ib=30*10^(-6); //A
//Calculation from Given Output Characteristics at Ib = 30uA
dVce=(12.5-7.5); //V
dic=(3.7-3.5)*10^(-3); //A
Ic=3.6*10^(-3); //A
ro=dVce/dic; // Dynamic Output Resistance
Beeta_dc=Ic/Ib; // DC Current Gain
Beeta_ac=((4.7-3.6)*10^(-3))/((40-30)*10^(-6));//AC Current Gain, From Graph, Bac=delta(ic)/delta(ib) for given Vce
//Displaying The Results in Command Window
printf("\n\t Dynamic Output Resistance ,ro = %f kOhms",ro/10^(3));
printf("\n\t DC Current Gain ,Bdc = %f ",Beeta_dc);
printf("\n\t AC Current Gain ,Bac = %f ",Beeta_ac);
```

Scilab code Exa 5.7 Q Point Determination

```
//Example 5.7
//Refer Figure 5.27 in the Textbook
//Program to Determine the Q point from given collector characteristics
clear;
clc ;
close ;
//Given Data
Vcc=12; //V
Rc=1*10^(3); //Ohms
Vbb=10.7; //V
```

```
Rb=200*10^(3); //Ohms
Vbe=0.7; //V
//Calculation
Ib=(Vbb-Vbe)/Rb;
//Value of Ib comes out to be 50uA. A dotted Curve is drawn for
//Ib=40uA and Ib=60uA. At the Point of Intersection:
Vce=6; //V
Ic=6*10^(-3); //A
//Displaying The Results in Command Window
printf("\n\t Q point: \n\n\t Ib = %f uA",Ib/10^(-6));
printf("\n\t Vce = %f V",Vce);
printf("\n\t Ic = %f mA",Ic/10^(-3));
```

Scilab code Exa 5.8 Calculation of Dynamic Drain Resistance of JFET

```
//Example 5.8
//Program to Calculate Dynamic Drain Resistance of JFET
clear;
clc ;
close ;
//Given Data
u=80; // Amplification Factor
gm=200*10^(-6); // S, Transconductance
//Calculation
rd=u/gm; //Dynamic Drain Resistance
//Displaying The Results in Command Window
printf("\n\t The Dynamic Drain Resistance of JFET is rd= %f kOhms.",rd/10^(3));
```

Chapter 6

VACUUM TUBES

Scilab code Exa 6.1 Dynamic Plate Resistance of the Diode Determination

```
//Example 6.1
//Program to Plot the Characteristics and
//Determine Dynamic Plate Resistance
clear;
clc ;
close ;
//Given Circuit Data
V=[0 0.5 1 1.5 2]; //V
I=[0 1.6 4 6.7 9.8]; //mA
//Plotting
plot(V,I);
a= gca ();
xlabel ('Plate Voltage (in V)');
ylabel ('Plate Current (in mA)');
title ('STATIC CHARACTERISTIC CURVE OF THE DIODE');
//Calculation
//Values from Characteristic Plot
dVp=0.5; //V
dIp=2.7*10^(-3); //A
```

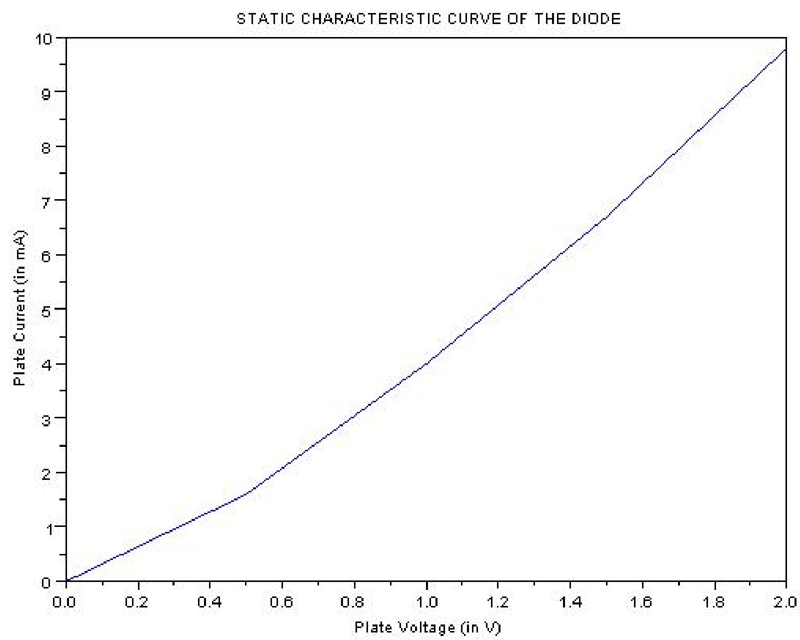

Figure 6.1: Dynamic Plate Resistance of the Diode Determination

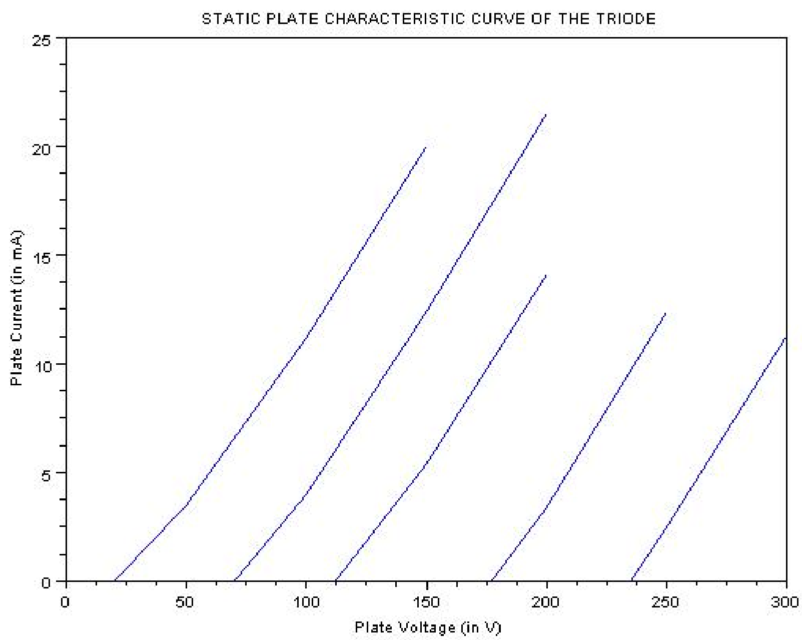

Figure 6.2: Plotting of Static Plate Characteristics

```
rp=dVp/dIp; //Dynamic Plate Resistance
//Displaying The Results in Command Window
printf("\n\t The Dynamic Plate Resistance is rp= %f
   Ohms .",rp);
```

Scilab code Exa 6.2 `Plotting of Static Plate Characteristics`

```
//Example 6.2
//Program to Plot the Static Plate Characteristics
   and Determine //Plate AC Resistance, Mutual
   Conductance & Amplification Factor
```

```
clear;
clc ;
close ;
//Given Circuit Data
//All Values Extrapolated to Touch x-axis
V0=[20 50 100 150]; //V
V1=[70 100 150 200]; //V
V2=[112 150 200]; //V
V3=[177 200 250]; //V
V4=[235 250 300]; //V
I0=[0 3.5 11.2 20]; //mA
I1=[0 4 12.4 21.5]; //mA
I2=[0 5.4 14.1]; //mA
I3=[0 3.4 12.4]; //mA
I4=[0 2.5 11.3]; //mA
//Plotting
plot(V0,I0);
plot(V1,I1);
plot(V2,I2);
plot(V3,I3);
plot(V4,I4);
a= gca ();
xlabel ('Plate Voltage (in V)');
ylabel ('Plate Current (in mA)');
title ('STATIC PLATE CHARACTERISTIC CURVE OF THE TRIODE');
//Calculation
//Values from Characteristic Plot
dip=(14.0-10.7)*10^(-3);//A
dvp=20;//V
rp=dvp/dip;
diP=(12.4-5.3)*10^(-3);//A
dvG=1;//V
gm=diP/dvG;
u=gm*rp;
ut=(192-150)/1;
//Displaying The Results in Command Window
printf("\n\t The Plate AC Resistance is rp= %f kOhms
```

```
    .",rp/10^(3));
printf("\n\t The Mutual Conductance is gm= %f mS .",
    gm/10^(-3));
printf("\n\t The Graphical Amplification Factor is u
    = %f .",u);
printf("\n\t The Theoretical Amplification Factor is
    ut= %f .",ut);
```

Chapter 7

TRANSISTOR BIASING AND STABILIZATION OF OPERATING POINT

Scilab code Exa 7.1 Calculate Ic and Vce for given Circuit

```
//Example 7.1
//Program to Calculate
//(a)Collector Current
//(b)Collector-to-Emitter Voltage
clear;
clc ;
close ;
//Given Circuit Data
Vcc=9; //V
Rb=300*10^3; //Ohms
Rc=2*10^3; //Ohms
Beeta=50;
//Calculation
Ib=(Vcc)/Rb;
Ic=Beeta*Ib;
Icsat=Vcc/Rc;
Vce=Vcc-Ic*Rc;
```

```
//Displaying The Results in Command Window
printf("The different Parameters are \n\t Ib = %f uA .",Ib/10^(-6));
if Ic < Icsat then
  disp("Transistor is not in Saturation");
  printf("\n\t Ic = %f mA .",Ic/10^(-3));
  printf("\n\t Vce = %f V .",Vce);
else
  disp("Transistor is in Saturation");
   printf("\n\t Ic = %f mA .",Icsat/10^(-3));
   printf("\n\t Vce = %f V .",0);
end
```

Scilab code Exa 7.2 `Calculate coordinates of Operating Point`

```
//Example 7.2
//Program to Calculate Operating Point Coordinates of the Circuit
clear;
clc ;
close ;
//Given Circuit Data
Vcc=10; //V
Rb=100*10^3; //Ohms
Rc=1*10^3; //Ohms
Beeta=60;
//Calculation
Ib=(Vcc)/Rb;
Ic=Beeta*Ib;
Icsat=Vcc/Rc;
Vce=Vcc-Ic*Rc;
//Displaying The Results in Command Window
printf("The Operating Point Coordinates of the Circuit are :\n\t Ib = %f uA .",Ib/10^(-6));
if Ic < Icsat then
```

```
  disp("Transistor is not in Saturation");
  printf("\n\t Ic = %f mA .",Ic/10^(-3));
  printf("\n\t Vce = %f V .",Vce);
else
  disp("Transistor is in Saturation");
   printf("\n\t Ic = %f mA .",Icsat/10^(-3));
   printf("\n\t Vce = %f V .",0);
end
```

Scilab code Exa 7.3 `Quiescent Operating Point Determination`

```
//Example 7.3
//Program to Calculate Operating Point Coordinates
   of the Circuit
clear;
clc ;
close ;
//Given Circuit Data
Vcc=10; //V
Rb=100*10^3; //Ohms
Rc=1*10^3; //Ohms
Beeta=150;
//Calculation
Ib=(Vcc)/Rb;
Ic=Beeta*Ib;
Icsat=Vcc/Rc;
Vce=Vcc-Ic*Rc;
//Displaying The Results in Command Window
printf("The Operating Point Coordinates of the
   Circuit are :\n\t Ib = %f uA .",Ib/10^(-6));
if Ic < Icsat then
  disp("Transistor is not in Saturation");
  printf("\n\t Ic = %f mA .",Ic/10^(-3));
  printf("\n\t Vce = %f V .",Vce);
else
```

```
  disp("Transistor is in Saturation");
   printf("\n\t Ic = %f mA .",Icsat/10^(-3));
   printf("\n\t Vce = %f V .",0);
end
```

Scilab code Exa 7.4.a Calculate value of Resistance Rb

```
//Example 7.4 (a)
//Program to Calculate Value of Rb in the Biasing Circuit
clear;
clc ;
close ;
//Given Circuit Data
Vcc=6; //V
Vbe=0.3; //V
Icbo=2*10^(-6); //A
Ic=1*10^(-3); //A
Beeta=20;
//Calculation
//Case 1: Considering Icbo and Vbe in the calculations
Ib=(Ic-(Beeta+1)*Icbo)/Beeta;
Rb1=(Vcc-Vbe)/Ib;
//Case 2: Neglecting Icbo and Vbe in the calculations
Ib=Ic/Beeta;
Rb2=Vcc/Ib;
//Percentage Error
E=(Rb2-Rb1)/Rb1*100;
//Displaying The Results in Command Window
printf("\n\t The Base Resistance is , Rb = %f kOhms .",Rb1/10^3);
printf("\n\t The Base Resistance (Neglecting Icbo and Vbe) is , Rb = %f kOhms .",Rb2/10^3);
```

```
printf("\n\t Percentage Error is = %f percent .",E);
```

Scilab code Exa 7.4.b Calculation of Collector Current Ic

```
//Example 7.4 (b)
//Program to Calculate Rb in the Biasing Circuit
clear;
clc ;
close ;
//Given Circuit Data
Icbo=10*10^(-6); //A
Ib=47.9*10^(-6); //A
Beeta=25;
//Calculation
Ic=Beeta*Ib+(Beeta+1)*Icbo;
//Displaying The Results in Command Window
printf("The Collector Current is :");
printf("\n\t Ic = %f mA .",Ic/10^(-3));
```

Scilab code Exa 7.5 Calculation of Ie and Vc in the Circuit

```
//Example 7.5
//Program to Calculate
//(a)Ie
//(b)Vc
clear;
clc ;
close ;
//Given Circuit Data
Vcc=10; //V
Rc=500; //Ohms
Rb=500*10^3; //Ohms
Beeta=100;
```

```
//Calculation
Ib=Vcc/(Rb+Beeta*Rc);
Ic=Beeta*Ib;
Ie=Ic;
Vce=Vcc-Ic*Rc;
Vc=Vce;
//Displaying The Results in Command Window
printf("The Different Parameters are :");
printf("\n\t Ie = %f mA .",Ie/10^(-3));
printf("\n\t Vc = %f V .",Vc);
```

Scilab code Exa 7.6 Calculate Minimum and Maximum Collector Currents

```
//Example 7.6
//Program to Calculate
//(a)Minimum Collector Current
//(b)Maximum Collector Current
clear;
clc ;
close ;
//Given Circuit Data
Vcc=20; //V
Rc=2*10^3; //Ohms
Rb=200*10^3; //Ohms
Beeta1=50;
Beeta2=200;
//Calculation CASE-1: Minimum Collector Current
Ibmin=Vcc/(Rb+Beeta1*Rc);
Icmin=Beeta1*Ibmin;
//Calculation CASE-2: Maximum Collector Current
Ibmax=Vcc/(Rb+Beeta2*Rc);
Icmax=Beeta2*Ibmax;
//Displaying The Results in Command Window
printf("\n\t The Minimum Collector Current Ic(min) =
    %f mA .",Icmin/10^(-3));
```

```
printf("\n\t The Maximum Collector Current Ic(max) =
    %f mA .",Icmax/10^(-3));
```

Scilab code Exa 7.7 Calculate Values of the three Currents

```
//Example 7.7
//Program to Calculate
//(a)Ib
//(b)Ic
//(c)Ie
clear;
clc ;
close ;
//Given Circuit Data
Vcc=10; //V
Rc=2*10^3; //Ohms
Rb=1*10^6; //Ohms
Re=1*10^3; //Ohms
Beeta=100;
//Calculation
Ib=Vcc/(Rb+(Beeta+1)*Re);
Ic=Beeta*Ib;
Ie=Ic+Ib;
//Displaying The Results in Command Window
printf("\n\t The Collector Current Ic = %f mA .",Ic
   /10^(-3));
printf("\n\t The Base Current Ib = %f uA .",Ib
   /10^(-6));
printf("\n\t The Emitter Current Ie = %f mA .",Ie
   /10^(-3));
```

Scilab code Exa 7.8 Calculate Minimum and Maximum Ie and corresponding Vce

```
//Example 7.8
//Program to Calculate
//(a)Minimum Emitter Current & corresponding Vce
//(b)Maximum Emitter Current & corresponding Vce
clear;
clc ;
close ;
//Given Circuit Data
Vcc=6; //V
Vbe=0.3; //V
Rc=50; //Ohms
Rb=10*10^3; //Ohms
Re=100; //Ohms
Beeta1=50;
Beeta2=200;
//Calculation CASE-1: Minimum Emitter Current &
    corresponding Vce
Iemin=(Vcc-Vbe)*(Beeta1+1)/(Rb+(Beeta1+1)*Re);
Vcemin=Vcc-(Rc+Re)*Iemin;
//Calculatioen CASE-2: Maximum Emitter Current &
    corresponding Vce
Iemax=(Vcc-Vbe)*(Beeta2+1)/(Rb+(Beeta2+1)*Re);
Vcemax=Vcc-(Rc+Re)*Iemax;
//Displaying The Results in Command Window
printf("\n\t The Minimum Emitter Current Ie(min) =
    %f mA .",Iemin/10^(-3));
printf("\n\t The Corresponding Vce = %f V .",Vcemin)
    ;
printf("\n\t The Maximum Emitter Current Ie(max) =
    %f mA .",Iemax/10^(-3));
printf("\n\t The Corresponding Vce = %f V .",Vcemax)
    ;
```

Scilab code Exa 7.9 `Determine the new Q Points`

```
//Example 7.9
//Program to Calculate new Q points for
//Minimum and Maximum value of Beeta
clear;
clc ;
close ;
//Given Circuit Data
Vcc=6; //V
Vbe=0.3; //V
Rc=1*10^3; //Ohms
Rb=10*10^3; //Ohms
Re=100; //Ohms
Beeta1=50;
Beeta2=200;
//Calculation CASE-1: Minimum Emitter Current & corresponding Vce
Iemin=(Vcc-Vbe)*(Beeta1+1)/(Rb+(Beeta1+1)*Re);
Icmin=Iemin;
Vcemin=Vcc-(Rc+Re)*Iemin;
//Calculatioen CASE-2: Maximum Emitter Current & corresponding Vce
Iemax=(Vcc-Vbe)*(Beeta2+1)/(Rb+(Beeta2+1)*Re);
Icmax=Iemax;
Vcemax=Vcc-(Rc+Re)*Iemax;
//Displaying The Results in Command Window
Icsat=Vcc/(Rc+Re);
//Displaying The Results in Command Window
printf("For Beeta=50 :\n\t");
if Icmin < Icsat then
  disp("Transistor is not in Saturation");
  printf("\n\t Ic = %f mA .",Icmin/10^(-3));
  printf("\n\t Vc = %f V .",Vce);
else
  disp("Transistor is in Saturation");
   printf("\n\t Ic(sat) = %f mA .",Icsat/10^(-3));
   printf("\n\t Vc(sat) = %f V .",0);
end
printf("\nFor Beeta=200 :\n\t");
```

```
if Icmax < Icsat then
  disp("Transistor is not in Saturation");
  printf("\n\t Ic = %f mA .",Icmax/10^(-3));
  printf("\n\t Vc = %f V .",Vce);
else
  disp("Transistor is in Saturation");
   printf("\n\t Ic(sat) = %f mA .",Icsat/10^(-3));
   printf("\n\t Vc(sat) = %f V .",0);
end
```

Scilab code Exa 7.10 Calculate the value of Rb

```
//Example 7.10
//Program to Calculate Rb in the Biasing Circuit
clear;
clc ;
close ;
//Given Circuit Data
Vcc=9; //V
Vce=3; //V
Re=500; //Ohms
Ic=8*10^(-3); //A
Beeta=80;
//Calculation
Ib=Ic/Beeta;
Rb=(Vcc-(Beeta+1)*Ib*Re)/Ib;
//Displaying The Results in Command Window
printf("The Base Resistance is :");
printf("\n\t Rb = %f kOhms .",Rb/10^3);
```

Scilab code Exa 7.11 Calculate DC bias Voltages and Currents

```
//Example 7.11
```

```
//Program to Calculate DC Bias Voltages and Currents
clear;
clc ;
close ;
//Given Circuit Data
Vcc=12; //V
Vbe=0.3; //V
R1=40*10^3; //Ohms
R2=5*10^3; //Ohms
Re=1*10^3; //Ohms
Rc=5*10^3; //Ohms
Beeta=60;
//Calculation
Vb=(R2/(R1+R2))*Vcc;
Ve=Vb-Vbe;
Ie=Ve/Re;
Ic=Ie;
Vc=Vcc-Ic*Rc;
Vce=Vc-Ve;
//Displaying The Results in Command Window
printf("The Different Parameters are :");
printf("\n\t Vb = %f V .",Vb);
printf("\n\t Ve = %f V .",Ve);
printf("\n\t Ie = %f mA .",Ie/10^(-3));
printf("\n\t Ic = %f mA .",Ic/10^(-3));
printf("\n\t Vc = %f V .",Vc);
printf("\n\t Vce = %f V .",Vce);
```

Scilab code Exa 7.12 Calculate Re and Vce in the Circuit

```
//Example 7.12
//Program to Calculate Re and Vce of the given
   Circuit Specifications
clear;
clc ;
```

```
close ;
//Given Circuit Data
Vcc=15; //V
R1=200; //Ohms
R2=100; //Ohms
Rc=20; //Ohms
Ic=100*10^(-3); //A
//Calculation
Ie=Ic;
Vb=(R2/(R1+R2))*Vcc;
Ve=Vb;// Neglecting Vbe
Re=Ve/Ie;
Vce=Vcc-(Rc+Re)*Ic;
//Displaying The Results in Command Window
printf("\n\t The Emitter Resistance is Re = %f Ohms.",Re);
printf("\n\t The Collector to Emitter Voltage is Vce = %f V.",Vce);
```

Scilab code Exa 7.13 Calculate Ic and Vce for given Circuit

```
//Example 7.13
///Program to Calculate Ic and Vce of the given Circuit Specifications
clear;
clc ;
close ;
//Given Circuit Data
Vcc=12; //V
Vbe=0.3; //V
R1=40*10^3; //Ohms
R2=5*10^3; //Ohms
Re=1*10^3; //Ohms
Rc=5*10^3; //Ohms
Beeta=60;
```

```
//Calculation
Vth=(R2/(R1+R2))*Vcc;
Rth=R1*R2/(R1+R2);
Ib=(Vth-Vbe)/(Rth+Beeta*Re);
Ic=Beeta*Ib;
Vce=Vcc-Ic*(Rc+Re);
//Displaying The Results in Command Window
printf("The Different Parameters are :");
printf("\n\t Ic = %f mA .",Ic/10^(-3));
printf("\n\t Vce = %f V .",Vce);
```

Scilab code Exa 7.14 Calculate Ic and Vce for given Circuit

```
//Example 7.14
//Program to Calculate
//(a)Ic
//(b)Vce
clear;
clc ;
close ;
//Given Circuit Data
Vcc=12; //V
Vee=15; //V
Rc=5*10^3; //Ohms
Re=10*10^3; //Ohms
Rb=10*10^3; //Ohms
Beeta=100;
//Calculation
Ie=Vee/Re;
Ic=Ie;
Vce=Vcc-Ic*Rc;
//Displaying The Results in Command Window
printf("The Parameters are :");
printf("\n\t Ic = %f mA .",Ic/10^(-3));
printf("\n\t Vce = %f V .",Vce);
```

Chapter 8

SMALL SIGNAL AMPLIFIERS

Scilab code Exa 8.1 `Determination of Hybrid Parameters`

```
//Example 8.1
//Refer Figure 8.15 and 8.16 in the Textbook
//Program to find the Hybrid Parameters from the
   given Transistor Characteristics
clear;
clc ;
close ;
//Given Circuit Data
Ic=2*10^(-3); //A
Vce=8.5; //V
//Calculation
//hfe=delta(ic)/delta(ib),Vce=constant
hfe=(2.7-1.7)*10^(-3)/((20-10)*10^(-6));
//hoe=delta(ic)/delta(Vce),ib=constant
hoe=(2.2-2.1)*10^(-3)/(10-7);
//hie=delta(Vbe)/delta(ib),Vce=constant
hie=(0.73-0.715)/((20-10)*10^(-6));
//hre=delta(Vbe)/delta(Vce),ib=constant
hre=(0.73-0.72)/(20-0);
```

```
//Displaying The Results in Command Window
printf("\n\t The Hybrid Parameters are:");
printf("\n\n\t hfe = %f ",hfe);
printf("\n\t hoe = %f uS",hoe/10^(-6));
printf("\n\t hie = %f kOhms",hie/10^3);
printf("\n\t hre = %f ",hre);
```

Scilab code Exa 8.2.a `Calculation of Input Impedance of Amplifier`

```
//Example 8.2 (a)
//Program to find the Input Impedance of the
    Amplifier
clear;
clc ;
close ;
//Given Circuit Data
ri=2*10^3; //Ohms
Rb=150*10^3; //Ohms
//Calculation
Zin=Rb*ri/(Rb+ri);
//Displaying The Results in Command Window
printf("\n\t The Input Impedance of the Amplifier is
     Zin = %f kOhms .",Zin/10^3);
```

Scilab code Exa 8.2.b `Calculation of Voltage Gain of Amplifier`

```
//Example 8.2 (b)
//Program to find the Voltage Gain of the Amplifier
clear;
clc ;
close ;
//Given Circuit Data
Beeta=100;
```

```
ri=2*10^3; //Ohms
Rac=5*10^3; //Ohms
//Calculation
Av=Beeta*Rac/ri;
//Displaying The Results in Command Window
printf("\n\t The Voltage Gain of the Amplifier is Av = %f with phase of 180 degrees .",Av);
```

Scilab code Exa 8.2.c `Calculation of Current Gain of Amplifier`

```
//Example 8.2 (c)
//Program to find the Current Gain of the Amplifier
clear;
clc ;
close ;
//Given Circuit Data
//Let input Current ib=2A
ib=2 ; //A, Assumption
io=100*ib ;
//Calculation
Ai=io/ib; // Current Gain
//Displaying The Results in Command Window
printf("\n\t The Current Gain of the Amplifier is Ai = %f .",Ai);
```

Scilab code Exa 8.3.a `Calculation of Voltage Gain of Amplifier`

```
//Example 8.3 (a)
//Program to find the Voltage Gain of the Amplifier
clear;
clc ;
close ;
//Given Circuit Data
```

```
Bac=150;
rin=2*10^3; //Ohms
R1=4.7*10^3; //Ohms
R2=12*10^3; //Ohms
//Calculation
Rac=R1*R2/(R1+R2);
Av=Bac*Rac/rin;
//Displaying The Results in Command Window
printf("\n\t The Voltage Gain of the Amplifier is Av
    = %f with phase of 180 degrees .",Av);
```

Scilab code Exa 8.3.b Calculation of Input Impedance of Amplifier

```
//Example 8.3 (b)
//Program to find the Input Impedance of the
   Amplifier
clear;
clc ;
close ;
//Given Circuit Data
rin=2*10^3; //Ohms
R3=75*10^3; //Ohms
R4=7.5*10^3; //Ohms
//Calculation
Zin=R3*R4*rin/(R3*R4+R4*rin+rin*R3);
//Displaying The Results in Command Window
printf("\n\t The Input Impedance of the Amplifier is
    Zin = %f kOhms .",Zin/10^3);
```

Scilab code Exa 8.3.c Calculation of Q Point Parameters of Amplifier

```
//Example 8.3 (c)
//Program to find the Q Point of the Amplifier
```

```
clear;
clc ;
close ;
//Given Circuit Data
Vcc=15; //V
R1=75*10^3; //Ohms
R2=7.5*10^3; //Ohms
Rc=4.7*10^3; //Ohms
Re=1.2*10^3; //Ohms
//Calculation
Vb=Vcc*R2/(R1+R2);
Ve=Vb;
Ie=Ve/Re;
Vce=Vcc-(Rc+Re)*Ie;
//Displaying The Results in Command Window
printf("\n\t The Different Parameters of the
    Amplifier are Ie = %f mA and Vce = %f V .",Ie
    /10^(-3),Vce);
```

Scilab code Exa 8.4 Calculation of Voltage Gain of Amplifier

```
//Example 8.4
//Program to find the Voltage Gain of the Amplifier
clear;
clc ;
close ;
//Given Circuit Data
u=20;
Rl=10*10^3; //Ohms
rp=10*10^3; //Ohms
//Calculation
A=u*Rl/(rp+Rl);
//Displaying The Results in Command Window
printf("\n\t The Voltage Gain of the Amplifier is A
    = %f with phase of 180 degrees .",A);
```

Scilab code Exa 8.5 `Calculation of Gain of Single Stage Amplifier`

```
//Example 8.5
//Program to find the Gain of the Amplifier
clear;
clc ;
close ;
//Given Circuit Data
gm=3000*10^(-6); //S
Rl=22*10^3; //Ohms
rp=300*10^3; //Ohms
//Calculation
//A=-(gm*Rl/(1+(Rl/rp))), For rp>>Rl we get
A=gm*Rl; //with Phase of 180 degrees
//Displaying The Results in Command Window
printf("\n\t The Gain of the Amplifier is A = %f
   with phase of 180 degrees .",A);
```

Scilab code Exa 8.6 `Calculation of Output Signal Voltage of FET Amplifier`

```
//Example 8.6
//Program to find the Output Signal Voltage of the
   Amplifier
clear;
clc ;
close ;
//Given Circuit Data
Rl=12*10^3; //Ohms
Rg=1*10^6; //Ohms
Rs=1*10^3; //Ohms
Cs=25*10^(-6); //F
```

```
u=20;
rd=100*10^3; //Ohms
vi=0.1; //V
f=1*10^3; //Hz
//Calculation
Xcs=1/(2*%pi*f*Cs);
//As Xcs comes out to be much smaller than Rs, Rs is
    completely bypassed
A=u*Rl/(Rl+rd);
vo=A*vi;
//Displaying The Results in Command Window
printf("\n\t The Output Signal Voltage of the
   Amplifier is vo = %f V .",vo);
```

Chapter 9

MULTI STAGE AMPLIFIERS

Scilab code Exa 9.1 Calculate overall Voltage Gain in dB

```
//Example 9.1
//Program to Calculate overall Voltage Gain of a
   Multistage
//Amplifier in dB
clear;
clc ;
close ;
//Given Data
A1=30;
A2=50;
A3=80;
//Calculation
A=A1*A2*A3; //Voltage Gain
Adb=20*log10(A); //Voltage Gain in dB
//Displaying The Results in Command Window
printf("\n\t The overall Voltage Gain of the
   Multistage Amplifier Adb = %f dB",Adb);
```

Scilab code Exa 9.2 Calculate Voltage at the Output Terminal

```
//Example 9.2
//Program to Calculate Voltage at the Output
   Terminal of
//Two Stage Direct Coupled Amplifier
clear;
clc ;
close ;
//Given Data
Vcc=30; //V
Vi=1.4; //V
Vbe=0.7; //V
B=300; //Beeta
R1=27*10^3; //Ohms
R2=680; //Ohms
R3=24*10^3; //Ohms
R4=2.4*10^3; //Ohms
//Calculation
Ve=Vi-Vbe;
Ie1=Vbe/R2;
Ic1=Ie1;
Vc1=Vcc-Ic1*R1;
Vb2=Vc1;
Ve2=Vb2-Vbe;
Ie2=Ve2/R4;
Ic2=Ie2;
Vc2=Vcc-Ic2*R3;
Vo=Vc2;
//Displaying The Results in Command Window
printf("\n\t The Voltage at the Output Terminal of
   Two Stage Direct Coupled Amplifier , Vo = %f V",Vo
   );
```

Scilab code Exa 9.3 `To Plot the Frequency Response Curve`

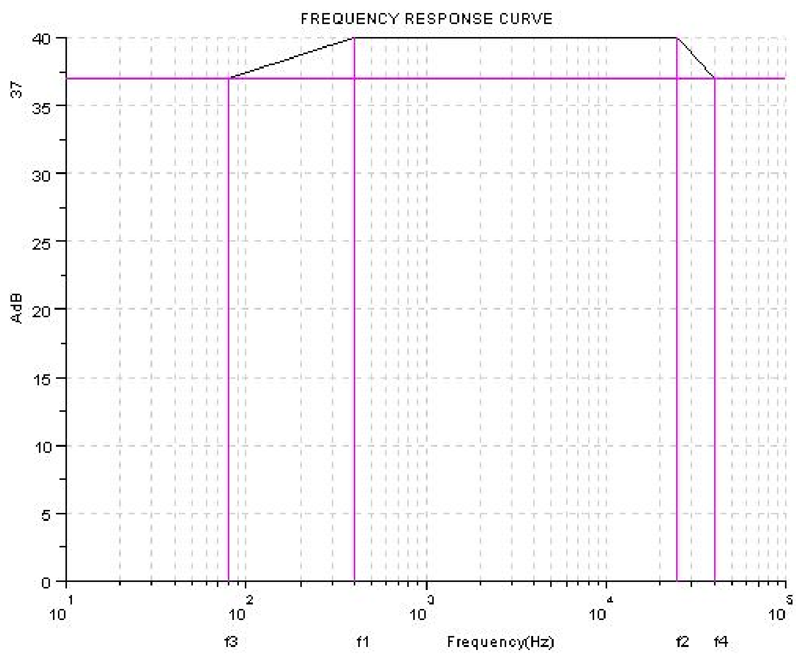

Figure 9.1: To Plot the Frequency Response Curve

```
//Example 9.3
//Program to Calculate Gain in dB at Cutoff Frequencies and
//Plot Frequency Response Curve
clear;
clc ;
close ;
//Given Data
A=100;
f1=400;
f2=25*10^3;
f3=80;
f4=40*10^3;
//Calculation
Adb=20*log10(A);
Adbc=Adb-3; //Lower by 3dB
//Displaying The Results in Command Window
printf("\n\t The Gain at Cutoff Frequencies is, Adb(at Cutoff Frequencies) = %f dB",Adbc);
//Plotting the Frequency Response Curve
x = [f3 f1 f2 f4];
x1= [1 1 1 1];
y = [Adbc Adb Adb Adbc];
gainplot(y,x1);
a = gca();
a.y_location = 'left';
a.x_location = 'bottom';
a.x_label.text = ' f3 f1 Frequency(Hz) f2 f4';
a.y_label.text = ' AdB 37';
a.title.text = 'FREQUENCY RESPONSE CURVE';
plot2d(x,y);
r= [37 37];
q = [10 100000];
```

```
plot2d2(q,r,6);
r2= [37 40 40 37];
q2 = [f3 f1 f2 f4];
plot2d3(q2,r2,6);
```

Scilab code Exa 9.4.a Calculate Input Impedance of Two Stage RC Coupled Amplifier

```
//Example 9.4 (a)
//Program to Calculate Input Impedance of the given
//Two Stage RC Coupled Amplifier
clear;
clc ;
close ;
//Given Data
R1=5.6*10^3; //Ohms
R2=56*10^3; //Ohms
R3=1.1*10^3; //Ohms
//Calculation
Zi=R1*R2*R3/(R1*R2+R2*R3+R3*R1);
//Displaying The Results in Command Window
printf("\n\t The Input Impedance, Zi = %f kOhms ",Zi/10^3);
```

Scilab code Exa 9.4.b Calculate Ouput Impedance of Two Stage RC Coupled Amplifier

```
//Example 9.4 (b)
//Program to Calculate Output Impedance of the given
//Two Stage RC Coupled Amplifier
clear;
clc ;
close ;
//Given Data
Ro1=3.3*10^3; //Ohms
```

```
Ro2=2.2*10^3; //Ohms
//Calculation
Zo=Ro1*Ro2/(Ro1+Ro2);
//Displaying The Results in Command Window
printf("\n\t The Output Impedance, Zo = %f kOhms ",
   Zo/10^3);
```

Scilab code Exa 9.4.c Calculate Voltage Gain of Two Stage RC Coupled Amplifier

```
//Example 9.4 (c)
//Program to Voltage Gain of the given Two Stage RC
   Coupled Amplifier
clear;
clc ;
close ;
//Given Data
Ro1=3.3*10^3; //Ohms
Ro2=2.2*10^3; //Ohms
hfe=120;
hie=1.1*10^3; //Ohms
R1=6.8*10^3; //Ohms
R2=56*10^3; //Ohms
R3=5.6*10^3; //Ohms
R4=1.1*10^3; //Ohms
//Calculation
Rac2=Ro1*Ro2/(Ro1+Ro2);
A2=-hfe*Rac2/hie;
Rac1=R1*R2*R3*R4/(R1*R2*R3+R2*R3*R4+R1*R3*R4+R1*R2*
   R4);
A1=-hfe*Rac1/hie;
A=A1*A2; //Overall Gain
//Displaying The Results in Command Window
printf("\n\t The Overall Gain, A = %f .",A);
```

Scilab code Exa 9.5 Calculate Maximum Voltage Gain and Bandwidth of Triode Amplifi

```
//Example 9.5
//Program to Calculate Maximum Voltage Gain & Bandwidth
clear;
clc ;
close ;
//Given Data
Rl=10*10^3; //Ohms
Rg=470*10^3; //Ohms
Cs=100*10^(-12); //F
u=25;
rp=8*10^3; //Ohms
Cc=0.01*10^(-6); //F
//Calculation
gm=u/rp;
Req=rp*Rl*Rg/(rp*Rl+Rl*Rg+Rg*rp);
Avm=gm*Req;
Avmd=Avm^2; // Voltage Gain of Two Stages
Rd=(rp*Rl/(rp+Rl))+Rg;
f1=1/(2*%pi*Cc*Rd); //Lower Cutoff Frequency
f1d=f1/sqrt(sqrt(2)-1); //Lower Cutoff Frequency of Two Stages
f2=1/(2*%pi*Cs*Req); //Upper Cutoff Frequency
f2d=f2*sqrt(sqrt(2)-1); //Upper Cutoff Frequency of Two Stages
BW=f2d-f1d; //Bandwidth
//Displaying The Results in Command Window
printf("\n\t The Voltage Gain of Two Stages , Avmd = %f ",Avmd);
printf("\n\t The Bandwidth , BW = %f kHz",BW/10^3);
```

Chapter 10

POWER AMPLIFIERS

Scilab code Exa 10.1 Calculation of Transformer Turns Ratio

```
//Example 10.1
//Program to Determine the Transformer Turns Ratio
clear;
clc ;
close ;
//Given Circuit Data
RL=16;// Ohms
RLd=10*10^3;// Ohms
//Calculation
N12=sqrt(RLd/RL);//N12=N1/N2
//Displaying The Results in Command Window
printf("\n\t The Transformer Turns Ratio is N1/N2 =
    %d:%d .",N12,1);
```

Scilab code Exa 10.2 Calculation of Effective Resistance seen at Primary

```
//Example 10.2
//Program to Determine the Effective Resistance seen
    looking into
```

```
//the Primary
clear;
clc ;
close ;
//Given Circuit Data
Rl=8; //Ohms
N12=15; //N12=N1/N2
//Calculation
Rld=(N12)^2*Rl;
//Displaying The Results in Command Window
printf("\n\t The Effective Resistance seen looking
   into the Primary, Rld = %f kOhms .",Rld/10^3);
```

Scilab code Exa 10.3.a Calculation of 2nd 3rd and 4th Harmonic Distortions

```
//Example 10.3(a)
//Program to Determine the Second, Third & Fourth
   Harmonic Distortions
clear;
clc ;
close ;
//Given Circuit Data
//io=15*sin(600*t)+1.5*sin(1200*t)+1.2*sin(1800*t)
   +0.5*sin(2400*t)
I1=15;
I2=1.5;
I3=1.2;
I4=0.5;
//Calculation
D2=(I2/I1)*100;
D3=(I3/I1)*100;
D4=(I4/I1)*100;
//Displaying The Results in Command Window
printf("\n\t The Second Harmonic Distortion is, D2 =
    %f percent .",D2);
```

```
printf("\n\t The Third  Harmonic Distortion is , D3 =
    %f percent .",D3);
printf("\n\t The Fourth Harmonic Distortion is , D4 =
    %f percent .",D4);
```

Scilab code Exa 10.3.b `Percentage Increase in Power because of Distortion`

```
//Example 10.3(b)
//Program to Determine the Percentage Increase in
   Power because of Distortion
clear;
clc ;
close ;
P1=poly(0,"P1");
//Given Circuit Data
//io=15*sin(600*t)+1.5*sin(1200*t)+1.2*sin(1800*t)
   +0.5*sin(2400*t)
I1=15;
I2=1.5;
I3=1.2;
I4=0.5;
//Calculation
D2=(I2/I1)*100;
D3=(I3/I1)*100;
D4=(I4/I1)*100;
D=sqrt(D2^2+D3^2+D4^2);//Distortion Factor
P=(1+(D/100)^2)*P1;
Pi=((P-P1)/P1)*100;
//Displaying The Results in Command Window
disp(Pi,"The Percentage Increase in Power because of
    Distortion is , Pi (in percent)= ");
```

Chapter 11

TUNED VOLTAGE AMPLIFIERS

Scilab code Exa 11.1.a `Calculation of Resonant Frequency`

```
//Example 11.1 (a)
//Program to Calculate Resonant Frequency of the
   given Circuit
clear;
clc ;
close ;
//Given Circuit Data
C=300*10^(-12); //F
L=220*10^(-6); //H
R=20; //Ohms
//Calculation
fr=1/(2*%pi*sqrt(L*C));
//Displaying The Results in Command Window
printf("\n\t The Resonant Frequency , fr = %f kHz .",
   fr/10^3);
```

Scilab code Exa 11.1.b `Calculation of Impedance at Resonance`

```
//Example 11.1 (b)
//Program to Calculate Impedance at Resonance of the
    given Circuit
clear;
clc ;
close ;
//Given Circuit Data
C=300*10^(-12); //F
L=220*10^(-6); //H
R=20; //Ohms
//Calculation
Rr=R;
//Displaying The Results in Command Window
printf("\n\t The Impedance at Resonance, Rr = %f
    Ohms .",Rr);
```

Scilab code Exa 11.1.c `Calculation of Current at Resonance`

```
//Example 11.1 (c)
//Program to Calculate the Current at Resonance of
    the given Circuit
clear;
clc ;
close ;
//Given Circuit Data
V=10; //V
C=300*10^(-12); //F
L=220*10^(-6); //H
R=20; //Ohms
//Calculation
I=V/R;
//Displaying The Results in Command Window
printf("\n\t The Current at Resonance, I = %f A .",I
```

```
);
```

Scilab code Exa 11.1.d Calculation of Voltage across each Component

```
//Example 11.1 (d)
//Program to Calculate the Voltage across each
   Component of the given Circuit
clear;
clc ;
close ;
//Given Circuit Data
V=10; //V
C=300*10^(-12); //F
L=220*10^(-6); //H
R=20; //Ohms
//Calculation
fr=1/(2*%pi*sqrt(L*C));
I=V/R;
Xl=2*%pi*fr*L;
Vl=I*Xl;
Xc=1/(2*%pi*fr*C);
Vc=I*Xc;
Vr=I*R;
//Displaying The Results in Command Window
printf("\n\t Voltage across the Inductance, Vl = %f
   V .",Vl);
printf("\n\t Voltage across the Capacitance, Vc = %f
    V .",Vc);
printf("\n\t Voltage across the Resistance, Vr = %f
   V .",Vr);
```

Scilab code Exa 11.2 Calculation of Parameters of the Resonant Circuit at Resonanc

```
//Example 11.2
//Program to Calculate fr, Il, Ic, Line Current & Impedance of
//the Resonant Circuit at Resonance
clear;
clc ;
close ;
//Given Circuit Data
C=100*10^(-12); //F
L=100*10^(-6); //H
R=10; //Ohms
V=100; //V
//Calculation
fr=1/(2*%pi*sqrt(L*C));
Xl=2*%pi*fr*L;
Il=V/Xl;
Xc=1/(2*%pi*fr*C);
Ic=V/Xc;
Zp=L/(R*C);
I=V/Zp;
//Displaying The Results in Command Window
printf("\n\t The Calculated Values are :");
printf("\n\t fr= %f kHz.",fr/10^3);
printf("\n\t Il= %f A.",Il);
printf("\n\t Ic= %f A.",Ic);
printf("\n\t Zp= %f Ohms .",Zp);
printf("\n\t I= %f mA.",I/10^(-3));
```

Scilab code Exa 11.3 Calculation of Impedance Q and Bandwidth of Resonant Circuit

```
//Example 11.3
//Program to Calculate Impedance, Q and Bandwidth of the
//Resonant Circuit
clear;
```

```
clc ;
close ;
//Given Circuit Data
C=100*10^(-12); //F
L=150*10^(-6); //H
R=15; //Ohms
//Calculation
fr=1/(2*%pi*sqrt(L*C));
Zp=L/(R*C);
Q=2*%pi*fr*L/R;
df=fr/Q; //Bandwidth
//Displaying The Results in Command Window
printf("\n\t The Calculated Values are :");
printf("\n\t Impedance, Zp= %f kOhms.",Zp/10^3);
printf("\n\t Quality Factor, Q= %f .",Q);
printf("\n\t Bandwidth, df= %f kHz .",df/10^3);
```

Chapter 12

FEEDBACK IN AMPLIFIERS

Scilab code Exa 12.1 Calculation of Gain of Negative Feedback Amplifier

```
//Example 12.1
//Program to Calculate the Gain of a Negative
   Feedback Amplifier with
//Given Specifications
clear;
clc ;
close ;
//Given Circuit Data
A=100; //Internal Gain
B=1/10; //Feedback Factor
//Calculation
Af=A/(1+A*B);
//Displaying The Results in Command Window
printf("\n\t The Value of the Gain of Feedback
   Amplifier is , Af = %f .",Af);
```

Scilab code Exa 12.2 Calculation of Internal Gain and Feedback Gain

```
//Example 12.2
//Program to Calculate the A(Internal Gain) and Beeta(Feedback Gain) of //a Negative Feedback Amplifier with given Specifications
clear;
clc ;
close ;
//Given Circuit Data
Af=100; //Voltage Gain
Vin=50*10^(-3); //V , Input Signal without Feedaback Gain
Vi=0.6; //V , Input Signal with Feedaback Gain
//Calculation
Vo=Af*Vi;
A=Vo/Vin;
B=((A/Af)-1)/A;
//Displaying The Results in Command Window
printf("\n\t The Value of the Internal Gain A is , A = %f .",A);
printf("\n\t The Value of the Feedback Gain B is , B = %f percent .",B*100);
```

Scilab code Exa 12.3 `Calculation of change in overall Gain of Feedback Amplifier`

```
//Example 12.3
//Program to Calculate the change in overall Gain of the Feedback //Amplifier with given Gain reduction
clear;
clc ;
close ;
//Given Circuit Data
A=1000; //60dB, Voltage Gain
B=0.005; //Negative Feedback
dAbyA=-0.12; //dA/A = 12 %
```

```
//Calculation
dAfbyAf=1/(1+A*B)*dAbyA; //dAf/Af=1/(1+A*B)*dA/A
//Displaying The Results in Command Window
printf("\n\t The change in overall Gain of the
   Feedback Amplifier is, dAf/Af = %f which is
   equivalent to %f percent.",dAfbyAf,dAfbyAf*-100);
```

Scilab code Exa 12.4 Calculation of Input Impedance of the Feedback Amplifier

```
//Example 12.4
//Program to Calculate the Input Impedance of the
   Feedback Amplifier //with given Specifications
clear;
clc ;
close ;
//Given Circuit Data
Zi=1*10^3; //Ohms
A=1000; //Voltage Gain
B=0.01; //Negative Feedback
//Calculation
Zid=(1+A*B)*Zi;
//Displaying The Results in Command Window
printf("\n\t The Value of the Input Impedance of the
    Feedback Amplifier is, Zid = %f kOhms.",Zid
   /10^3);
```

Scilab code Exa 12.5 Calculation of Feedback Factor and Percent change in overall

```
//Example 12.5
//Program to Calculate the value of Feedback Factor
   and Percentage //change in overall Gain of the
   Internal Amplifier
clear;
```

```
clc ;
close ;
//Given Circuit Data
A=1000; //60dB, Voltage Gain
Zo=12000; //Ohms
Zod=600; //Ohms
dAbyA=0.1; //dA/A = 10 %
//Calculation
B=((Zo/Zod)-1)/A; //Zod=Zo/(1+A*B)
dAfbyAf=1/(1+A*B)*dAbyA; //dAf/Af=1/(1+A*B)*dA/A
//Displaying The Results in Command Window
printf("\n\t The Feedback Factor of the Feedback
    Amplifier is, B = %f percent .",B*100);
printf("\n\t The change in overall Gain of the
    Feedback Amplifier is, dAf/Af = %f percent.",
    dAfbyAf*100);
```

Chapter 13

OSCILLATORS

Scilab code Exa 13.1 `Calculate Frequency of Oscillation of Tuned Collector Oscilla`

```
//Example 13.1
//Program to Calculate Frequency of Oscillation of
//Tuned Collector Oscillator
clear;
clc ;
close ;
//Given Circuit Data
L=58.6*10^(-6);// H
C=300*10^(-12);// F
//Calculation
fo=1/(2*%pi*sqrt(L*C));
//Displaying The Results in Command Window
printf("\n\t The Frequency of Oscillation of Tuned
   Collector Oscillator is fo = %f kHz .",fo/10^3);
```

Scilab code Exa 13.2 `Calculate Frequency of Oscillation of Phase Shift Oscillator`

```
//Example 13.2
```

```
//Program to Calculate Frequency of Oscillation of
//Vacuum Tube Phase Shift Oscillator
clear;
clc ;
close ;
//Given Circuit Data
R=100*10^3;// Ohms
C=0.01*10^(-6);//F
//Calculation
fo=1/(2*%pi*R*C*sqrt(6));
//Displaying The Results in Command Window
printf("\n\t The Frequency of Oscillation of Vacuum
    Tube Phase Shift Oscillator is fo = %f Hz .",fo);
```

Scilab code Exa 13.3 Calculate Frequency of Oscillation of Wein Bridge Oscillator

```
//Example 13.3
//Program to Calculate Frequency of Oscillation of
//Wein Bridge Oscillator
clear;
clc ;
close ;
//Given Circuit Data
R1=220*10^3;// Ohms
R2=220*10^3;// Ohms
C1=250*10^(-12);//F
C2=250*10^(-12);//F
//Calculation
fo=1/(2*%pi*sqrt(R1*C1*R2*C2));
//Displaying The Results in Command Window
printf("\n\t The Frequency of Oscillation of Wein
    Bridge Oscillator is fo = %f kHz .",fo/10^3);
```

Chapter 14

ELECTRONIC INSTRUMENTS

Scilab code Exa 14.1 Caculation of Series Resistance for coversion to Voltmeter

```
//Example 14.1
//Program to Determine the Series Resistance to Convert given
//d' Arsonval movement into a Voltmeter with the specified Range
clear;
clc ;
close ;
//Given Circuit Data
Rm=100; //Ohms
Is=100*10^(-6); //A
Vr=100; //V
//Calculation
Rtotal=Vr/Is;
Rs=Rtotal-Rm;
//Displaying The Results in Command Window
printf("\n\t The Series Resistance to Convert given dArsonval movement into a Voltmeter is , Rs = %f kOhms .",Rs/10^3);
```

Scilab code Exa 14.2 Calculation of Shunt Resistance

```
//Example 14.2
//Program to Determine the Shunt Resistance required
clear;
clc ;
close ;
//Given Circuit Data
Rm=100; //Ohms
CS=100*10^(-6); //A
Imax=10*10^(-3); //A
//Calculation
Ish=Imax-CS;
Rsh=Rm*CS/Ish;
//Displaying The Results in Command Window
printf("\n\t The Value of Shunt Resistance is , Rsh = %f Ohms .",Rsh);
```

Scilab code Exa 14.3 Designing of a Universal Shunt for making a Multi Range Milli

```
//Example 14.3
//Program to Design the Universal Shunt for making Multi−Range //Milliammeter with Range 0−1 mA ,0−100 mA,0−500 mA,0−1 A
clear;
clc ;
close ;
//Given Circuit Data
CS=100*10^(-6); //A
R=100; //Ohms
Rm=900; //Ohms
```

```
//(a)Calculation
Imax1=1*10^(-3); //A
Rsh=CS*R/(Imax1-CS);
Rm1=Rm;
Ish1=Imax1-CS;
Rsh1=Rm1*CS/Ish1;
//(b)Calculation
Imax2=10*10^(-3); //A
Ish2=Imax2-CS;
R1=(R*Ish2-Rm*CS)/(Ish2-CS);
//(c)Calculation
Imax3=100*10^(-3); //A
Ish3=Imax3-CS;
R2=((R-R1)*Ish3-Rm*CS)/(Ish3-CS);
//(d)Calculation
Imax4=500*10^(-3); //A
Ish4=Imax4-CS;
R3=((R-R1-R2)*Ish4-Rm*CS)/(Ish4-CS);
//(e)Calculation
Imax5=1; //A
Ish5=Imax5-CS;
R4=((R-R1-R2-R3)*Ish5-Rm*CS)/(Ish5-CS);
R5=R-R1-R2-R3-R4;
//Displaying The Results in Command Window
printf("\n\t Shunt Resistance            , Rsh = %f Ohms .",Rsh);
printf("\n\t For Range switch at 1 mA   , Rsh1 = %f Ohms .",Rsh1);
printf("\n\t For Range switch at 10 mA , R1 = %f Ohms .",R1);
printf("\n\t For Range switch at 100 mA, R2 = %f Ohms .",R2);
printf("\n\t For Range switch at 500 mA, R3 = %f Ohms .",R3);
printf("\n\t For Range switch at 1 A    , R4 = %f Ohms .",R4);
printf("\n\t\t\t            R5 = %f Ohms .",R5);
```

Scilab code Exa 14.4 Determination of Peak and RMS AC Voltage

```
//Example 14.4
//Program to Determine the AC Voltage
clear;
clc ;
close ;
//Given Circuit Data
DS=5; //V/cm, Deflection Sensitivity
l=10; //cm, Trace Length
//Calculation
Vp=DS*l;
Vm=Vp/2;
V=Vm/sqrt(2);
//Displaying The Results in Command Window
printf("\n\t The Peak AC Voltage, Vm = %f V .",Vm);
printf("\n\t The RMS AC Voltage, V = %f V .",V);
```

Scilab code Exa 14.5 Determination of Magnitude and Frequency of Voltage Fed to Y

```
//Example 14.5
//Program to Determine the Magnitude and the
   Frequency of the
//wave Voltage fed to the Y-input
clear;
clc ;
close ;
//Given Circuit Data
Am=3.5; //V, Amplitude
tb=0.1*10^(-3); //seconds
```

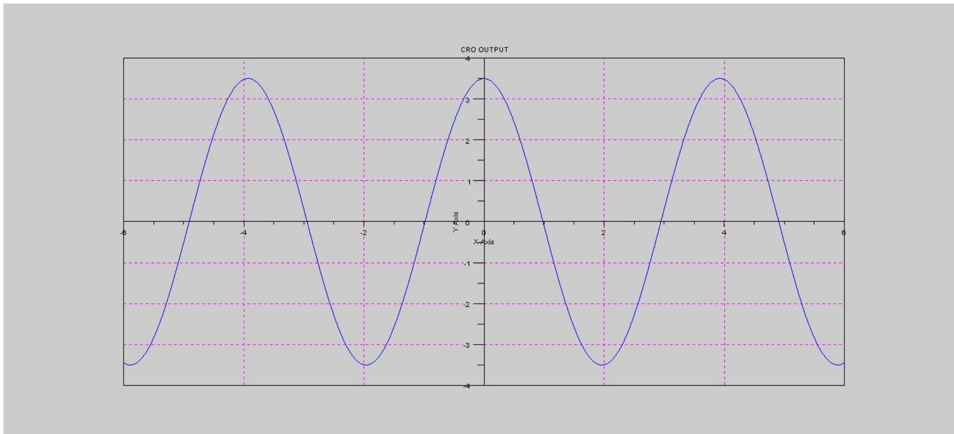

Figure 14.1: Determination of Magnitude and Frequency of Voltage Fed to Y Input

```
TP=4; //Time Period
//Calculation
Vm=2*Am;
V=Vm/sqrt(2);
T=TP*tb;
f=1/T;
//Displaying The Results in Command Window
printf("\n\t The Magnitude of Wave Voltage, V = %f V.",V);
printf("\n\t The Frequency of Wave Voltage, f = %f kHz .",f/10^3);
//Plot of the given Wave
figure
x=-6:0.01:6;
y=Am*cos(1.6*x); //Given Waveform
plot (x,y);
a= gca ();
a.x_location="origin";
a.y_location="origin";
xlabel ('X Axis');
ylabel ('Y Axis');
title ('CRO OUTPUT');
```

```
xgrid (6);
```